CITY OF ST. AUGUSTINE

LAKE MARIA SANCHEZ

FLOOD MITIGATION & DRAINAGE PROJECT

FEMA GRANT NO. DR-4283-22-R
CITY PROJECT #PW2018-05

30% BASIS OF DESIGN REPORT

September 2019

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EXECUTIVE SUMMARY

1.0 INTRODUCTION

This Basis of Design Report (BDR) has been developed by the team of McKim & Creed following evaluation of existing information available for the Lake Maria Sanchez Flood Mitigation and Drainage Project (Project). Critical elements associated with the FEMA HMGP application are included.

1.1 Project Background

In October 2016, the City of St. Augustine (City) suffered severe damage because of Hurricane Matthew. This event was declared a disaster by the Federal Emergency Management Agency (FEMA 4283-DR). As a result, Hazard Mitigation Grant Program (HMGP) funding became available for projects that would mitigate future disasters. The City applied for and received HMGP funding for the Lake Maria Sanchez Flood Mitigation and Drainage Project. In September 2017 the City was impacted by Hurricane Irma, which further emphasized the urgency to implement this important mitigation project.

1.2 Project Description

To mitigate the flood hazards in the Lake Maria Sanchez area, the City proposes to implement a series of improvements to prevent both coastal and stormwater flooding from impacting the area. The City plans to provide back flow prevention within its storm sewer piping through a combination of stormwater check valves, a pump station to pump stormwater out of the project area to the Matanzas River, stormwater conveyance improvements and a bulkhead to protect the marsh area south of Lake Maria Sanchez. The following report details the 30 percent design details for the project. The current proposed level of protection is the 25-year storm + 2050 SLR, which will protect approximately 186 structures from flooding. In addition, the project will provide flood reduction benefits for many additional properties and infrastructure from precipitation-based flooding events, the primary project corridor expected to meet roadway flooding level of service for approximately the 10-year 24-hour rainfall event.

2.0 EVALUATION OF DESIGN FOR FEMA COMPLIANCE

Per earlier discussions, portions of the design have been modified to achieve the intent and goals of the project. This includes eliminating the underground storage vault, increasing stormwater pipe

capacity, and extending the footprint of the improved stormwater system. Based on the preliminary assessment of these modifications, there will not be any related compliance issues with FEMA NFIP regulations or the FEMA HMGP requirements. The modified project components still fall within the originally identified scope of work. An updated Benefit-Costa Analysis is being created to demonstrate cost effectiveness of the current design concept.

3.0 CONCLUSIONS AND RECOMMENDATIONS

In addition to the design details and plans, the following Conclusions and Recommendations are made pursuant to the report:

3.1 Right-of-Way Easements

Proposed new stormwater conveyance and other improvements will be constructed in property controlled by the City of St. Augustine. More than half of the proposed new marshland bulkhead is to be installed on private or non-City property. This will require permanent and temporary easements with the property owners for construction.

3.2 Detailed Cultural Resources Survey

The desktop analysis of Cultural Resources was performed to provide a preliminary indication of significant sites within the project area. While no significant sites were immediately identified as impacted by the project, the report provides a starting point to complete the review with the City.

3.3 Bulkhead Construction

Design parameters, location, and various alternative bulkhead walls were considered for the marshland area south of Lake Maria Sanchez. The three Alternatives included Steel Sheet Piles, Precast Concrete Sheet Piles, and Cantilever Retaining Walls. While each type of Bulkhead provided its own unique Advantages and Disadvantages, the Steel Sheet Piles afford a cost-effective solution.

3.4 Wetlands and Tree Inspection in Marshland Area

A preliminary alignment of the proposed marshland bulkhead was developed with input from the city. The alignment impacts delineated wetlands and will require further discussion with regulatory agencies for permitting and mitigation. The area in the southeast corner of the proposed bulkhead alignment contains several trees that will require additional review by the City. If the trees are to

remain, an Alternate Bulkhead Location will be further analyzed.

3.5 Pump Station Location and Design

Initial planning documents within the HMGP Engineering report located the proposed pump station at or near the existing South Street Weir Structure of Lake Maria Sanchez. Further, the pump station level of protection and design were established based on the 100-year base flood elevation and roadway flooding level of service.

3.6 Stormwater Design and New Outfall Structure

The stormwater conveyance system was modeled and designed based on a 10-year roadway level of service. This design required updates to the existing conditions model as well as optimization of the originally proposed conveyance system.

The Engineering Report accompanying the HMGP application described a new "static" outfall structure to replace the existing weir structure beneath South Street. The static structure as described will only allow water to exit the lake. Discussions with the City determined the desire of the City to retain the ability for brackish water to continue to enter the lake during times of high tide. This will necessitate a variation to the planned structure.

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1.0 INTRODUCTION

This Basis of Design Report (BDR) has been developed to evaluate information provided by the City and establish critical elements associated with the FEMA Grant application. The report includes key areas addressing the goals and objectives of the City.

1.1 Project Background

In October 2016, the City of St. Augustine (City) suffered severe damage because of Hurricane Matthew. This event was declared a disaster by the Federal Emergency Management Agency (FEMA 4283-DR). As a result, Hazard Mitigation Grant Program (HMGP) funding became available for projects that would mitigate future disasters. The City applied for and received HMGP funding for the Lake Maria Sanchez Flood Mitigation and Drainage Project.



Figure 1-1: Photo credit to The Weather Channel

1.2 Project Description

To mitigate the flood hazards in the Lake Maria Sanchez area, the City proposes to implement a series of improvements to prevent both coastal and stormwater flooding from impacting the area. The City plans to provide back flow prevention within its storm sewer piping through a combination of stormwater check valves, a pump station to pump

stormwater out of the project area to the Matanzas River, stormwater conveyance improvements and a bulkhead to protect the marsh area south of Lake Maria Sanchez.

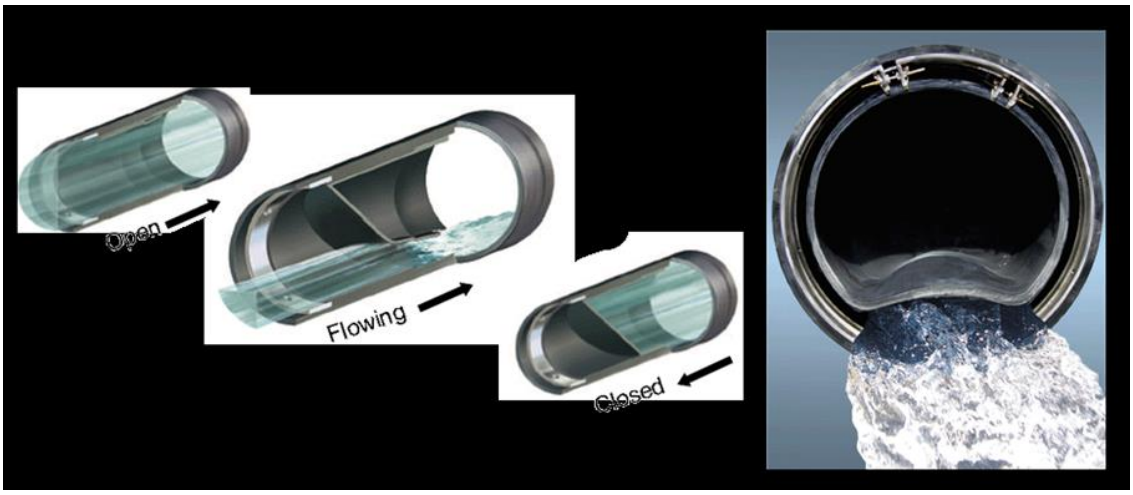


Figure 1-2: Photo credit to Tideflex Technologies

Stormwater Check Valves - The proposed project will include the installation of Inline Check Valves on each outfall to prevent elevated tail water conditions from back flowing through select outfall pipes into the project area and contributing to flooding.

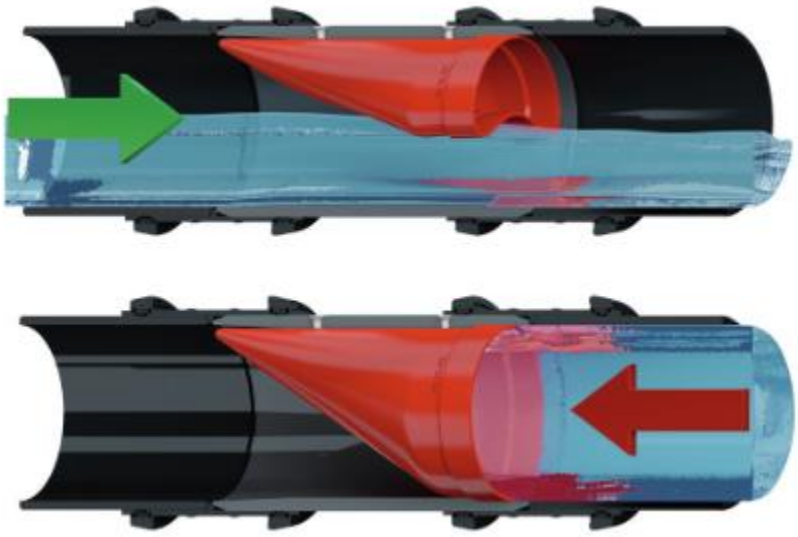


Figure 1-3: Photo credit to Wapro

Stormwater Pump Station – The current concept is to modify the Lake Maria Sanchez outfall and construct a triplex pump station with a new force main.

Conveyance Improvements - The project includes upsizing of the existing storm sewer system along Cordova Street, Bridge Street, and Granada Street to increase capacity.

Bulkhead – The project will include installation of a bulkhead along approximately 1,900 feet of shoreline south of Lake Maria Sanchez. The bulkhead is to be adjacent to Washington Street, South Street and along the east bank of the marsh. The floodwall will be tied in at either end to existing grade.

According to the HMGP Application approved by FEMA, the project will be designed to provide protection to 216 structures for a 10-year storm event and protection to 270 structures for a 25-year storm event, per FEMA approval. Activities will be completed in compliance with Federal, State and Local rules and regulations.

Further review of the level of protection using structure footprint inventory and best available LiDAR, the following estimates were developed:

- 45 properties (80 structures) are at or below 6.1 feet NAVD88 (Approx. 10-year storm event + 2050 SLR)
- 109 properties (186 structures) at or below 6.4 feet NAVD88 (Approx. 25-year storm + 2050 SLR)
- 264 properties (421 structures) at or below 7.1 feet NAVD88 (Approx. 100-year stillwater w/out 2050 SLR)

The current proposed level of protection will protect up to the 25-year storm + 2050 SLR, protecting 186 structures from flooding.

1.3 Project Location

The project area extends approximately from the corner of Duero Street and Washington Street (in the south) to Saragossa Street (in the north) and is bounded by Martin Luther King Boulevard on the west and the City seawall on the east.



Figure 1-4: Project Location Aerial Image. Photo Credit ESRI Open Street Maps

The project area is primarily situated in Section 21, Township 7 South, Range 30 East within the City of St. Augustine. The area encompasses approximately 200 acres of the City's core downtown, including residential and commercial properties, churches, Flagler College, City Hall, and historically significant buildings, monuments and structures. The project area is located between the San Sebastian River to the west and Matanzas River to the east.

1.4 Existing Conditions

Currently, high tide and coastal storm surge events contribute to preventing stormwater within the basin from exiting the existing stormwater outfall via gravity flow. This is confirmed by the City through their Master Stormwater Management Plan (MSMP) modeling using EPA SWMM 5.1.011. The model evaluated flooding events associated with the mean annual, 10-percent, 4-percent, and 1-percent annual chance storm events. The area surrounding Lake Maria Sanchez was found to be prone to roadway flooding during the mean annual storm event. The following local roadways were found to be impassable (i.e., greater than 6.3 inches of flooding) during the mean annual storm event:

- Granada Street South of King Street intersection
- Intersection of Granada Street and Cedar Street
- Cordova Street north of Bridge Street intersection

- Intersection of Granada Street and Desoto Place
- Intersection of Cordova Street and Bridge Street
- Intersection of Granada Street and Bridge Street
- Cordova Street south of Bridge Street intersection



Figure 1-5: Project Location. USGS High Water Mark Locations

During the October 2016 Hurricane Matthew storm event, coastal waters entered the City's downtown area. Historic buildings like the Flagler College Main Hall were reported to be inundated with up to 4 feet of water. USGS High Water Mark (HWM) Measurements (Site

No. FLSTJ18597) estimated a flood elevation of 7.2 feet NAVD88 in the Lake Maria Sanchez Project area, which corroborates with other adjacent HWM. In addition, flooding within the project area from Hurricane Irma in September of 2017 was estimated at about 5.2 feet NAVD88 (Site No. FLSTJ23144).

1.5 Site Investigation

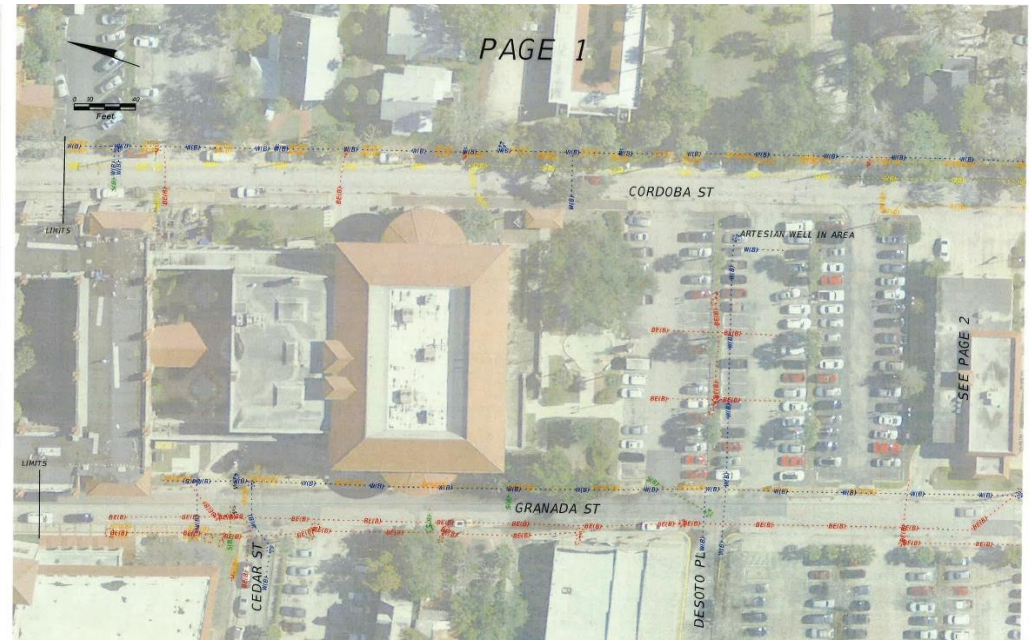
Field visits were conducted to visually confirm the existing conditions of the storm sewer inlets, the lake outlet structure at South Street and the areas of the proposed bulkhead.

1.6 Utilities

The project area contains City of St. Augustine water and sewer utilities. It is also confirmed that buried power, telephone, and cable TV will be encountered.

1.7 Natural Features

The natural features located within the project area include Lake Maria Sanchez itself and the saltwater marsh immediately downstream of Lake Maria Sanchez. An Artesian Well in the parking lot of the Lightner Museum was reported to crews performing Subsurface Utility Engineering but was not located by topographic surveying. This will be further investigated prior to any construction in the area.



1.8 Geotechnical Data

A Geotechnical Exploration was conducted by Meskel & Associates Engineering and a report of findings made available March 29, 2019.

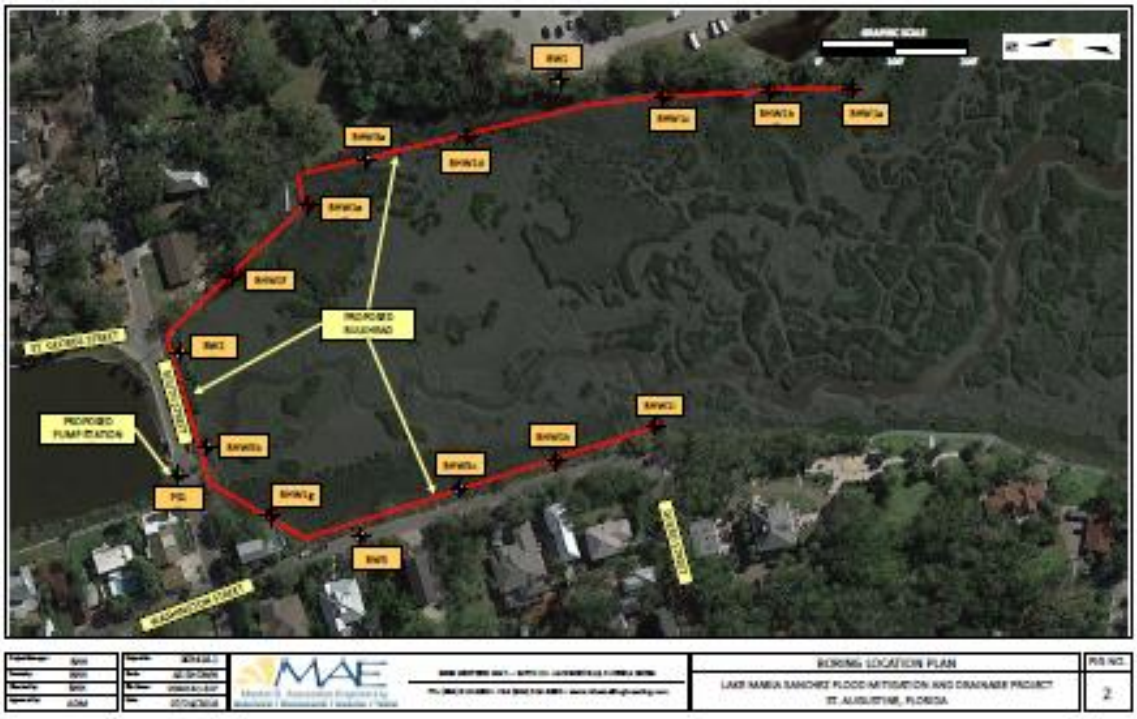


From the report:

> "In general, the borings for the planned stormwater conveyance improvements encountered a surficial pavement section consisting of an asphalt layer 2 to 3 inches thick, underlain by a limerock base course 4.5 to 6 inches thick. This was typically followed by loose to medium dense fine sands, fine sands with silt, and silty fine sands (SP, SP-SM, SM) to the boring termination depths of up to 15 feet below the existing grade. The boring for the planned pump station encountered a surficial topsoil layer 6 inches thick, underlain by loose to very loose fine sands to silty fine sands (SP, SP-SM, SM) and then terminating in firm clay at 40 feet below the existing ground surface. We note that very loose (weight-of-hammer) sands containing

varying amounts of organic fines were encountered at the planned pump station location between approximate depths of 6 to 23.5 feet. The borings for the planned bulkhead generally encountered very loose to loose fine sands with silt, silty fine sands, clayey fine sands, the occasional very soft silt (SP-SM, SM, SC, ML) or firm to stiff clay (CL) often containing trace to some amounts of shell fragments to the boring termination depths of up to 80 feet below the existing grade. The near surface soils along the planned bulkhead alignment typically contained varying amounts of organic fines and/or root fragments."

"Based on … field exploration and laboratory testing, … the encountered subsurface conditions are adaptable for support of the planned structures provided the recommendations in this report are followed."



A copy of the Geotechnical Exploration Report is included in Appendix I.

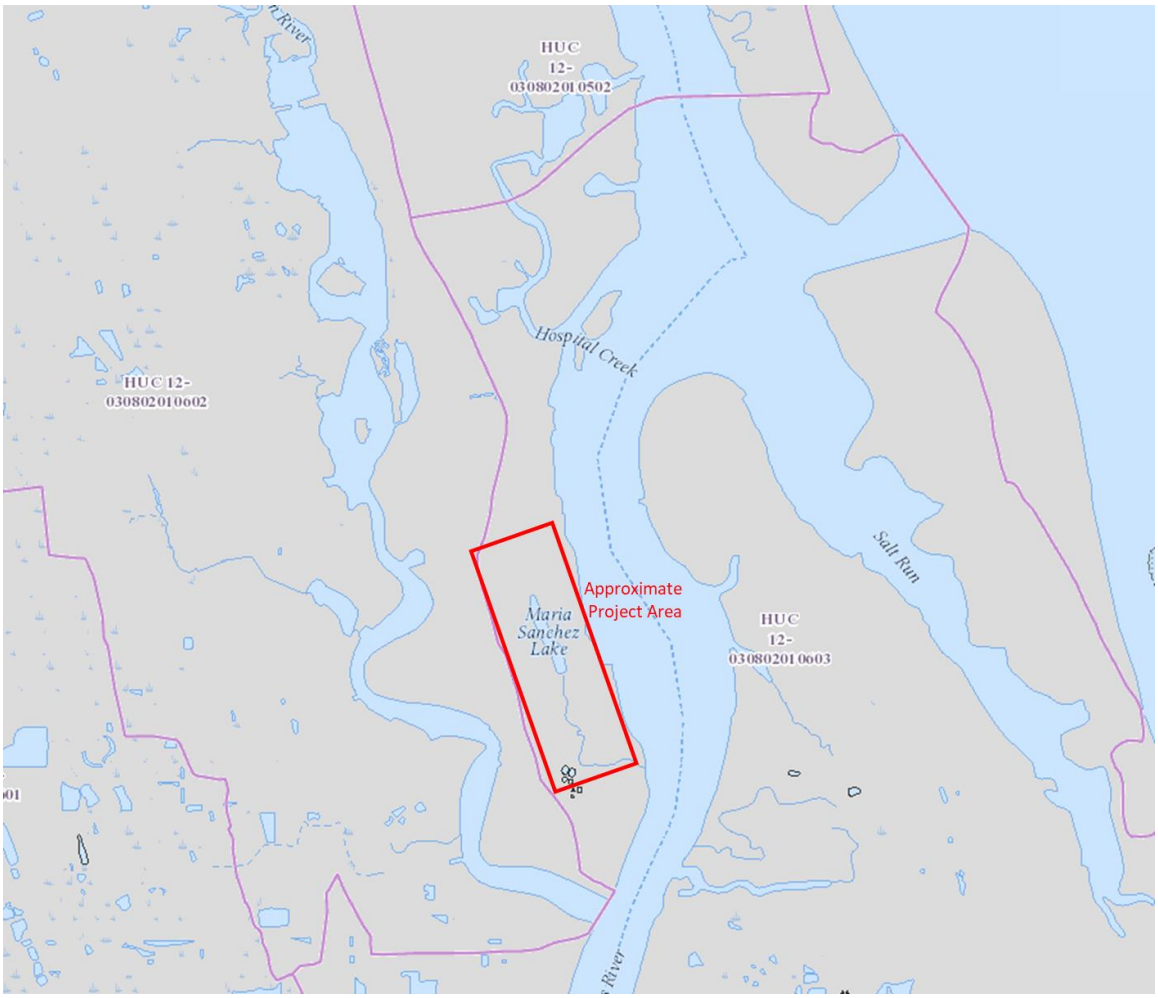


Figure 1-6: Project Watershed Boundary Image. Photo Credit USGS - The National Map

1.9 Watershed Information

The project is in the Hydrologic Unit Code (HUC) Tolomato River-Moses Creek Frontal Sub-Basin Area 030802010603.

The watershed is primarily urbanized. The historic drainage patterns in this area typically begin at the Northern portion of the project area and flow to the south into the Matanzas River.

A more detailed watershed study was developed as part of the 2013 City of St. Augustine Stormwater Master Plan Update (SWMPU), which included subcatchment delineations and hydrologic and hydraulic analysis in priority locations, which included the Lake Maria Sanchez area.

1.10 Cultural Resources

A desktop analysis of Cultural Resources in the project area was performed for this report. Portions of the project are in or adjacent to City identified Archaeological zones and Historic Preservation zoning districts.

For this report, Area 1 includes the streets of Cordova, Bridge, and Granada immediately north of Lake Maria Sanchez. Area 2 includes South Street and the foreshore of Maria Sanchez Creek.

For the purposes of this desktop and reconnaissance survey, the direct Area of Potential Effect (APE) for the Project includes the existing right-of-way for the roads slated for construction, the City parking lot, and the bulkhead footprint. The visual or indirect APE, as defined for this document, includes the parcels immediately adjacent to the Project in Area 2.

Aboveground constructions that will require architectural history consideration include the bulkhead at the south end of Lake Maria Sanchez and the new pump station and stormwater outfall. At the current state of planning for this project, there is no aboveground construction within Area 1 and the architectural historian will not review adjacent parcels for historic resources.

Below-ground disturbances that will require archaeological consideration include the construction of the stormwater conveyance system south of the Lightner Museum, the pump station, and the bulkhead at the south end of Lake Maria Sanchez. Only the bulkhead is located on undeveloped property. All the undeveloped property is very poorly drained. The other facilities are to be placed below streets or lots that are currently paved.

This report will be instrumental in coordinating additional cultural resource assessments with the City.

A copy of the Desktop Analysis and Reconnaissance for the Lake Maria Sanchez Flood Mitigation and Drainage Project, dated April 2019, is included in Appendix I.

This report will be updated as the project layout and scope are revised.

2.0 DATA COLLECTION AND REVIEW

Information was gathered from the City to assist in the development of the design activities. City staff was interviewed to retrieve pertinent information and to collect background data useful in developing the design.

2.1 Data Collected

The following data was provided by the City to assist with the stormwater analysis and the basis of design:

- Stormwater Master Plan Files and supporting GIS Data;
- City Stormwater Asset Inventory;
- Hazard Mitigation Grant Program (HMGP) Application Support Files;
- Existing Survey within Project Area; and
- Gage and Monitoring Data for Lake Maria Sanchez and Existing Weir

In addition, site specific field survey and wetland delineations and environmental field assessments were conducted as part of this project to support the overall project design.

The original existing condition Lake Maria Sanchez model covers approximately 262 acres and contains 46 sub-catchments, 68 nodes, and 96 links.

2.2 Right of Way Easements

The proposed improvements for the storm sewer collection system upgrades and pump station construction will occur within lands owned and right-of-ways maintained by the City of St. Augustine. While some of the bulkhead is proposed to be constructed on public lands, other portions will be located on private property and require permanent and temporary easements for construction. See map of impacted properties in Appendix II.

2.3 Additional Information

The Lake Maria Sanchez Engineering Report information and the Hydrologic and Hydraulic (H&H) Model is also provided by the City for use in the development of this Basis of Design Report.

3.0 STORMWATER OPTIMIZATION ANALYSIS

The study area is approximately 228 acres surrounding Lake Maria Sanchez located between the San Sebastian River and the Matanzas River, as shown on Figure 1 (Figures referenced in this Section are included in Appendix III). Lake Maria Sanchez and the surrounding project areas is located within a bowl-shaped depression, surrounded by areas of relatively higher elevation. The project area topography is shown on Figure 2. The high point in the project area is approximately 9 feet NAVD88, with the low areas at or below 1.5 feet NAVD88 (Lake Maria Sanchez).

Previously referenced model information was evaluated for this report and focused on the stormwater system. These elements were analyzed for their current data quality as well as impacts on the model and proposed design.

The following summarizes the proposed condition concepts applied to the Revised Existing Conditions Model as well as the analysis of results.

The goal of the analysis is to validate previously proposed concepts as well as an optimization analysis to achieve a feasible level of protection in a cost-effective manner. The analysis consists of the following elements:

- Lake Maria Sanchez Stormwater Improvements Scenario Review
- Model of Proposed Scenarios
- Revised Stormwater Conveyance Feasibility and Optimization
- Underground Storage Sizing and Preliminary Design Details
- Backflow Prevention Location Preliminary Validation
- Pump Station Design Flow Capacity Determination
- Lake Maria Sanchez Outfall Design Characteristics
- Water Quality Impacts Assessment and Potential Mitigation
- Proposed Design Concept Exhibit to support Design team

A hydrologic and hydraulic (H&H) analysis of the project area is required to support the Basis of Design regarding stormwater improvements, demonstrate compliance with regulatory requirements, and assess ancillary benefits for the project.

3.1 Improvements Scenarios

The stormwater modeling effort built upon a previous model developed in support of the HMGP application, which was a revised version of the Lake Maria Sanchez model developed as part of the 2013 City of St. Augustine Stormwater Master Plan Update (SWMPU). The revisions consisted of expansion of the modeled study area to incorporate the proposed elements contained within the Lake Maria Sanchez HMGP project application and has been designated as the existing conditions model for this study. More detail regarding the existing conditions model information can be found in the report provided in support of the HMGP Application submittal titled, Maria Sanchez Lake Flood Control Feasibility Study Hydrology and Hydraulics Modeling Report (CDM Smith, 2017).

The original existing condition Lake Maria Sanchez model covers approximately 262 acres and contains 46 sub-catchments, 68 nodes, and 96 links.

3.2 Model of Scenarios

The existing model developed for the Lake Maria Sanchez HMGP Application was revised to address modeling errors or omissions, as well as include site specific detail within the project area. The revised existing Lake Maria Sanchez model covers approximately 200 acres and contains 46 sub-catchments, 73 nodes, and 105 links.

The revisions were made using collected field data, in addition to engineering judgement and sound modeling practices. The revisions were made to sub-catchments, nodes, and links to create a more accurate model that better reflects hydrologic and hydraulic behavior in the complex urban network. The revised existing condition serves as the base model for the proposed improvements to be incorporated. Also, the revised existing conditions model serves as the comparison reference for net benefits and no-impact analysis. Figure 3 represents the revised existing condition model schematic for the project area. The following major revisions were made to the Lake Maria Sanchez Existing Conditions Model:

- Free discharge Outfalls added to the western and northern portions of the study area to avoid artificial node staging and surcharge. These include Cordova Street north of Carrera Street, St. George Street north of Hypolita Street, Valencia Street West of Sevilla Street, and King Street West of Sevilla Street.

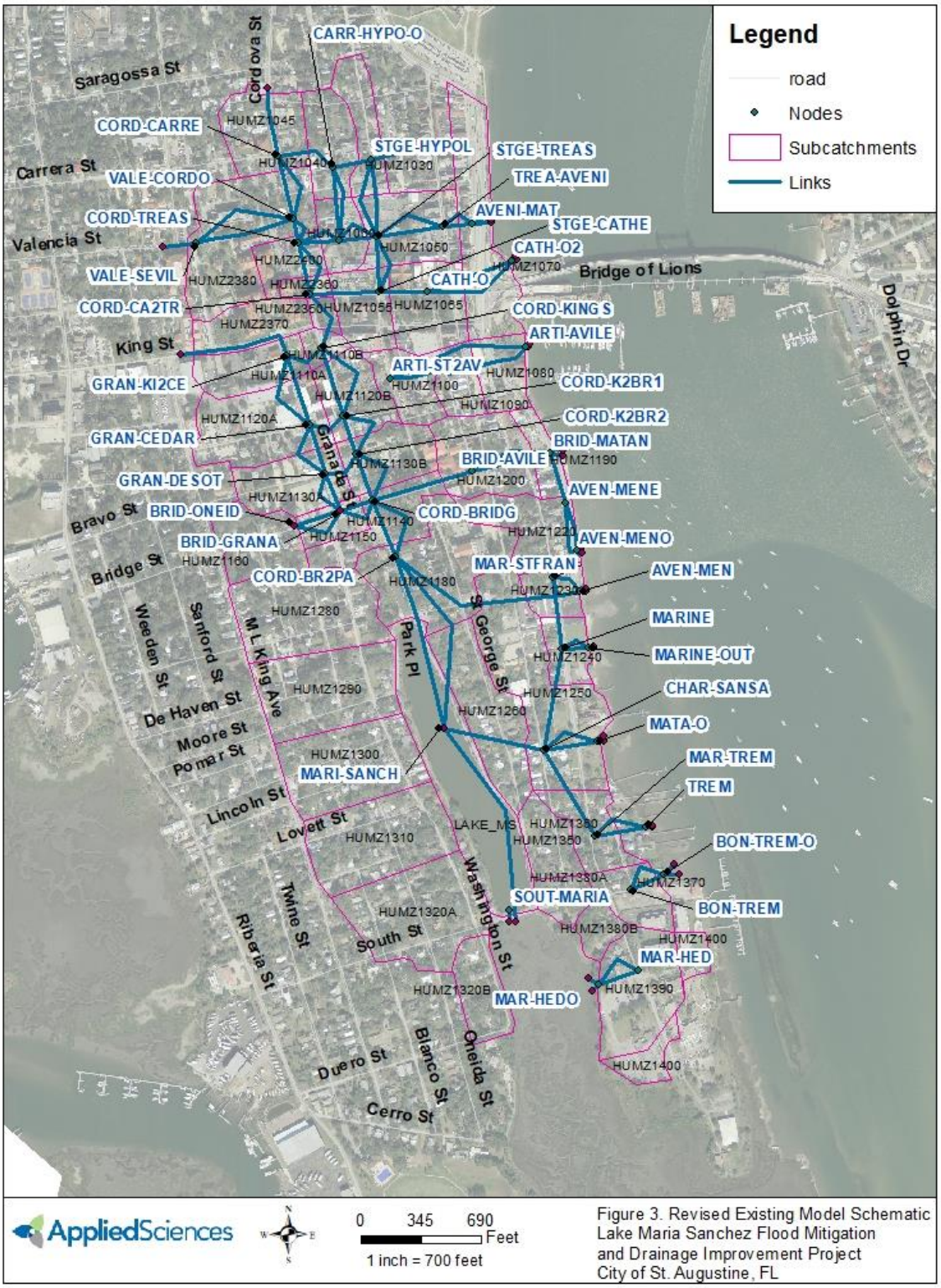


Figure 3. Revised Existing Model Schematic
Lake Maria Sanchez Flood Mitigation
and Drainage Improvement Project
City of St. Augustine, FL

- Overland flow connectivity added east of Cordova Street along Cathedral Place. Specifically, between Node CORD-CA2TR to STGE-CATHE, and from STGE-CATHE to CATH-O.

- Improved pipe and overland connectivity in the Historic Downtown St. Augustine Area. Specifically, improved detail along Spanish Street, St. George Street, and Treasury Street. The existing model showed artificial stacking and 'glass walling' of floodplain in the area of Cordova-Carrera and Hypolita-St. George Street. The model reported 100-year stages as high as 16.9 feet NAVD88, which is in excess of 10 feet above ground elevation. This is a model error due to inadequate representation of node storage and channel conveyance. Other design storm events also had artificially high stages, which is why the hydraulic network was revised to more accurately reflect overland flow, including a free discharge outfall to the north.

- Split sub-catchments HUMZ1320B and HUMZ1380, which are near the southern end of Lake Maria Sanchez. The purpose was to show more of the stormwater runoff volume discharging to Lake Maria Sanchez as opposed to the downstream tidally influenced marsh system.

- Removed the non-contributing area catchment (MATANZ-WET)

- Lowered road overtopping link SOUT-MARIA-O, as it was set at invert of 4.8 feet NAVD88 and greatly overestimating the elevation of South Street, and artificially staging Lake Maria Sanchez.

3.3 Revised Existing Conditions Evaluation

Peak stages were extracted at eight (8) locations within the project area to assess the change in results between the existing model and the revised existing conditions. The resulting comparisons between the two models are shown in Table 3-1 located on the following page. The complete Summary of peak stage comparison for all nodes and input/output files are provided in Appendix III.

Table 3-1

Comparison of Peak Stages (feet NAVD 88) between Existing Model and Revised Existing Conditions within Improvements Area

	Mean Annual			5 Year			10 Year		
Node ID	Orig. Existing (ft)	Rev. Existing (ft)	Δ (ft)	Orig. Existing (ft)	Rev. Existing (ft)	Δ (ft)	Orig. Existing (ft)	Rev. Existing (ft)	Δ (ft)
Cordova									
CORD-KINGS	5.5	5.4	0.0	5.6	5.5	-0.1	5.7	5.7	-0.1
CORD-K2BR1	5.1	5.2	0.0	5.2	5.2	0.0	5.4	5.4	0.0
CORD-K2BR2	5.0	4.8	-0.1	5.1	4.9	-0.2	5.3	5.1	-0.2
CORD-BRIDG	4.9	4.7	-0.2	5.1	4.8	-0.2	5.3	5.1	-0.2
CORD-BR2PA	4.7	4.5	-0.2	4.9	4.7	-0.2	5.0	4.8	-0.2
MARI-SANCH	3.8	3.8	0.0	4.1	4.0	0.0	4.5	4.4	-0.1
Granada									
GRAN-KI2CE	5.1	4.9	-0.1	5.2	5.0	-0.2	5.4	5.2	-0.2
GRAN-CEDAR	5.0	4.8	-0.2	5.2	5.0	-0.2	5.4	5.2	-0.2
GRAN-DESOT	5.0	4.8	-0.2	5.1	4.9	-0.2	5.3	5.1	-0.2
BRID-GRANA	5.0	4.7	-0.2	5.1	4.9	-0.2	5.3	5.1	-0.2

	25 Year			50 Year			100 Year		
Node ID	Orig. Existing (ft)	Rev. Existing (ft)	Δ (ft)	Orig. Existing (ft)	Rev. Existing (ft)	Δ (ft)	Orig. Existing (ft)	Rev. Existing (ft)	Δ (ft)
Cordova									
CORD-KINGS	5.8	5.8	-0.1	6.0	5.8	-0.1	6.0	5.9	-0.1
CORD-K2BR1	5.5	5.5	-0.1	5.7	5.6	-0.2	5.7	5.6	-0.1
CORD-K2BR2	5.5	5.3	-0.2	5.6	5.4	-0.2	5.6	5.4	-0.2
CORD-BRIDG	5.4	5.2	-0.2	5.6	5.3	-0.3	5.6	5.4	-0.2
CORD-BR2PA	5.1	5.0	-0.2	5.3	5.1	-0.2	5.3	5.1	-0.2
MARI-SANCH	4.8	4.7	-0.1	5.0	4.9	-0.1	5.0	4.9	0.0
Granada									
GRAN-KI2CE	5.5	5.3	-0.2	5.7	5.5	-0.2	5.7	5.5	-0.2
GRAN-CEDAR	5.5	5.3	-0.2	5.7	5.4	-0.2	5.7	5.5	-0.2
GRAN-DESOT	5.5	5.3	-0.2	5.6	5.4	-0.2	5.6	5.4	-0.2
BRID-GRANA	5.5	5.3	-0.2	5.6	5.4	-0.3	5.6	5.4	-0.2

*values are in feet NAVD88

3.4 Revised Stormwater Conveyance Feasibility and Optimization

The following stormwater improvements are proposed within the Lake Maria Sanchez project area:



- Increase stormwater conveyance along Granada Street between King Street and Cedar Street through installed equivalent 24-inch RCP;

- Increase stormwater conveyance along Granada Street between Cedar Street and City Hall Parking lot through installed 4 ft x 3 ft box culvert;

- Increase stormwater conveyance through City hall parking lot parallel to Bridge Street between Cordova Street and Granada Street through installed 4 ft x 3 ft box culvert;

- Increase stormwater conveyance along Cordova Street from King Street to Palm Row through equivalent 18-inch RCP;

- Increase stormwater conveyance along Cordova Street from Palm Row to north of Bridge Street (3 ft x 3 ft box culvert), and from north of Bridge Street to Lake Maria Sanchez through installed 6 ft x 4 ft box culvert;

- Install three low-head pumps (two duty, one standby), capable of pumping 75-cfs each. Discharge through a 36-inch DI pipe routed under South Street to Matanzas River;

- Construct new Outfall that will meet design flood protection levels while still in accordance with the existing Environmental Resource Permit (ERP) #82626; and

- Backflow preventers installed at critical locations.

The associated changes were incorporated into the Revised Existing Conditions EPA SWMM5 model to create the proposed conditions model.

Peak stages were analyzed at eight locations to determine the effectiveness of the proposed Alternative. Result Comparisons between the two models are shown below in Table 3-2 located on the following page.

Reductions in peak stages are observed at all locations for all design storm events. No adverse impacts are observed throughout the model. The mean annual and 5-year design storm events have recognized benefits exceeding one foot in the mean annual and 5 year 24-hour design storm events. The results also show that as the magnitude of the storm events increase, the flood reduction benefits decrease. This is can be attributed to the increased runoff volume and increased rainfall intensity of the larger events. The increased volume and intensity of the larger events impact the hydraulic performance of the system by raising the stages in Lake Maria Sanchez and creating runoff inflows that exceed feasible design flow capacity of both the Pump Station and Stormwater Conveyance system.

The results in Table 3-2 suggest that almost all locations meet the Level of Service (LOS) for a 10-year design storm event, except for the intersections of Bridge Street and Granada Street, which is within 0.1 feet of meeting the LOS based on the model results.

At the request of the City, an analysis was performed to assess an alternative conveyance system that is sized for a 5-year LOS instead of the 10-year LOS. This analysis demonstrated that any meaningful changes to the conveyance system resulted in LOS impact, most notably at the intersections of Bridge and Granada and Bridge and Cordova

Street. From this analysis, it has been concluded that any minor cost savings from what little reductions in box culvert sizes can be manageable would be outweighed by the decreases in flood reduction benefits. From a stormwater conveyance standpoint, the cost-effective solution is to maintain the current proposed configuration.

A separate LOS alternative was performed based on adjustments to the pump station design flow. The pump station analysis results suggest that the pump station design flow could be reduced to below 100 cfs and still meet LOS. If subsurface conflicts and alignments become a cost and feasibility issue, consideration for an inverted crown streetscaping concept would utilize the road as an effective flow conveyance feature while minimizing underground disturbance. The concept would prevent standing water but would result in moving water along the centerline and expanding out.

Finally, a drawdown analysis was performed to note if any benefit would be recognized from drawing down the Lake based on a forecasted large storm event. The model results suggested the increase in benefits from pre-emptive drawdown ranging from 0.2 feet to no benefit for the 25, 50, and 100 year 24-hour storm events. The conclusion from this analysis is that the drawdown of Lake Maria Sanchez would not provide significant flood reduction benefit, and therefore is not currently a recommended mitigation activity as part of this project.

Table 3-2

Comparison of Peak Stages within Improvements Area Between Revised Existing Model and Proposed Conditions

		Mean Annual			5 Year			10 Year		
Node ID	LOS El. (ft) (Crown + 0.5 ft)	Rev. Ex. Stage (ft)	Proposed Stage (ft)	Δ (ft)	Rev. Ex. Stage (ft)	Proposed Stage (ft)	Δ (ft)	Rev. Ex. Stage (ft)	Proposed Stage (ft)	Δ (ft)
Cordova										
CORD-KINGS	5.7	5.4	5.4	0.0	5.5	5.5	0.0	5.7	5.7	0.0
CORD-K2BR1	5.4	5.2	4.2	-1.0	5.2	4.6	-0.6	5.4	5.0	-0.3
CORD-K2BR2	5.1	4.8	4.0	-0.8	4.9	4.3	-0.6	5.1	4.7	-0.4
CORD-BRIDG	4.5	4.7	3.8	-0.9	4.8	4.2	-0.7	5.1	4.5	-0.5
CORD-BR2PA	4.2	4.5	3.4	-1.1	4.7	3.8	-0.9	4.8	4.2	-0.6
MARI-SANCH	4.1	3.8	2.6	-1.2	4.0	3.0	-1.0	4.4	3.6	-0.8
Granada										
GRAN-KI2CE	5.2	4.9	4.9	-0.1	5.0	4.9	-0.1	5.2	5.1	-0.2
GRAN-CEDAR	4.9	4.8	4.4	-0.4	5.0	4.6	-0.4	5.2	4.8	-0.3
GRAN-DESOT	4.8	4.8	4.2	-0.5	4.9	4.5	-0.5	5.1	4.7	-0.4
BRID-GRANA	4.6	4.7	4.2	-0.5	4.9	4.4	-0.5	5.1	4.7	-0.4

		25 Year			50 Year			100 Year		
Node ID	LOS El. (ft) (Crown + 0.5 ft)	Rev. Ex. Stage (ft)	Proposed Stage (ft)	Δ (ft)	Rev. Ex. Stage (ft)	Proposed Stage (ft)	Δ (ft)	Rev. Ex. Stage (ft)	Proposed Stage (ft)	Δ (ft)
Cordova										
CORD-KINGS	5.6	5.8	5.7	0.0	5.8	5.8	0.0	5.9	5.9	0.0
CORD-K2BR1	5.4	5.5	5.2	-0.2	5.6	5.3	-0.2	5.6	5.4	-0.2
CORD-K2BR2	5.1	5.3	4.9	-0.3	5.4	5.0	-0.4	5.4	5.1	-0.4
CORD-BRIDG	4.5	5.2	4.7	-0.4	5.3	4.9	-0.4	5.4	5.0	-0.4
CORD-BR2PA	4.2	5.0	4.5	-0.5	5.1	4.6	-0.4	5.1	4.7	-0.4
MARI-SANCH	4.1	4.7	4.1	-0.6	4.9	4.4	-0.5	4.9	4.5	-0.4
Granada										
GRAN-KI2CE	5.3	5.3	5.1	-0.2	5.5	5.2	-0.3	5.5	5.3	-0.2
GRAN-CEDAR	4.9	5.3	5.0	-0.3	5.4	5.1	-0.3	5.5	5.2	-0.3
GRAN-DESOT	4.8	5.3	4.9	-0.4	5.4	5.1	-0.3	5.4	5.1	-0.3
BRID-GRANA	4.6	5.3	4.9	-0.4	5.4	5.0	-0.4	5.4	5.1	-0.3

*values are in feet NAVD88

3.5 Underground Storage Recommendation

The original concept included construction of a 22,500-cu-ft foot stormwater detention vault in the parking lot south of City Hall. The vault invert would be below the seasonal high-water table, and therefore need to be sealed. For the vault to be dry prior to precipitation events, a drawdown pump of limited capacity to pump down its volume in a time frame of 48-96 hours after the storm is required. Ballast and/or anchoring would also be required for consideration of buoyancy effects.

Preliminary modeling and analysis have been performed to quantify a high-level cost-benefit assessment, which considered a number of challenges anticipated with constructing the proposed stormwater vault. Based on geotechnical investigation, the seasonal high groundwater table was estimated to be within 2 feet of the land surface. Also, an artesian well was identified near the proposed vault underneath the surface lot. Preliminary modeling results suggest benefits ranging from 0.2 feet to 0.0 feet of peak stage reduction for the mean annual through 25-year 24-hour design storm events, with an average of 0.1 feet. This assumes a raised parking lot of 12 inches. Based on the estimated inflows, the proposed vault would provide 2.9 percent to 1.0 percent of the volumetric storage for the mean annual through 25 year 24-hour design storm event.

A concrete vault that would provide 22,500 cubic feet of storage has an opinion of probable cost installed of approximately $750,000. A modular product wrapped with an impermeable liner has an opinion of probable cost of $500,000. These vault systems would also require pumping system operations and maintenance, as well as sediment and debris maintenance.

From discussions with the City on February 8, 2019 and determination provided on February 20, 2019, the City elected to allocate grant funds towards other areas of the project that would be more beneficial, such as extending the conveyance system to the northern segments of Granada and Cordova from Cedar Street up to King Street as part of the overall drainage improvement concept.

3.6 Backflow Prevention Identification

A preliminary backflow prevention needs list was created from a desktop exercise as part

of the original engineering analysis for the project grant application. Field verification took place on March 5th and March 14th, with additional support from the City Stormwater Maintenance Crew and coordination with FDOT.

3.7 Locations List Preliminary Validation

The current list of Outfalls and Pipes to be retrofitted is provided in **Table 3-3**.

Table 3-3

Vulnerable Outfalls for Check Valve Retrofit

Outfall ID	Project Component/ Location	Report Comment
OF-LMS	LMS Outlet Structure	Proposed structure, 2 @24”
SWGM000848 (N) SWGM000854 (S)	Carrera St 2- 12" Concrete	In-line Protection along Carrera Street Between Riberia and Sevilla. Protects from surface inflows off Riberia Street.
SWGM000270	Valencia St 2- 12"	In-line Protection along Valencia Street Between Riberia and Sevilla. Protects from surface inflows off Riberia Street.
OF-0046	Avenida Menendez @ Fort 1- 42" (FDOT Plan to Install)	FDOT has installed or plans to install Valves along the Bayfront
OF-0050 OF-0051	Avenida Menendez @ Hypolita St 2- 24" (FDOT Installed)	
OF-0045	Avenida Menendez just North of Treasury St 1- 48" (FDOT Plan to Install)	
OF-0047	Avenida Menendez @ Treasury St 1- 12" (FDOT have not Installed)	FDOT does not have plans to install in these locations. City needs to work with FDOT on retrofitting for this project
OF-0053* OF-0157*	Bridge of Lions 1- 12" (not Installed) 1- 24" (FDOT Installed)	
OF-0052*	King Street (FDOT To Upgrade and Install)	12” to be removed and replaced with dual 42” pipes for the King Street project. May need temporary valve install due to timing between projects.
OF-0054	Artillery Lane/Municipal Marina 1- 18" PVC	There is a flap 18" (similar style to the Seawall outfalls) inside the vault located near the street, on the side closest to sidewalk

Outfall ID	Project Component/ Location	Report Comment
OF-0062	Avenida Menendez @ Bravo Lane 1- 24" CPP	Measurements of the outfall pipe at the seawall differ than As Builts; OF-0159 is 24" I.D. corrugated plastic
OF-0159	Avenida Menendez @ Bridge Street 1- 24" CPP	Measurements of the outfall pipe at the seawall differ than As Builts; OF-0159 is 24" I.D. corrugated plastic
OF-0056	Avenida Menendez 1- 24" CPP	Measurements of the outfall pipe at the seawall differ than As Builts; OF-0156 is 24" I.D. corrugated plastic, slightly out of round
OF-0061	Avenida Menendez @ St. Francis Street 1-12" CPP	Measurements of the outfall pipe at the seawall differ than As Builts; 12" I.D. corrugated plastic
OF-0063	Marine Street 1- 10" PVC	located second pipe that is connected to the inlet basin. Outfall was not able to be measured because the end of pipe is damaged and needs replacement and/or repairs. Propose Install inline valve at upstream inlet.
OF-0071	San Salvador 1- 18" PVC	Outfall area had been recently cleaned out. Would be best to plan to replace the old style duck bill with the new inline design
OF-0072	Tremerton Place 1- 12" Clay	Located the outfall pipe, its shown in the current GIS layout, 12-inch clay I.D.
OF-0074	Bonita Bay Drive 1- 24" RCP	There is an old style flap gate on the end of pipe that is rusted and missing the seal. Would need to be replaced with updated design (inline). Confirmed that the pipe size is 24-inch RCP. Pipe also needs cleaning, had sediment, leaves build up inside. No oyster growth. There is a stormceptor manhole system upstream in place that is not mapped. Needs maintenance (build up of sediment that needs to be removed).
OF-0078	Hedrick Street 1- 10" Clay	Propose integrating this outfall into the bulkhead design as this would be located near the proposed bulkhead.
~~SWGM000446~~	~~Bridge St @ Sanford St~~	**Determined No Backflow Preventer Required**
~~OF-0048~~	~~Cordova Street Outfall 2~~	**Determined No Backflow Preventer Required**
~~OF-0057~~	~~Cordova Street Outfall 2~~	**Determined No Backflow Preventer Required**
~~OF-0060~~	~~Park Place Outfall~~	**Determined No Backflow Preventer Required**
~~OF-0068~~	~~St Francis Street Outfall~~	**Determined No Backflow Preventer Required**
~~OF-0069~~	~~Park Place Outfall~~	**Determined No Backflow Preventer Required**
~~OF-0070~~	~~Cordova Street Outfall 3~~	**Determined No Backflow Preventer Required**

Outfall ID	Project Component/ Location	Report Comment
OF-0075	Cordova Street Outfall 4 1- 15" Plastic	Outfalls into the marsh, south of Lake Maria Sanchez from St. George Street. The outfall is a 15-inch round plastic pipe.
OF-0077	South Street Outfall 1- 24" RCP	Outfalls into the marsh, south of Lake Maria Sanchez from Washington Street. The outfall is an elliptical shape, RCP, not clear on the size/diameter, was silted in about 50%.

***** For OF-0053, the FDOT 12-inch outfall, this is not on FDOT's list of outfalls to be retrofitted along the Bayfront. The City will need to work with FDOT on this location. May need to go ahead and install as part of the Lake Maria Sanchez project with FDOT's permission.

Similarly, OF-0157 (FDOT 12-inch outfall), is not on FDOT's list of outfalls to be retrofitted along the Bayfront. The City will coordinate with FDOT for both locations since they are not part of the initial valve retrofitting for FDOT.

For OF-0052 (12" existing outfall), the City may consider a temporary valve in this location due to the timing of the King Street FDOT project and this project.

3.8 Pump Station Design Flow Capacity Determination

The pump station will include three (3) low head pumps capable of pumping 75 cfs each, with two (2) duty and one (1) standby. The pumps will be controlled by a local control panel and a level system (such as a pressure transducer or ultrasonic device) based on wetwell water elevations.

3.9 Lake Maria Sanchez Outfall Design Characteristics

A new gravity discharge was recommended in the Engineering Report submitted with the HMGP application. The new structure recommended was to consist of a precast FDOT Type H inlet structure approximately 10 ft long by 4 ft wide by 10 ft deep. The normal water level and weir height restrictions are to be maintained in accordance with the existing Environmental Resource Permit (ERP) number 82626, as discussed with the St. Johns River Water Management District (SJRWMD) during a pre-application meeting on May 23, 2017. This recommendation will be further evaluated and may be modified in future designs to maintain brackish water conditions to preserve current lake ecology, though this is not a requirement of the ERP.

3.10 Water Quality Impacts Assessment

The proposed project will not alter existing water quality function in Lake Maria Sanchez.

As previously mentioned, the lake conditions will adhere to ERP Permit 82626. Based on preliminary public input, the outfall will need to maintain current tidal flow but to also provide for flood protection.

As for wetlands, temporary wetland impacts due to construction activities are expected to occur as well as minor impacts to adjacent wetlands depending on the final seawall route and extent in relation to MHW line.

3.11 Proposed Design Elements Sketch Plan and Detail Sheets

Conceptual plan and profile sheets are attached in Appendix III.

4.0 BACKFLOW PREVENTION DEVICES FIELD VERIFICATION

The location of the proposed backflow prevention devices was evaluated and corroborated with City staff. The review included field reconnaissance for documentation. Condition assessments were conducted by the City and provided in Appendix IV.

5.0 STORMWATER/UTILITY REVIEW AND ANALYSIS

Following topographic surveying of the project area roadways, review of the information revealed that the storm sewer inlets are mostly full of water and sediment. This was confirmed through site visits and visual observation. Visual observation also confirmed the discharge pipe(s) to be submerged below the lake water surface. Further information obtained confirmed the outfall pipe(s) are submerged and "silted in" as indicated on a Lake Maria Sanchez cross-section dated February 5, 2002. The cross-section drawing in Figure 5-1 is part of the project plans developed in 2002 titled, Maria Sanchez Basin Stormwater Improvement. This project was not implemented nor was the muck and silt removed from the lake.

Muck and silt removal are not part of the project scope approved by FEMA.

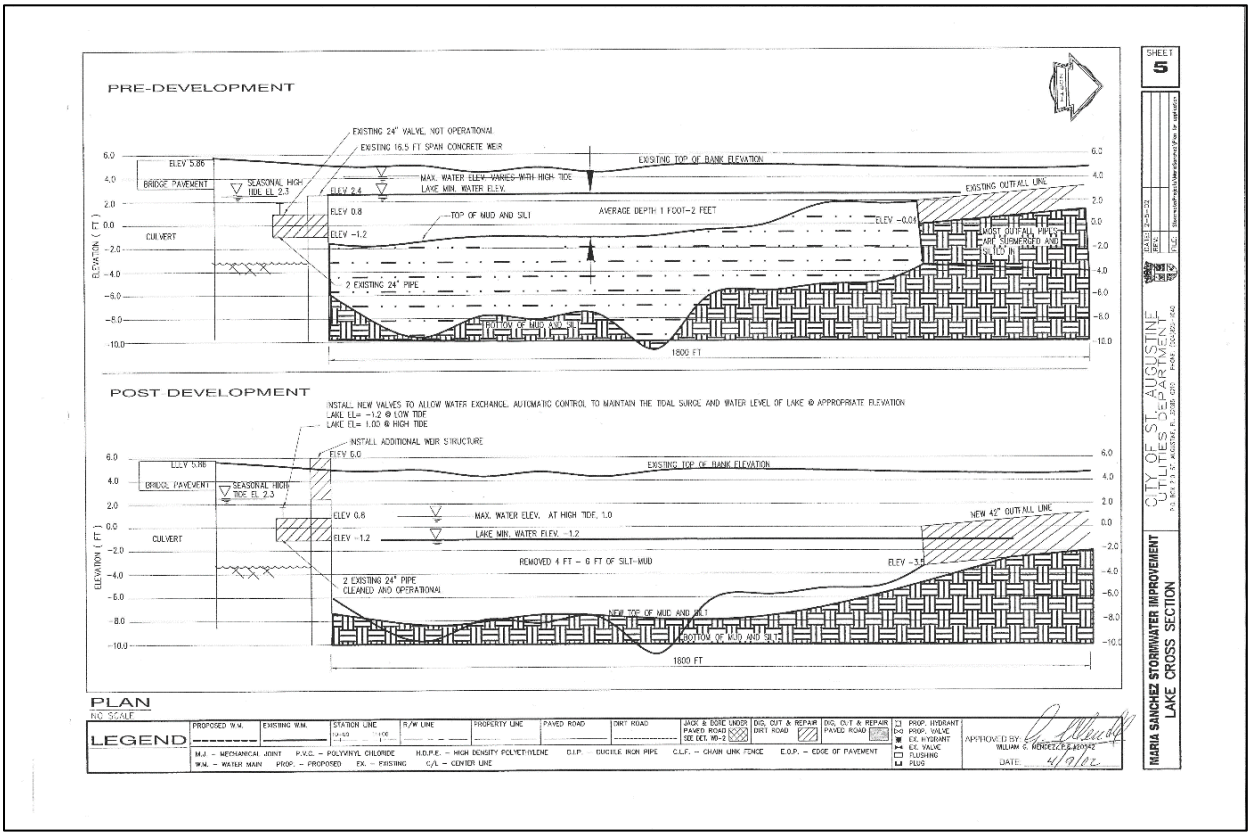


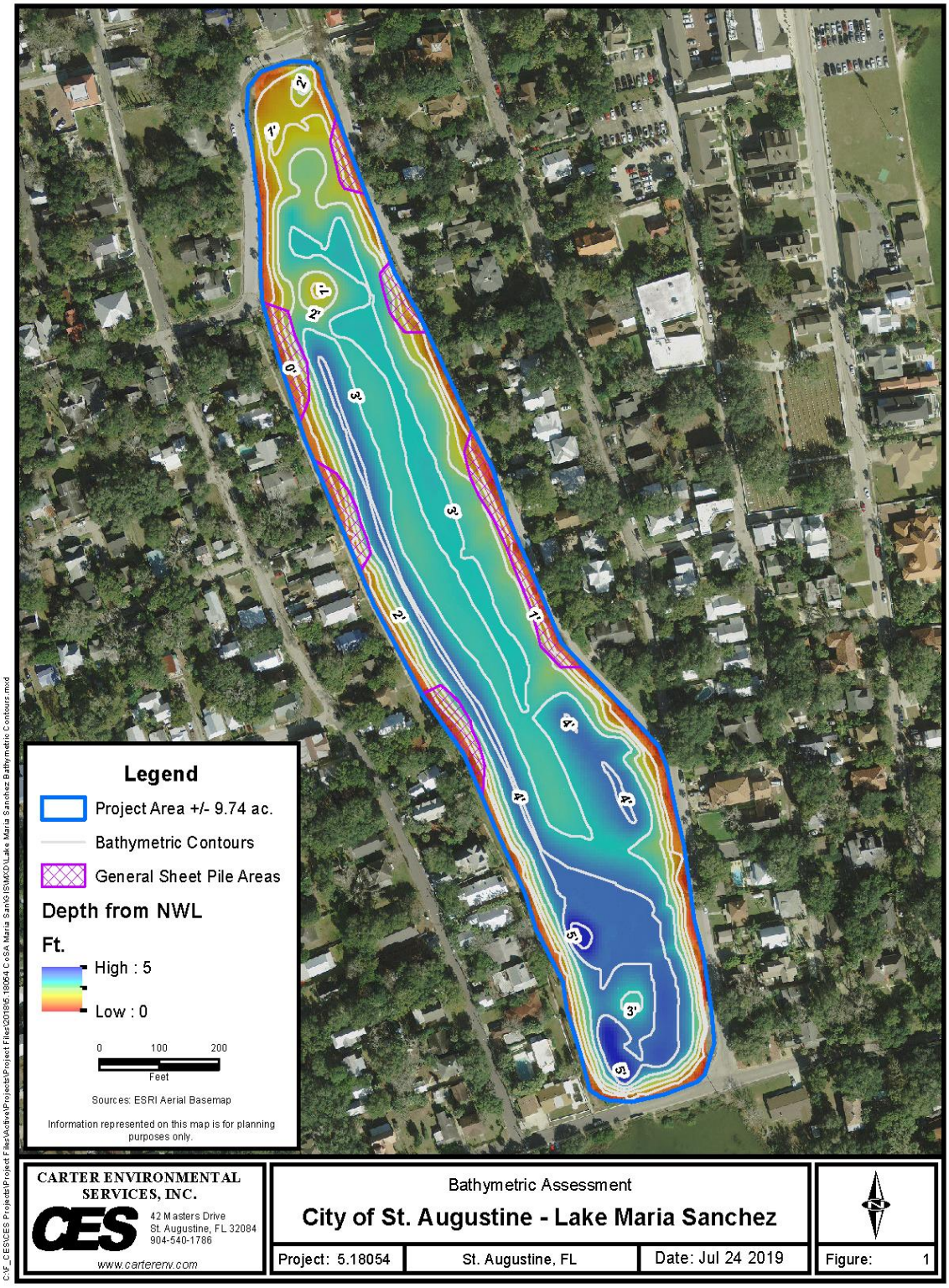
Figure 5-1: 2002 Survey Cross Section of Lake Maria Sanchez. Credit City of St. Augustine, FL

It should be noted the previous survey is not correlated to the recent topographic information. The survey performed in 2002 used the National Geodetic Vertical Datum of 1929 (NGVD 29) and the recent survey uses the North American Vertical Datum of 1988 (NAVD 88).

There is an approximate conversion from NGVD 29 to NAVD 88. The conversion in the Lake Maria Sanchez area is 1.056 feet. So, NAVD 88 = NGVD 29 – 1.056. This is as provided by the City and reported to be in Table 20 of the Flood Insurance Study for St. Johns County, Volume 3 of 7, revised December 7, 2018

While this survey information was useful in determining the storm sewer conveyance is submerged and likely silted over, it is dated 2002 and probably does not represent actual subsurface elevations.

Additional information was acquired through Carter Environmental to help identify water depths within the lake near proposed improvements prior to detailed design.


Legend
Project Area +/- 9.74 ac.
Bathymetric Contours
General Sheet Pile Areas
Depth from NWL
Ft.
High : 5
Low : 0
0
100
200
Feet
Sources: ESRI Aerial Basemap
Information represented on this map is for planning purposes only.
CARTER ENVIRONMENTAL SERVICES, INC.
CES
42 Masters Drive
St. Augustine, FL 32084
904-540-1786
www.carterenv.com
Bathymetric Assessment
City of St. Augustine - Lake Maria Sanchez
Project: 5.18054
St. Augustine, FL
Date: Jul 24 2019
Figure: 1
C:\F_CES\CES Projects\Project Files\Active\Projects\Project Files\2018\5.18054 CoSA Maria San\GIS\MXD\Lake Maria Sanchez Bathymetric Contours.mxd

6.0 PUMPING STATION LEVEL OF SERVICE

6.1 Basic Data Reviewed

The following data was utilized for the analysis of pumping station alternatives:

- State of Florida – Hazard Mitigation Grant Program (HMGP) Application, including the Lake Maria Sanchez Flood Mitigation Project Engineering Report, submitted by the City of St. Augustine, Florida.
- Aerial photography viewed on Google Earth.

6.2 Site Conditions

The pumping station site is proposed to be constructed with direct connection to Lake Maria Sanchez to control the lake level. Additional bathymetric survey information may be required to develop the bottom elevation of the pump station within the lake. The Current Effective 100-year Base Flood Elevation (BFE) for proposed location of the Pump Station is 8 feet NAVD88.

6.3 Design Considerations

6.3.1 Site Layout

The initial site for the proposed pump station construction is at or near the existing lake outfall as indicated in the Engineering Report of the HMGP application.

6.3.2 Pumps

The pump station concept provided in the HMGP Application depicted submersible pumps and a standby generator to provide emergency power. The City indicated they have no preference to type of pump or manufacturers. Stormwater pump manufacturers will be contacted regarding equipment requirements during detail design.

6.3.3 Hydraulics

The pumping station will discharge through a force main that will originate at the

station and discharge under South Street to the area downstream of Lake Marcia Sanchez. The size of force main was depicted as a 36-inch diameter pipe in the HMGP Report.

At 75 cfs, the velocity in the 36-inch force main will be 10.6 ft/s, based on the nominal diameter. Given the higher velocity realized in a 36-inch pipeline, larger diameter pressure main piping will be considered during detail design. Consideration will also be given to placement of energy dissipation at the pipe outlet.

6.4 Pertinent Features

The following items will be reviewed for final design.

- Current design standards of the City of St. Augustine will be followed including, but not limited to, requirements for all electrical equipment/panels be located at least 2 feet above the 100-year flood elevation.

- Pumps will be either constant speed or may operate at reduced speed (capacity) by use of variable frequency drive equipment (VFDs). If VFDs are used, each pump will be equipped with a VFD to provide reliability.

- Firm capacity will be provided for the pumping equipment (i.e., a standby pump of the largest capacity pump installed will be provided).

- A generator will be provided for the firm capacity of the pumping equipment, plus miscellaneous building loads or an engine driven pump included for emergency backup.

- A manual coarse bar screen will be provided ahead of the station to prevent entry of large solids.

- A baffle will be provided in front of the pumps to prevent wet well currents that may cause vortex formation around the pumps. This baffle can be constructed of either concrete or aluminum frame/plate.

- The pump discharge piping will be routed through a valve vault and combined outside of the vault to a common header (force main).

- The top of the station and hatches will be traffic rated (H20 loading).

- Layout of the pump station will be optimized to allow adequate vehicular access to the pumps.

- Florida Power & Light was contacted regarding availability of 480-volt, three phase electrical service. The local engineer reported there is an overhead 3 phase line running along South Street but not an existing 3 phase 480V transformer. Facilities will need to be installed for service, but power is available.

6.5 Pump Station Operation

The pump capacities will be used to determine the dimensions of the wet well. These pumps have a limitation on how many times they can be started per hour without overheating. A value of 10 starts per hour (i.e., every 6 minutes) is a typical design value and will be used for this evaluation. The required operating volume is a function of the pump capacity and the maximum number of starts per hour.

For the Triplex pump station, operations will be specified such that one pump is always on standby. As stormwater enters the pump station, a Lead starts at a fixed (higher) level and operates until the pump off (lower) level is reached.

However, if the water level continues to rise, the lag pump starts. Both pumps continue to operate down to a common "pump off" level. The third, or standby pump, only starts if the lead or lag pump fail.

Once this scenario of pump operations starts and stops, the sequence will rotate to the other pumps.

For VFD operation, the range of operating depth for control of the VFD is related to the reaction time of the VFD and the rate of change of incoming flow. A value of 2 feet will be assumed for the control range in the wet well for the VFD. In addition, an operating volume below the VFD operating level will be calculated based on the low speed capacity of the pump. This protects the pump from overheating if the flow entering the station is

lower than the capacity of the pump at lowest speed.

Use of VFD driven pumps may not result in significant reduction of pump station depth; however, use of VFD driven pumps may present advantages over constant speed pumps. The main advantage is that the pump capacity can be matched to stormwater flow rate, resulting in fewer starts and stops for the pumps and energy savings.

A disadvantage of VFD use is the requirement of a nominally larger air conditioning unit. VFD units can generate significant heat during operation.

6.6 Recommendation of Alternative

The recommended site and layout provide a means of conveying the improved stormwater conveyance directly to the pump station. The pump station will be open to the lake with a screen to prevent large debris from entering. Other criteria and components include the following:

- The capacity of the station will be met by two operating and one standby VFD pumps.

- Variable frequency drives will be utilized to minimize pump starts by matching flow within the pump/drive capability.

- Landscaping shall be provided to blend with the existing neighborhood residential landscaping and will be low maintenance.

- Site lighting will be designed to minimize the light pollution to the night sky and to reduce the impact on nocturnal ecology.

- The stormwater pump station control building will be constructed to blend in with neighborhood structures. The materials of construction for the building will be selected for their low maintenance characteristics, both interior and exterior. The first floor of the pump station building will be located one foot above the 100-year flood elevation. Electrical equipment will be set above the 100-year BFE plus 2 feet.

- The pump station wetwell will be constructed of cast in place reinforced concrete.

- A standby power generator is proposed to provide power for the pumping equipment and other miscellaneous building loads during interruption of utility power. The standby power generator will be at the same elevation as the Electrical equipment room.

- The proposed electrical and instrumentation equipment will be located inside the pumping station building. The only external electrical equipment that is located on the station site will be: 1) junction boxes located 2 feet above the 100 year flood elevation for connecting the pump submersible power cables to power and control wiring from the electrical control room, 2) pad-mounted transformer elevated so that critical components are 2 feet above the 100-year flood elevation, and 3) site lighting at the pumping station.

7.0 BULKHEAD PLANNING AND ANALYSIS

7.1 Background

The Lake Maria Sanchez Flood Mitigation and Drainage project has been launched to reduce flooding risk in the City of St. Augustine. The design includes approximately 1,900 linear feet of a bulkhead floodwall along the north, east and west boundaries of the wetland to the south of Lake Maria Sanchez which feeds the Lake. It will be constructed to aid in flood mitigation and control, specifically for nuisance flooding and the 1% annual chance flood.

The purpose of this section is to analyze alternative floodwall concepts and determine advantages and disadvantages of each alternative from the perspective of capital cost and technical merit. The analyses presented are considered sufficient as the basis for comparison but note that they are not finalized.

7.2 Environmental Criteria

The following environmental criteria and loadings are recommended as a basis for the analysis/design for the bulkhead, or similar structure and its associated structures:

7.2.1 Design Life

The design life for the primary structural components of the flood wall shall be 50 years. This is typical, economical practice for marine structures due to the corrosive environment. If desired, longer design life may be achieved through a combination of coatings and protective barriers to minimize saltwater exposure, sacrificial material, and cathodic protection measures.

7.2.2 Wind Criteria

Wind speed is taken for a 3-second gust at 33 feet above the ground for Exposure Category ‘C’. The 100-year return period wind at the project location is estimated to be 71 mph. For structures, in accordance with section 26 of ASCE 7-10, the maximum design wind speed of 131 mph is considered.

7.2.3 Current Criteria

Currents in the Lake Maria Sanchez area and south of the lake are assumed to be low. The effect of flowing water on the bulkhead shall be based on an assumed

nominal current speed of 0.6 feet per second used in combination with the other loads listed.

7.2.4 Wave Criteria

Operational wave conditions at the Project location were assessed through hindcast wind-driven waves based on a 1-year wind return period condition. Using the 1-year return period wind condition of 32.3 knots, the fetch limited operational wave at the project location was calculated to be 1.2 feet with a 1.9 second period. A 1-year operational water level of 4.16 feet NAVD was calculated by summing MHHW (1.96 feet NAVD88) and the intermediate scenario sea level rise (SLR) (2.2 feet).

The depth-limited wave, assuming a water depth of 7.5 feet (corresponding to the wall height and bathymetry contours at the toe of the wall), is 5.9 feet (max height). This yields a significant wave height of 3.3 feet with a period of 3.5 seconds, which is to be taken as a maximum loading condition on the wall based on a sensitivity analysis of worst-case water elevation. This corresponds to an averaged wave height of a Category 1 and Category 2 hurricane wind event.

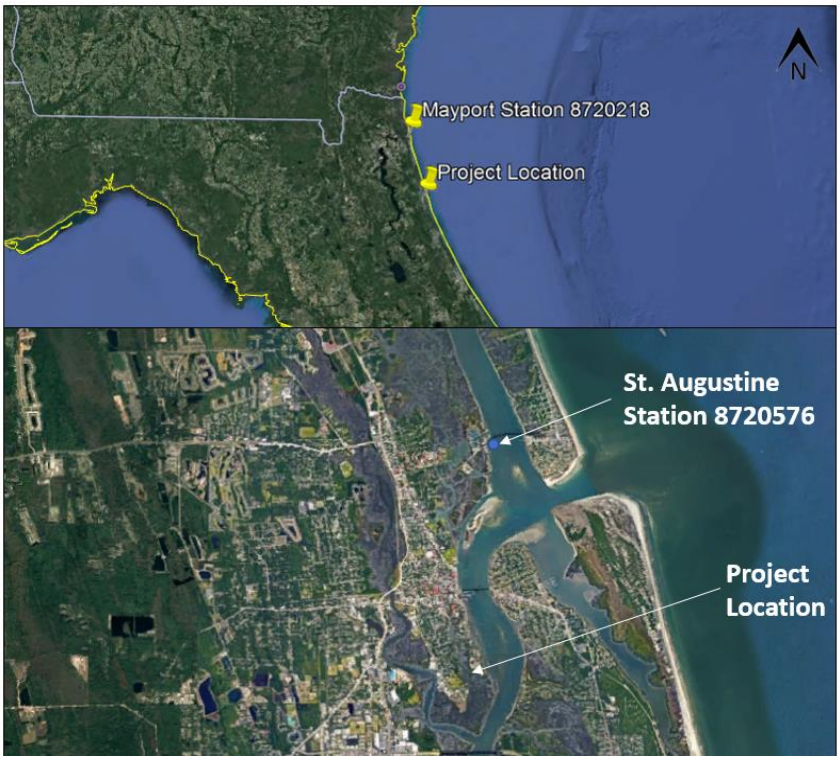


Figure 7-1: NOAA Station Locations

7.2.5 Tide Levels

Operational water levels were determined based on two tidal references: NOAA St. Augustine Station 8720576 near the project site and NOAA Mayport Station 8720218 near Jacksonville, Florida. The water level due to tides taken at the Mean Higher High-Water level is 2.05 feet. Figure 7-1 shows the station locations and Table 7-1 shows the tidal datums for the Mayport station.

Table 7-1

Tidal Datums for St. Augustine Station (NOAA)

Datum	MLLW	NAVD88	Description
Wall Height	**9.93**	**7.00**	**Design Wall Elevation**
MHHW	**4.98**	**2.05**	**Mean Higher-High Water**
MHW	**4.64**	**1.71**	**Mean High Water**
MSL	**2.43**	**-0.50**	**Mean Sea Level**
MLW	**0.17**	**-2.76**	**Mean Low Water**
MLLW	**0.00**	**-2.93**	**Mean Lower-Low Water**
NAVD88	**2.93**	**0.00**	**North American Vertical Datum of 1988**
GT	**4.98**	**2.05**	**Great Diurnal Range**
MN	**4.48**	**1.55**	**Mean Range of Tide**
Max Tide	**7.06**	**4.13**	**Highest Observed Tide**
Max Tide Date & Time	**10/7/2016 18:54**	**11/3/1978 15:18**	**Highest Observed Tide Date & Time**
Min Tide	**-2.65**	**-5.58**	**Lowest Observed Tide**
Min Tide Date & Time	**3/8/2008 19:42**	**4/5/1977 19:06**	**Lowest Observed Tide Date & Time**

7.2.6 FEMA Flood Elevations

Flood elevations are based on FEMA Flood Insurance Rate Map (FIRM) No. 12109C0318J, dated December 7, 2018.

- Flood Zone Classification: AE
- Base Flood Elevation (100-year flood): EL +7 ft to EL +8 ft

7.2.7 Sea Level Rise (SLR)

With a majority of the city being located in a flood plain, the City of St. Augustine is proactively identifying areas of risks as it relates to the inevitable effects of sea level rise.

The Florida Department of Economic Opportunity (DEO) Community Resiliency Initiative selected the City of St. Augustine to participate as one of three pilot communities to study vulnerability to coastal flooding and to assist in identifying steps that can be taken to help adapt to those vulnerabilities. The result of the project were two deliverables, a Coastal Vulnerability Assessment and a Strategic Adaptation Plan, which are both publicly available and references as part of this study.

Sea level rise projections for a variety of scenarios were investigated to establish a likely SLR scenario for the Project. Ultimately an SLR of 1.5 feet for the year 2050 was selected for project planning and design criteria based on the NOAA high intermediate projections at the Mayport, Florida short-term gauge.

Aside from this project, the City is taking a number of actions, in mitigating, managing, educating, and adapting to Sea Level Rise.

7.2.8 Surge Elevations

Extreme water levels were evaluated using Peak-Over-Threshold methodology in order to determine return periods for surge. Design will consider a surge of 2.0 feet, corresponding to the 100-year event. This statistical approach to risk, in accordance with FEMA methodology, is recommended for economical design, rather than constructing to a specific historical storm (e.g. Hurricane Matthew).

7.2.9 Design Still Water Level

The design still water level for the project was calculated as a combination of water levels above, outlined as follows:

- Tides – Mean Higher High Water (MHHW) level: 1.96 feet NAVD88
- Surge – 100-year event: 2.0 feet

- Wave Setup – Average of Category 1/Category 2 Hurricane induced wind-wave: 0.77 feet
- Sea Level Rise – Intermediate Scenario: 2.2 feet

The summation of the values above results in a Design Water Elevation of 6.93 feet NAVD88, or approximately 7 feet NAVD88, which is recommended for extreme water level design.

The floodwall will initially be constructed to EL +7.0, with an adaptable design providing for an increase to EL +8.4 in the future. It is important to note that at EL +7.0 the floodwall will decrease nuisance flooding, but it will not be effective for larger storm events and will not modify the FEMA FIRM.

7.2.10 Temperature

The record high temperature for St. Augustine, FL is 103°F, and the record low is 10°F. All structures shall be designed to accommodate thermal forces across this range of temperature.

7.3 Structural Loads

The following vertical and horizontal loading conditions shall be used for the design of the proposed structures, considering the conditions outlined in "Environmental Criteria."

7.3.1 Vertical Design Loads

Dead Load: The bulkhead structure or similar alternative shall be designed for the structure self-weight and the superimposed dead load transmitted by earth pressures, hydrostatic pressures, and miscellaneous features.

Uniform Live Load: The bulkhead structure shall be analyzed with 250 psf uniform live load to simulate truck and emergency vehicle access.

Uplift Loads: The structures shall be designed to withstand uplift loads due to tidal rise, storm surge, and wave action.

7.3.2 Lateral Design Loads

Wind Load: Wind loads shall be calculated per ASCE 7-10. In order to calculate necessary coefficients for the lateral wind force, the bulkhead or alternative structure will be considered a solid, freestanding wall.

Current, Waves: The effect of flowing water on the structure shall be calculated in accordance with section 3.7 of AASHTO Standard Specifications for Highway Bridges assuming a current speed outlined in Section 2, "Environmental Criteria."

The design wave force on the floodwall is calculated using Goda's formula for wave force on a vertical wall, summarized in the Coastal Engineering Manual (USACE, 2008), with an increase of 25% based on guidance from the Coastal Engineering Research Center (USACE, 1988). For the design, depth-limited wave, this yields a design load of 2,920 plf.

Impact Loads: Accidental impact of personal vessels and impact of floating debris shall be considered in accordance with the recommendations of HSDRRS. Impact loads from vehicles on crash barriers shall be considered in accordance with AASHTO recommendations.

7.3.3 Seismic Loads

Building Loads: No buildings are anticipated within the zone of influence of the floodwall.

Lateral Earth Pressure: Earth pressure will be determined in accordance with Rankine theory based on the geotechnical properties provided by the geotechnical engineer.

Seismic Loads and Methods of Analysis

The structure will be analyzed in accordance with the ASCE 7-10, Chapters 12 and 15 "Seismic Design Requirements for Nonbuilding Structures." The following seismic design loads and methods of analysis are utilized:

- Lateral loads are resisted by the interaction of the substructure elements with the surrounding soil and rock mass.

- For the analysis it is assumed that the seismic mass is calculated from the sum of dead loads.
- The equivalent lateral force procedure will be used to determine seismic loads.
- Seismic design parameters:

o	Short Period Spectral Response Acceleration	0.099 g
o	Site Amplification Factor Short Period	1.6
o	Soil Site Class	D
o	Occupancy Category	II
o	Importance Factor	1.0
o	Seismic Design Category	B

Load Combinations

Combinations of applied loading shall be in accordance with Chapter 2 of ASCE 7-10 and the International Building Code (IBC) Chapter 16.

7.4 Analysis and Design

7.4.1 Analysis

Structural models shall be based on a pseudo-static analysis. Live loads and environmental forces such as wind, wave, and current shall be considered as static loads.

7.4.2 Design Limit States

For the floodwall, flexure and embedment failure modes will meet the minimum factor of safety specified by EM 1110-2-2502.

7.4.3 Deflection Limits

To prevent damage to concrete cap and nonstructural components, the bulkhead shall be designed with a maximum deflection of 3.0 inches under normal loads. Limit under impact load cases will be determined during design. For design purposes, deflection is measured theoretically with respect to the sheet pile toe.

7.4.4 Overtopping

The maximum wave runup and overtopping flow rate will be estimated to aid

design of the landside drainage system. A scour protection mat will be sized to prevent loss of passive earth pressure in the event of overtopping.

7.4.5 Permeability and Seepage

Bulkhead interlocks will include a sealant installed by the contractor prior to installation. The intent of the sealant is to significantly slow the flow of water through the bulkhead interlocks. It is important to note that the interlocks will not be completed sealed and that leaking of water through the bulkhead interlocks should be anticipated and accounted for as part of the landside drainage system (by others). Seepage under the bulkhead tip will be consider in conjunction with the drainage system design.

7.5 Corrosion Protection

Design for longevity of reinforced concrete components will be accomplished with the use of increased clear cover over the reinforcing and a durable concrete mix design. The design will not rely on epoxy coating of reinforcement as nicks are inevitable and the resulting longitudinal path for corrosion between coating and bar can accelerate deterioration compared to conventional black reinforcing.

Corrosion protection for miscellaneous metal (carbon steel) fabrications shall be achieved by epoxy polyamide coating or hot-dipped galvanizing. Where required, provide paints and primers compatible with substrate to enhance both visibility and durability.

Steel sheet piling which is usually submerged may be further protected by sacrificial anodes.

7.6 Floodwall Alternatives

Three alternatives are considered for the structural design of the floodwall. The same ground profile was used for all three to calculate earth pressures and capacity, and a 50-year design life is considered. Each alternative will have a similar drainage system to manage excess hydrostatic pressures and infiltration due to rainfall or under-seepage. See Appendix VII for typical floodwall sections. Note that a concrete coquina fascia or other architectural finish may be used for any of the alternatives to address aesthetic concerns.

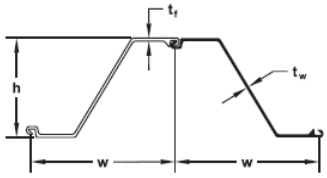
Appropriate modifications to the concrete cap (e.g. sloped top surface) will be made to ensure public access is restricted.

The design subsurface profiles were determined from the geotechnical report, then preliminary structural analyses were performed to determine the required size and capacity of each primary element. Calculations considered hydrostatic loading and stability criteria only. Seepage calculations have not yet been performed, and this concern may dictate additional wall embedment to reduce demand on the landside conveyance and pumping systems. The seepage rate will be comparable for each alternative and is therefore neglected for the purposes of this analysis.

Alternative 1 – Steel Sheet Piles

This concept uses steel sheet piles in an I-wall configuration to provide the required flood control. SupportIT version 2.37 by Gtsoft was used to design the pile size and embedment. An AZ 26-700 section was selected with a tip elevation of approximately EL -24 feet (NAVD 88). A typical section of the steel sheet pile is provided in Figure 7-2, with corresponding section parameters, and an example appearance is shown in Photo 7-1. A concrete cap will be used for this alternative. Also, a scour blanket will be provided on the protected side to prevent loss of passive earth resistance in the event of overtopping.

Alternate sheet pile materials are not considered due to durability and performance concerns. For example, vinyl sheet piling is subject to excessive deflection and creep under load, and the potential ground deformations and resulting seepage paths are detrimental to floodwall design. Fiberglass sheeting may meet the structural demands initially but can deteriorate when exposed to UV light despite recent advances in protective veils. Additionally, maintenance and repair of these materials is more difficult and less common.



SECTION	Width (w) in (mm)	Height (h) in (mm)	THICKNESS Flange (t_f) in (mm)	THICKNESS Web (t_w) in (mm)	Cross Sectional Area in²/ft (cm²/m)	WEIGHT Pile lb/ft (kg/m)	WEIGHT Wall lb/ft² (kg/m²)	SECTION MODULUS Elastic in³/ft (cm³/m)	SECTION MODULUS Plastic in³/ft (cm³/m)	Moment of Inertia in⁴/ft (cm⁴/m)	COATING AREA Both Sides ft²/ft of single (m²/m)	COATING AREA Wall Surface ft²/ft² (m²/m²)
AZ 26-700	27.56 700	18.11 460.0	0.480 12.20	0.480 12.20	8.84 187.2	69.12 102.90	30.10 146.90	48.4 2600	57.1 3070	437.3 59720	6.33 1.93	1.38 1.38

Figure 7-2: Typical Steel Sheet Pile Section with Corresponding Dimensions



Photo 7-1. Example Steel Sheet Pile Finish

Alternative 2 – Precast Concrete Sheet Piles

This concept uses precast/prestressed concrete sheet piles in an I-wall configuration to provide the required flood control. This has a similar structure to the previous alternative, differentiating primarily in the sheet pile material. A cast-in-place concrete cap will be also

used for this alternative, and a scour blanket will be provided on the protected side to prevent loss of passive earth resistance in the event of overtopping.

The concept design estimates a required thickness from 14 to 18 inches. For this alternative analysis, a section depth of 14 inches will be assumed with 16 reinforcing strands per pile. Tip elevation will be EL -24 feet. The typical sheet pile section is shown in Figure 7-3, and an example appearance is shown in Photo 7-2.

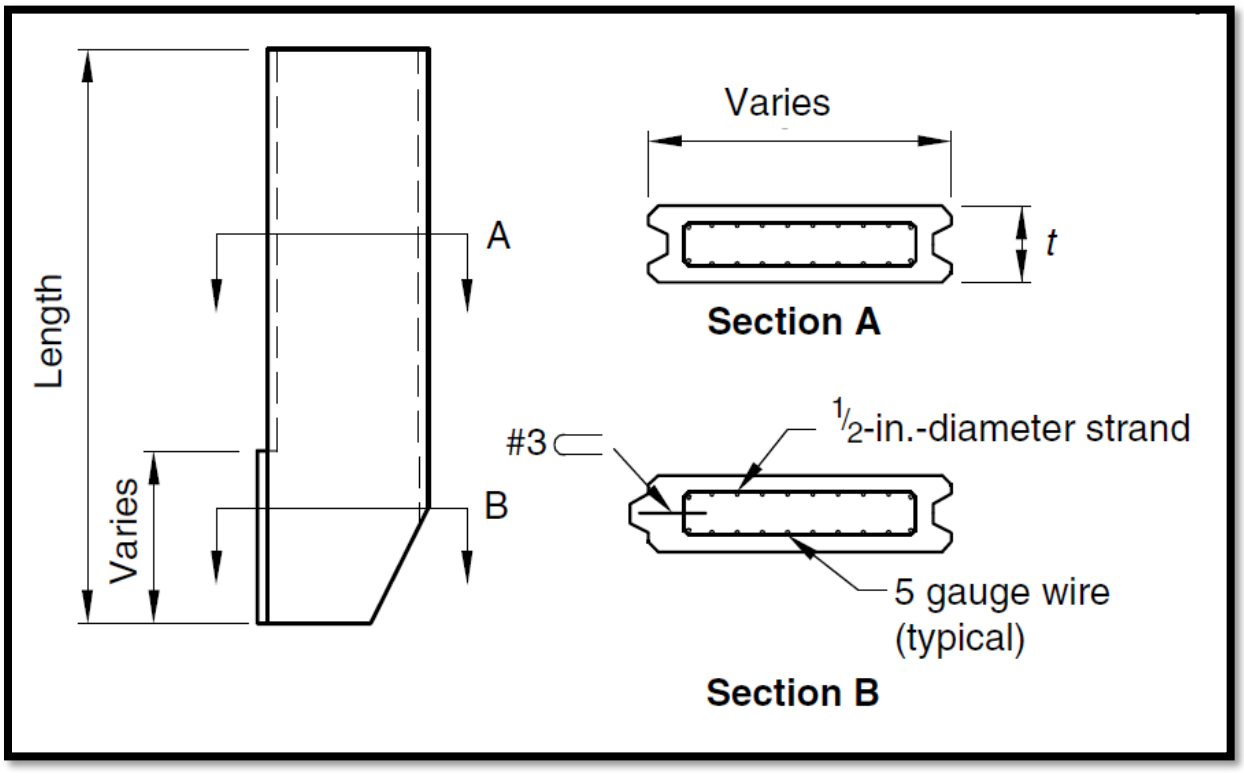


Figure 7-3: Typical Concrete Sheet Pile, Elevation and Section



Photo 7-2: Example Concrete Sheet Pile Finish

Alternative 3 – Cantilever Retaining Wall

This alternative uses a cast-in-place cantilever L- or T-wall to provide flood control. A preliminary design was created for the cantilever wall in accordance with ACI 318-14. Stability calculations showed a required wall height of 10.5 feet, with a 9.5-foot base and a 1.5 feet thick heel (see Appendix VII). A cutoff wall with tip at EL -24 was assumed to provide uniform seepage rate for comparison to Alternatives 1 and 2. Additionally, the cutoff wall improves stability of the L-wall by acting as a tension anchor to resist overturning moments. No scour blanket is required, as the structural heel of the wall serves this function. An example photo of this alternative is shown in Photo 7-3.



Photo 7-3: Example Concrete L-Wall Finish, Including Decorative Murals

7.7 Technical Comparison

The following section discusses the advantages and disadvantages of each Alternative from a technical perspective. Note that the final impact on cost and performance due to these factors can be subjective and prone to variation depending on the specific subsurface conditions and the contractor selected.

Alternative 1 – Steel Sheet Piles

Advantages:

- Steel sheet piling is more readily available and faster to install than concrete sheeting.
- Easy to splice, cut, extract, and redrive, allowing for flexibility and adaptability during construction.

- Interlocks are readily sealed with commercially available asphalt- or wax-based compounds.
- Small displacement pile section is less likely to damage adjacent structures and pavement during installation.

Disadvantages:

- Carbon steel is susceptible to corrosion in a marine environment, resulting in ongoing maintenance and unsightly rust staining. A sacrificial concrete fascia can be added to the steel sheet piling to effectively prevent corrosion of the steel, but this adds capital cost.
- Protective coatings are susceptible to impact and abrasion.
- Cathodic protection anodes, if used, require additional maintenance.

Alternative 2 – Precast Concrete Sheet Piles

Advantages:

- Aesthetically pleasing, with customized shapes and architectural finishes available.
- Potential for local materials and fabrication.
- Insensitive to current and abrasion from suspended sediment and debris.

Disadvantages:

- Precast sections susceptible to cracks and spalls during transportation and installation of the piles, so a thorough post-installation inspection is required.
- Increased displacement of soils during installation due to thicker section, which is more likely to damage adjacent structures and pavement.
- Tongue-and-groove portion of interlocks is difficult to seal, resulting in higher overall seepage rate. Note that upper portion of interlock is grouted after installation to form a watertight seal.
- Difficult to splice if needed due to field conditions.

Alternative 3 – Cantilever Retaining Wall

Advantages:

- The seepage cutoff may be formed by driven sheet piling or cast-in-place concrete (e.g. secant pile wall or slurry wall). If sheeting is used, overhead electrical lines will need to be permanently relocated or temporarily de-energized and downed during driving. If CIP concrete and low-clearance equipment is used, the overhead lines may not be affected.

- Cast-in-place concrete stem wall allows most precise alignment (compared to pile driving tolerance) and can readily be tied into existing head walls.
- Insensitive to current and abrasion from suspended sediment and debris.

Disadvantages:

- Larger excavation required for retaining wall heel will be more disruptive to wetlands, existing infrastructure, and private property.

7.8 Capital Cost Comparison

A budgetary Cost Comparison for the Alternatives is presented in Figure 7-4. Note that this is not a complete Opinion of Probable Cost for the construction. Instead, the Cost Comparison neglects the elements which are similar (e.g. landside drainage system) and highlights the elements which are different between Alternatives.

The Cost Comparison shows that the unique elements for Alternative 1 cost approximately 23% less than the unique elements for Alternative 2, and 12% less than Alternative 3. When combined with the remaining, duplicated elements, the relative cost percentage will be somewhat reduced.

Alternative	Description	Quantity	Unit	Unit Price	Extension
1	**Steel Sheet Piles**				
	AZ 26-700 Sheet Piles	1,900	LF	$1,100	$2,089,668
	Reinforced Concrete Cap	400	CY	$800	$320,000
	Scour Protection - Excavate and Armor	700	CY	$100	$70,000
	Total - Alt 1 Unique Items				**$2,479,668**
					$1310 per LF
2	**Precast Concrete Sheet Piles**				
	Prestressed Concrete Sheet Piles	1,900	LF	$1,400	$2,660,000
	Reinforced Concrete Cap	400	CY	$800	$320,000
	Scour Protection - Excavate and Armor	700	CY	$100	$70,000
	Total - Alt 2 Unique Items				**$3,050,000**
					$1610 per LF
3	**Cantilever Retaining Wall**				
	CIP L-wall	1,950	CY	$ 700	$1,365,000
	Excavation and Backfill	3,000	CY	$ 30	$90,000
	Sheet Pile Cutoff Wall	1900	LF	$ 700	$1,330,000
	Total - Alt 3 Unique Items				**$2,785,000**
					$1470 per LF

Figure 7-4: Cost Comparison

7.9 Conclusions

Alternative 1 – Steel Sheet Piles will minimize seepage rate and has advantages in flexibility (i.e. splicing and burning to account for changed conditions), reduced disturbance to existing infrastructure, and lower capital cost. There is risk of corrosion in the marine environment, which will be mitigated through a combination of protective coatings and concrete fascia, sacrificial thickness, and possibly sacrificial anodes. From a technical standpoint, as well as to minimize capital expenditure, steel sheeting is the recommended structural alternative.

8.0 COASTAL FLOOD RISK ANALYSIS

This section covers the feasibility analysis regarding the proposed level of protection, recommended level of protection based on the resulting identified project limitations, and assessment of vulnerable locations.

8.1 Review of Previous Coastal Vulnerability and Risk Studies

The proposed concept in the Preliminary Engineering Report and Analysis developed as part of the approved HMGP Application cited a coastal flood protection level of 7.0 feet NAVD88 for the project area. This value was evaluated through a desktop feasibility analysis utilizing LiDAR and stormwater inventory data.

Based on the desktop analysis, a coastal stillwater elevation of 7.0 feet NAVD88 contains a significant number of pathways for coastal waters to enter the project area, which decreases the feasibility for a level of protection at this elevation. The source of most of the pathways is from the San Sebastian River, up Riberia Street, and down the cross streets. There are also contributions from both San Sebastian River and Matanzas River from the Northern portion of the project area. Example locations of these path of entries include, but are not limited to Duero Street, Marine Street, King Street, Valencia Street, Carrera Street, Saragossa Street, Orange Street, Cordova Street, Spanish Street, Charlotte Street, and Avenida Menendez.

8.2 Proposed Coastal Level of Protection Feasibility Analysis

Adjusting the stillwater extent to 6.5 feet NAVD88 provides a significant reduction in inundation extents for inflow pathways, but the project area still has critical flood entry points that extend beyond roadway widths. Appendix VIII shows an approximation of the extents of flooding for a 6.5 ft coastal event.

Additionally, the extent and depth of inundation of these pathways do not allow for feasible alternatives to prevent or manage the inflows. Existing topographic elevations near the terminus of the bulkhead measure 5 feet NAVD88 or less. Therefore, inflow will occur at the southern end of the project area during a 7.0-foot coastal event. Figures in Appendix VIII shows an approximation of the extents of flooding for a 7.0 ft coastal event.

8.3 Assessment of Other Vulnerable Flood Protection Requirements

At a 6.0-foot NAVD88 stillwater extent, the vulnerable entry points into the project area are reduced to a manageable level. The remaining vulnerable locations and their approximate elevations are summarized in Appendix VIII. The vulnerable locations vary from 5.6 feet along Cordova Street to 5.9 feet along Sevilla Street. In total, there are eight pipes or outfalls and eight vulnerable roadways that are susceptible to conveying coastal flood waters into the project area at an elevation of 6.0 feet NAVD88.

Based on these observations, it is recommended that a minimum coastal flood protection level of at least 6.0 and 6.5 feet NAVD88 be the design standards for this project. The bulkhead and other barriers should still provide adequate freeboard above this elevation to account for wave action and other contingencies. The proposed bulkhead design of 7.0 feet appears to be consistent with other bulkheads and seawalls within the City.

9.0 OPINION OF PROBABLE CONSTRUCTION COST

The following table presents the Engineer's Opinion of Probable Cost for the entirety of the conceptual design presented.

Table 9-1

Engineer's Estimate of Probable Construction Costs

City of St. Augustine - Lake Maria Sanchez					
Opinion of Probable Construction Costs for Concept Design					
No.	Item Description	Units	Quantity	Unit Price	Estimated Cost
1.0	Mobilization (10%)	LS	1	$1,227,605.25	$1,227,605.25
2.0	Maintenance of Traffic	LS	1	$613,802.63	$613,802.63
3.0	Sediment Barrier	LF	12,000	$3.00	$36,000.00
4.0	5' Dia. Manhole	EA	3	$7,020.00	$21,060.00
5.0	6' Dia. Manhole	EA	3	$9,360.00	$28,080.00
6.0	9' Dia. Manhole	EA	1	$11,895.00	$11,895.00
7.0	8' x 10' Junction Box	EA	1	$13,000.00	$13,000.00
8.0	10' x 10' Junction Box	EA	3	$15,600.00	$46,800.00
9.0	18" RCP	LF	300	$88.00	$26,400.00
10.0	24" RCP	LF	400	$123.50	$49,400.00
11.0	12" x 18" RECP	LF	200	$65.00	$13,000.00
12.0	14" x 23" RECP	LF	70	$65.00	$4,550.00
13.0	3' x 3' Box Culvert	LF	480	$695.50	$333,840.00
14.0	4' x 3' Box Culvert	LF	600	$929.50	$557,700.00
15.0	6' x 4' Box Culvert	LF	945	$1,157.00	$1,093,365.00
16.0	Inlets, Curb (Type 3)	EA	30	$5,980.00	$179,400.00
17.0	Type F Curb & Gutter	LF	3,000	$45.50	$136,500.00
18.0	Type S-1 Asphalt Paving	SY	8,300	$22.00	$182,600.00
19.0	10" Aggregate Base Course	SY	4,150	$312.00	$1,294,800.00
20.0	12" Compacted Subgrade	SY	4,150	$3.25	$13,487.50
21.0	Hardscaping	SY	1,000	$78.00	$78,000.00
22.0	Milling Existing Pavement	SY	8,300	$9.00	$74,700.00
23.0	Stormwater Pump Station	LS	1	$3,900,000.00	$3,900,000.00
24.0	New Lake Outfall Structure	LS	1	$260,000.00	$260,000.00

25.0	54" HDPE SW Force Main	LF	85	$775.00	$65,875.00
26.0	Steel Sheet Pile Wall	LF	1,900	$1,700.00	$3,230,000.00
27.0	In-Line Storm Drain Check Valve	EA	23	$27,200.00	$625,600.00
	Sub-Total				$14,117,460.38
	Construction Engineering & Inspection (15% of Subtotal)				$2,117,619.06
	Total Cost				**$16,235,079.43**

Notes:

1. This cost estimate does not include permitting, land or easement acquisition, utility adjustments, wetland mitigation, contamination remediation or other unforeseen conditions.
2. Total cost rounded to two significant figures.
3. If the project is more than 6 months from being bid/awarded, it is recommended to carry an escalation percentage(+/- 3% per year).
4. The cost estimates are shown in 2019 dollars.

10.0 EVALUATION OF DESIGN FOR FEMA COMPLIANCE

Portions of the project which were included in the approved HMGP have been modified to achieve the intent and goals of the project. This includes eliminating the underground storage vault, increasing stormwater pipe capacity, and extending the footprint of the improved stormwater system. In addition, the alignment of the floodwall has been generally established.

One of the primary requirements of a project funded by a FEMA HMGP grant is that it must perform independent of any future projects. Therefore, the Benefit Cost Analysis (BCA) and funded project components must function holistically. If any aspect of the project does not perform, then its benefit cannot be included in the BCA and it cannot be included in the HMGP Project costs. There are several components of the project that potentially fall into this category.

A project at the north end of the project along King Street is currently under design and planning by the Florida Department of Transportation (FDOT). This project will improve and modify the stormwater and conveyance system along King Street. The King Street project will provide additional stormwater capacity and potential benefit to the project area and could be included or partially included in the HGMP Project. The execution and timing of this project will be the primary determining factor of whether it is included, and the City will continue to coordinate with FDOT and update the Project Team accordingly. Design of the King Street project is not currently included within the scope of the LMS Flood Mitigation and Drainage Project and its benefits are not part of the BCA.

The general floodwall alignment has been established. As previously discussed, this alignment will be refined as coordination with property owners and easement acquisition continue, and other design implications are addressed. The end points of the wall cease at lower elevations than the floodwall thus allowing flood waters to go around the wall. On the west end of the wall, a low area along Duero Street provides a flow way for coastal flood waters to enter behind the wall. On the east end, low areas at the end of Marine Street, adjacent to the Council on Aging property, would allow a similar flow way for floodwaters Therefore, additional design components in these areas are being incorporated into the overall HMGP project. This includes raising portions of Duero Street and Marine Street to the level of protection provided by the project. Design of these projects is being handled separately by the City and is not included within the scope of the LMS Flood Mitigation and Drainage Project. However, these components will be part of he overall HMGP project in order to meet the level of protection and are reflected in the BCA.

Based on the preliminary assessment of these modifications, there will be no compliance issues related to FEMA NFIP regulations or HMGP requirements. In addition, the modified project components still fall within the originally identified scope of work.

11.0 BENEFIT COST ANALYSIS

The BCA in the FEMA-approved HMGP grant application resulted in a Benefit Cost Ratio (BCR) of 1.03. This was based on a project cost of $11,500,000, annual operations and maintenance costs, and established benefits of approximately $12,300,000. However, in reviewing the BCA from the approved application, there were several gaps noted in the memorandum and analysis. The benefits only included reduction in building damage, and did not include benefits from road inundation reduction, or environmental and social benefits. In addition, the building values were based on standard values, and are conservatively low for the historic building inventory in the City of St. Augustine. These additional benefits have been incorporated into the BCA and are being refined with additional data.

Another primary gap in the application BCA is that no benefit was included for non-coastal flooding reduction. The analysis only looked at protection from coastal storm surge and flooding events. Since a large portion of this project is an improvement in stormwater conveyance and infrastructure, there are significant benefits to the project area from the reduction of rainfall-induced flooding. While the 100-year coastal event will completely inundate the majority of the project area, the area is not flooded by some smaller coastal events. In addition, even though the floodwall will protect the project area from other coastal events less than 100-year flood, there will still be flooding from rainfall events. Therefore, by looking at the rainfall flooding separately and incorporating the results of the stormwater modeling into the BCA, additional benefit is noted for smaller storm events. This additional benefit includes reduction in building and yard flooding and flooding durations, as well as eliminating or shortening the flooding of roadways. Furthermore, while the floodwall does not provide protection from the coastal 100-year flood, it does reduce the extent and duration of 100-year rainfall flooding. These benefits are reflected in the updated BCA, with attention to making sure no duplication of benefits occurs.

It should be noted that the Project Team is continuing to refine the BCA with additional data and information in order to better quantify the benefits. This refinement will continue as the design is finalized, and the BCR will continue to improve. This revised BCA results in a BCR over 1.00 and sufficient to accommodate the updated project cost of approximately $16,236,000.00.

To accommodate the refinement of the BCA and increasing BCR, the design team is dividing the project components into tiered funding categories. Tier 1 will be components that must be included

in the HMGP Project for the design to be holistically independent and fall within FEMA's available funding. Tier 2 will be those portions that can be included to provide additional benefit and obtain additional funding, if FEMA's available funding increases; and Tier 3 are those components that can either be included or excluded from the HMGP Project, based on available funding, such as replacing older impacted conflicting utilities to improve project efficiency and reduce the impact area, rather than avoiding these conflicts and thus increasing the impact areas of the project.

APPENDIX I

Supporting Survey
Geotechnical Report
And
(Historical/Archaeological)
Desktop Analysis and Reconnaissance
for the Lake Maria Sanchez
Flood Mitigation and Drainage Project

CITY OF ST. AUGUSTINE

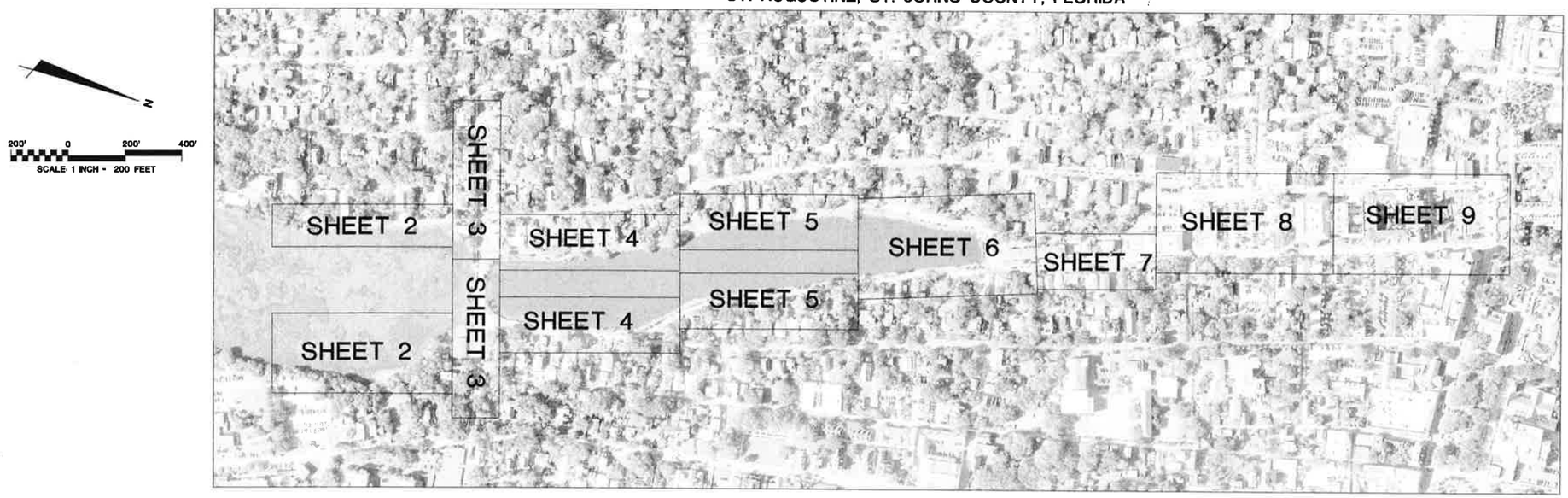
LAKE MARIA SANCHEZ FLOOD MITIGATION

Basis of Design Report

September 2019

TOPOGRAPHIC SURVEY

PART OF THE CITY OF ST. AUGUSTINE
SECTION 4 AND 21, TOWNSHIP 7 SOUTH, RANGE 30 EAST
ST. AUGUSTINE, ST. JOHNS COUNTY, FLORIDA





VICINITY MAP
(NOT TO SCALE)

SYMBOL LEGEND

BFP	BACKFLOW PREVENTER		GUY ANCHOR		RIGHT TURN SYMBOL
	BOLLARD		HICKORY TREE	S	SANITARY SEWER MANHOLE
	BUSH		IRON PIPE FOUND – AS NOTED	SV	SANITARY SEWER VALVE
TV	CABLE TELEVISION RISER		IRON ROD FOUND – AS NOTED		SIGN – AS NOTED
	CATCH BASIN		IRON ROD SET – AS NOTED	D	STORM MANHOLE
	CEDAR TREE	IRV	IRRIGATION CONTROL VALVE	TC	TELECOM CABINET
CO	CLEANOUT		LEFT TURN SYMBOL		TELECOM JUNCTION BOX
	CONCRETE LIGHT POLE		MAIL BOX	TR	TELECOM RISER
	CONCRETE MONUMENT FOUND – AS NOTED		MAPLE TREE		TRAFFIC MAST ARM
E	ELECTRIC CABINET		METAL LIGHT POLE	SB	TRAFFIC SIGNAL BOX
EM	ELECTRIC METER		MONITORING WELL		TRANSFORMER
	ELECTRIC PANEL		NAIL AND DISK FOUND – AS NOTED	WM	WATER METER
E	ELECTRIC MANHOLE		NAIL AND DISK SET – AS NOTED	WV	WATER VALVE
	FIBER OPTIC MARKER		OAK TREE		WETLAND FLAG
	FIRE HYDRANT		PALM TREE		WOOD LIGHT POLE
	FLAG POLE		PARKING METER		WOOD UTILITY POLE
GAS	GAS FLAG		PINE TREE		WOOD UTILITY POLE AND TRANSFORMER
GV	GAS VALVE		POST		

COMMON SYMBOLS AND ABBREVIATIONS

A	DELTA ANGLE	C		E		G		L		N	
°	DEGREE(S)	(C)	CALCULATED	E:	EASTING	GAS	NATURAL GAS	LS	LAND SURVEYOR	NW	NORTHWEST
'	MINUTES	C	CURVE	E	EAST	GOV	GOVERNMENT	LT	LEFT	NGS	NATIONAL GEODETIC SURVEY
"	SECONDS	CB	CHORD BEARING	EA	EDGE OF ASPHALT	GRAV	GRAVEL	LAT	LATITUDE	NLY	NORTHERLY
±	PLUS OR MINUS	CH	CHORD DISTANCE	EC	EDGE OF CONCRETE			LFT	LINEAR FEET	NTS	NOT TO SCALE
B	BOUNDARY LINE	CR	COUNTY ROAD	EG	EDGE OF GRAVEL	H		LONG	LONGITUDE	NAVD	NORTH AMERICAN VERTICAL DATUM 1988
C	CENTER LINE	CT	COURT	EL	ELEVATION	HP	HIGH POINT	M		NELY	NORTHEASTERLY
P	PROPERTY LINE	CIR	CIRCLE	ELY	EASTERLY	HGT	HEIGHT	(M)	MEASURED	NGVD	NATIONAL GEODETIC VERTICAL DATUM 1929
E	FLOW LINE	CMP	CORRUGATED METAL PIPE	ELEC	ELECTRIC	HOR	HORIZONTAL	MB	MAP BOOK	NOAA	NATIONAL OCEANIC AND ATMOSPHERIC ASSOCIATION
		COL	COLUMN	ERCL	EROSION CONTROL LINE	HWY	HIGHWAY	MAX	MAXIMUM	NWLY	NORTHWESTERLY
A		CPP	CORRUGATED PLASTIC PIPE	ERCP	ELLIPTICAL REINFORCED CONCRETE PIPE	HDWD	HARDWOOD	MER	MERIDIAN		
A	ARC LENGTH			ESMT	EASEMENT	HDWL	HEAD WALL	MES	MITERED END SECTION		
AC	ACRES	CRK	CREEK					MHW	MEAN HIGH WATER		
ASB	AS-BUILT	CCCL	COASTAL CONSTRUCTION CONTROL LINE	F		I		MIN	MINIMUM		
ASP	ASPHALT			(F)	FIELD MEASURED	INT	INTERSTATE	MLW	MEAN LOW WATER		
AVE	AVENUE	CONC	CONCRETE	FL	FLORIDA	INV	INVERT	MOL	MORE OR LESS		
AVG	AVERAGE			FM	FORCE MAIN	IRR	IRRIGATION	MHHW	MEAN HIGHER HIGH WATER		
		D		FO	FIBER OPTIC	ICWW	INTRACOASTAL WATER WAY	MLLW	MEAN LOWER LOW WATER		
B		(D)	DEED/DESCRIPTION	FT	FEET						
BFE	BASE FLOOD ELEVATION	DB	DEED BOOK	FAC	FLORIDA ADMINISTRATIVE CODE	L		N			
		DR	DRIVE			L	LENGTH	N	NORTHING		
BFP	BACK FLOW PREVENTER	DIA	DIAMETER	FFE	FINISHED FLOOR ELEVATION	LB	LICENSED BUSINESS	(NR)	NON-RADIAL		
BOB	BOTTOM OF BANK	DIP	DUCTILE IRON PIPE	FND	FOUND	LK	LAKE	N	NORTH		
BLVD	BOULEVARD	DWY	DRIVEWAY	FDOT	FLORIDA DEPARTMENT OF TRANSPORTATION	LP	LOW POINT	NE	NORTHEAST		
								NO	NUMBER		

P		PE	PROFESSIONAL ENGINEER	R/W	RIGHT OF WAY	SLY	SOUTHERLY	V			
PG/PGS	PAGE/PAGES	PG	PROFESSIONAL GEODETIC SURVEY	RD	ROAD	SUB	SUBDIVISION	VAR	VARIES		
PI	POINT OF INTERSECTION	PI	POINT OF INTERSECTION	RR	RAILROAD	STA	STATION	VCP	VITRIFIED CLAY PIPE		
PL	PLACE	PL	PLACE	RT	RIGHT	STM	STORM	VERT	VERTICAL		
PT	POINT OF TANGENCY	PT	POINT OF TANGENCY	RAD	RADIUS	STY	STORY				
PAR	PARALLEL	PAR	PARALLEL	RCP	REINFORCED CONCRETE PIPE	SELY	SOUTHEASTERLY	W			
PCC	POINT OF COMPOUND CURVE	PCC	POINT OF COMPOUND CURVE	REC	RECORD/RECORDED	SWLY	SOUTHWESTERLY	W	WEST		
PCP	PERMANENT CONTROL POINT	PCP	PERMANENT CONTROL POINT	REG	REGISTERED			WC	WITNESS CORNER		
PER	PERPENDICULAR	PER	PERPENDICULAR	RNG	RANGE	T		WD	WOOD		
PKG	PARKING	PKG	PARKING	RTE	ROUTE	T	TANGENT	WAT	WATER		
PKY	PARKWAY	PKY	PARKWAY	RVR	RIVER	TB	TANGENT BEARING	WLY	WESTERLY		
PLS	PROFESSIONAL LAND SURVEYOR	PLS	PROFESSIONAL LAND SURVEYOR	RCLM	RECLAIMED WATER	TBM	TEMPORARY BENCHMARK	WSP	WOOD STAVE PIPE		
POB	POINT OF BEGINNING	POB	POINT OF BEGINNING			TEL	TELECOMMUNICATIONS	WTP	WATER TREATMENT PLANT		
POC	POINT OF COMMENCEMENT	POC	POINT OF COMMENCEMENT	S		TER	TERRACE				
POL	POINT ON LINE	POL	POINT ON LINE	S	SOUTH	TOB	TOP OF BANK	WWTP	WASTE WATER TREATMENT PLANT		
PRC	POINT OF REVERSE CURVE	OR	OFFICIAL RECORD	S/W	SIDEWALK	TOP	TOP OF PIPE				
PRM	PERMANENT REFERENCE MONUMENT	OHE	OVERHEAD ELECTRIC	SB	SETBACK	TON	TOP OPERATING NUT				
PSM	PROFESSIONAL SURVEYOR AND MAPPER	OHW	ORDINARY HIGH WATER	SE	SOUTHEAST	TRL	TRAIL	Z			
PVC	POLYVINYL CHLORIDE PIPE	OIL	PETROLEUM	SQ	SQUARE	TWP	TOWNSHIP	Z:	ELEVATION		
		ORB	OFFICIAL RECORD BOOK	SR	STATE ROAD	TYP	TYPICAL				
				ST	STREET						
				SW	SOUTHWEST	U					
				SAN	SANITARY	UND	UNDERGROUND				
				SEC	SECTION	UTIL	UTILITY/UTILITIES				
				SHW	SEASONAL HIGH WATER						

P	PLAT	
(P)	PLAT	
PB	PLAT BOOK	
PC	POINT OF CURVATURE	
R		
(R)	RADIAL	

SURVEYORS NOTES:
1. THIS IS A TOPOGRAPHIC SURVEY, NOT A BOUNDARY SURVEY. THE PURPOSE OF THIS SURVEY IS TO SHOW EXISTING SITE CONDITIONS AS REQUESTED BY THE CLIENT FOR THE FUTURE ENGINEERING DESIGN OF SITE IMPROVEMENTS.
2. EVERY EFFORT HAS BEEN MADE TO ACCURATELY IDENTIFY THE SPECIES OF TREES SHOWN HEREON. THE TREES SHOWN HEREON WERE IDENTIFIED BY INDIVIDUALS THAT DO NOT PRACTICE IN THE FIELD OF DENDROLOGY OR BOTANY. IT IS POSSIBLE THAT SOME TREES SHOWN ON THIS SURVEY WERE MISTAKENLY IDENTIFIED.
4. THE LANDS SHOWN HEREON ARE CONSIDERED URBAN HIGH RISK. THE CALCULATED ERROR OF CLOSURE MEETS OR EXCEEDS THE MINIMUM STANDARD REQUIREMENTS.
5. EASEMENTS SHOWN HEREON ARE PER THE RECORDED PLAT, INSTRUMENTS OF RECORD PROVIDED TO THE SURVEYOR, OR INFORMATION OBTAINED BY A CURSORY SEARCH OF THE PUBLIC RECORDS OF THIS COUNTY.
6. NO OTHER INSTRUMENTS OF RECORD WERE PROVIDED TO THIS SURVEYOR.
7. THERE MAY BE ADDITIONAL COVENANTS, EASEMENTS, RESERVATIONS AND/OR, RESTRICTIONS NOT SHOWN ON THIS SURVEY THAT MAY BE RECORDED IN THE PUBLIC RECORDS OF THIS COUNTY.
8. THE BASIS OF BEARINGS FOR THIS SURVEY IS N21°31'34"W, ALONG THE SURVEY BASELINE BETWEEN STATIONS 29+00.10 AND 34+64.90 AS DEPICTED HEREON.
9. THIS SURVEY MAKES NO CLAIMS REGARDING OWNERSHIP OR RIGHTS OF POSSESSION.
10. ALL DIMENSIONS SHOWN HEREON ARE STATED IN U.S. SURVEY FEET AND DECIMALS THEREOF. FOOT TO METER CONVERSION FORMULA IS 1 US FT = 0.304800609601 M.
11. ALL STREETS AND RIGHT OF WAYS ARE OPEN AND ACCESSIBLE UNLESS NOTED OTHERWISE.
12. ALL ELEVATIONS SHOWN HEREON ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 1988) BENCHMARK 872 0576 6 RESET PID AQ1544, HAVING A PUBLISHED ELEVATION OF 6.72 FEET.
13. THE VERTICAL ERROR OF CLOSURE FOR THIS SURVEY IS LESS THAN OR EQUAL TO .05' TIMES THE SQUARE ROOT OF THE BENCH LOOP IN MILES.
14. WETLANDS SHOWN ON THIS SURVEY WERE DELINEATED BY CARTER ENVIRONMENTAL SERVICES, INC., (7 WALDO STREET, ST. AUGUSTINE, FL. 32084) ON 10/18/2018 AND LOCATED ON 10/31/2018.
15. UNDERGROUND FOUNDATIONS, IF ANY, WERE NOT LOCATED.
16. ANY REFERENCE TO UTILITIES THAT MAY APPEAR ON THIS MAP, HAVE BEEN LOCATED FROM VISIBLE SURFACE EVIDENCE THAT EXISTED AT OR ABOVE THE SURFACE OF THE EARTH AT THE TIME OF THIS SURVEY. NO UNDERGROUND UTILITY INFORMATION WAS COLLECTED OR VERIFIED AS PART OF THIS SURVEY.
17. UNDERGROUND UTILITIES WERE NOT LOCATED EXCEPT AS SHOWN.
18. THIS PROPERTY LIES WITHIN FLOOD ZONE AE (BASE FLOOD ELEVATION 7), FLOOD ZONE AE (BASE FLOOD ELEVATION 8), FLOOD ZONE X (0.2% ANNUAL CHANCE FLOOD HAZARD, AREAS OF 1% ANNUAL CHANCE FLOOD WITH AVERAGE DEPTH LESS THAN ONE FOOT OR WITH DRAINAGE AREAS OF LESS THAN ONE SQUARE MILE), PER THE NATIONAL FLOOD INSURANCE PROGRAM FLOOD INSURANCE RATE MAPS, (NFIP FIRM) MAP NO. 12109C0314J, WITH AN EFFECTIVE DATE OF DECEMBER 07, 2018, AND (NFIP FIRM) MAP NO. 12109C0318J, WITH AND EFFECTIVE DATE OF DECEMBER 07, 2018.
19. THIS SURVEY WAS PERFORMED FOR THE SOLE AND EXCLUSIVE BENEFIT OF THE FOLLOWING PARTY(IES): MCKIM & CREED, ST. JOHNS COUNTY AND THE CITY OF ST. AUGUSTINE AND IS NON-TRANSFERABLE TO ANY OTHER PARTY(IES). THIS SURVEY SHALL NOT BE RELIED UPON BY ANY OTHER ENTITY OR INDIVIDUAL. ANY RE-USE OF THIS SURVEY FOR ANY PURPOSE OTHER THAN WHICH IT WAS ORIGINALLY INTENDED, WITHOUT THE WRITTEN PERMISSION OF THE UNDERSIGNED SURVEYOR AND MAPPER, WILL BE DONE SO AT THE RISK OF THE RE-USING PARTY AND WITHOUT ANY LIABILITY TO THE UNDERSIGNED SURVEYOR AND MAPPER.
20. ADDITIONS OR DELETIONS TO SURVEY MAPS OR REPORTS BY ANYONE OTHER THAN THE SIGNING SURVEYOR IS PROHIBITED WITHOUT THE WRITTEN CONSENT OF THE SIGNING SURVEYOR.
21. THIS SURVEY WAS CONDUCTED IN COMPLIANCE WITH THE STANDARDS OF PRACTICE ESTABLISHED IN CHAPTER 5J-17, FLORIDA ADMINISTRATIVE CODE, PURSUANT TO SECTION 472.027 FLORIDA STATUTES, UNDER THE RESPONSIBLE CHARGE OF THE SIGNING SURVEYOR NAMED BELOW.
22. THIS SURVEY IS NOT VALID UNLESS SIGNED BY THE PROFESSIONAL SURVEYOR AND MAPPER NOTED, AND EMBOSSED WITH THE SURVEYOR'S SEAL.
23. THIS SURVEY MAP WAS PREPARED AT A SCALE OF 1 INCH EQUALS 200 FEET FOR SHEET 1 AND 1 INCH EQUALS 20 FEET FOR SHEETS 2 THROUGH 9 ON 24 INCH BY 36 INCH MEDIA. THIS SURVEY MAY HAVE BEEN REDUCED OR ENLARGED IN SIZE BY REPRODUCTION. THIS MUST BE CONSIDERED WHEN OBTAINING SCALED INFORMATION.
24. FIELD WORK FOR THIS SURVEY WAS PERFORMED ON SEPTEMBER 06, 2018 THROUGH DECEMBER 03, 2018.

DATE	REVISION	BY

ATS Land Surveying, LLC
1362 N. US HWY 1, SUITE 304
ORMOND BEACH, FL 32174
Phone:386.264.8490
Fax:386.845.9218
LB#7900

I HEREBY CERTIFY THAT THIS SURVEY OF THE SUBJECT PROPERTY IS CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION AND BELIEF, AS SURVEYED IN THE FIELD UNDER MY SUPERVISION AS SHOWN HEREON. I FURTHER CERTIFY THAT THIS SURVEY MEETS THE STANDARDS OF PRACTICE AS SET FORTH IN THE FLORIDA ADMINISTRATIVE CODE CHAPTER 5J-17, ADOPTED BY THE BOARD OF PROFESSIONAL SURVEYORS AND MAPPERS, PURSUANT TO FLORIDA STATUTES SECTION 472.027, BEING SUBJECT TO THE QUALIFICATIONS NOTED HEREON.

SIGNED _____
JOSEPH JAY WOOLDRIDGE, PSM#6994
DATE JANUARY 11, 2019

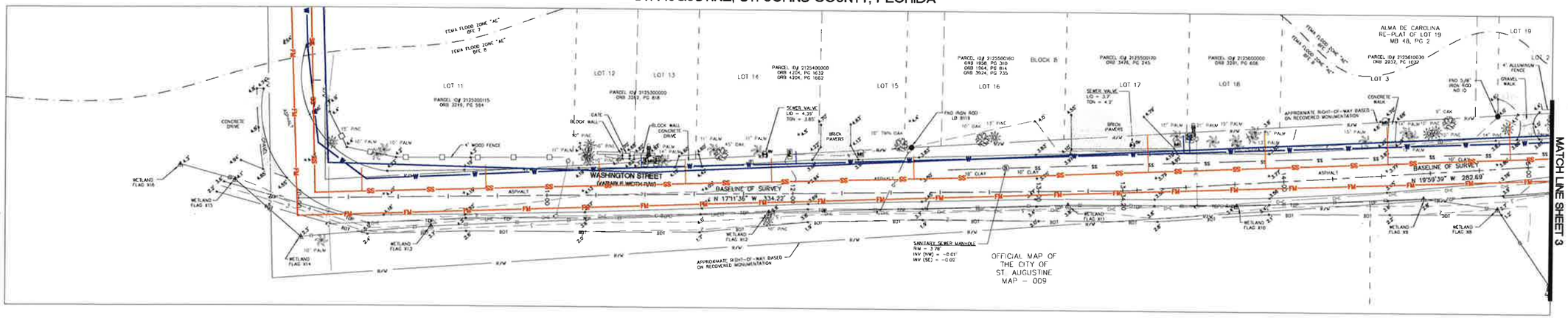
TOPOGRAPHIC SURVEY
FOR
MCKIM & CREED
139 EXECUTIVE CIRCLE, SUITE 201
DAYTONA BEACH, FLORIDA 32114

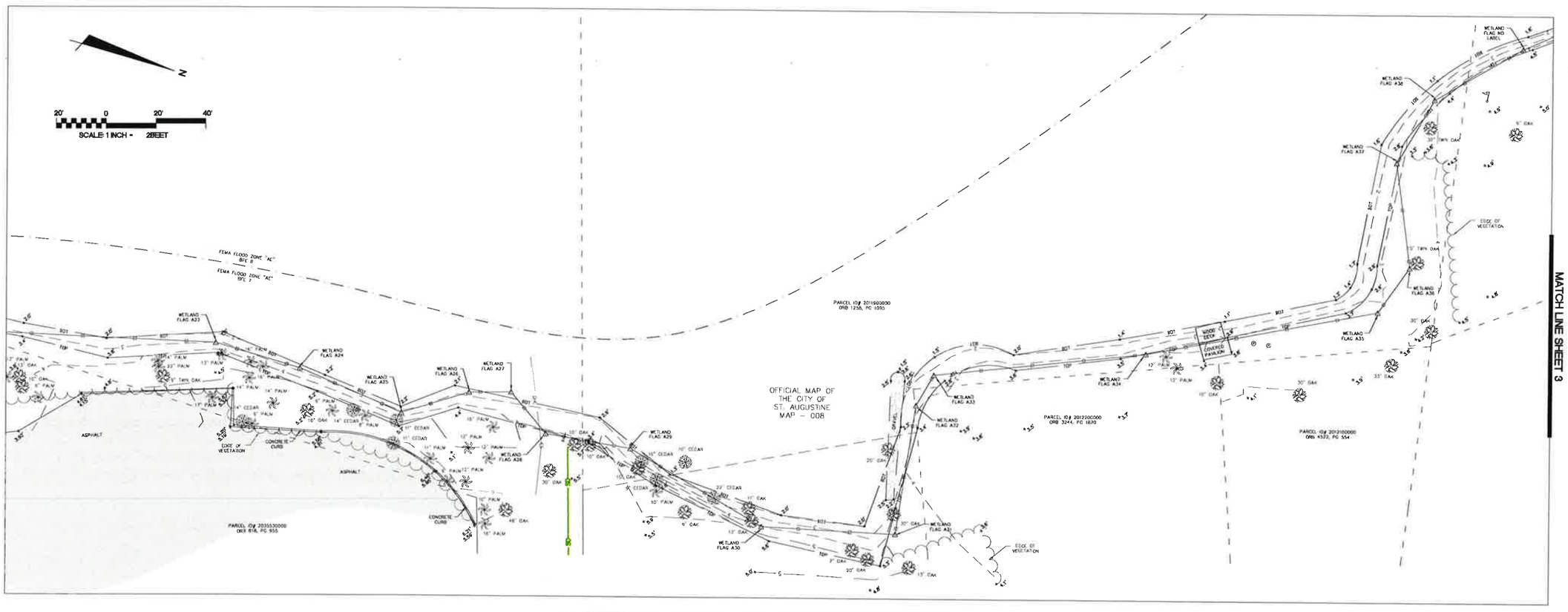
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CHECKED	JJW
SHEET NO	1 OF 10
FILE LOCATION	S:Survey Projects 2018/2018-MKC-0050/St Augustine-Lake Maria Sanchez_PRJ/dwg/2018-MKC-0050 Route Survey.dwg

TOPOGRAPHIC SURVEY

PART OF THE CITY OF ST. AUGUSTINE
SECTION 4 AND 21, TOWNSHIP 7 SOUTH, RANGE 30 EAST
ST. AUGUSTINE, ST. JOHNS COUNTY, FLORIDA





SEE SHEET 1 FOR SURVEYORS NOTES, ABBREVIATIONS AND SYMBOL LEGEND

DATE	REVISION	BY

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ORMOND BEACH, FL 32174
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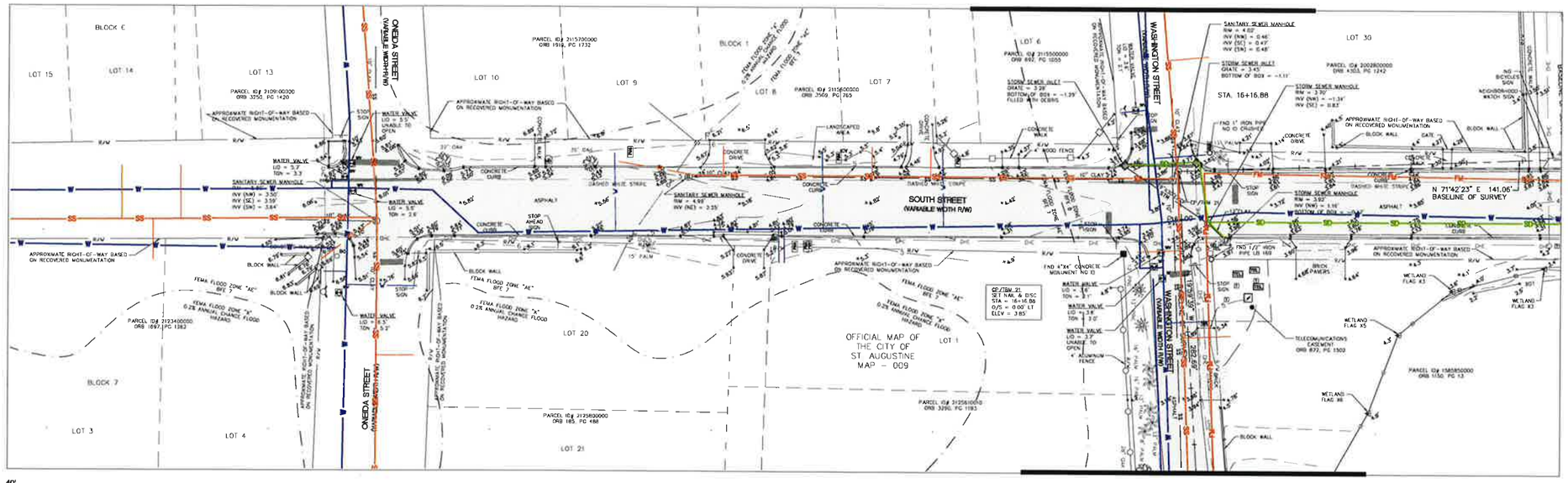
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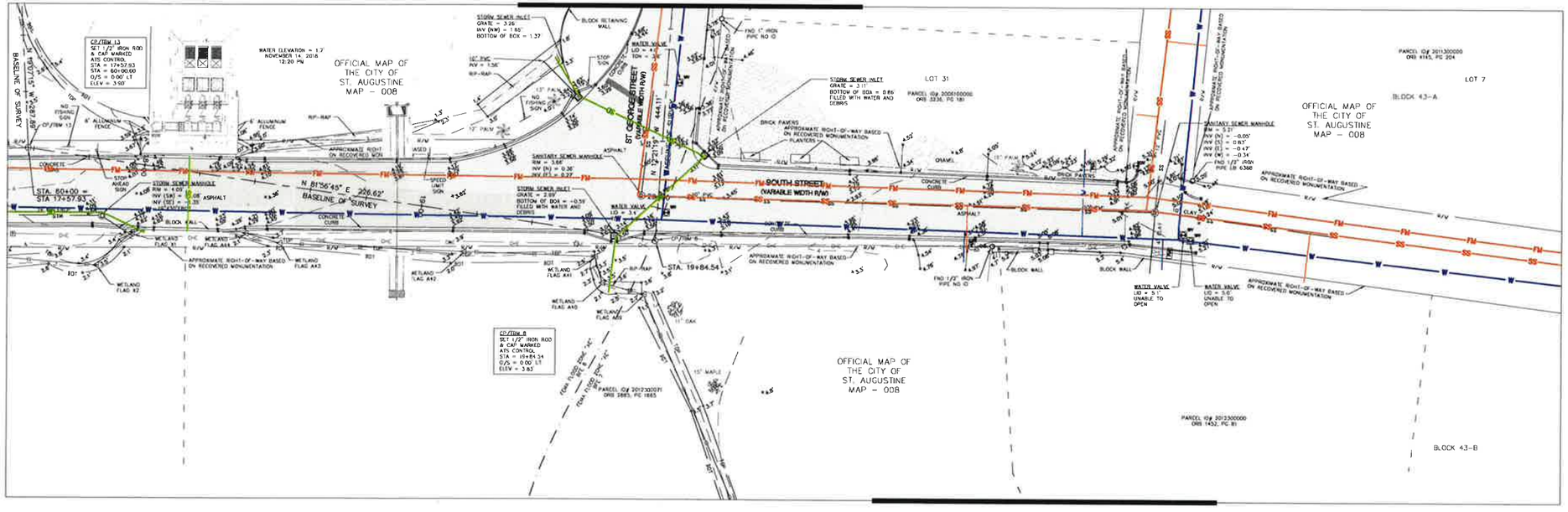
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SHEET NO	2 OF 10
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TOPOGRAPHIC SURVEY

PART OF THE CITY OF ST. AUGUSTINE
SECTION 4 AND 21, TOWNSHIP 7 SOUTH, RANGE 30 EAST
ST. AUGUSTINE, ST. JOHNS COUNTY, FLORIDA





SEE SHEET 1 FOR SURVEYORS NOTES, ABBREVIATIONS AND SYMBOL LEGEND

DATE	REVISION	BY

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ORMOND BEACH, FL 32174
Phone:386.264.8490 Fax:386.845.9216
LB#7900

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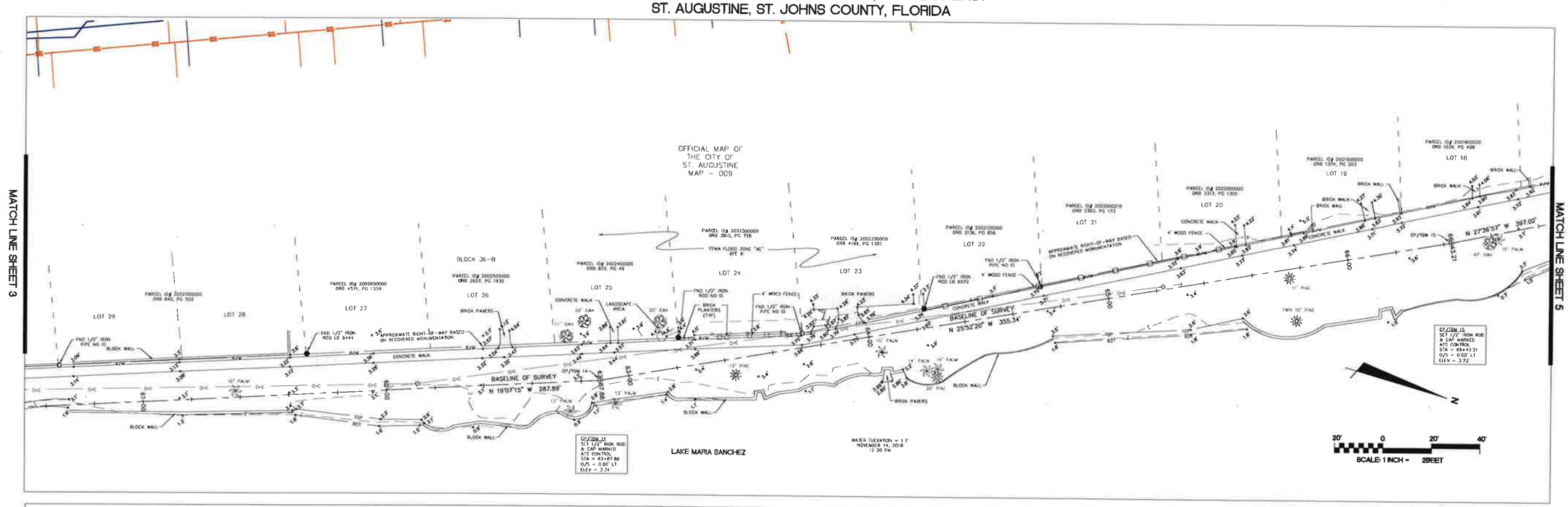
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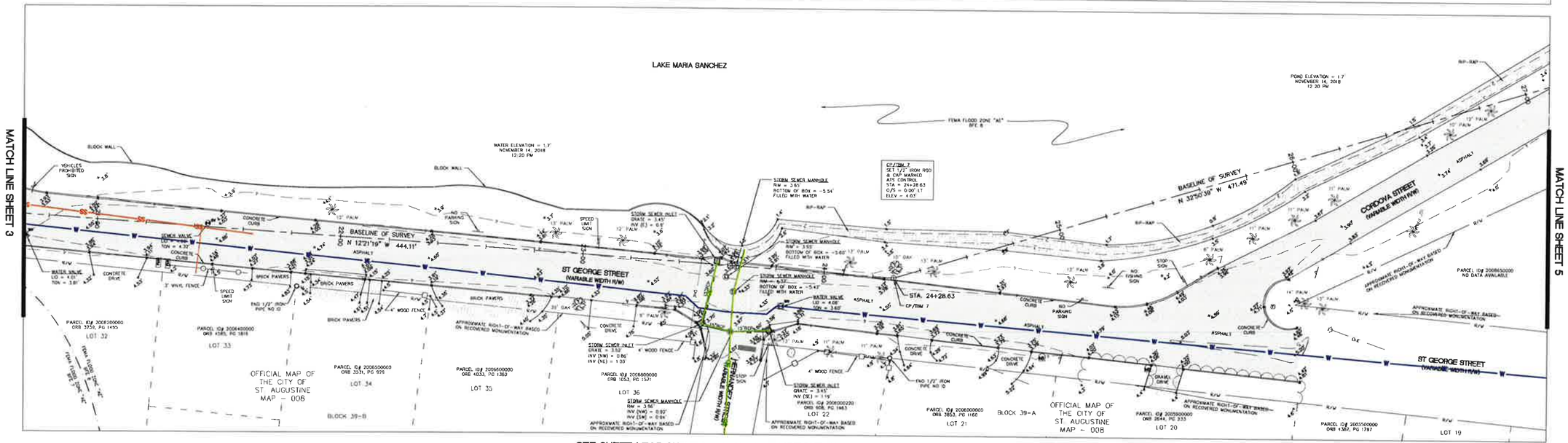
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TOPOGRAPHIC SURVEY

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SECTION 4 AND 21, TOWNSHIP 7 SOUTH, RANGE 30 EAST
ST. AUGUSTINE, ST. JOHNS COUNTY, FLORIDA





SEE SHEET 1 FOR SURVEYORS NOTES, ABBREVIATIONS AND SYMBOL LEGEND

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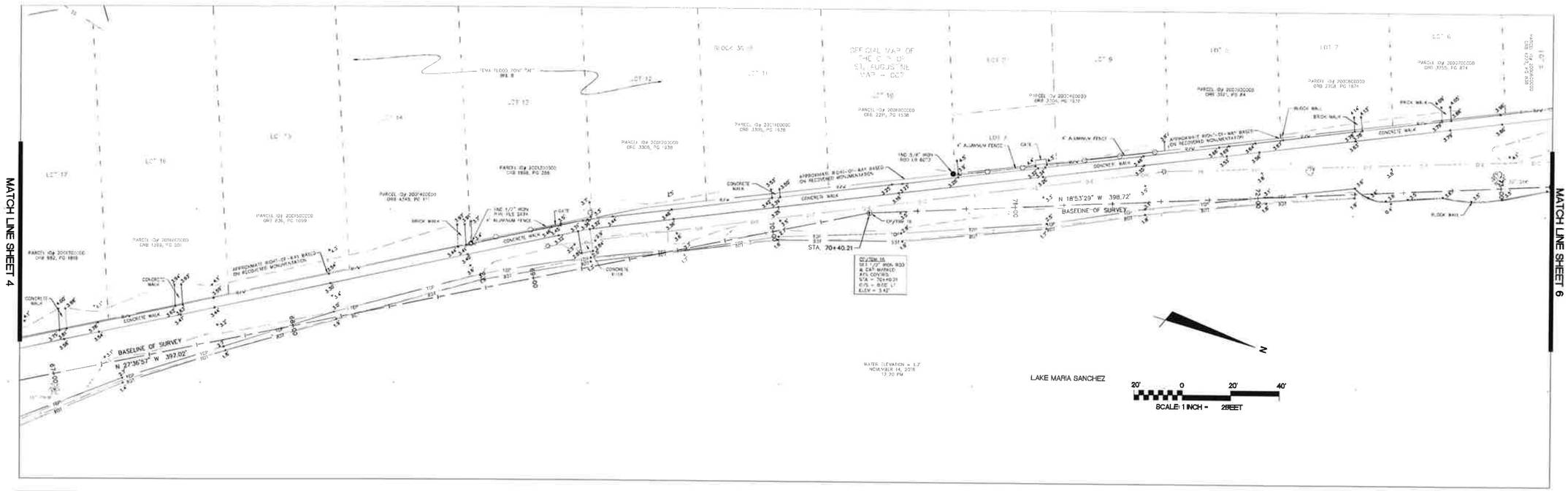
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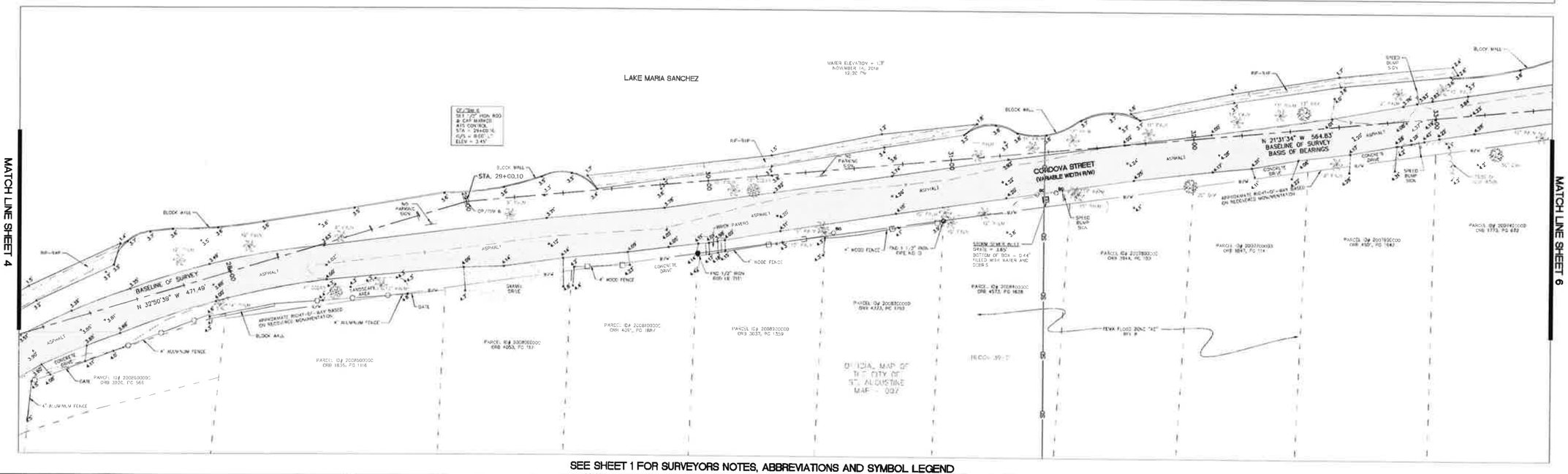
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TOPOGRAPHIC SURVEY

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SECTION 4 AND 21, TOWNSHIP 7 SOUTH, RANGE 30 EAST
ST. AUGUSTINE, ST. JOHNS COUNTY, FLORIDA





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JOSEPH JAY WOOLDRIDGE, PSM#6994
DATE JANUARY 11, 2019

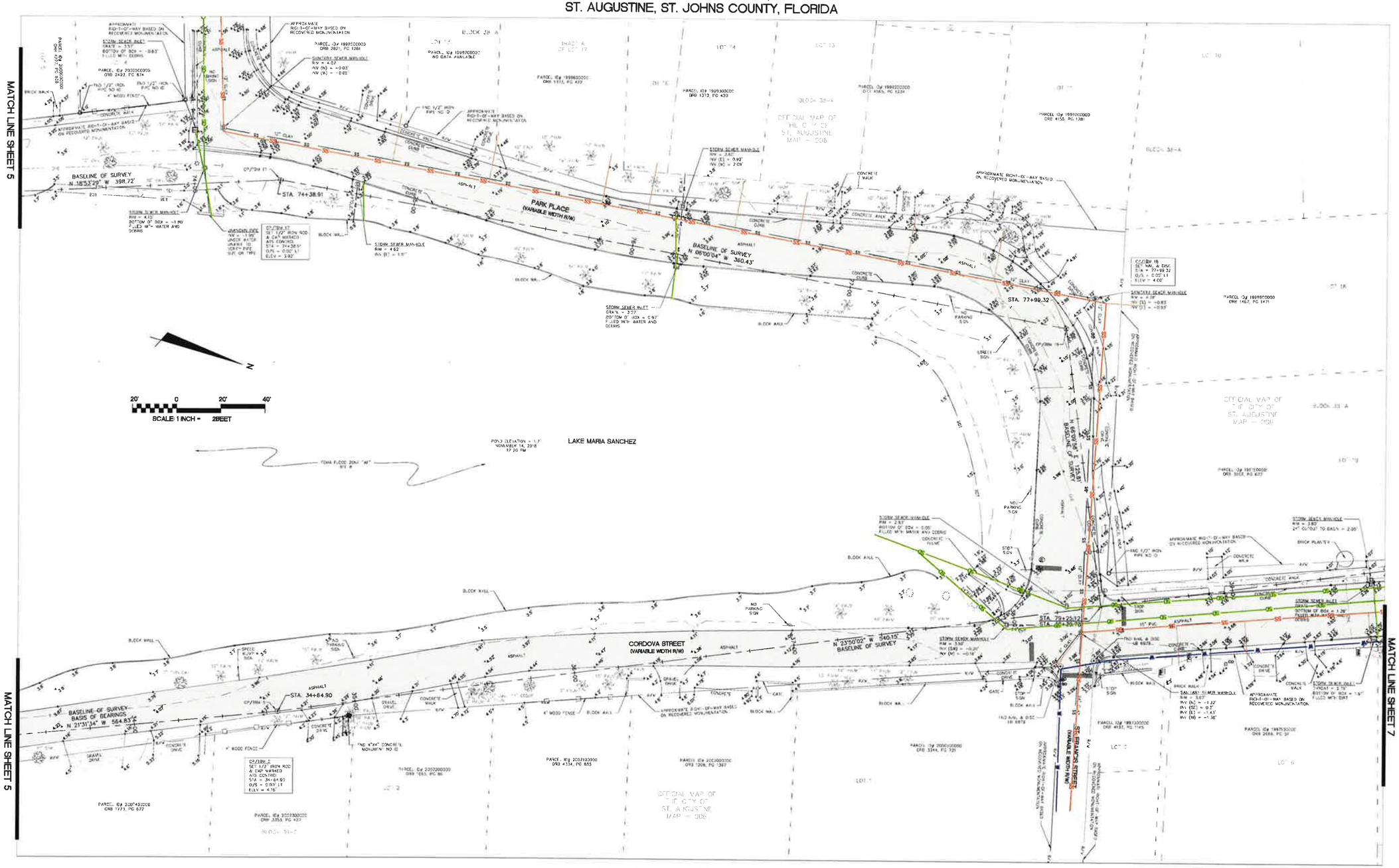
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LB#7900

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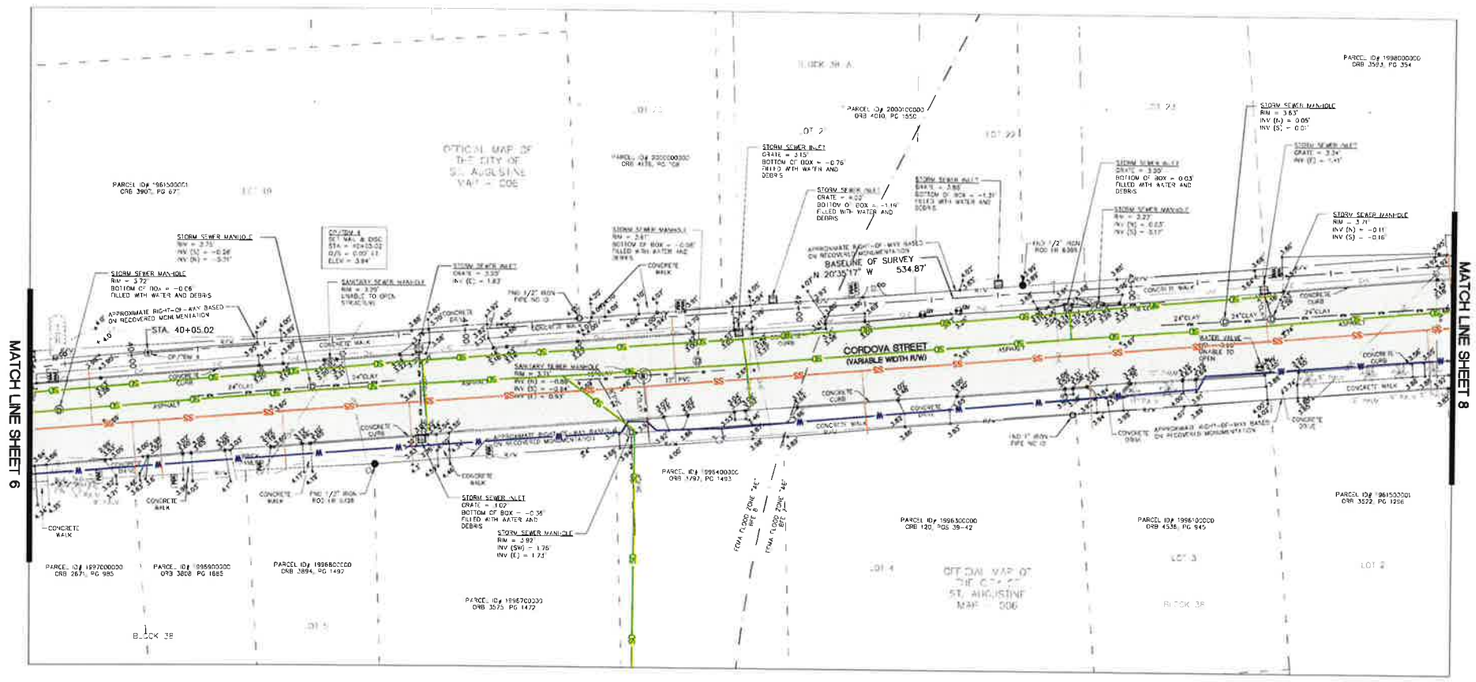
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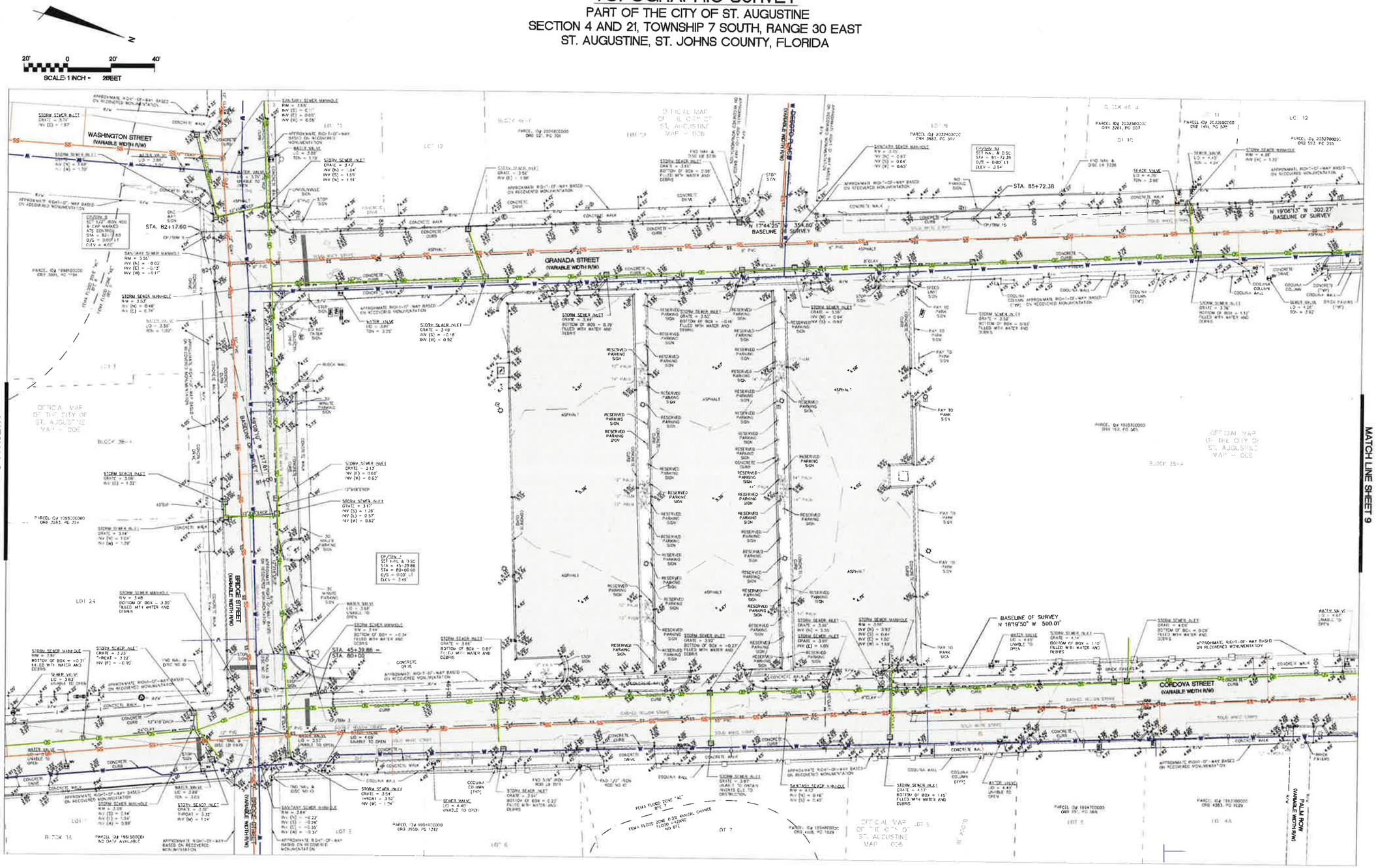
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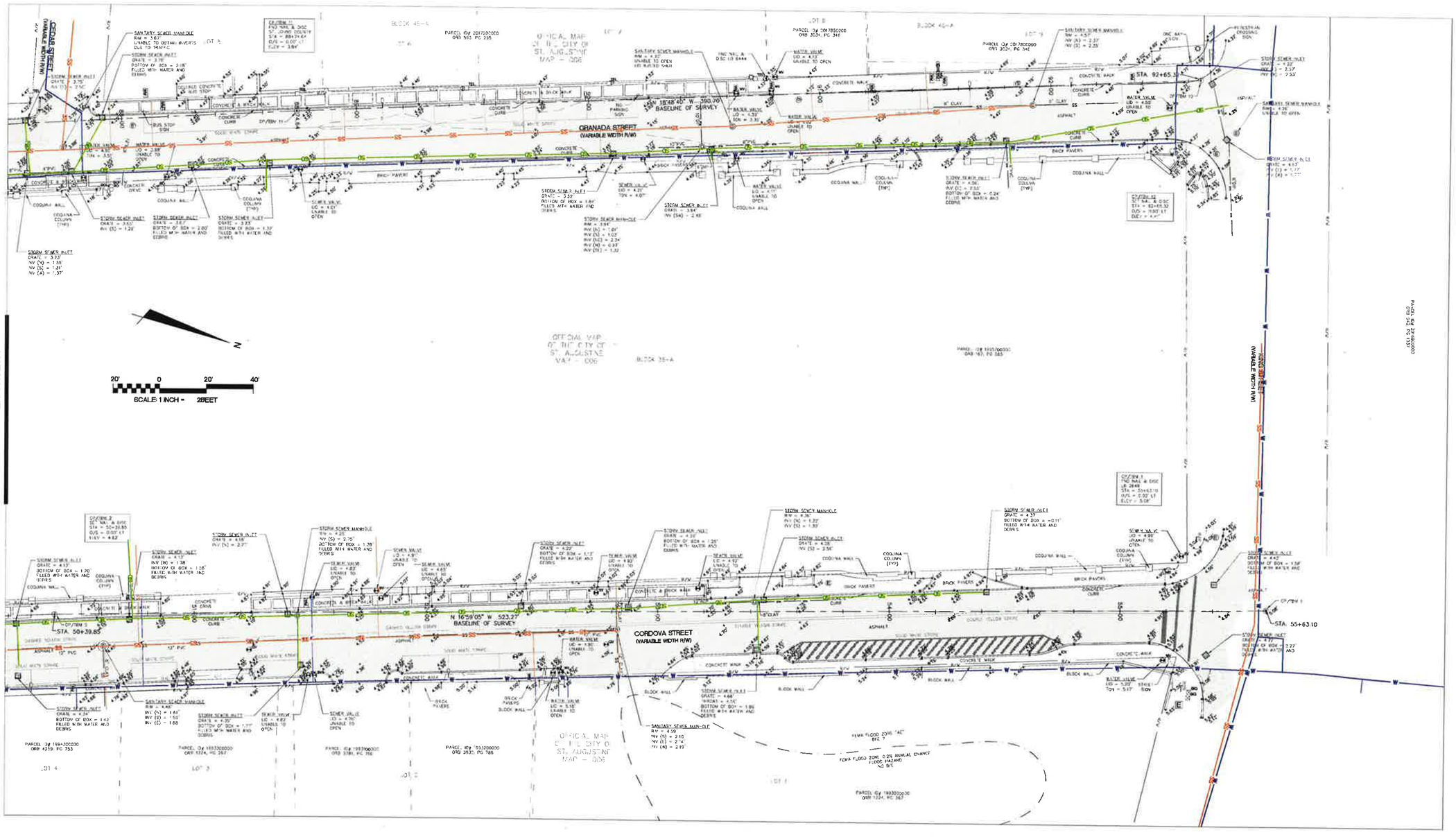
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Report of Geotechnical Exploration
For

Lake Maria Sanchez

MAE Project No. 0194-0003
March 29, 2019

Prepared for:

McKIM&CREED
ENGINEERS SURVEYORS PLANNERS

CITY OF ST AUGUSTINE
EST. 1565

Prepared by:

TEN YEARS 10 MAE
Meskel & Associates Engineering
Geotechnical • Environmental • Inspection • Testing

8936 Western Way, Suite 12
Jacksonville, Florida 32256
Phone (904) 519-6990
Fax (904) 519-6992

March 29, 2019

Brett Harbison, State of Florida, Professional Engineer, License No. 74679. This item has been electronically signed and sealed by Brett Harbison, P.E. on 3/29/2019 using a Digital Signature. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Mr. Robert Garland, P.E.
4720 Salisbury Road, Suite 117
Jacksonville, Florida 32256

Reference: Report of Geotechnical Exploration
Lake Maria Sanchez
Project Location
MAE Project No. 0194-0003

Meskel & Associates Engineering
Geotechnical ⌜ Environmental
Inspection ⌜ Testing

Dear Mr. Garland:

Meskel & Associates Engineering, PLLC (MAE) has completed a geotechnical exploration for the subject project. Our work was performed in general accordance with our revised proposal dated July 24, 2018. The geotechnical exploration was performed to evaluate the general subsurface conditions within the areas of the proposed construction, and to provide recommendations for foundation design and support for the proposed construction and for site preparation. A summary of our findings and related recommendations are presented below; however, we recommend that you consider this report in its entirety.

In general, the borings for the planned stormwater conveyance improvements encountered a surficial pavement section consisting of an asphalt layer 2 to 3 inches thick, underlain by a limerock base course 4.5 to 6 inches thick. This was typically followed by loose to medium dense fine sands, fine sands with silt, and silty fine sands (SP, SP-SM, SM) to the boring termination depths of up to 15 feet below the existing grade. The boring for the planned pump station encountered a surficial topsoil layer 6 inches thick, underlain by loose to very loose fine sands to silty fine sands (SP, SP-SM, SM) and then terminating in firm clay at 40 feet below the existing ground surface. We note that very loose (weight-of-hammer) sands containing varying amounts of organic fines were encountered at the planned pump station location between approximate depths of 6 to 23.5 feet. The borings for the planned bulkhead generally encountered very loose to loose fine sands with silt, silty fine sands, clayey fine sands, the occasional very soft silt (SP-SM, SM, SC, ML) or firm to stiff clay (CL) often containing trace to some amounts of shell fragments to the boring termination depths of up to 80 feet below the existing grade. The near surface soils along the planned bulkhead alignment typically contained varying amounts of organic fines and/or root fragments. Estimated soil parameters for use in design of the bulkhead structure are included in Appendix C of this report.

Based on our field exploration and laboratory testing, it is our opinion that the encountered subsurface conditions are adaptable for support of the planned structures provided the recommendations in this report are followed.

We appreciate this opportunity to be of service as your geotechnical consultant on this phase of the project. If you have any questions, or if we may be of any further service, please contact us.

Sincerely,
MESKEL & ASSOCIATES ENGINEERING, PLLC
MAE FL Certificate of Authorization No. 28142

_____
W. Josh Mele, E.I.
Staff Engineer

_____
Brett Harbison, P.E.
Director, Geotechnical Services
Registered, Florida No. 74679

Distribution: Mr. Robert Garland, P.E., with McKim & Creed 1 pdf

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FIGURES

Figure 1.	Site Location Map
Figures 2A & 2B.	Boring Location Plan
Figures 3 to 11.	Generalized Soil Profiles

APPENDICES

Appendix A.	Soil Boring Logs
	Field Exploration Procedures
	Key to Boring Logs
	Key to Soil Classification
Appendix B.	Summary of Laboratory Test Results
	Summary of Corrosion Series Test Results
	Laboratory Test Procedures
Appendix C.	Soil Design Parameters

1.0 PROJECT INFORMATION

1.1 General

Project information was provided to us by McKim & Creed via several emails and telephone conversations. We were also provided with the following project documents for review and reference:

- A document titled "City of St. Augustine – Lake Maria Sanchez Flood Mitigation and Drainage Project, FEMA Grant No. DR-4283-22-R – Proposal for Design, Survey, Permitting, Bidding, and Construction Services", undated, prepared by COSA which detailed the background of the project and requested scope of work;
- A document titled "Scope of Work Document Pump Station Section", undated, prepared by CDM Smith which detailed the project information and requested scope of work related to the stormwater pump station and drainage conveyance improvements;
- An annotated aerial photograph titled "Figure 1-25, Maria Sanchez Lake Conveyance Improvements", undated, prepared by CDM Smith which detailed the type and limits of drainage improvements for the project; and
- A document titled "Lake Maria Sanchez Area", undated, prepared by Ms. Deborah MacPherson, P.E. of Moffatt and Nichol which detailed the proposed boring locations along the proposed bulkhead.

1.2 Project Description

The site for the subject project is located in St. Augustine, Florida; extending approximately from South Street to Saragossa Street, bounded by Martin Luther King Blvd on the west and the City of St. Augustine (COSA) seawall on the east. It encompasses approximately 200 acres of the downtown St. Augustine, including residential and commercial properties, churches, Flagler College, City Hall, and many more historically significant buildings, monuments and structures. The general site location is shown on Figure 1.

Based on the provided information and our discussions with Mr. Burkett, it is our understanding that this project will include backflow prevention through a combination of stormwater check valves and a bulkhead, in conjunction with the installation of conveyance improvements (culverts), and a storm water pump station to pump stormwater out of the project area during periods of high water in the Matanzas River.

The stormwater pump station would be constructed at the existing Lake Maria Sanchez outfall, by a triplex pump station with gravity outfall. A new gravity discharge would consist of a precast FDOT Type H inlet structure approximately 10-feet long by 4-feet wide, by 10-feet deep. The pump station will include three low-head pumps capable of pumping 75 cfs each. The pumps would be controlled by a local control panel and a float system based on lake water surface elevation. The control panel will be equipped with an emergency generator receptacle. Both systems will be equipped with backflow preventers for low tide/high tide control. Each system will penetrate the proposed bulkhead.

The stormwater conveyance improvements would include upsizing the existing pipes along Cordova Street, Bridge Street, and Granada Street to increase conveyance to Lake Maria Sanchez. The upsizing consists of approximately 2,010 LF of concrete box culvert. This would also include stormwater treatment

through an underground vault system with an approximate volume of 22,500 CF, located within an existing paved parking area.

The bulkhead (or similar type structure or wall) would be installed along the south shoreline of the project boundary, adjacent to South Street at an elevation of at least +7 feet. The bulkhead will be approximately 2,100 linear feet along protected shoreline.

If actual project information varies from these conditions, then the recommendations in this report may need to be re-evaluated. Any changes in these conditions should be provided so the need for re-evaluation of our recommendations can be assessed prior to final design.

2.0 FIELD EXPLORATION

Our field exploration for this project consisted of two separate phases: The first phase was for the stormwater conveyance improvements (i.e., the box culverts, stormwater vault system, and the pump station) and the second phase was for the planned bulkhead structure.

The first phase of our exploration was performed during the period of October 30 through November 13, 2018, and the second phase was performed during the period of January 8 through 29, 2019. An annotated aerial, which shows the approximate boring locations, is included as the *Boring Location Plan*, Figures 2A & 2B.

The boring locations were determined by us, and then GPS coordinates were obtained using Google Earth. Prior to starting our field exploration, our field personnel located each boring location using a Garmin GPSMAP 78 hand-held GPS receiver and marked the location for reference. A utility locate request was then submitted to the Sunshine State One-Call. Once the site utilities were located and marked, our field crew mobilized to the site. The boring locations as shown on Figures 2A & 2B should be considered accurate only to the degree implied by the method of measurement used.

2.1 SPT and Auger Borings

To explore the subsurface conditions within the areas of the planned stormwater conveyance and bulkhead structure areas, we located and performed 24 Standard Penetration Test (SPT) borings, drilled to depths of up to approximately 80 feet below the existing ground surface. To avoid potential utility conflicts, several of the borings were initially advanced using a hand-held bucket auger to a depth of 4 feet below existing grade. The portion of the borings performed using a hand auger were performed in general accordance with the methodology outlined in ASTM D 1452. The borings were then continued as an SPT boring to depths of up to 80 feet below the existing ground surface. The SPT portion of each boring was continuously sampled to a depth of 10 feet, and thereafter sampled every 5 feet in general accordance with the methodology outlined in ASTM D-1586. Split-spoon soil samples recovered during performance of the borings were visually described in the field and representative portions of the samples were transported to our laboratory for further evaluation.

Due to limited accessibility and utility conflicts, three borings along the southern end of Cordova Street (BC-3a, BC-3b, and BC-3c) were advanced to depths of approximately 5 feet below the existing ground surface using a hand-held bucket auger, in general accordance with the methodology outlined in ASTM D 1452. Representative soil samples also were recovered from the auger borings and returned to our laboratory for further evaluation. A summary of the field procedures is included in Appendix A.

2.2 Field Permeability Test

Three field permeability tests were performed: one adjacent to boring location BW-1, one adjacent to boring location BW-2, and one adjacent to boring location BW-3. The field permeability tests were performed by installing a solid-walled, open-bottom PVC casing snugly fit into a 4-inch diameter augered borehole to the test depth. To estimate the vertical permeability rate of the soil, the pipe was left flush with the borehole bottom. Once the vertical permeability test was complete, the bottom 1-foot of the pipe was filled with silica sand or gravel and the pipe raised one foot above the bottom of the borehole to estimate the horizontal permeability rate of the soil. For all three tests, the pipe was filled to the top with water, and since relatively permeable sandy soils were encountered in the borings, the tests were conducted as "falling head" tests in which the rate of water (head) drop within the pipe was measured over a period of up to 30 minutes. Each test was conducted three times and then averaged to estimate the in-situ permeability rate for the soil conditions at their respective locations.

3.0 LABORATORY TESTING

3.1 Visual Classification

Representative soil samples obtained during our field exploration were visually classified by a geotechnical engineer using the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488. A *Key to the Soil Classification System* is included in Appendix A.

3.2 Index Tests

Quantitative laboratory testing was performed on selected samples of the soils encountered during the field exploration to better define the composition of the soils encountered and to provide data for correlation to their anticipated strength and compressibility characteristics. The laboratory testing determined the natural moisture, the percent passing a U.S. No. 200 sieve (percent fines), the Atterberg Limits, and the organic contents of selected soil samples. The results of the laboratory testing are shown in the Summary of Laboratory Test Results included in Appendix B. Also, these results are shown on the *Generalized Soil Profiles on* Figures 3 through 11, and on the Log of Boring records at the respective depths from which the tested samples were recovered.

3.3 Corrosion Series Tests

Four composite soil samples were selected for corrosion potential testing. These samples were obtained from selected borings to be representative to the project site. The testing included soil pH, resistivity, and chloride and sulfate contents. The test results are included in Appendix B on the *Summary of Laboratory Corrosivity Tests.*

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 General Soil Profile

Graphical presentation of the generalized subsurface conditions is presented on Figures 3 through 11. Detailed boring records are included in Appendix A. When reviewing these records, it should be understood that the soil conditions will vary between the boring locations.

4.1.1 Culverts and Stormwater Vault

In general, the borings encountered either a surficial pavement section consisting of an asphalt layer 2 to 3 inches thick, underlain by a limerock base course 4.5 to 6 inches thick. As an exception, underlaying the asphalt at boring locations BC-1a and BC-2a, a concrete layer was encountered approximately 5.5 inches thick. Underlaying the pavement section, the borings generally encountered very loose to medium dense fine sands (SP), fine sands with silt (SP-SM) and silty fine sands (SM) to the boring termination depths of up to 15 feet below the existing grades. The upper soil strata, to a depth of approximately 4 feet, typically contained trace to few amounts of gravel sized shell fragments, organic fines and/or root fragments.

4.1.2 Pump Station

The boring encountered a surficial topsoil layer approximately 6 inches thick, underlain by loose fine sands (SP) containing some amounts of gravel sized shell fragments to an approximate depth of 2 feet, followed by very loose silty fine sands (SM) containing trace organic fines and/or small roots to an approximate depth of 6 feet below the existing grade. Following this very loose silty fine sand stratum, the boring advanced through very loose silty fine sands with organic fines (SM) to an approximate depth of 18 feet before transitioning to fine sands with silt (SP-SM) to an approximate depth of 22 feet. The boring then encountered loose silty fine sand to an approximate depth of 38.5 feet before terminating in firm silty clay (CL) at 40 feet below the existing ground surface.

4.1.3 Bulkhead Structure – Waterside Borings

In general, the borings typically encountered very loose to loose fine sands with silt (SP-SM) to silty fine sands (SM), or the occasional very soft silt (ML) with varying amounts of sand content, to depths of up to approximately 13.5 feet below the existing grade. The near surface soils often contained trace to with amounts of organic fines, small roots, and/or trace to some amounts of shell fragments. Following, the borings typically encountered loose to medium dense fine sands (SP), fine sands with silt (SP-SM), and silty fine sands (SM) often containing trace to some amounts of shell fragments to the boring termination depths of up to 80 feet below the existing grade. As exceptions, several borings encountered loose to medium dense clayey fine sands (SC) to firm to stiff clay (CL) layers starting at an approximate of 38.5 feet and continuing to depths of up to 48.5 feet below the existing grade.

4.1.4 Bulkhead Structure – Landside Borings (BW1, BW3)

In general, the borings typically encountered a surficial pavement section consisting of an asphalt layer 2 inches thick, underlain by a limerock base course 4.5 to 6 inches thick. Following the pavement sections, the two borings (BW1 and BW2) encountered slightly different profiles:

Following the pavement section at the BW1 location, the boring encountered medium dense silty fine sands to loose fine sands (SP) to an approximate depth of 4 feet, underlain by stiff very sandy silt (ML) to a depth of approximately 12 feet below the existing grade. This was followed by loose to medium dense silty fine sands (SM) and fine sands with silt (SP-SM) to an approximate depth of 43.5 feet. A layer of firm silty clay (CL) was encountered between approximate depths of 43.5 and 48.5, followed by stiff sandy silt (ML) containing little amounts of gravel sized shell fragments to the boring termination depth of 50 feet below the existing pavement surface.

Underlaying the pavement section at the BW3 location, the boring encountered fine sands containing little amounts of gravel sized shell fragments (SP), followed by loose to medium dense fine sands (SP), fine sands with silt (SP-SM), and silty fine sands (SM) to an approximate depth of 38.5 feet below the existing

grade. This was followed by a layer of stiff silty clay (CL) between approximate depths of 38.5 and 48.5 feet, underlain by medium dense fine sands with silt (SP-SM) containing little amounts of gravel sized shell fragments to the boring termination depth of 50 feet below the existing pavement surface.

4.2 Groundwater Level

The groundwater level was encountered at each of the boring locations and recorded at the time of drilling at depths varying from approximately 1.5 to 4 feet below the existing ground surface. However, it should be anticipated that the groundwater levels will fluctuate seasonally and with changes in climate. As such, we recommend that the water table be verified prior to construction. Measured groundwater levels are shown the boring profiles and boring logs.

4.3 Review of the USDA Web Soil Survey Map

The results of a review of the USDA Soil Survey Conservation Service (SSCS) Web Soil Survey of St. Johns County are shown in the table below. There are two predominant soil map units at the project sight: St. Augustine-Urban land complex and Pellicer silty clay loam. We note that according to the Web Soil Survey, the Pellicer silty clay soils are confined to the marsh areas of this project site. The soil drainage class, hydrological group, and estimated seasonal high groundwater levels reported in the Soil Survey are as follows:

Map Unit Symbol	Map Unit Name	Drainage Class	Hydrologic Group	Depth to the Water Table[(1)] (inches)
24	Pellicer silty clay loam, frequently flooded	Very Poorly Drained	D	0 to 12
51	St. Augustine-Urban land complex[(2)]	Somewhat Poorly Drained	A	18 to 36

[(1)] The "Water Table" above refers to a saturated zone in the soil which occurs during specified months, typically the summer wet season. Estimates of the upper limit shown in the Web Soil Survey are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

[(2)] The term "complex", as defined by the USDA, refers to a map unit consisting 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 map.

4.4 Seasonal High Groundwater Level

In estimating seasonal high groundwater level, a number of factors are taken into consideration including antecedent rainfall, soil redoximorphic features (i.e., soil mottling), stratigraphy (including presence of hydraulically restrictive layers), vegetative indicators, effects of development, and relief points such as drainage ditches, low-lying areas, etc.

Based on our interpretation of the current site conditions, including the boring logs and review of published data, we estimate the seasonal high groundwater levels at the site to be generally 1 to 2 feet above the water levels measured at the time of our field work.

It is possible that higher groundwater levels may exceed the estimated seasonal high groundwater level as a result of significant or prolonged rains. Therefore, we recommend that design drawings and specifications account for the possibility of groundwater level variations, and construction planning should be based on the assumption that such variations will occur.

5.0 DESIGN RECOMMENDATIONS

5.1 General

The following evaluation and recommendations are based on the provided project information as presented in this report, results of the field exploration and laboratory testing performed, and the construction techniques recommended in Section 6.0 below. If the described project conditions are incorrect or changed after this report, or subsurface conditions encountered during construction are different from those reported, MAE should be notified so these recommendations can be re-evaluated and revised, if necessary. We recommend that MAE review the foundation plans and earthwork specifications to verify that the recommendations in this report have been properly interpreted and implemented.

5.2 Culvert Foundation Support Recommendations

Based on the results of the subsurface explorations, laboratory testing, and provided information, as included in this report, we consider the subsurface conditions at the site adaptable for supporting the planned culverts when constructed upon properly prepared subgrade soils. Provided the site is prepared in accordance with the recommendations presented in this report, the following parameters may be used for design of the planned culvert systems.

5.2.1 Bearing Pressure

The maximum allowable net soil bearing pressure for use in foundation design for the culvert should not exceed 2,000 psf. Net bearing pressure is defined as the soil bearing pressure at the foundation (bottom of pipe) bearing level in excess of the natural overburden pressure at that level. The foundations should be designed based on the maximum load that could be imposed by all loading conditions.

5.2.2 Bearing Material

The culvert foundation should bear on the compacted structural backfill or compacted native sandy soils. The bearing level soils, after compaction, should exhibit densities equivalent to 98 percent of the modified Proctor maximum dry density (AASHTO T 180), to a depth of at least one foot below the foundation bearing levels.

5.2.3 Settlement Estimates

Post-construction settlement of the culvert structure will be influenced by several interrelated factors, such as (1) subsurface stratification and strength compressibility characteristics; (2) culvert size, bearing levels, applied loads, and resulting bearing pressures beneath the culvert; and (3) site preparation and earthwork construction techniques used by the contractor. Any deviation from these recommendations could result in an increase in the estimated post construction settlements of the structure.

Due to the sandy nature of the surficial soils and granular nature of the recommended backfill soils, we expect the majority of settlement to occur in an elastic manner, relatively concurrent with loading. Using

the recommended maximum bearing pressure, recommended in this report and the field and laboratory tests and site preparation techniques data that we have correlated to geotechnical strength and compressibility characteristics of the subsurface soils, we estimate that total settlement of the culvert could be on the order of one inch or less.

Differential settlements result from differences in applied bearing pressures and variations in the compressibility characteristics of the subsurface soils. Based on the recommended foundation design for the culvert and the site preparation and earthwork construction techniques outlined in Section 6.0, we estimate the differential settlement along the length of the culvert to be one-half inch or less.

Provided the site preparation and earthwork construction recommendations outlined in Section 6.0 of this report are performed, the following parameters may be used for design.

5.2.4 Lateral Earth Pressure Soil Parameters

In general, walls that have adjacent compacted fill will be subjected to lateral earth pressures. The wing walls for the cross drain culverts, assumed to not be restrained at the top and that sufficient movement is anticipated, will be subjected to active earth pressures. Surcharge effects for sloped backfill, point or area loads behind the walls, and adequate drainage provisions should be incorporated in the wall design. Passive resistance, resulting from footing embedment at the wall toe, could be neglected for safer design.

The following soil parameters can be used for the project where soils are placed adjacent to the culvert wing walls:

- Retained Soil Unit Weight, Saturated (γ_{sat}) = 120 pcf
- Retained Soil Unit Weight, Moist (γ_m) = 110 pcf
- Retained Soil Angle of Internal Friction (ϕ) = 30 degrees
- Coefficient of Active Earth Pressure, k_a = 0.33
- Coefficient of Passive Earth Pressure, k_p = 3.0
- Foundation Soil Unit Weight, Saturated (γ_{sat}) = 125 pcf
- Foundation Soil Angle of Internal Friction (ϕ) = 30 degrees

The above parameters are based on clean sand backfill (SP) placed and compacted behind the walls and on compaction of the wall foundation soils as discussed in Section 6.3. A coefficient of friction for poured in-place concrete of 0.45 may be used in the wall design. The walls should be designed to include all temporary construction and permanent traffic and surcharge loads acting on the walls.

5.2.5 Hydrostatic Uplift Resistance

It is anticipated that the buried structures will exert little or no net downward pressure on the soils, rather, the structures may be subject to hydrostatic uplift pressure when empty. Below grade structures should be designed to resist hydrostatic uplift pressures appropriate for their depth below existing grade and the normal seasonal high groundwater table. Hydrostatic uplift forces can be resisted in several ways including:

- Addition of dead weight to the structure.
- Mobilizing the dead weight of the soil surrounding the structure through extension of footings outside the perimeter of the structure.

A moist compacted soil unit weight of 110 lb/ft^3 may be used in designing structures to resist buoyancy.

5.3 Pump Station and Stormwater Vault Foundation Recommendations

Based on the results of our exploration, we consider the subsurface conditions at the site adaptable for support of the proposed pump station equipment on a slab-on-grade foundation, provided that surficial topsoil is removed from within the construction area and replaced with suitable structural fill material as outlined in Section 6.0.

5.3.1 Bearing Pressure

The maximum allowable net soil bearing pressure for use in slab-on-grade design should not exceed 2,000 psf. The maximum allowable net soil bearing pressure for the wet well and stormwater vault base slabs should not exceed 1,500 psf. Net bearing pressure is defined as the soil bearing pressure at the foundation bearing level in excess of the natural overburden pressure at that level. The slab-on-grade and base slab foundations should be designed based on the maximum load that could be imposed by all loading conditions.

5.3.2 Bearing Depth

The slab-on-grade supporting surface pump station equipment should bear at a depth of at least 12 inches below the exterior final grades. It is recommended that stormwater be diverted away from these slabs to reduce the possibility of erosion beneath the slabs.

5.3.3 Bearing Material

The subgrade soils below the slab-on-grade and the wet well/stormwater vault slabs should consist of suitable on-site or import structural fill soils. The fine sands (SP) and fine sands with silt (SP-SM) as encountered in the borings are considered suitable onsite soils. These soils should be compacted to at least 95 percent of the soil's modified Proctor Maximum Dry Density (ASTM D-1557) to a depth of at least one foot below the slab bearing levels. Control of the soil's moisture content, particularly for the subgrade soils below the wet well/stormwater vault slabs, will be necessary to achieve the required level of compaction.

5.4 Bulkhead Design - Geotechnical Soil Parameters

Estimated soil parameters that can be used for design of the proposed bulkhead are presented in Appendix C. These parameters are based on the subsurface conditions encountered at the boring locations, and on empirical correlations between N-values and various soil properties. In each case, N-values were averaged over the zone of interest. We have assumed for design purposes that the groundwater behind the bulkhead is at the existing ground surface.

5.4.1 Field Permeability Tests

The results of the saturated field permeability tests provided the following vertical and horizontal soil permeabilities:

Test Location	Approximate Test Depth (feet)*	Measured Permeability (cm/s)
FP-1 – Vertical	17	4.14×10^{-4}

Test Location	Approximate Test Depth (feet)*	Measured Permeability (cm/s)
FP-1 - Horizontal	16 to 17	1.10×10^{-3}
FP-2 – Vertical	17	2.20×10^{-4}
FP-2 – Horizontal	16 to 17	3.98×10^{-3}
FP-3 - Vertical	18	7.47×10^{-5}
FP-3 - Horizontal	17 to 18	1.73×10^{-4}

*Test depth is relative to the existing ground surface.

The measured soil permeability rates should not be construed to represent the actual soil permeability rate at the site. Differences in soil gradation, plasticity and relative density between boring locations and different depths will influence soil permeability. We recommend a minimum factor of safety of 2 be applied to the above soil permeability rate values for determining design flow rates to the horizontal well.

5.5 Environmental Classification

Soil corrosion series tests were performed on a soil samples obtained at selected boring locations across the project site to determine the environmental classification of the soils encountered. The samples were classified in accordance with FDOT procedures contained in Chapter 1.3.2.1 of the January 2019 edition of the FDOT *Structures Design Guidelines*. Sample location and test results are included in Appendix B.

6.0 SITE PREPARATION AND EARTHWORK RECOMMENDATIONS

Site preparation as outlined in this section should be performed to provide more uniform foundation bearing conditions, to reduce the potential for post-construction settlements of the planned structure.

6.1 Clearing and Stripping

Prior to construction, the location of existing underground utility lines within the construction area should be established. Provisions should then be made to relocate interfering utilities to appropriate locations. It should be noted that, if underground pipes are not properly removed or plugged, they may serve as conduits for subsurface erosion, which may subsequently lead to excessive settlement of overlying structure.

The soil boring performed adjacent to the existing culverts encountered pavement layer thicknesses of up to 3 inches of asphalt and 5.5 inches of limerock or concrete base courses.

The boring performed in the area of the planned pump station encountered a topsoil layer approximately 6 inches thick along with silty fine sands with organic material to a depth of approximately 20 feet below existing grade. Therefore, it should be anticipated that up to about 6 inches of topsoil and soils containing significant amounts of organic materials may be encountered in this area. The actual depths of topsoil should be determined by MAE using visual observation and judgment during earthwork operations.

Debris laden soils and soils with significant organic content should not be reused as backfill material within the planned culvert and/or pump station structure excavations. During the demolition process, the debris laden soils and unsuitable soils should be stockpiled a safe distance from the construction area and

removed from the site. However, topsoil may be stockpiled and used subsequently in areas to be landscaped.

6.2 Temporary Groundwater Control

Because of the need for excavation to the bottom elevation of the culverts, stormwater vault, and the pump station wet well bottom slab, followed by compaction of the bedding and backfill soils, it may be necessary to install temporary groundwater control measures to dewater the area to facilitate the excavation and compaction processes.

The groundwater control measures should be determined by the contractor but can consist of sumps or wellpoints (or a combination of these or other methods) capable of lowering the groundwater level to at least 2 feet below the required depth of excavation. The dewatering system should not be decommissioned until excavation, compaction, and fill placement is complete, and sufficient deadweight exists on the culvert structure to prevent uplift.

Note that discharge of produced groundwater to surface waters of the state from dewatering operations or other site activities is regulated and requires a permit from the State of Florida Department of Environmental Protection (FDEP). This permit is termed a *Generic Permit for the Discharge of Produced Groundwater From Any Non-Contaminated Site Activity*. If discharge of produced groundwater is anticipated, we recommend sampling and testing of the groundwater early in the site design phase to prevent project delays during construction. MAE can provide the sampling, testing, and professional consulting required to evaluate compliance with the regulations.

6.3 Compaction of Excavation Bottoms and Backfilling

Once the clearing and stripping has been completed, and subsequent to the clearing and removal of all debris associated with the demolition of the existing infrastructure, excavation for the culverts, stormwater vault, and pump station wet well structures may commence. The excavations should extend at least 3 feet in all directions outside the lateral dimensions of the structures. Once the culverts, stormwater vault, and pump station wet well structure excavations have achieved their target depths, backfill placement can commence.

The temporary dewatering method should remain in-place to facilitate compaction of the bottom soils at the bearing depth of these structures, and to facilitate the backfilling operation. The bottom soils for the wet well and stormwater vault slabs should be compacted to 95 percent of their modified Proctor maximum dry density for a depth of 12 inches below subgrade elevation. It is anticipated that loose silty sands will be encountered at the bearing elevations, therefore we recommend the excavation continue to the bottom of the very loose silty fine sand at a depth of approximately 20 feet and be backfilled with structural backfill as described in Section 6.5 or a graded aggregate such as ASTM C33 Gradation 67 stone.

If stone is used, the excavation bottom soils should be overlain with a filter fabric to act as a separation layer between the silty fine sand and the stone backfill. The fabric should continue up the sides of the excavation to separate the soil backfill from the adjacent silty soils. The stone should be placed in lifts of equal thickness but with no lift greater than 12 inches thick, with each lift compacted to form a stable working surface.

Backfill soil placed against the sides of the structure above the subgrade stone should consist of structural backfill as defined in Section 6.5 below. The backfill should be placed in maximum 6-inch lifts, with each lift compacted with hand-held equipment as defined in Section 6.6. Backfill placed more than 5 feet away from the structure walls may be placed in lifts up to 12 inches in thickness, with each lift compacted with

appropriate compaction equipment to achieve the same level of compaction.

Dewatering should remain in place until the level of backfill is at least 2 feet above the groundwater table at the time of construction.

To avoid damage to the culvert wingwalls during the compaction process, heavy compaction equipment should not be used within 5 feet of the walls. Hand-held compaction equipment should be used in these areas. The fill material within 5 feet of the wall should be placed in thin lifts (6 inches or less) and compacted as discussed above. Excessive compaction should be avoided as it can result in overstressing of the walls.

6.4 Surface Compaction

The exposed surface areas outside of the excavation areas should be compacted with a vibratory drum roller (operating in static mode only) having a minimum static, at-drum weight, on the order of 3 to 5 tons. Static mode is recommended due to the proximity of numerous nearby structures including residential homes and buildings as well as retaining walls. Alternatively, a track-mounted bulldozer may be used for compaction.

Typically, the material should exhibit moisture contents within ±2 percent of the modified Proctor optimum moisture content (ASTM D 1557) during the compaction operations. Compaction should continue until densities of at least 95 percent of the modified Proctor maximum dry density (ASTM D 1557) have been achieved within the upper 2 feet of the compacted natural soils at the sites.

Should the surface soils experience pumping and soil strength loss during the compaction operations, compaction work should be immediately terminated. The disturbed soils should be removed and backfilled with dry structural fill soils, which are then compacted, or the excess moisture content within the disturbed soils should be allowed to dissipate before recompacting.

Care should be exercised to avoid damaging any nearby structures while the compaction operation is underway. Prior to commencing compaction, occupants of adjacent structures should be notified, and the existing conditions of the structures should be documented with photographs and survey (if deemed necessary). Compaction should cease if deemed detrimental to adjacent structures, and MAE should be contacted immediately.

6.5 Structural Backfill and Fill Soils

Any structural backfill or fill required for site development should be placed in loose lifts not exceeding 12 inches in thickness and compacted by the use of the above described vibratory drum roller. The lift thickness should be reduced to 8 inches if the roller operates in the static mode or if track-mounted compaction equipment is used. If hand-held compaction equipment is used, the lift thickness should be further reduced to 6 inches.

Structural fill is defined as a non-plastic, inorganic, granular soil having less than 12 percent material passing the No. 200 mesh sieve and containing less than 4 percent organic material. The fine sand and slightly silty fine sand, without roots, as encountered in the borings, are suitable as fill materials and, with proper moisture control, should densify using conventional compaction methods. It should be noted that soils with more than 12 percent passing the No. 200 sieve will be more difficult to compact, due to their nature to retain soil moisture, and may require drying. Typically, the material should exhibit moisture contents within ±2 percent of the modified Proctor optimum moisture content (ASTM D 1557) during the compaction operations. Compaction should continue until densities of at least 95 percent of the modified

Proctor maximum dry density (ASTM D 1557) have been achieved within each lift of the compacted structural fill.

We recommend that material excavated from the wet well, stormwater vault, and culvert trenches, which meet the criteria for structural fill and will be reused as backfill, be stockpiled a safe distance from the excavations and in such a manner that promotes runoff away from the open trenches and limits saturation of the materials.

6.6 Pavement Areas

After completing the clearing/stripping operations in the pavement areas, structural backfill and fill required to achieve the finish pavement grades then can be placed and compacted as described Section 6.4 above.

6.7 Excavation Protection

Excavation work for the culvert construction will be required to meet OSHA Excavation Standard Subpart P regulations for Type C Soils. The use of excavation support systems will be necessary where there is not sufficient space to allow the side slopes of the excavation to be laidback to at least 2H:1V (2 horizontal to 1 vertical) to provide a safe and stable working area and to facilitate adequate compaction along the sides of the excavation.

The method of excavation support should be determined by the contractor but can consist of a trench box, drilled-in soldier piles with lagging, interlocking steel sheeting or other methods. The support structure should be designed according to OSHA sheeting and bracing requirements by a Florida registered Professional Engineer.

7.0 QUALITY CONTROL TESTING

A representative number of field in-place density tests should be made in the upper 2 feet of compacted natural soils, in each lift of compacted backfill and fill, and in the upper 12 inches below the bearing levels in the footing excavations. The density tests are considered necessary to verify that satisfactory compaction operations have been performed. We recommend density testing be performed as listed below:

- one location for every 10,000 square feet of pavement area
- one location for every 500 feet of below-grade culvert alignment
- minimum of 2 locations at the wet well and 2 locations at the stormwater vault areas

8.0 REPORT LIMITATIONS

This report has been prepared for the exclusive use of McKim & Creed and the City of St. Augustine for specific application to the design and construction of the *Lake Maria Sanchez* project. An electronically signed and sealed version, and a version of our report that is signed and sealed in blue ink, may be considered an original of the report. Copies of an original should not be relied on unless specifically allowed by MAE in writing. Our work for this project was performed in accordance with generally accepted geotechnical engineering practice. No warranty, express or implied, is made.

The analyses and recommendations contained in this report are based on the data obtained from this

project. This testing indicates subsurface conditions only at the specific locations and times, and only to the depths explored. These results do not reflect subsurface variations that may exist away from the boring locations and/or at depths below the boring termination depths. Subsurface conditions and water levels at other locations may differ from conditions occurring at the tested locations. In addition, it should be understood that the passage of time may result in a change in the conditions at the tested locations. If variations in subsurface conditions from those described in this report are observed during construction, the recommendations in this report must be re-evaluated.

The scope of our services did not include any environmental assessment or testing for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the subject site. Any statements made in this report, and/or notations made on the generalized soil profiles or boring logs, regarding odors or other potential environmental concerns are based on observations made during execution of our scope of services and as such are strictly for the information of our client. No opinion of any environmental concern of such observations is made or implied. Unless complete environmental information regarding the site is already available, an environmental assessment is recommended.

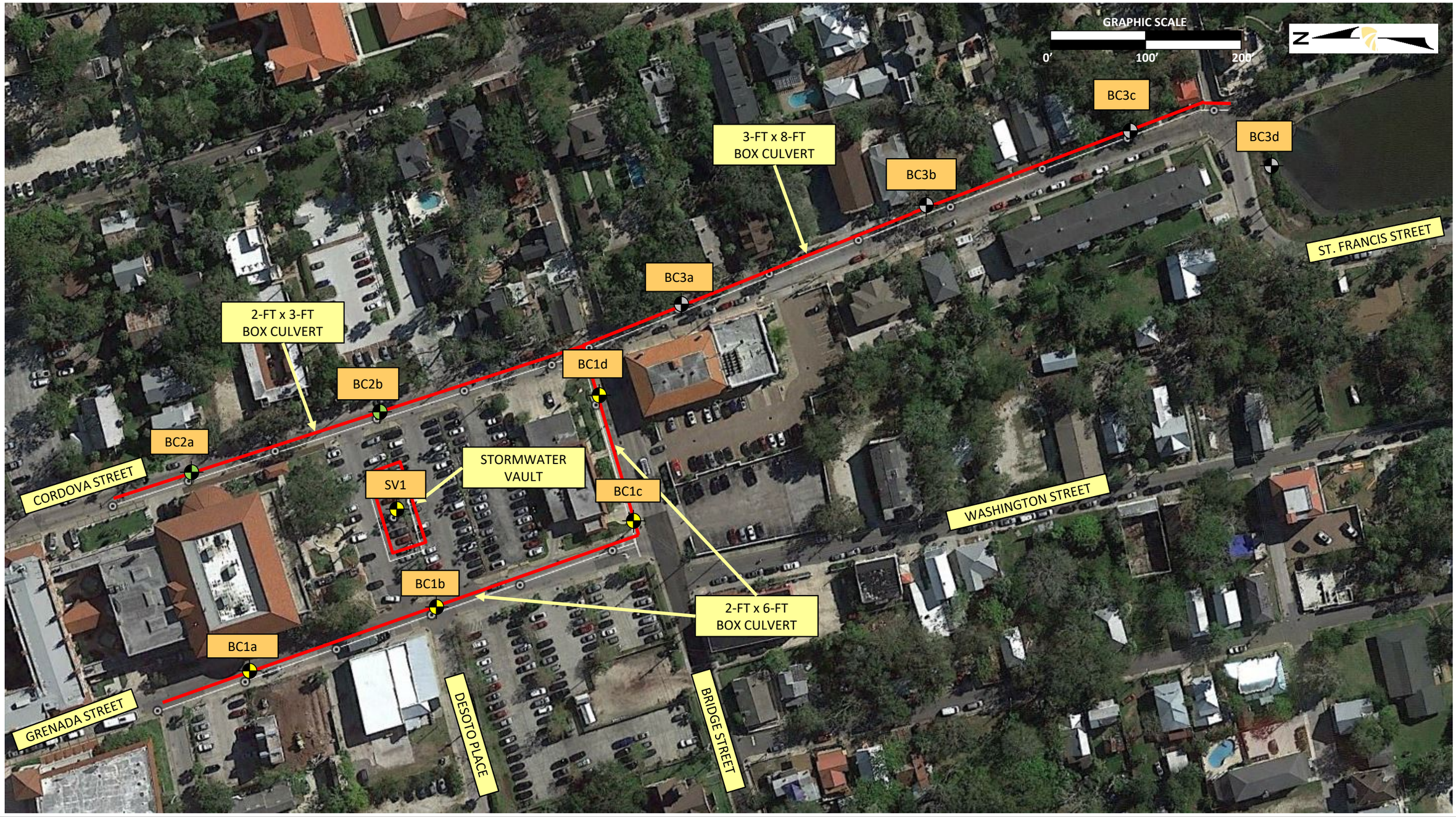
If changes in the design or location of the structures occur, the conclusions and recommendations contained in this report may need to be modified. We recommend that these changes be provided to us for our consideration. MAE is not responsible for conclusions, interpretations, opinions or recommendations made by others based on the data contained in this report.

Figures



Site Location Map

PREPARED BY	PROJECT NAME	
TEN YEARS 10 Meskel & Associates Engineering	**Lake Maria Sanchez Flood Mitigation and Drainage Project St. Augustine, Florida**	
	REFERERENCE	SCALE
	Delorme XMap 7.0	NTS
PREPARED FOR	MAE PROJECT NO.	**FIGURE NO.**
McKim & Creed	0194-0003	1



Project Manager:	BHH
Drawn by:	BHH
Checked by:	BHH
Approved by:	ADM

Project No.	003418.1
Scale:	AS SHOWN
File Name:	003418.1.BLP
Date:	07/24/2018

Meskel & Associates Engineering
Geotechnical ◤ Environmental ◤ Inspection ◤ Testing

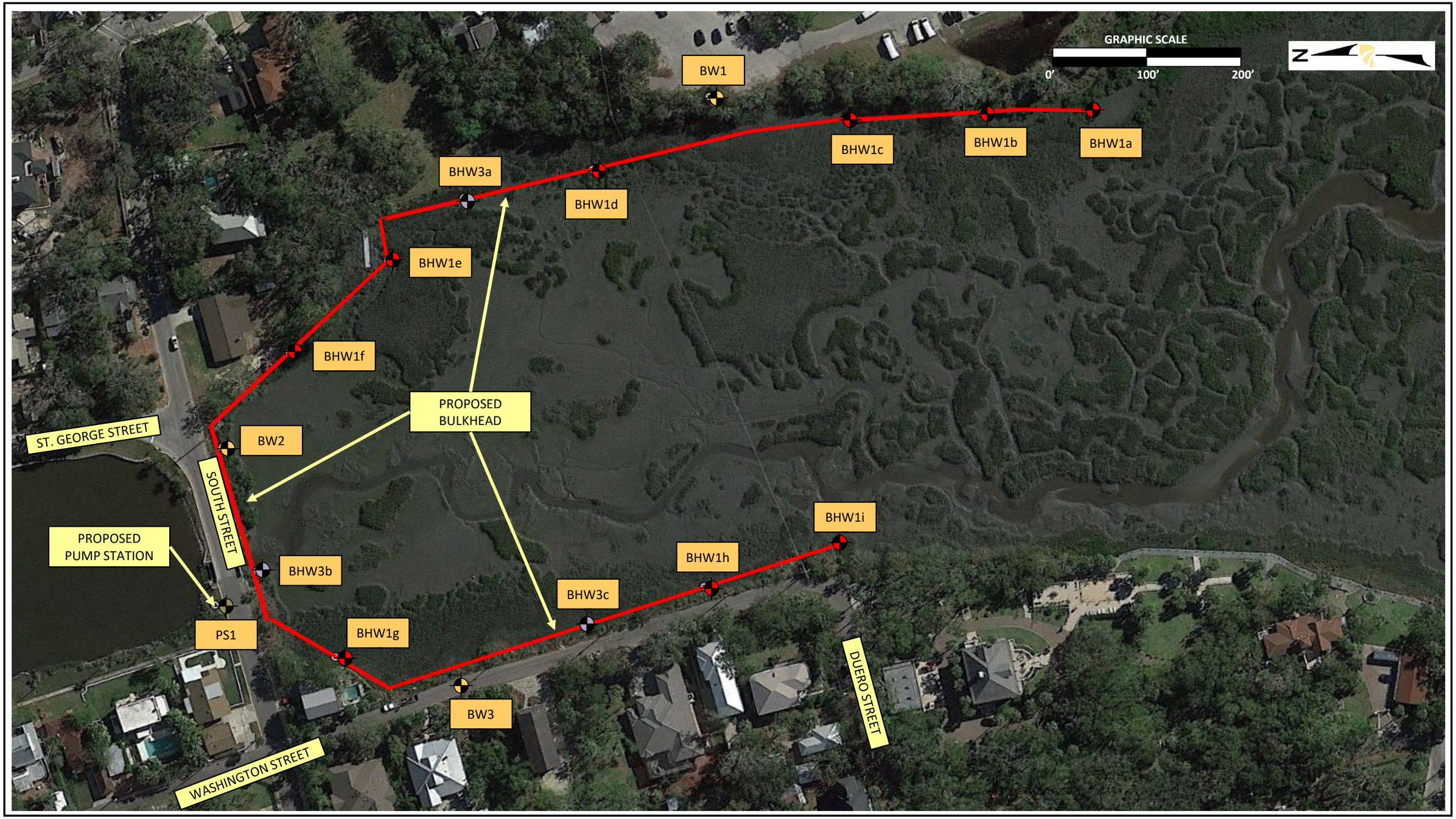
8936 WESTERN WAY. – SUITE 12 • JACKSONVILLE, FLORIDA 32256

PH. (904) 519-6990 • FAX (904) 519-6992 • www.MeskelEngineering.com

BORING LOCATION PLAN

LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT
ST. AUGUSTINE, FLORIDA

FIG NO. 1



Project Manager:	BHH
Drawn by:	BHH
Checked by:	BHH
Approved by:	ADM

Project No.	003418.1
Scale:	AS SHOWN
File Name:	003418.1.BLP
Date:	07/24/2018

MAE
Meskel & Associates Engineering
Geotechnical ⌜ Environmental ⌜ Inspection ⌜ Testing

8936 WESTERN WAY. – SUITE 12 • JACKSONVILLE, FLORIDA 32256

PH. (904) 519-6990 • FAX (904) 519-6992 • www.MeskelEngineering.com

BORING LOCATION PLAN

LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT
ST. AUGUSTINE, FLORIDA

FIG NO. 2

GRENADA STREET

BRIDGE STREET

BC1a
Latitude: 29°53'25.60"N
Longitude: 81°18'50.50"W

N

HA

- 0.0–0.2: Asphalt (2 3/4")
- 0.2–0.6: Concrete (5 1/2")
- 0.6–2.0: Very dark gray clayey fine SAND, trace gravel (rock fragments), poorly graded. (SC)
- 2.0–4.0: Very dark grayish brown fine SAND with silt, trace root fragments, poorly graded. (SP-SM)
- 4.0–6.0: Very dark grayish brown fine SAND with silt, trace gravel (rock fragments), poorly graded. (SP-SM)
- 6.0–8.0: Very dark grayish brown fine SAND with silt, trace root fragments, poorly graded. (SP-SM)
- 8.0–10.0: Medium dense, Very dark grayish brown fine SAND with silt, poorly graded. (SP-SM) — N = 11
- 10.0–12.0: Medium dense, Very dark grayish brown fine SAND with silt, poorly graded. (SP-SM) — N = 15
- 12.0–14.0: Loose, Dark yellowish brown fine SAND with silt, trace root fragments, poorly graded. (SP-SM) — N = 5
- 14.0–15.0: Medium dense, Light gray fine SAND, poorly graded. (SP-SM) — N = 11

BT @ 15.'
Date Drilled: 11/12/2018
Boring Grouted upon Termination.

BC1b
Latitude: 29°53'23.58"N
Longitude: 81°18'49.69"W

N

HA

- 0.0–4.0: Dark brown fine SAND, trace root fragments, poorly graded. (SP)
- 4.0–8.0: Very dark grayish brown fine SAND, trace gravel (shell fragments), poorly graded. (SP)
- 8.0–10.0: Loose, Very dark brown fine SAND with silt, poorly graded. (SP-SM) — w = 31, -200 = 8 — N = 6
- 10.0–12.0: Loose, Brown fine SAND with silt, trace root fragments, poorly graded. (SP-SM) — N = 4
- 12.0–14.0: Loose, Pale brown fine SAND with silt, trace root fragments, poorly graded. (SP-SM) — w = 21, -200 = 6 — N = 7
- 14.0–15.0: Loose, Very dark grayish brown fine SAND with silt, trace organic fines and root fragments, poorly graded. (SP-SM) — N = 9

BT @ 15.'
Date Drilled: 10/30/2018
Boring Grouted upon Termination.

BC1c
Latitude: 29°53'21.60"N
Longitude: 81°18'48.67"W

N

HA

- 0.0–4.0: Brown fine SAND, trace root fragments, trace gravel (shell fragments), poorly graded. (SP)
- 4.0–8.0: Very dark grayish brown fine SAND with silt, trace gravel (shell fragments), poorly graded. (SP-SM)
- 8.0–10.0: Loose, Very dark brown fine SAND with silt, poorly graded. (SP-SM) — w = 27, -200 = 6 — N = 3
- 10.0–12.0: Very loose to loose, Grayish brown fine SAND with silt, poorly graded. (SP-SM) — N = 5
- 12.0–14.0: Loose, Grayish brown fine SAND with silt, little wood fragments, poorly graded. (SP-SM) — N = 8

BT @ 15.'
Date Drilled: 10/30/2018
Boring Grouted upon Termination.

BC1d
Latitude: 29°53'22.05"N
Longitude: 81°18'47.30"W

N

HA

- 0.0–4.0: Dark brown fine SAND, few root fragments, poorly graded. (SP)
- 4.0–8.0: Very dark grayish brown fine SAND with silt, trace gravel (shell fragments), poorly graded. (SP-SM) — w = 20, -200 = 11
- 8.0–10.0: Loose, Very dark grayish brown fine SAND, trace gravel (shell fragments), poorly graded. (SP) — N = 4
- 10.0–12.0: Loose, Very dark grayish brown fine SAND, trace root fragments, poorly graded. (SP) — N = 7
- 12.0–14.0: Very loose, Dark grayish brown fine SAND with silt, trace gravel (shell fragments), poorly graded. (SP-SM) — w = 30, -200 = 8 — N = 2
- 14.0–15.0: Medium dense, Dark grayish brown fine SAND with silt, trace gravel (shell fragments), trace root fragments, poorly graded. (SP-SM) — N = 12

BT @ 15.'
Date Drilled: 10/30/2018
Boring Grouted upon Termination.

Depth (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16

Legend

- Asphalt
- Concrete
- Clayey Fine Sand
- Fine Sand with Silt
- Fine Sand

N — Standard Penetration Resistance, Blows/Foot
BT — Boring Terminated at Depth Below Existing Grade
(SP) — Unified Soil Classification System (USCS)
▽ — Depth to Groundwater at Time of Drilling
w — Natural Moisture Content (%)
-200 — % Passing No. 200 U.S. Standard Sieve
HA — Boring Advanced by hand-held bucket auger due to possible underground utilities.

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

BRETT H. HARBISON, P.E. P.E. NO.: 74679
TEN YEARS
Meskel & Associates Engineering
FL Certificate of Authorization No. 28142
8936 Western Way, Suite 12, Jacksonville, FL 32256

McKim & Creed

DATE:	MAE PROJECT NO.
2/8/2019	0194-0003

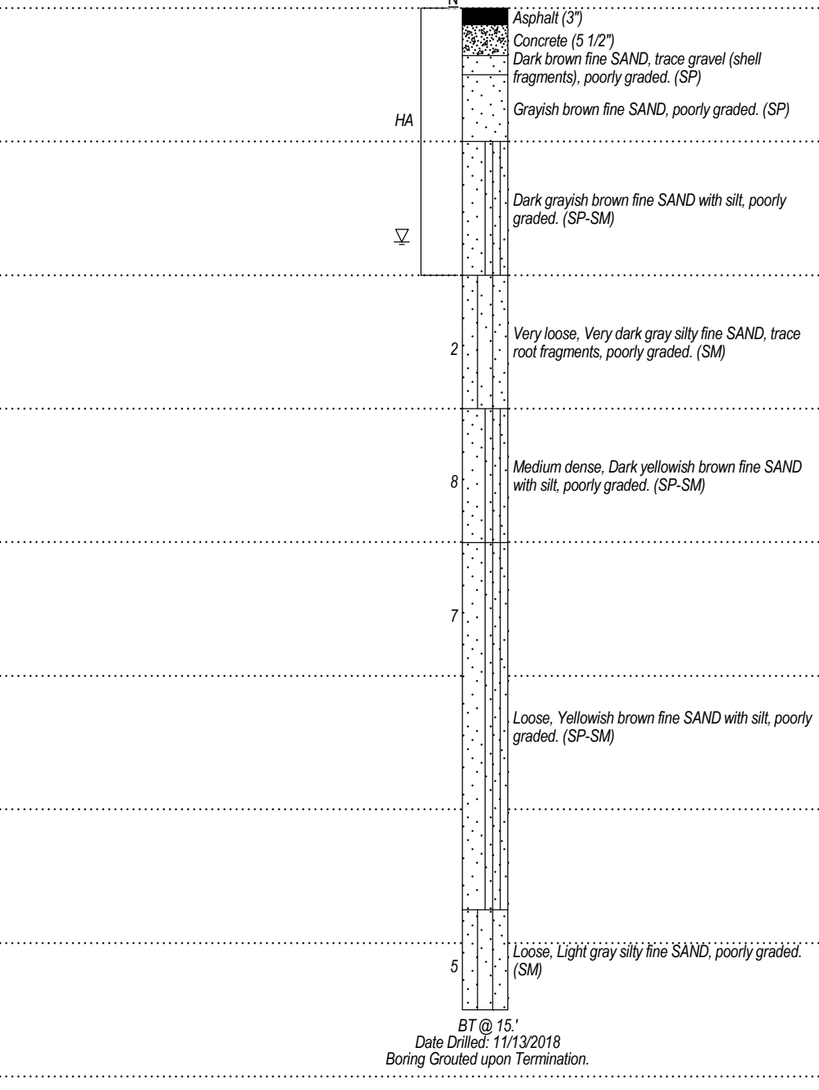
SHEET TITLE: *Generalized Soil Profiles*

PROJECT NAME: *Lake Maria Sanchez Flood Mitigation and Drainage Project*
St. Augustine, Florida

FIGURE NO. 3

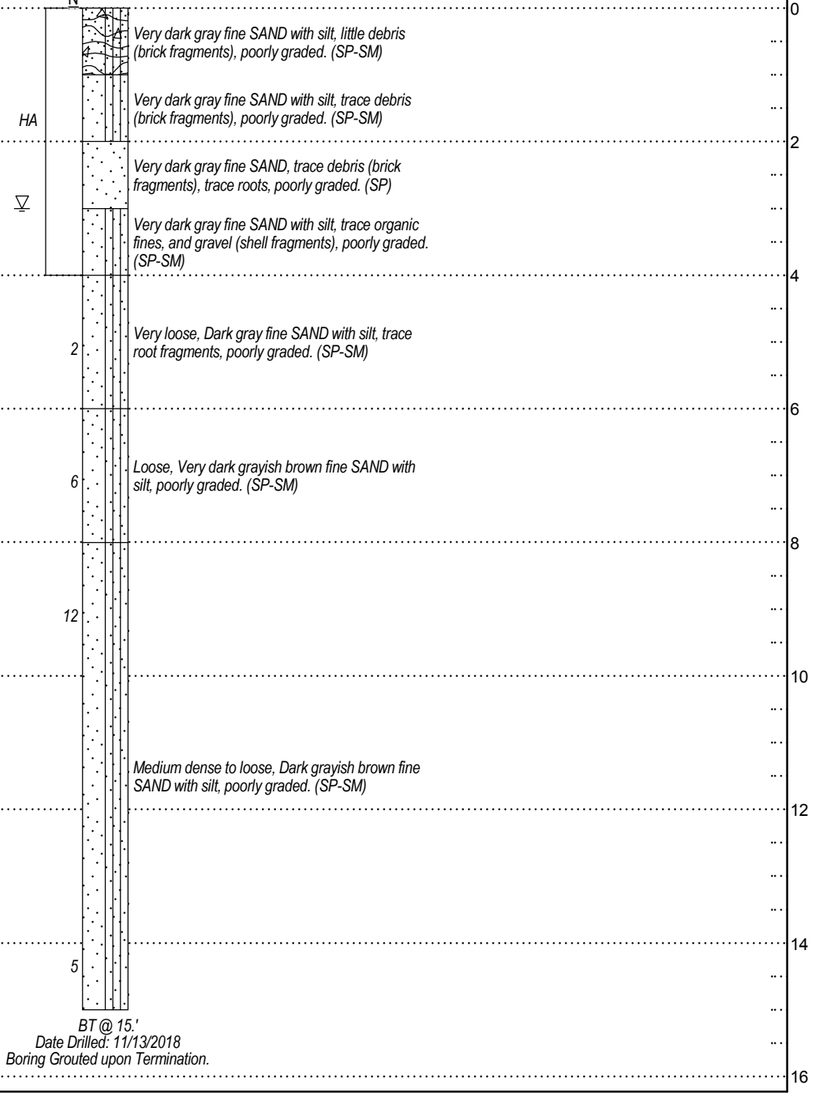
CARDOVA STREET

BC2a
Latitude: 29°53'26.28"N
Longitude: 81°18'48.13"W



BT @ 15.'
Date Drilled: 11/13/2018
Boring Grouted upon Termination.

BC2b
Latitude: 29°53'24.37"N
Longitude: 81°18'47.45"W



BT @ 15.'
Date Drilled: 11/13/2018
Boring Grouted upon Termination.

Depth (ft)

0 2 4 6 8 10 12 14 16

Legend

- Asphalt
- Concrete
- Fine Sand
- Fine Sand with Silt
- Silty Fine Sand
- Fine Sand with Silt and Debris

N — Standard Penetration Resistance, Blows/Foot

BT — Boring Terminated at Depth Below Existing Grade

(SP) — Unified Soil Classification System (USCS)

▽ — Depth to Groundwater at Time of Drilling

HA — Boring Advanced by hand-held bucket auger due to possible underground utilities.

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

BRETT H. HARBISON, P.E. P.E. NO.: 74679
TEN YEARS
Meskel & Associates Engineering
FL Certificate of Authorization No. 28142
8936 Western Way, Suite 12, Jacksonville, FL 32256

McKim & Creed

DATE:	MAE PROJECT NO.
2/8/2019	0194-0003

SHEET TITLE: *Generalized Soil Profiles*

PROJECT NAME: *Lake Maria Sanchez Flood Mitigation and Drainage Project*
St. Augustine, Florida

FIGURE NO. 4

CARDOVA STREET

BC3a
Latitude: 29°53'21.30"N
Longitude: 81°18'46.01"W

- Very dark gray fine SAND with silt, poorly graded. (SP-SM)
- Dark gray silty fine SAND, trace gravel (rock fragments), poorly graded. (SM)
- Very dark gray silty fine SAND, poorly graded. (SM)

BT @ 5.'
Date Drilled: 11/13/2018
Boring Grouted upon Termination.
4" Diameter PVC Casing Set to 5 ft.

BC3b
Latitude: 29°53'18.64"N
Longitude: 81°18'44.78"W

- Very dark grayish brown fine SAND with silt, trace gravel (shell fragments), poorly graded. (SP-SM)
- Dark brown fine SAND with silt, trace gravel (shell fragments), poorly graded. (SP-SM)
- Very dark gray fine SAND with silt, trace gravel (shell fragments), poorly graded. (SP-SM)
- Very dark gray silty fine SAND, trace root fragments, poorly graded. (SM)
- Very dark gray silty fine SAND, poorly graded. (SM)

BT @ 5.'
Date Drilled: 11/13/2018
Boring Grouted upon Termination.
4" Diameter PVC Casing Set to 5 ft.

BC3c
Latitude: 29°53'16.52"N
Longitude: 81°18'43.82"W

- Dark brown fine SAND with silt, poorly graded. (SP-SM)
- Dark grayish brown fine SAND with silt, poorly graded. (SP-SM)
- Dark gray silty fine SAND, poorly graded. (SM)
- Dark gray fine SAND with silt, poorly graded. (SP-SM)

BT @ 5.'
Date Drilled: 11/13/2018
Boring Grouted upon Termination.
4" Diameter PVC Casing Set to 5 ft.

BC3d
Latitude: 29°53'15.12"N
Longitude: 81°18'44.26"W

N

- HA — Very dark gray fine SAND, few gravel (shell fragments), poorly graded. (SP)
- Very dark gray silty fine SAND, trace root fragments, poorly graded. (SM)
- 3 — Very dark gray silty fine SAND, poorly graded. (SM)
- Very dark gray silty fine SAND, trace gravel (rock fragments), poorly graded. (SM)
- Loose, Dark gray fine SAND with silt, poorly graded. (SP-SM)
- 6 — Loose, Very dark gray silty fine SAND, poorly graded. (SM)
- 6 — Loose, Light olive gray silty fine SAND, poorly graded. (SM)
- 5 — Loose, Light yellowish brown silty fine SAND, poorly graded. (SM)
- 20 — Medium dense, Pale brown fine SAND with silt, some gravel (shell fragments), poorly graded. (SP-SM)

BT @ 25.'
Date Drilled: 11/13/2018
Boring Grouted upon Termination.

Depth (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26

Legend

- Fine Sand with Silt
- Silty Fine Sand
- Fine Sand
- 4" Dia. PVC Casing
- N — Standard Penetration Resistance, Blows/Foot
- BT — Boring Terminated at Depth Below Existing Grade
- (SP) — Unified Soil Classification System (USCS)
- ▽ — Depth to Groundwater at Time of Drilling
- HA — Boring Advanced by hand-held bucket auger due to possible underground utilities.

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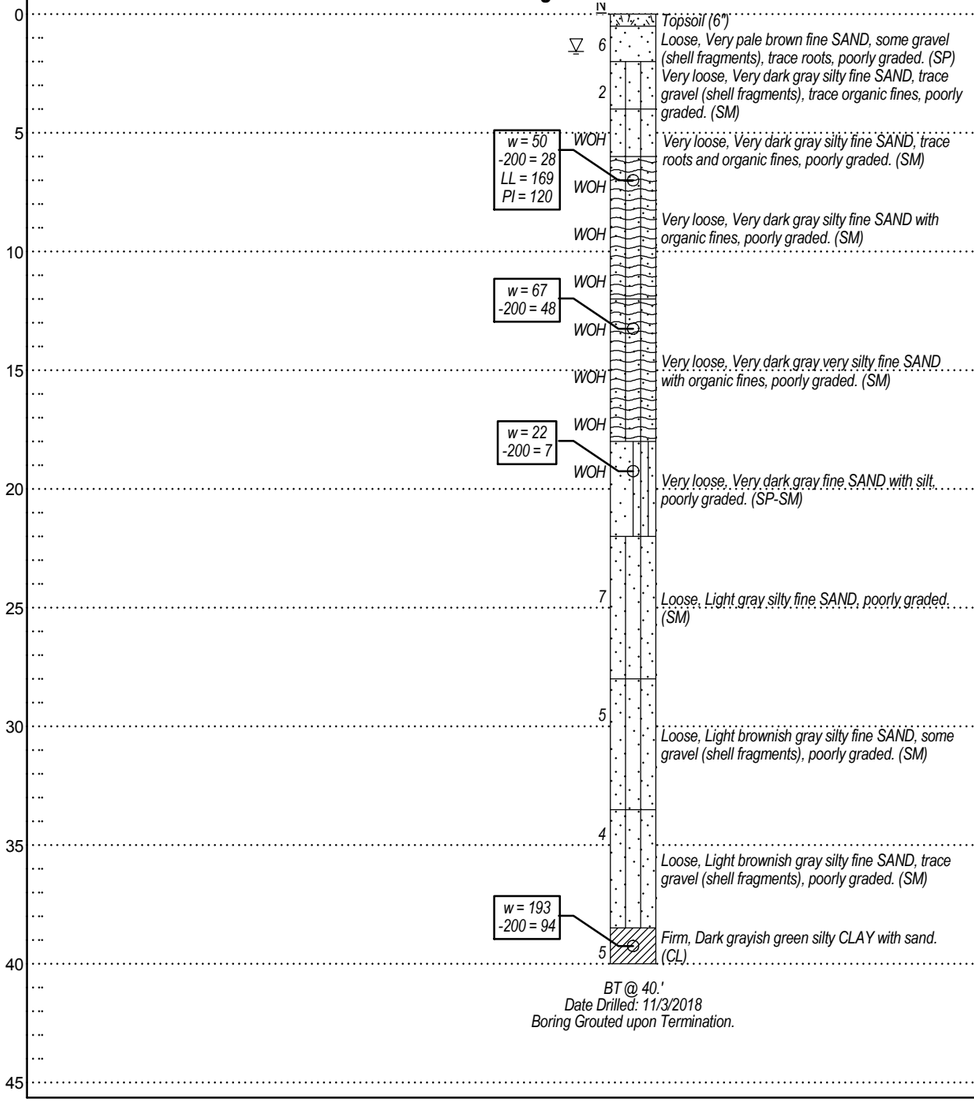
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PROJECT NAME: *Lake Maria Sanchez Flood Mitigation and Drainage Project*
St. Augustine, Florida

FIGURE NO. 5

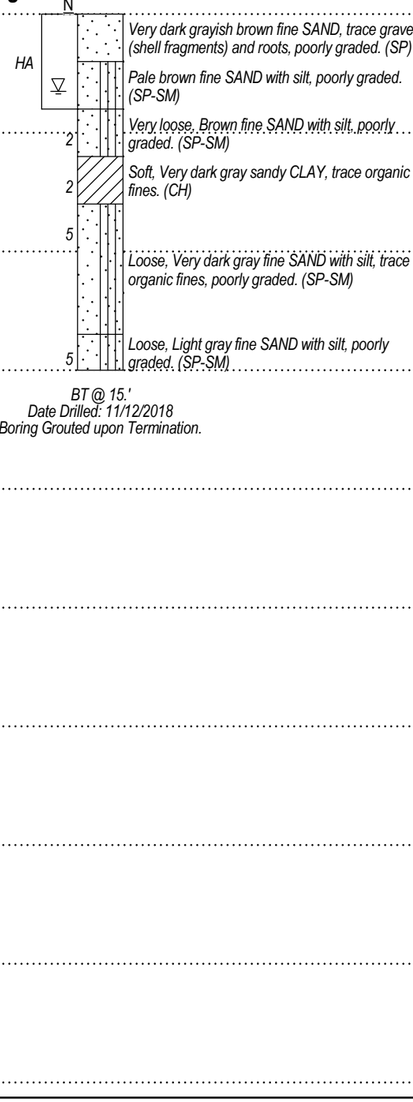
Pump Station
PS1
Latitude: 29°52'58.85"N
Longitude: 81°18'38.17"W



Topsoil (6")
Loose, Very pale brown fine SAND, some gravel (shell fragments), trace roots, poorly graded. (SP)
Very loose, Very dark gray silty fine SAND, trace gravel (shell fragments), trace organic fines, poorly graded. (SM)
Very loose, Very dark gray silty fine SAND, trace roots and organic fines, poorly graded. (SM)
Very loose, Very dark gray silty fine SAND with organic fines, poorly graded. (SM)
Very loose, Very dark gray very silty fine SAND with organic fines, poorly graded. (SM)
Very loose, Very dark gray fine SAND with silt, poorly graded. (SP-SM)
Loose, Very dark gray silty fine SAND, poorly graded. (SM)
Loose, Light brownish gray silty fine SAND, some gravel (shell fragments), poorly graded. (SM)
Loose, Light brownish gray silty fine SAND, trace gravel (shell fragments), poorly graded. (SM)
Firm, Dark grayish green silty CLAY with sand. (CL)

BT @ 40.'
Date Drilled: 11/3/2018
Boring Grouted upon Termination.

Stormwater Vault
SV1
Latitude: 29°53'24.15"N
Longitude: 81°18'48.50"W



Very dark grayish brown fine SAND, trace gravel (shell fragments) and roots, poorly graded. (SP)
Pale brown fine SAND with silt, poorly graded. (SP-SM)
Very loose, Brown fine SAND with silt, poorly graded. (SP-SM)
Soft, Very dark gray sandy CLAY, trace organic fines. (CH)
Loose, Very dark gray fine SAND with silt, trace organic fines, poorly graded. (SP-SM)
Loose, Light gray fine SAND with silt, poorly graded. (SP-SM)

BT @ 15.'
Date Drilled: 11/12/2018
Boring Grouted upon Termination.

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 35, 40, 45

Legend

Topsoil
Silty Fine Sand with Organic Material
Fine Sand
Fine Sand with Silt
Silty Fine Sand
Clay

N — Standard Penetration Resistance, Blows/Foot
BT — Boring Terminated at Depth Below Existing Grade
(SP) — Unified Soil Classification System (USCS)
▽ — Depth to Groundwater at Time of Drilling
w — Natural Moisture Content (%)
-200 — % Passing No. 200 U.S. Standard Sieve
OC — Organic Content
WOH — Sampler advanced by weight of hammer
HA — Boring Advanced by hand-held bucket auger due to possible underground utilities.
LL — Liquid Limit
PI — Plasticity Index

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SHEET TITLE: *Generalized Soil Profiles*

PROJECT NAME: *Lake Maria Sanchez Flood Mitigation and Drainage Project*
St. Augustine, Florida

FIGURE NO. 6

Proposed Bulkhead

BHW1a
Latitude: 29°52'49.56"N
Longitude: 81°18'31.76"W

N	Depth (ft)	Description
3	0	Very loose, Dark greenish brown fine SAND with silt, few root fragments, poorly graded. (SP-SM)
3		
2	5	Very loose, Dark grayish brown fine SAND with silt, poorly graded. (SP-SM)
3		Very loose, Yellowish brown fine SAND with silt, trace root fragments, poorly graded. (SP-SM)
2	10	Very loose, Dark brown fine SAND with silt, trace root fragments, poorly graded. (SP-SM)
5	15	Loose, Greenish gray silty fine SAND, poorly graded. (SM)
8		Loose, Light greenish gray silty fine SAND, trace root fragments, poorly graded. (SM)
15	25	Medium dense, Pale brown fine SAND, some gravel (shell fragments), poorly graded. (SP)
14	30	Medium dense, Pale brown fine SAND with silt, some gravel (shell fragments), poorly graded. (SP-SM)
5	35	Loose, Grayish green silty fine SAND, trace gravel (shell fragments), poorly graded. (SM)
5	40	
12	45	Loose to medium dense, Grayish green clayey fine SAND with silt, trace gravel (shell fragments), poorly graded. (SC)
10	50	Medium dense, Light grayish green fine SAND with silt, some gravel (shell fragments), poorly graded. (SP-SM)
	55	

BT @ 50.'
Date Drilled: 1/10/2019
Boring Grouted upon Termination.

BHW1b
Latitude: 29°52'51.07"N
Longitude: 81°18'31.90"W

N	Depth (ft)	Description
WOH	0	Very soft, Very dark grayish olive SILT with sand, trace gravel (shell fragments). (ML)
1		Very loose, Dark olive brown silty fine SAND, trace root fragments, poorly graded. (SM)
2	5	
4		Very loose, Yellowish brown very silty fine SAND, trace root fragments, poorly graded. (SM)
4	10	
5	15	Loose, Pale olive very silty fine SAND, poorly graded. (SM)
w = 31 -200 = 5		
6	20	Loose, Olive yellow fine SAND with silt, poorly graded. (SP-SM)
11	25	Medium dense, Pale brown fine SAND with silt, some gravel (shell fragments), poorly graded. (SP-SM)
10	30	Medium dense, Gray fine SAND with silt, few gravel (shell fragments), poorly graded. (SP-SM)
5	35	Loose, Greenish gray silty fine SAND, few gravel (shell fragments), poorly graded. (SM)
w = 88 -200 = 97		
7	40	
8	45	Firm to stiff, Greenish gray silty CLAY, trace gravel (shell fragments). (CL)
11	50	Medium dense, Dark greenish gray fine SAND with silt, some gravel (shell fragments), poorly graded. (SP-SM)
	55	

BT @ 50.'
Date Drilled: 1/11/2019
Boring Grouted upon Termination.
4" Diameter Steel Casing Set to 15 ft.

BHW1c
Latitude: 29°52'52.32"N
Longitude: 81°18'31.99"W

N	Depth (ft)	Description
3	0	Very loose, Dark brown fine SAND with silt, trace organic fines, poorly graded. (SP-SM)
2		Very loose, Dark brown silty fine SAND, trace root fragments, poorly graded. (SM)
2	5	
5		Very loose, Dark brown very silty fine SAND, poorly graded. (SM)
5	10	Loose, Dark brown silty fine SAND, poorly graded. (SM)
w = 28 -200 = 4		
12	15	Medium dense, Light gray fine SAND, trace silt, poorly graded. (SP)
9	20	Loose, Pale yellow fine SAND, some gravel (shell fragments), poorly graded. (SP)
11	25	Medium dense, Pale brown fine SAND, some gravel (shell fragments), poorly graded. (SP)
16	30	Medium dense, Gray fine SAND with silt, some gravel (shell fragments), poorly graded. (SP-SM)
5	35	
6		Loose, Grayish green silty fine SAND, trace gravel (shell fragments), poorly graded. (SM)
6	40	
13	45	Medium dense, Dark greenish gray silty fine SAND, poorly graded. (SM)
13	50	Medium dense, Greenish gray fine SAND with silt, poorly graded. (SP-SM)
	55	

BT @ 50.'
Date Drilled: 1/14/2019
Boring Grouted upon Termination.

Legend

- Clayey Fine Sand
- Fine Sand with Silt
- 4" Dia. Steel Casing
- Silty Fine Sand
- Silt
- Fine Sand
- Clay

N — Standard Penetration Resistance, Blows/Foot
BT — Boring Terminated at Depth Below Existing Grade
(SP) — Unified Soil Classification System (USCS)
▽ — Depth to Groundwater at Time of Drilling
w — Natural Moisture Content (%)
-200 — % Passing No. 200 U.S. Standard Sieve
WOH — Sampler advanced by weight of hammer

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SHEET TITLE: Generalized Soil Profiles

PROJECT NAME: Lake Maria Sanchez Flood Mitigation and Drainage Project
St. Augustine, Florida

FIGURE NO. 7

Proposed Bulkhead

BHW1d
Northing: 29°52'54.98"N
Easting: 81°18'32.64"W

N	Description
2	Very loose, Very dark brown fine SAND with silt, trace root fragments, poorly graded. (SP-SM)
2	Very loose, Very dark brown silty fine SAND, trace organic fines, poorly graded. (SM)
3	Medium dense, Yellowish brown fine SAND with silt, trace organic fines and root fragments, poorly graded. (SP-SM)
11	
12	Medium dense, Light olive gray silty fine SAND, poorly graded. (SM)
11	
7	Medium dense to loose, Light olive gray fine SAND with silt, poorly graded. (SP-SM)
15	Medium dense, Olive yellow fine SAND, some gravel (shell fragments), poorly graded. (SP)
13	Medium dense, Gray fine SAND with silt, some gravel (shell fragments), poorly graded. (SP-SM)
5	Loose, Grayish green silty fine SAND, trace gravel (shell fragments), poorly graded. (SM)
7	Loose, Greenish gray very clayey fine SAND, few gravel (shell fragments). (SC)
11	Medium dense, Dark grayish green silty fine SAND with clay, poorly graded. (SM)
11	Medium dense, Dark greenish gray silty fine SAND, some gravel (shell fragments), poorly graded. (SM)

w = 29, OC = 1.9
w = 25, OC = 1.9
w = 59, -200 = 49, LL = 118, PI = 91

BT @ 50'.
Date Drilled: 1/14/2019
Boring Grouted upon Termination.

BHW1e
Northing: 29°52'57.09"N
Easting: 81°18'33.84"W

N	Description
WOH	Very loose, Very dark grayish brown very silty fine SAND with organic fines, little root fragments, poorly graded. (SM)
WOH	Wood and root fragments.
WOH	Very loose, Dark gray silty fine SAND with organic fines, poorly graded. (SM)
4	Loose, Light olive brown silty fine SAND, poorly graded. (SM)
4	Loose, Grayish gray silty fine SAND, poorly graded. (SC)
24	Medium dense, Light gray silty fine SAND, poorly graded. (SM)
11	Medium dense, Light olive gray silty fine SAND, poorly graded. (SM)
13	Medium dense, Pale brown fine SAND, some gravel (shell fragments), poorly graded. (SP)
19	Medium dense to loose, Gray fine SAND with silt, little gravel (shell fragments), p0oorly graded. (SP-SM)
7	Loose, Dark greenish gray silty fine SAND, little gravel (shell fragments), poorly graded. (SM)
6	Medium dense, Dark greenish gray silty fine SAND with clay, poorly graded. (SM)
11	Medium dense, Very dark greenish gray silty fine SAND, some gravel (shell fragments), poorly graded. (SM)
11	Dense to medium dense, Light gray fine SAND with silt, some gravel (shell fragments), poorly graded. (SP-SM)
14	Medium dense, Olive fine SAND with silt, trace gravel (shell fragments), poorly graded. (SP-SM)
34	Medium dense, Olive fine SAND with silt, poorly graded. (SP-SM)
13	
17	
13	
12	

BT @ 80'.
Date Drilled: 1/16/2019
Boring Grouted upon Termination.
4" Diameter Steel Casing Set to 10 ft.

BHW1f
Northing: 29°52'57.98"N
Easting: 81°18'34.96"W

N	Description
WOH	Very loose, Very dark brown fine SAND with silt, some gravel (rock fragments), trace roots, poorly graded. (SM)
2	Very loose, Very dark gray very silty fine SAND with organic fines, poorly graded. (SM)
4	Loose, Dark gray silty fine SAND, few gravel (shell fragments), trace roots and organic fines, poorly graded. (SM)
12	Medium dense, Very dark gray silty fine SAND, trace gravel (shell fragments), trace roots, poorly graded. (SP-SM)
13	Medium dense, Gray fine SAND with silt, poorly graded. (SM)
12	Medium dense, Dark grayish green silty fine SAND, poorly graded. (SP-SM)
17	Medium dense, Pale brown fine SAND with silt, little gravel (shell fragments), poorly graded. (SP-SM)
11	Medium dense, Light gray fine SAND with silt, some gravel (shell fragments), poorly graded. (SP-SM)
9	Loose, Gray fine SAND with silt, some gravel (shell fragments), poorly graded. (SP-SM)
5	Loose, Dark greenish gray fine SAND with silt, trace gravel (shell fragments), poorly graded. (SM)
5	Loose, Very dark gray silty fine SAND, trace gravel (shell fragments), poorly graded. (SC)
19	Medium dense, Very dark gray silty fine SAND, poorly graded. (SM)
13	Medium dense, Gray silty fine SAND, some gravel (shell and rock fragments), poorly graded. (SM)

BT @ 50'.
Date Drilled: 1/16/2019
Boring Grouted upon Termination.

Depth (ft)

Legend

- Fine Sand with Silt
- Clayey Fine Sand
- 4" Dia. Steel Casing
- Silty Fine Sand
- Silty Fine Sand with Organic Material
- Fine Sand
- Wood

N	Standard Penetration Resistance, Blows/Foot	(SP)	Unified Soil Classification System (USCS)	w	Natural Moisture Content (%)	LL	Liquid Limit
BT	Boring Terminated at Depth Below Grade	▽	Depth to Groundwater at Time of Drilling	-200	% Passing No. 200 U.S. Standard Sieve	PI	Plasticity Index
				WOH	Sampler advanced by weight of hammer	OC	Organic Content

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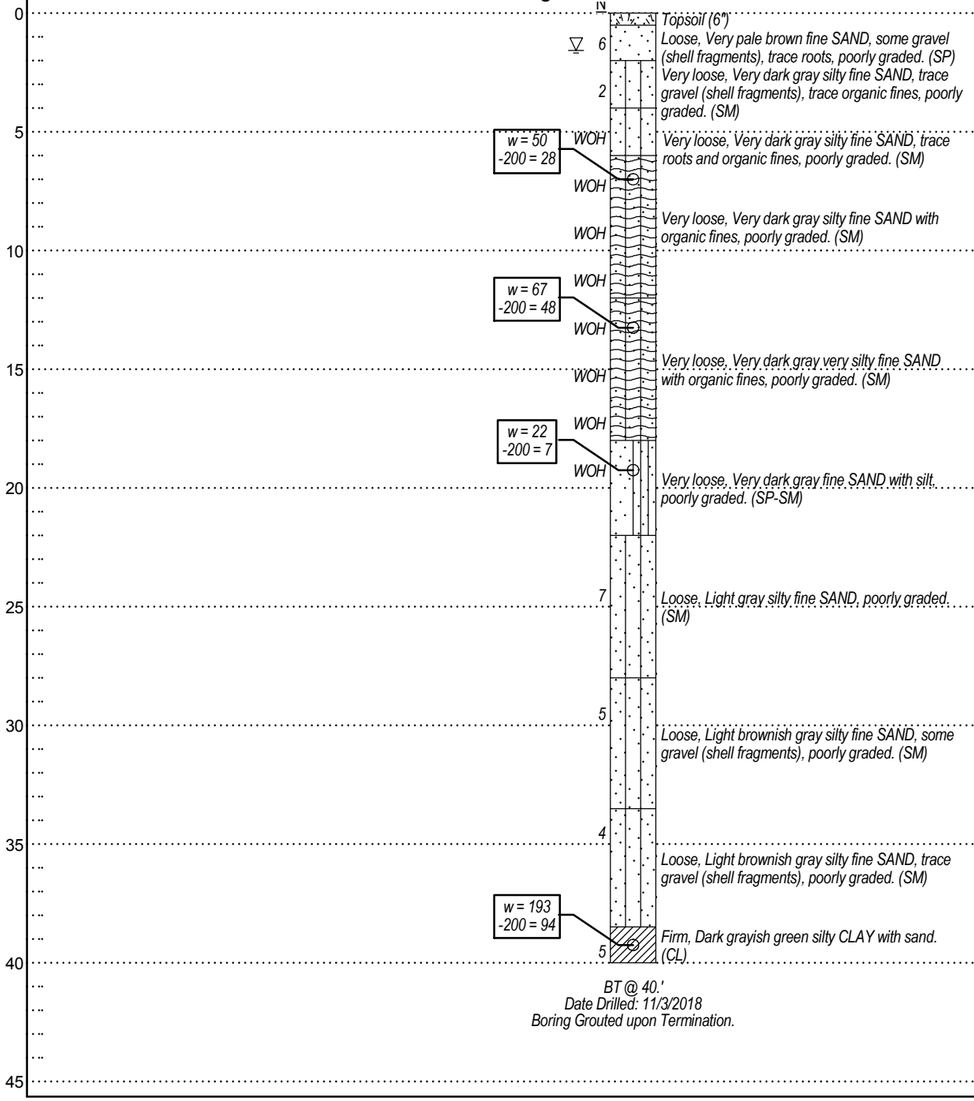
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St. Augustine, Florida

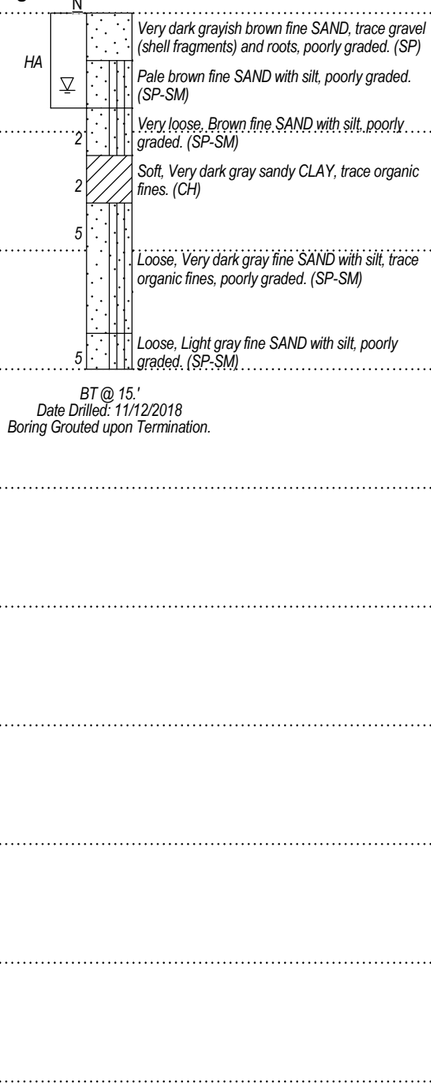
FIGURE NO. 8

Pump Station
PS1
Latitude: 29°52'58.85"N
Longitude: 81°18'38.17"W



BT @ 40.'
Date Drilled: 11/3/2018
Boring Grouted upon Termination.

Stormwater Vault
SV1
Latitude: 29°53'24.15"N
Longitude: 81°18'48.50"W



BT @ 15.'
Date Drilled: 11/12/2018
Boring Grouted upon Termination.

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 35, 40, 45

Legend

- Topsoil
- Silty Fine Sand with Organic Material
- Fine Sand
- Fine Sand with Silt
- Silty Fine Sand
- Clay

- N — Standard Penetration Resistance, Blows/Foot
- BT — Boring Terminated at Depth Below Existing Grade
- (SP) — Unified Soil Classification System (USCS)
- ▽ — Depth to Groundwater at Time of Drilling
- w — Natural Moisture Content (%)
- -200 — % Passing No. 200 U.S. Standard Sieve
- OC — Organic Content
- HA — Boring Advanced by hand-held bucket auger due to possible underground utilities.
- WOH — Sampler advanced by weight of hammer

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St. Augustine, Florida

FIGURE NO. 9

Proposed Bulkhead

BHW3a
Northing: 29°52'56.28"N
Easting: 81°18'32.99"W

N	Description
WOH	Very loose, Very dark gray silty fine SAND with organic fines, little root fragments, poorly graded. (SM)
WOH	Very loose, Very dark gray silty fine SAND, trace root fragments, poorly graded. (SM)
2	Very loose, Very dark gray silty fine SAND, few organic fines, trace root fragments, poorly graded. (SM)
3	
5	Loose,Greenish gray fine SAND with silt, poorly graded. (SP-SM)
20	Medium dense, Gray silty fine SAND, poorly graded. (SM)
11	Medium dense, Greenish gray silty fine SAND, poorly graded. (SM)
7	Loose, Pale brown fine SAND, some gravel (shell fragments), poorly graded. (SP)
10	Medium dense, Greenish gray fine SAND with silt, poorly graded, some gravel (shell fragments), poorly graded. (SP-SM)
4	Loose, Greenish gray silty fine SAND, poorly graded. (SM)
6	
9	Loose, Greenish gray silty fine SAND with clay, poorly graded. (SM)
7	Loose, Dark greenish gray silty fine SAND, few gravel (shell fragments), poorly graded. (SM)
17	Medium dense, Greenish gray silty fine SAND, some gravel (shell fragments), poorly graded. (SM)
23	Medium dense, Gray fine SAND, little gravel (shell fragments), poorly graded. (SP)
18	

BT @ 65'.
Date Drilled: 1/15/2019
Boring Grouted upon Termination.
4" Diameter Steel Casing Set to 10 ft.

BHW3b
Northing: 29°52'58.45"N
Easting: 81°18'37.55"W

N	Description
6	Loose, Very dark gray silty fine SAND with organic fines, little gravel (shell fragments), trace root, poorly graded. (SM)
3	Very loose, Very dark grayish green silty fine SAND with silt, trace gravel (shell fragments), poorly graded. (SM)
WOH	Very loose, Very dark grayish green silty fine SAND with silt, trace gravel (shell fragments), trace roots, poorly graded. (SM)
WOH	Very loose, Very dark grayish green silty fine SAND with organic fines, poorly graded. (SM)
WOH	
1	Very loose, Very dark grayish green very silty fine SAND with organic fines, poorly graded. (SM)
WOH	
10	Medium dense, Very dark gray fine SAND with silt, poorly graded. (SP-SM)
28	Medium dense, Light gray very silty fine SAND, poorly graded. (SM)
21	Medium dense, Olive yellow silty fine SAND, trace gravel (rock fragments), poorly graded. (SM)
12	Medium dense, Pale yellow very silty fine SAND, some gravel (limestone fragments), poorly graded. (SM)
12	
16	Medium dense, Dark grayish green silty fine SAND with clay, poorly graded. (SM)
23	Medium dense, Dark grayish green silty fine SAND, poorly graded. (SM)
8	Loose, Greenish gray fine SAND with silt, some gravel (shell fragments), poorly graded. (SP-SM)
11	Medium dense, Greenish gray silty fine SAND, little gravel (shell fragments), poorly graded. (SM)
11	Medium dense, Greenish gray silty fine SAND, few gravel (shell fragments), poorly graded. (SM)
20	Medium dense, Light greenish gray fine SAND with silt, some gravel (shell fragments), poorly graded. (SP-SM)
25	Medium dense, Grayish green fine SAND with silt, some gravel (shell fragments), poorly graded. (SP-SM)
38	Dense, Grayish green silty fine SAND, little gravel (shell fragments), poorly graded. (SM)
48	Dense, Grayish green fine SAND with silt, few gravel (shell fragments), poorly graded. (SP-SM)

BT @ 80'.
Date Drilled: 1/28/2019
Boring Grouted upon Termination.

BHW3c
Northing: 29°52'55.06"N
Easting: 81°18'38.14"W

N	Description
2	Very soft, Dark olive gray highly organic SILT (Muck). (OL)
3	Very loose, Dark olive brown silty fine SAND, few root fragments, poorly graded. (SM)
4	Loose, Light olive brown silty fine SAND, few root fragments, poorly graded. (SM)
6	Loose, Olive brown fine SAND with silt, trace root fragments, poorly graded. (SP-SM)
6	Loose, Gray fine SAND with silt, poorly graded. (SP-SM)
12	Medium dense, Light grayish green fine SAND with silt, poorly graded. (SP-SM)
8	Loose, Olive yellow fine SAND with silt, poorly graded. (SP-SM)
13	Medium dense, Light yellowish brown fine SAND with silt, some gravel (shell fragments), poorly graded. (SP-SM)
11	Medium dense, Olive silty fine SAND, some gravel (shell fragments), poorly graded. (SM)
5	Loose, Grayish green silty fine SAND, few gravel (shell fragments), poorly graded. (SM)
11	Firm, Dark grayish green SILT with sand, trace clay, poorly graded. (ML)
12	Medium dense, Light grayish green very silty fine SAND, some gravel (shell fragments), poorly graded. (SM)
15	Medium dense, Grayish green silty fine SAND, some gravel (shell fragments), poorly graded. (SM)
21	Medium dense, Light grayish green fine SAND with silt, some gravel (limestone fragments), poorly graded. (SP-SM)
15	Medium dense, Light gray silty fine SAND, few gravel (shell and limestone fragments), poorly graded. (SM)
17	Medium dense, Pale olive fine SAND with silt, few gravel (limestone fragments), trace shell, poorly graded. (SP-SM)
13	Medium dense, Pale olive fine SAND with silt, little gravel (limestone fragments), poorly graded. (SP-SM)
14	

w = 28
-200 = 8

w = 89
-200 = 97

BT @ 80'.
Date Drilled: 1/9/2019
Boring Grouted upon Termination.

Depth (ft): 0, 10, 20, 30, 40, 50, 60, 70, 80

Legend

- Silty Fine Sand with Organic Material
- Fine Sand
- 4" Dia. Steel Casing
- Silty Fine Sand
- Muck
- Fine Sand with Silt
- Silt

N — Standard Penetration Resistance, Blows/Foot
BT — Boring Terminated at Depth Below Grade
(SP) — Unified Soil Classification System (USCS)
▽ — Depth to Groundwater at Time of Drilling
w — Natural Moisture Content (%)
-200 — % Passing No. 200 U.S. Standard Sieve
WOH — Sampler advanced by weight of hammer

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St. Augustine, Florida

FIGURE NO. 10

Proposed Bulkhead

BW1
Northing: 29°52'53.85"N
Easting: 81°18'31.66"W

N	Depth (ft)	Description
	0	Asphalt (2")
		Limerock Base (4 1/2")
11		Medium dense, Very pale brown silty fine SAND, poorly graded. (SM)
6		Loose, Brown fine SAND, trace root fragments, poorly graded. (SP)
11	5	
10		Stiff, Brown very sandy SILT. (ML)
8	10	
6	15	Loose, Pale olive silty fine SAND, poorly graded. (SM)
10	20	Medium dense, Pale olive silty fine SAND, poorly graded. (SM)
14	25	Medium dense, Olive yellow silty fine SAND, poorly graded. (SP-SM)
12	30	Medium dense, Olive yellow silty fine SAND, little gravel (shell fragments), poorly graded. (SP-SM)
24	35	Medium dense, Gray fine SAND with silt, trace gravel (shell fragments), poorly graded. (SP-SM)
4	40	Loose, Olive gray silty fine SAND, little gravel (shell fragments), poorly graded. (SM)
5	45	Firm, Dark grayish green silty CLAY with sand. (CL)
9	50	Stiff, Grayish green sandy SILT, little gravel (shell fragments). (ML)
	55	

w = 23, -200 = 66
w = 25, -200 = 16
w = 87, -200 = 94

BT @ 50'.
Date Drilled: 11/6/2018
Boring Grouted upon Termination.

BW2
Northing: 29°52'58.85"N
Easting: 81°18'36.11"W

N	Depth (ft)	Description
1	0	Very loose, Black silty fine SAND, little root fragments, trace organic fines, poorly graded. (SM)
WOH		Very loose, Very dark gray very silty fine SAND, few root fragments, poorly graded. (SM)
2		Very loose, Very dark brown silty fine SAND, poorly graded. (SM)
4		Loose, Very dark gray fine SAND with silt, trace roots and organic fines, poorly graded. (SP-SM)
11	5	
		Medium dense, Dark gray fine SAND with silt, trace root fragments, poorly graded. (SP-SM)
12	10	
		Medium dense, Dark gray fine SAND with silt, poorly graded. (SP-SM)
12	15	
		Medium dense, Olive fine SAND with silt, poorly graded. (SP-SM)
14	20	
		Medium dense, Pale olive fine SAND with silt, some gravel (shell fragments), poorly graded. (SP-SM)
18	25	
		Medium dense, Dark gray fine SAND with silt, some gravel (shell fragments), poorly graded. (SP-SM)
8	30	
		Loose, Dark greenish gray silty fine SAND, little gravel (shell fragments), poorly graded. (SM)
10	35	
		Stiff, Very dark gray CLAY with sand. (CL)
18	40	
		Medium dense, Dark gray fine SAND with clay. (SP-SC)
20	45	Medium dense, Gray fine SAND with silt, some gravel (shell fragments), poorly graded. (SP-SM)
	50	
	55	

BT @ 50'.
Date Drilled: 1/29/2019
Boring Grouted upon Termination.

BW3
Northing: 29°52'56.27"N
Easting: 81°18'38.97"W

N	Depth (ft)	Description
	0	Asphalt (2")
		Limerock Base (6")
HA		Brown fine SAND, little gravel (shell fragments), trace debris (glass), poorly graded. (SP)
		Very dark grayish brown fine SAND, few gravel (shell fragments), poorly graded. (SP)
7	5	Loose, Very dark grayish brown fine SAND, few gravel (rock and shell fragments), poorly graded. (SP)
6		Loose, Brown fine SAND with silt, poorly graded. (SP-SM)
5	10	
		Loose to medium dense, Brown fine SAND with silt, trace organic fines, poorly graded. (SP-SM)
12	15	
10	20	Medium dense, Yellowish red silty fine SAND, poorly graded. (SM)
5	25	Loose, Yellow fine SAND with silt, poorly graded. (SP-SM)
8	30	Medium dense, Yellow fine SAND with silt, few gravel (shell fragments), poorly graded. (SP-SM)
5	35	Loose, Gray fine SAND with silt, few gravel (shell fragments), poorly graded. (SP-SM)
7	40	Stiff, Dark gray silty CLAY. (CL)
6	45	Stiff, Dark grayish green silty CLAY. (CL)
8	50	Medium dense, Light gray fine SAND with silt, little gravel (shell fragments), poorly graded. (SP-SM)
	55	

w = 21, -200 = 3
w = 28, -200 = 11
w = 85, -200 = 94

BT @ 50'.
Date Drilled: 11/5/2018
Boring Grouted upon Termination.

Legend

Asphalt
Fine Sand
Clay
Limerock Base
Silt
Fine Sand with Silt
Silty Fine Sand
Fine Sand with Silt
Fine Sand with Clay

N — Standard Penetration Resistance, Blows/Foot
BT — Boring Terminated at Depth Below Grade
(SP) — Unified Soil Classification System (USCS)
▽ — Depth to Groundwater at Time of Drilling
w — Natural Moisture Content (%)
-200 — % Passing No. 200 U.S. Standard Sieve
WOH — Sampler advanced by weight of hammer
HA — Boring Advanced by hand-held bucket auger due to possible underground utilities.

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

BRETT H. HARBISON, P.E. P.E. NO.: 74679
TEN YEARS
Meskel & Associates Engineering
FL Certificate of Authorization No. 28142
8936 Western Way, Suite 12, Jacksonville, FL 32256

McKim & Creed

DATE:	MAE PROJECT NO.
2/8/2019	0194-0003

SHEET TITLE: Generalized Soil Profiles

PROJECT NAME: Lake Maria Sanchez Flood Mitigation and Drainage Project
St. Augustine, Florida

FIGURE NO. 11

Appendix A

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Meskel & Associates Engineering

BORING BC1a

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 11/12/18 **COMPLETED** 11/12/18 **LATITUDE** 29°53'25.60"N **LONGITUDE** 81°18'50.50"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Asphalt (2 3/4") Concrete (5 1/2") Very dark gray clayey fine SAND, trace gravel (rock fragments), poorly graded.	SC											
	2	Very dark grayish brown fine SAND with silt, trace root fragments, poorly graded.	SP-SM											
	3	▽ Very dark grayish brown fine SAND with silt, gravel (rock fragments), poorly graded.	SP-SM											
	4	Very dark grayish brown fine SAND with silt, trace root fragments, poorly graded.	SP-SM											
5	5	Medium dense, Very dark grayish brown fine SAND with silt, poorly graded.	SP-SM		3 5 6 6	11								
	6	Medium dense, Dark yellowish brown fine SAND with silt, poorly graded.	SP-SM		5 7 8 8	15								
10	7	Loose, Dark yellowish brown fine SAND with silt, trace root fragments, poorly graded.	SP-SM		2 2 3 2	5								
15	8	Medium dense, Light gray fine SAND, poorly graded.	SP-SM		4 5 6	11								
		Bottom of borehole at 15 feet. Boring Grouted upon Termination.												

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 2 ft 4 in *▽ **END OF DAY** ---

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BORING BC1b

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 10/30/18 **COMPLETED** 10/30/18 **LATITUDE** 29°53'23.58"N **LONGITUDE** 81°18'49.69"W

DRILLING CONTRACTOR Independent Drilling, Inc. **DRILLING METHOD** Standard Penetration Test

LOGGED BY Tim **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Dark brown fine SAND, trace root fragments, poorly graded.	SP											
	2	Very dark grayish brown fine SAND, trace gravel (shell fragments), poorly graded.	SP											
5	3	Loose, Very dark brown fine SAND with silt, poorly graded.	SP-SM		2 2 4 2	6	31	8						
	4	Loose, Brown fine SAND with silt, trace root fragments, poorly graded.	SP-SM		1 2 2 1	4								
10	5	Loose, Pale brown fine SAND with silt, trace root fragments, poorly graded.	SP-SM		3 3 4 5	7	21	6						
15	6	Loose, Very dark grayish brown fine SAND with silt, trace organic fines and root fragments, poorly graded.	SP-SM		4 3 6	9								
		Bottom of borehole at 15 feet. Boring Grouted upon Termination.												

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 4 ft 0 in *▽ **END OF DAY** ---

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BORING BC1c

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 10/30/18 **COMPLETED** 10/30/18 **LATITUDE** 29°53'21.60"N **LONGITUDE** 81°18'48.67"W

DRILLING CONTRACTOR Independent Drilling, Inc. **DRILLING METHOD** Standard Penetration Test

LOGGED BY Tim **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Brown fine SAND, trace root fragments, trace gravel (shell fragments), poorly graded.	SP											
	2	Very dark grayish brown fine SAND with silt, trace gravel (shell fragments), poorly graded. ▽	SP-SM											
5	3				1 2 1 1	3	27	6						
	4				2 1 2 3	3								
10	5	Very loose to loose, Grayish brown fine SAND with silt, poorly graded.	SP-SM		2 2 3 2	5								
15	6	Loose, Grayish brown fine SAND with silt, little wood fragments, poorly graded.	SP-SM		3 3 5	8								
		Bottom of borehole at 15 feet. Boring Grouted upon Termination.												

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 4 ft 0 in *▽ **END OF DAY** ---

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BORING BC1d

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 10/30/18 **COMPLETED** 10/30/18 **LATITUDE** 29°53'22.05"N **LONGITUDE** 81°18'47.30"W

DRILLING CONTRACTOR Independent Drilling, Inc. **DRILLING METHOD** Standard Penetration Test

LOGGED BY Tim **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Dark brown fine SAND, few root fragments, poorly graded.	SP											
	2	▽ Very dark grayish brown fine SAND with silt, trace gravel (shell fragments), poorly graded.	SP-SM				20	11						
5	3	Loose, Very dark grayish brown fine SAND, trace gravel (shell fragments), poorly graded.	SP		3 2 2 2	4								
	4	Loose, Very dark grayish brown fine SAND, trace root fragments, poorly graded.	SP		3 4 3 3	7								
10	5	Very loose, Dark grayish brown fine SAND with silt, trace gravel (shell fragments), poorly graded.	SP-SM		2 1 1 3	2	30	8						
15	6	Medium dense, Dark grayish brown fine SAND with silt, trace gravel (shell fragments), trace root fragments, poorly graded.	SP-SM		4 5 7	12								
		Bottom of borehole at 15 feet. Boring Grouted upon Termination.												

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 3 ft 0 in *▽ **END OF DAY** ---

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BORING BC2a

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 11/13/18 **COMPLETED** 11/13/18 **LATITUDE** 29°53'26.28"N **LONGITUDE** 81°18'48.13"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Asphalt (3") Concrete (5 1/2") Dark brown fine SAND, trace gravel (shell fragments), poorly graded.	SP											
	2	Grayish brown fine SAND, poorly graded.	SP											
	3	Dark grayish brown fine SAND with silt, poorly graded.	SP-SM											
	4 ▽													
5	5	Very loose, Very dark gray silty fine SAND, trace root fragments, poorly graded.	SM		1 1 1 1	2								
	6	Medium dense, Dark yellowish brown fine SAND with silt, poorly graded.	SP-SM		4 4 4 5	8								
10	7	Loose, Yellowish brown fine SAND with silt, poorly graded.	SP-SM		7 3 4 4	7								
15	8	Loose, Light gray silty fine SAND, poorly graded.	SM		2 2 3	5								
		Bottom of borehole at 15 feet. Boring Grouted upon Termination.												

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 3 ft 6 in *▽ **END OF DAY** ---

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 11/13/18 **COMPLETED** 11/13/18 **LATITUDE** 29°53'24.37"N **LONGITUDE** 81°18'47.45"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Very dark gray fine SAND with silt, little debris (brick fragments), poorly graded.	SP-SM											
	2	Very dark gray fine SAND with silt, trace debris (brick fragments), poorly graded.	SP-SM											
	3	Very dark gray fine SAND, trace debris (brick fragments), trace roots, poorly graded.	SP											
	4	▽ Very dark gray fine SAND with silt, trace organic fines, and gravel (shell fragments), poorly graded.	SP-SM											
5	5	Very loose, Dark gray fine SAND with silt, trace root fragments, poorly graded.	SP-SM		2 1 1 2	2								
	6	Loose, Very dark grayish brown fine SAND with silt, poorly graded.	SP-SM		1 1 5 6	6								
10	7	Medium dense to loose, Dark grayish brown fine SAND with silt, poorly graded.	SP-SM		4 6 6 8	12								
15	8				2 2 3	5								
		Bottom of borehole at 15 feet. Boring Grouted upon Termination.												

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 3 ft 0 in *▽ **END OF DAY** ---

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BORING BC3a

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 11/13/18 **COMPLETED** 11/13/18 **LATITUDE** 29°53'21.30"N **LONGITUDE** 81°18'46.01"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Hand Auger

LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0.0	1	Very dark gray fine SAND with silt, poorly graded.	SP-SM											
	2													
2.5	3	▽ Dark gray silty fine SAND, trace gravel (rock fragments), poorly graded.	SM											
	4	Very dark gray silty fine SAND, poorly graded.	SM											
5.0	5													
		Bottom of borehole at 5 feet. Boring Grouted upon Termination. 4" Diameter PVC Casing Set to 5 ft.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 2 ft 4 in *▽ **END OF DAY** ---

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BORING BC3b

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 11/13/18 **COMPLETED** 11/13/18 **LATITUDE** 29°53'18.64"N **LONGITUDE** 81°18'44.78"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Hand Auger

LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0.0	1	Very dark grayish brown fine SAND with silt, trace gravel (shell fragments), poorly graded.	SP-SM											
	2	Dark brown fine SAND with silt, trace gravel (shell fragments), poorly graded.	SP-SM											
2.5	3	▽ Very dark gray fine SAND with silt, trace gravel (shell fragments), poorly graded.	SP-SM											
	4	Very dark gray silty fine SAND, trace root fragments, poorly graded.	SM											
5.0	5	Very dark gray silty fine SAND, poorly graded.	SM											
		Bottom of borehole at 5 feet. Boring Grouted upon Termination. 4" Diameter PVC Casing Set to 5 ft.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 2 ft 5 in *▽ **END OF DAY** ---

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BORING BC3c

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 11/13/18 **COMPLETED** 11/13/18 **LATITUDE** 29°53'16.52"N **LONGITUDE** 81°18'43.82"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Hand Auger

LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0.0	1	Dark brown fine SAND with silt, poorly graded.	SP-SM											
	2	Dark grayish brown fine SAND with silt, poorly graded.	SP-SM											
2.5	3	▽ Dark gray silty fine SAND, poorly graded.	SM											
	4	Dark gray fine SAND with silt, poorly graded.	SP-SM											
5.0	5													
		Bottom of borehole at 5 feet. Boring Grouted upon Termination. 4" Diameter PVC Casing Set to 5 ft.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 2 ft 7 in *▽ **END OF DAY** ---

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BORING BC3d

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 11/13/18 **COMPLETED** 11/13/18 **LATITUDE** 29°53'15.12"N **LONGITUDE** 81°18'44.26"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Very dark gray fine SAND, few gravel (shell fragments), poorly graded.	SP											
	2	Very dark gray silty fine SAND, trace root fragments, poorly graded.	SM											
	3	▽ Very dark gray silty fine SAND, poorly graded.	SM											
	4	Very dark gray silty fine SAND, trace gravel (rock fragments), poorly graded.	SM											
5	5	Loose, Dark gray fine SAND with silt, poorly graded.	SP-SM		1 1 2 2	3								
	6				1 3 3 4	6								
10	7	Loose, Very dark gray silty fine SAND, poorly graded.	SM		2 3 3 3	6								
	8				1 3 3	6								
15		Loose, Light olive gray silty fine SAND, poorly graded.	SM											
20	9	Loose, Light yellowish brown silty fine SAND, poorly graded.	SM		1 2 3	5								

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 2 ft 7 in *▽ **END OF DAY** ---

(Continued Next Page)

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BORING BC3d

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Loose, Light yellowish brown silty fine SAND, poorly graded. *(continued)*	SM											
25	10	Medium dense, Pale brown fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		6 10 10	20								
		Bottom of borehole at 25 feet. Boring Grouted upon Termination.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 2 ft 7 in *▽ **END OF DAY** ---

NEW MAE LOG LAT/LONG-EOD-HA - NEW TEMPLATE 7-30-12.GDT - 2/1/19 17:04 - F:\GINT\GINT FILES\PROJECTS\0194-0003\LAKE MARIA SANCHEZ.GPJ

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BORING PS1

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 11/6/18 **COMPLETED** 11/3/18 **LATITUDE** 29°52'58.85"N **LONGITUDE** 81°18'38.17"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Topsoil (6") Loose, Very pale brown fine SAND, some gravel (shell fragments), trace roots, poorly graded.	SP		1 2 4 5	6								
	2	Very loose, Very dark gray silty fine SAND, trace gravel (shell fragments), trace organic fines, poorly graded.	SM		1 1 1 1	2								
5	3	Very loose, Very dark gray silty fine SAND, trace roots and organic fines, poorly graded.	SM		WOH	WOH								
	4	Very loose, Very dark gray silty fine SAND with organic fines, poorly graded.	SM		WOH	WOH	50	28						
10	5				WOH	WOH								
	6				WOH	WOH								
	7				WOH	WOH	67	48						
15	8	Very loose, Very dark gray very silty fine SAND with organic fines, poorly graded.	SM		WOH	WOH								
	9				WOH	WOH								
20	10	Very loose, Very dark gray fine SAND with silt, poorly graded.	SP-SM		WOH	WOH	22	7						

NOTES WOH-Sampler advanced by weight of hammer only.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 1 ft 7 in *▽ **END OF DAY** ---

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BORING PS1

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Very loose, Very dark gray fine SAND with silt, poorly graded. *(continued)*	SP-SM											
25	11	Loose, Light gray silty fine SAND, poorly graded.	SM		5 3 4	7								
30	12	Loose, Light brownish gray silty fine SAND, some gravel (shell fragments), poorly graded.	SM		3 3 2	5								
35	13	Loose, Light brownish gray silty fine SAND, trace gravel (shell fragments), poorly graded.	SM		1 2 2	4								
40	14	Firm, Dark grayish green silty CLAY with sand.	CL		3 2 3	5	193	94						
		Bottom of borehole at 40 feet. Boring Grouted upon Termination.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 1 ft 7 in *▽ **END OF DAY** ---

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BORING SV1

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 11/12/18 **COMPLETED** 11/12/18 **LATITUDE** 29°53'24.15"N **LONGITUDE** 81°18'48.50"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Very dark grayish brown fine SAND, trace gravel (shell fragments) and roots, poorly graded.	SP											
	2													
	3	▽ Pale brown fine SAND with silt, poorly graded.	SP-SM											
	4													
5	5	Very loose, Brown fine SAND with silt, poorly graded.	SP-SM		1 1 1 1	2								
	6	Soft, Very dark gray sandy CLAY, trace organic fines.	CH		1 1 1 1	2								
10	7	Loose, Very dark gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM		1 2 3 3	5								
15	8	Loose, Light gray fine SAND with silt, poorly graded.	SP-SM		2 3 2	5								
		Bottom of borehole at 15 feet. Boring Grouted upon Termination.												

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 3 ft 3 in *▽ **END OF DAY** ---

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BORING BHW1a

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 1/10/19 **COMPLETED** 1/10/19 **LATITUDE** 29°52'49.56"N **LONGITUDE** 81°18'31.76"W

DRILLING CONTRACTOR Reliable Drilling **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.Taylor **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Very loose, Dark greenish brown fine SAND with silt, few root fragments, poorly graded.	SP-SM		1 2 1 1	3								
	2				1 1 2 1	3								
5	3	Very loose, Dark grayish brown fine SAND with silt, poorly graded.	SP-SM		2 1 1 1	2								
	4	Very loose, Yellowish brown fine SAND with silt, trace root fragments, poorly graded.	SP-SM		2 2 1 2	3								
10	5	Very loose, Dark brown fine SAND with silt, trace root fragments, poorly graded.	SP-SM		2 1 1 3	2								
15	6	Loose, Greenish gray silty fine SAND, poorly graded.	SM		3 2 3	5								
20	7	Loose, Light greenish gray silty fine SAND, trace root fragments, poorly graded.	SM		3 3 5	8								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 2' Above Surface *▽ **END OF DAY** ---

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Loose, Light greenish gray silty fine SAND, trace root fragments, poorly graded. *(continued)*	SM											
25	8	Medium dense, Pale brown fine SAND, some gravel (shell fragments), poorly graded.	SP		7 7 8	15								
30	9	Medium dense, Pale brown fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		7 7 7	14								
35	10	Loose, Grayish green silty fine SAND, trace gravel (shell fragments), poorly graded.	SM		3 2 3	5								
40	11	Loose to medium dense, Grayish green clayey fine SAND with silt, trace gravel (shell fragments), poorly graded.	SC		1 2 3	5								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 2' Above Surface *▽ **END OF DAY** ---

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
45	12	Loose to medium dense, Grayish green clayey fine SAND with silt, trace gravel (shell fragments), poorly graded. *(continued)*	SC		5 6 6	12								
50	13	Medium dense, Light grayish green fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		7 4 6	10								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 2' Above Surface *▽ **END OF DAY** ---

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BORING BHW1b

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 1/11/19 **COMPLETED** 1/11/19 **LATITUDE** 29°52'51.07"N **LONGITUDE** 81°18'31.90"W

DRILLING CONTRACTOR Reliable Drilling **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.Taylor **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Very soft, Very dark grayish olive SILT with sand, trace gravel (shell fragments).	ML		WOH	WOH								
	2	Very loose, Dark olive brown silty fine SAND, trace root fragments, poorly graded.	SM		WOH 1 1	1								
5	3				1 1 1 1	2								
	4				1 2 2 1	4								
10	5	Very loose, Yellowish brown very silty fine SAND, trace root fragments, poorly graded.	SM		2 2 2 3	4								
	6				3 2 3	5								
15		Loose, Pale olive very silty fine SAND, poorly graded.	SM											
20	7	Loose, Olive yellow fine SAND with silt, poorly graded.	SP-SM		2 3 3	6	31	5						

NOTES WOH-Sampler advanced by weight of hammer only.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 2" Above Surface *▽ **END OF DAY** ---

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BORING BHW1b

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Loose, Olive yellow fine SAND with silt, poorly graded. *(continued)*	SP-SM											
25	8	Medium dense, Pale brown fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		6 5 6	11								
30	9	Medium dense, Gray fine SAND with silt, few gravel (shell fragments), poorly graded.	SP-SM		4 5 5	10								
35	10	Loose, Greenish gray silty fine SAND, few gravel (shell fragments), poorly graded.	SM		5 3 2	5								
40	11	Firm to stiff, Greenish gray silty CLAY, trace gravel (shell fragments).	CL		2 3 4	7	88	97						

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 2" Above Surface *▽ **END OF DAY** ---

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
45	12	Firm to stiff, Greenish gray silty CLAY, trace gravel (shell fragments). *(continued)*	CL		4 4 4	8								
50	13	Medium dense, Dark greenish gray fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		5 6 5	11								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination. 4" Diameter Steel Casing Set to 15 ft.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 2" Above Surface *▽ **END OF DAY** ---

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BORING BHW1c

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 1/14/19 **COMPLETED** 1/14/19 **LATITUDE** 29°52'52.32"N **LONGITUDE** 81°18'31.99"W

DRILLING CONTRACTOR Reliable Drilling **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.Taylor **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Very loose, Dark brown fine SAND with silt, trace organic fines, poorly graded.	SP-SM		1 1 2 1	3								
	2	Very loose, Dark brown silty fine SAND, trace root fragments, poorly graded.	SM		1 1 1 2	2								
5	3				2 1 1 2	2								
	4	Very loose, Dark brown very silty fine SAND, poorly graded.	SM		1 2 3 2	5								
10	5	Loose, Dark brown silty fine SAND, poorly graded.	SM		3 3 2 3	5								
15	6	Medium dense, Light gray fine SAND, trace silt, poorly graded.	SP		5 6 6	12	28	4						
20	7	Loose, Pale yellow fine SAND, some gravel (shell fragments), poorly graded.	SP		6 4 5	9								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

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BORING BHW1c

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Loose, Pale yellow fine SAND, some gravel (shell fragments), poorly graded. *(continued)*	SP											
25	8	Medium dense, Pale brown fine SAND, some gravel (shell fragments), poorly graded.	SP		4 6 5	11								
30	9	Medium dense, Gray fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		9 8 8	16								
35	10	Loose, Grayish green silty fine SAND, trace gravel (shell fragments), poorly graded.	SM		4 2 3	5								
40	11				3 3 3	6								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
		Loose, Grayish green silty fine SAND, trace gravel (shell fragments), poorly graded. *(continued)*	SM											
45	12				6 7 6	13								
		Medium dense, Dark greenish gray silty fine SAND, poorly graded.	SM											
50	13	Medium dense, Greenish gray fine SAND with silt, poorly graded.	SP-SM		6 6 7	13								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

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BORING BHW1d

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 1/14/19 **COMPLETED** 1/14/19 **LATITUDE** 29°52'54.98"N **LONGITUDE** 81°18'32.64"W

DRILLING CONTRACTOR Reliable Drilling **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.Taylor **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Very loose, Very dark brown fine SAND with silt, trace root fragments, poorly graded.	SP-SM		1 1 1 2	2								
	2				2 1 1 2	2								
5	3	Very loose, Very dark brown silty fine SAND, trace organic fines, poorly graded.	SM		2 2 1 1	3	29		1.9					
	4	Medium dense, Yellowish brown fine SAND with silt, trace organic fines and root fragments, poorly graded.	SP-SM		2 6 5 6	11	25		1.9					
10	5	Medium dense, Light olive gray silty fine SAND, poorly graded.	SM		7 6 6 5	12								
15	6	Medium dense to loose, Light olive gray fine SAND with silt, poorly graded.	SP-SM		6 6 5	11								
20	7				6 4 3	7								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

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BORING BHW1d

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Medium dense to loose, Light olive gray fine SAND with silt, poorly graded. *(continued)*	SP-SM											
25	8	Medium dense, Olive yellow fine SAND, some gravel (shell fragments), poorly graded.	SP		6 7 8	15								
30	9	Medium dense, Gray fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		7 6 7	13								
35	10	Loose, Grayish green silty fine SAND, trace gravel (shell fragments), poorly graded.	SM		2 2 3	5								
40	11	Loose, Greenish gray very clayey fine SAND, few gravel (shell fragments).	SC		2 3 4	7	59	49		118	91			

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

NEW MAE LOG LAT/LONG-EOD-HA - NEW TEMPLATE 7-30-12.GDT - 2/1/19 17:04 - F:\GINT\GINT FILES\PROJECTS\0194-0003\LAKE MARIA SANCHEZ.GPJ

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BORING BHW1d

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
		Loose, Greenish gray very clayey fine SAND, few gravel (shell fragments). *(continued)*	SC											
45	12	Medium dense, Dark grayish green silty fine SAND with clay, poorly graded.	SM		5 5 6	11								
50	13	Medium dense, Dark greenish gray silty fine SAND, some gravel (shell fragments), poorly graded.	SM		5 4 7	11								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 1/16/19 **COMPLETED** 1/16/19 **LATITUDE** 29°52'57.09"N **LONGITUDE** 81°18'33.84"W

DRILLING CONTRACTOR Reliable Drilling **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.Taylor **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Very loose, Very dark grayish brown very silty fine SAND with organic fines, little root fragments, poorly graded.	SM		WOH	WOH								
	2				WOH	WOH								
		Wood and root fragments.												
5	3				WOH	WOH								
		Very loose, Dark gray silty fine SAND with organic fines, poorly graded.	SM											
	4				1 2 2 3	4								
		Loose, Light olive brown silty fine SAND, poorly graded.	SM											
	5				1 1 3 6	4								
10		Loose, Grayish gray silty fine SAND, poorly graded.	SC											
	6				10 11 13	24								
15		Medium dense, Light gray silty fine SAND, poorly graded.	SM											
	7				5 5 6	11								
20		Medium dense, Light olive gray silty fine SAND, poorly graded.	SM											

NOTES WOH-Sampler advanced by weight of hammer only.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Medium dense, Light olive gray silty fine SAND, poorly graded. *(continued)*	SM											
25	8	Medium dense, Pale brown fine SAND, some gravel (shell fragments), poorly graded.	SP		6 6 7	13								
30	9	Medium dense to loose, Gray fine SAND with silt, little gravel (shell fragments), p0oorly graded.	SP-SM		8 9 10	19								
35	10				3 3 4	7								
40	11	Loose, Dark greenish gray silty fine SAND, little gravel (shell fragments), poorly graded.	SM		2 3 3	6								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
		Loose, Dark greenish gray silty fine SAND, little gravel (shell fragments), poorly graded. *(continued)*	SM											
45	12	Medium dense, Dark greenish gray silty fine SAND with clay, poorly graded.	SM		5 6 5	11								
50	13	Medium dense, Very dark greenish gray silty fine SAND, some gravel (shell fragments), poorly graded.	SM		6 5 6	11								
55	14				5 7 7	14								
60	15	Dense to medium dense, Light gray fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		10 11 23	34								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
65	16	Dense to medium dense, Light gray fine SAND with silt, some gravel (shell fragments), poorly graded. *(continued)*	SP-SM		4 5 8	13								
70	17	Medium dense, Olive fine SAND with silt, trace gravel (shell fragments), poorly graded.	SP-SM		4 8 9	17								
75	18				6 6 7	13								
80	19	Medium dense, Olive fine SAND with silt, poorly graded.	SP-SM		4 5 7	12								
		Bottom of borehole at 80 feet. Boring Grouted upon Termination. 4" Diameter Steel Casing Set to 10 ft.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 1/16/19 **COMPLETED** 1/16/19 **LATITUDE** 29°52'57.98"N **LONGITUDE** 81°18'34.96"W

DRILLING CONTRACTOR Reliable Drilling **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.Taylor **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		▽												
	1	Very loose, Very dark brown fine SAND with silt, some gravel (rock fragments), trace roots, poorly graded.	SM		1 WOH ↓ 4	WOH								
	2	Very loose, Very dark gray very silty fine SAND with organic fines, poorly graded.	SM		1 1 1 1	2								
5	3				1 2 2 3	4								
	4	Loose, Dark gray silty fine SAND, few gravel (shell fragments), trace roots and organic fines, poorly graded.	SM		3 5 7 8	12								
	5	Medium dense, Very dark gray silty fine SAND, trace gravel (shell fragments), trace roots, poorly graded.	SP-SM		7 7 6 5	13								
10		Medium dense, Gray fine SAND with silt, poorly graded.	SM											
	6				5 6 6	12								
15		Medium dense, Dark grayish green silty fine SAND, poorly graded.	SP-SM											
20	7	Medium dense, Pale brown fine SAND with silt, little gravel (shell fragments), poorly graded.	SP-SM		3 6 11	17								

NOTES WOH-Sampler advanced by weight of hammer only.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Medium dense, Pale brown fine SAND with silt, little gravel (shell fragments), poorly graded. *(continued)*	SP-SM											
25	8	Medium dense, Light gray fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		6 5 6	11								
30	9	Loose, Gray fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		9 5 4	9								
35	10	Loose, Dark greenish gray fine SAND with silt, trace gravel (shell fragments), poorly graded.	SM		5 3 2	5								
40	11	Loose, Very dark gray silty fine SAND, trace gravel (shell fragments), poorly graded.	SC		4 2 3	5								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
		Loose, Very dark gray silty fine SAND, trace gravel (shell fragments), poorly graded. *(continued)*	SC											
45	12	Medium dense, Very dark gray silty fine SAND, poorly graded.	SM		7 9 10	19								
50	13	Medium dense, Gray silty fine SAND, some gravel (shell and rock fragments), poorly graded.	SM		7 7 6	13								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

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BORING BHW1g

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 1/10/19 **COMPLETED** 1/10/19 **LATITUDE** 29°52'57.68"N **LONGITUDE** 81°18'38.62"W

DRILLING CONTRACTOR Reliable Drilling **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.Taylor **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		▽												
	1	Very loose, Very dark grayish brown organic fine SAND with silt, trace root fragments, poorly graded.	SP-SM		WOH ↓ 1	WOH								
	2	Very loose, Very dark gray silty fine SAND, trace root fragments, poorly graded.	SM		WOH ↓ 1	WOH								
5	3	Loose, Grayish brown fine SAND with silt, poorly graded.	SP-SM		2 2 3 4	5								
	4	Medium dense, Light brownish gray fine SAND with silt, trace root fragments, poorly graded.	SP-SM		5 5 6 8	11								
10	5	Medium dense, Grayish brown fine SAND with silt, trace root fragments, poorly graded.	SP-SM		5 6 8 8	14								
15	6	Medium dense, Light grayish green fine SAND with silt, poorly graded.	SP-SM		7 7 7	14								
20	7	Loose, Olive yellow silty fine SAND, poorly graded.	SM		4 4 5	9								

NOTES WOH-Sampler advanced by weight of hammer only.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 1" Above Surface *▽ **END OF DAY** ---

(Continued Next Page)

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Loose, Olive yellow silty fine SAND, poorly graded. *(continued)*	SM											
25	8	Loose, Pale olive fine SAND with silt, some gravel (limestone fragments), poorly graded.	SP-SM		2 3 5	8								
30	9	Medium dense, Pale olive silty fine SAND, some gravel (shell fragments), poorly graded.	SM		2 4 9	13								
35	10	Loose, Grayish green silty fine SAND with gravel (shell fragments), poorly graded.	SM		3 3 4	7								
40	11	Medium dense, Dark grayish green silty fine SAND with clay, poorly graded.	SM		4 4 6	10								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 1" Above Surface *▽ **END OF DAY** ---

(Continued Next Page)

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
		Medium dense, Dark grayish green silty fine SAND with clay, poorly graded. *(continued)*	SM											
45	12				6 7 7	14								
		Medium dense, Greenish gray silty fine SAND, trace clay, poorly graded.	SM											
50	13	Medium dense, Greenish gray fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		5 6 7	13								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 1" Above Surface *▽ **END OF DAY** ---

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BORING BHW1h

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 1/9/19 **COMPLETED** 1/9/19 **LATITUDE** 29°52'53.76"N **LONGITUDE** 81°18'37.64"W

DRILLING CONTRACTOR Reliable Drilling **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.Taylor **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Very loose, Very dark grayish green very silty fine SAND, little organic fines, trace root fragments, poorly graded.	SM		WOH	WOH	115		9.1					
	2				1 1 1 1	2								
5	3	Very loose, Dark brown silty fine SAND, trace root fragments and organic fines, poorly graded.	SM		2 1 2 2	3								
	4	Loose, Olive silty fine SAND, trace root fragments and organic fines, poorly graded.	SM		2 3 2 2	5	33		1.6					
10	5				2 3 4 3	7								
	6	Loose, Greenish gray silty fine SAND, poorly graded.	SM		3 4 5	9								
15														
	7	Medium dense, Olive yellow silty fine SAND, poorly graded.	SM		7 5 5	10								
20														

NOTES WOH-Sampler advanced by weight of hammer only.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Medium dense, Olive yellow silty fine SAND, poorly graded. *(continued)*	SM											
25	8	Loose, Light gray silty fine SAND, some gravel (shell fragments), poorly graded.	SM		2 3 4	7								
30	9	Loose, Dark greenish gray silty fine SAND, some gravel (shell fragments), poorly graded.	SM		4 1 4	5								
35	10	Loose, Greenish gray silty fine SAND, some gravel (shell fragments), poorly graded.	SM		3 2 3	5								
40	11	Dense, Gray fine SAND with silt, little gravel (shell fragments), poorly graded.	SP-SM		19 20 18	38								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
		Dense, Gray fine SAND with silt, little gravel (shell fragments), poorly graded. *(continued)*	SP-SM				23	23						
45	12	Medium dense, Dark greenish gray clayey fine SAND, trace gravel (shell fragments), poorly graded.	SC		5 6 10	16								
50	13	Medium dense, Very dark gray silty fine SAND, some gravel (shell fragments), poorly graded.	SM		7 6 7	13								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

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BORING BHW1i

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 1/8/19 **COMPLETED** 1/8/19 **LATITUDE** 29°52'52.37"N **LONGITUDE** 81°18'37.26"W

DRILLING CONTRACTOR Reliable Drilling **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.Taylor **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Very loose, Very dark grayish green very organic silty fine SAND, trace root fragments, poorly graded.	SM		WOH	WOH								
	2				WOH	WOH								
5	3	Loose, Very dark grayish green very silty fine SAND, few organic fines, trace root fragments, poorly graded.	SM		2 2 2 2	4	30		2.5					
	4	Very loose, Olive gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM		1 1 2 2	3								
10	5	Loose, Dark grayish brown fine SAND,trace organic fines and root fragments, poorly graded.	SP-SM		2 3 4 4	7	31		1.9					
		Loose, Olive fine SAND with silt, poorly graded.	SP-SM											
15	6				3 2 4	6	24	8						
		Loose, Greenish gray fine SAND with silt, poorly graded.	SP-SM											
20	7	Medium dense, Olive yellow fine SAND with silt, poorly graded.	SP-SM		6 6 7	13								

NOTES WOH-Sampler advanced by weight of hammer only.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

NEW MAE LOG LAT/LONG-EOD-HA - NEW TEMPLATE 7-30-12.GDT - 2/1/19 17:05 - F:\GINT\GINT FILES\PROJECTS\0194-0003\LAKE MARIA SANCHEZ.GPJ

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BORING BHW1i

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Medium dense, Olive yellow fine SAND with silt, poorly graded. *(continued)*	SP-SM											
25	8	Loose, Pale yellow fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		6 3 3	6								
30	9	Loose, Olive gray fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		5 4 5	9								
35	10	Loose, Grayish green fine SAND with silt, little gravel (shell fragments), poorly graded.	SP-SM		3 2 2	4								
40	11	Stiff, Dark grayish green CLAY with sand.	CL		5 4 4	8	90	93						

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

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BORING BHW1i

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
		Stiff, Dark grayish green CLAY with sand. *(continued)*	CL				34	44		45	26			
45	12	Medium dense, Dark grayish green very clayey fine SAND, poorly graded.	SC		5 5 5	10								
50	13	Loose, Grayish green fine SAND, some gravel (shell fragments), poorly graded.	SP		6 5 4	9								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination. 4" Diameter Steel Casing Set to 15 ft.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

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BORING BHW3a

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 1/15/19 **COMPLETED** 1/15/19 **LATITUDE** 29°52'56.28"N **LONGITUDE** 81°18'32.99"W

DRILLING CONTRACTOR Reliable Drilling **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.Taylor **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Very loose, Very dark gray silty fine SAND with organic fines, little root fragments, poorly graded.	SM		WOH	WOH								
	2				WOH	WOH								
5	3	Very loose, Very dark gray silty fine SAND, trace root fragments, poorly graded.	SM		1 1 1 1	2								
	4	Very loose, Very dark gray silty fine SAND, few organic fines, trace root fragments, poorly graded.	SM		1 1 2 1	3								
10	5	Loose,Greenish gray fine SAND with silt, poorly graded.	SP-SM		2 2 3 2	5								
15	6	Medium dense, Gray silty fine SAND, poorly graded.	SM		8 9 11	20								
20	7	Medium dense, Greenish gray silty fine SAND, poorly graded.	SM		3 5 6	11								

NOTES WOH-Sampler advanced by weight of hammer only.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Medium dense, Greenish gray silty fine SAND, poorly graded. *(continued)*	SM											
25	8	Loose, Pale brown fine SAND, some gravel (shell fragments), poorly graded.	SP		5 3 4	7								
30	9	Medium dense, Greenish gray fine SAND with silt, poorly graded, some gravel (shell fragments), poorly graded.	SP-SM		6 4 6	10								
35	10	Loose, Greenish gray silty fine SAND, poorly graded.	SM		3 2 2	4								
40	11				2 3 3	6								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Suurface *▽ **END OF DAY** ---

(Continued Next Page)

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
		Loose, Greenish gray silty fine SAND, poorly graded. *(continued)*	SM											
45	12	Loose, Greenish gray silty fine SAND with clay, poorly graded.	SM		4 4 5	9								
50	13	Loose, Dark greenish gray silty fine SAND, few gravel (shell fragments), poorly graded.	SM		5 3 4	7								
55	14	Medium dense, Greenish gray silty fine SAND, some gravel (shell fragments), poorly graded.	SM		9 9 8	17								
60	15	Medium dense, Gray fine SAND, little gravel (shell fragments), poorly graded.	SP		5 8 15	23								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
65	16	Medium dense, Gray fine SAND, little gravel (shell fragments), poorly graded. *(continued)*	SP		5 8 10	18								
		Bottom of borehole at 65 feet. Boring Grouted upon Termination. 4" Diameter Steel Casing Set to 10 ft.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

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BORING BHW3b

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 1/28/19 **COMPLETED** 1/28/19 **LATITUDE** 29°52'58.45"N **LONGITUDE** 81°18'37.55"W

DRILLING CONTRACTOR Reliable Drilling **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.Taylor **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Loose, Very dark gray silty fine SAND with organic fines, little gravel (shell fragments), trace root, poorly graded.	SM		WOH 3 3 2	6								
	2				3 2 1 1	3								
		Very loose, Very dark grayish green silty fine SAND with silt, trace gravel (shell fragments), poorly graded.	SM											
5	3	Very loose, Very dark grayish green silty fine SAND with silt, trace gravel (shell fragments), trace roots, poorly graded.	SM		WOH ↓	WOH								
	4				WOH ↓	WOH								
10	5	Very loose, Very dark grayish green silty fine SAND with organic fines, poorly graded.	SM		WOH ↓	WOH								
	6				WOH ↓ 1 1	1								
	7	Very loose, Very dark grayish green very silty fine SAND with organic fines, poorly graded.	SM		WOH ↓	WOH								
15	8				1 3 7 7	10								
		Medium dense, Very dark gray fine SAND with silt, poorly graded.	SP-SM											
20	9	Medium dense, Light gray very silty fine SAND, poorly graded.	SM		12 13 15	28								

NOTES WOH-Sampler advanced by weight of hammer only.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Medium dense, Light gray very silty fine SAND, poorly graded. *(continued)*	SM											
25	10				7 11 10	21								
		Medium dense, Olive yellow silty fine SAND, trace gravel (rock fragments), poorly graded.	SM											
30	11				2 6 6	12								
		Medium dense, Pale yellow very silty fine SAND, some gravel (limestone fragments), poorly graded.	SM											
35	12				3 4 8	12								
		Medium dense, Dark grayish green silty fine SAND with clay, poorly graded.	SM											
40	13				4 7 9	16								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
45	14	Medium dense, Dark grayish green silty fine SAND with clay, poorly graded. *(continued)*	SM		10 9 14	23								
		Medium dense, Dark grayish green silty fine SAND, poorly graded.	SM											
50	15	Loose, Greenish gray fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		9 4 4	8								
55	16	Medium dense, Greenish gray silty fine SAND, little gravel (shell fragments), poorly graded.	SM		7 5 6	11								
60	17	Medium dense, Greenish gray silty fine SAND, few gravel (shell fragments), poorly graded.	SM		3 4 7	11								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

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BORING BHW3b

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
65	18	Medium dense, Light greenish gray fine SAND with silt, some gravel (shell fragments), poorly graded. *(continued)*	SP-SM		8 10 10	20								
70	19	Medium dense, Grayish green fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		12 14 11	25								
75	20	Dense, Grayish green silty fine SAND, little gravel (shell fragments), poorly graded.	SM		8 17 21	38								
80	21	Dense, Grayish green fine SAND with silt, few gravel (shell fragments), poorly graded.	SP-SM		73 23 25	48								
		Bottom of borehole at 80 feet. Boring Grouted upon Termination.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

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BORING BHW3c

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 1/9/19 **COMPLETED** 1/9/19 **LATITUDE** 29°52'55.06"N **LONGITUDE** 81°18'38.14"W

DRILLING CONTRACTOR Reliable Drilling **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.Taylor **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Very soft, Dark olive gray highly organic SILT (Muck).	OL		1 1 1 1	2								
	2	Very loose, Dark olive brown silty fine SAND, few root fragments, poorly graded.	SM		2 1 2 2	3								
5	3	Loose, Light olive brown silty fine SAND, few root fragments, poorly graded.	SM		2 2 2 2	4								
	4	Loose, Olive brown fine SAND with silt, trace root fragments, poorly graded.	SP-SM		3 3 3 4	6	28	8						
10	5	Loose, Gray fine SAND with silt, poorly graded.	SP-SM		3 3 3 4	6								
15	6	Medium dense, Light grayish green fine SAND with silt, poorly graded.	SP-SM		6 5 7	12								
20	7	Loose, Olive yellow fine SAND with silt, poorly graded.	SP-SM		4 3 5	8								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Loose, Olive yellow fine SAND with silt, poorly graded. *(continued)*	SP-SM											
25	8	Medium dense, Light yellowish brown fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		4 7 6	13								
30	9	Medium dense, Olive silty fine SAND, some gravel (shell fragments), poorly graded.	SM		4 5 6	11								
35	10	Loose, Grayish green silty fine SAND, few gravel (shell fragments), poorly graded.	SM		5 2 3	5								
40	11	Firm, Dark grayish green SILT with sand, trace clay, poorly graded.	ML				89	97						

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

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PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
45	12	Firm, Dark grayish green SILT with sand, trace clay, poorly graded. *(continued)*	ML		6 5 6	11								
50	13	Medium dense, Light grayish green very silty fine SAND, some gravel (shell fragments), poorly graded.	SM		6 5 7	12								
55	14	Medium dense, Grayish green silty fine SAND, some gravel (shell fragments), poorly graded.	SM		3 5 10	15								
60	15	Medium dense, Light grayish green fine SAND with silt, some gravel (limestone fragments), poorly graded.	SP-SM		6 10 11	21								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

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BORING BHW3c

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
65	16	Medium dense, Light gray silty fine SAND, few gravel (shell and limestone fragments), poorly graded. *(continued)*	SM		3 6 9	15								
70	17	Medium dense, Pale olive fine SAND with silt, few gravel (limestone fragments), trace shell, poorly graded.	SP-SM		9 8 9	17								
75	18				5 6 7	13								
		Medium dense, Pale olive fine SAND with silt, little gravel (limestone fragments), poorly graded.	SP-SM											
80	19				6 6 8	14								
		Bottom of borehole at 80 feet. Boring Grouted upon Termination.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

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BORING BW1

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 11/6/18 **COMPLETED** 11/6/18 **LATITUDE** 29°52'53.85"N **LONGITUDE** 81°18'31.66"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Asphalt (2")												
		Limerock Base (4 1/2")												
	1	Medium dense, Very pale brown silty fine SAND, poorly graded.	SM		5 5 6	11								
	2	▽ Loose, Brown fine SAND, trace root fragments, poorly graded.	SP		4 2 4 8	6								
5	3				3 5 6 6	11	23	66						
	4				3 4 6 9	10								
	5	Stiff, Brown very sandy SILT.	ML		3 4 4 4	8								
10														
	6				3 3 3	6	25	16						
15		Loose, Pale olive silty fine SAND, poorly graded.	SM											
	7	Medium dense, Pale olive silty fine SAND, poorly graded.	SM		3 5 5	10								
20														

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 2 ft 10 in *▽ **END OF DAY** ---

(Continued Next Page)

NEW MAE LOG LAT/LONG-EOD-HA - NEW TEMPLATE 7-30-12.GDT - 2/1/19 17:05 - F:\GINT\GINT FILES\PROJECTS\0194-0003\LAKE MARIA SANCHEZ.GPJ

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BORING BW1

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Medium dense, Pale olive silty fine SAND, poorly graded. *(continued)*	SM											
25	8	Medium dense, Olive yellow silty fine SAND, poorly graded.	SP-SM		4 6 8	14								
30	9	Medium dense, Olive yellow silty fine SAND, little gravel (shell fragments), poorly graded.	SP-SM		5 6 6	12								
35	10	Medium dense, Gray fine SAND with silt, trace gravel (shell fragments), poorly graded.	SP-SM		7 11 13	24								
40	11	Loose, Olive gray silty fine SAND, little gravel (shell fragments), poorly graded.	SM		2 2 2	4								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 2 ft 10 in *▽ **END OF DAY** ---

(Continued Next Page)

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DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
		Loose, Olive gray silty fine SAND, little gravel (shell fragments), poorly graded. *(continued)*	SM											
45	12	Firm, Dark grayish green silty CLAY with sand.	CL		2 3 2	5	87	94						
		Stiff, Grayish green sandy SILT, little gravel (shell fragments).	ML											
50	13				2 3 6	9								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 2 ft 10 in *▽ **END OF DAY** ---

NEW MAE LOG LAT/LONG-EOD-HA - NEW TEMPLATE 7-30-12.GDT - 2/1/19 17:05 - F:\GINT\GINT FILES\PROJECTS\0194-0003\LAKE MARIA SANCHEZ.GPJ

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BORING BW2

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 1/29/19 **COMPLETED** 1/29/19 **LATITUDE** 29°52'58.85"N **LONGITUDE** 81°18'36.11"W

DRILLING CONTRACTOR Reliable Drilling **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.Taylor **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Very loose, Black silty fine SAND, little root fragments, trace organic fines, poorly graded.	SM		WOH 1 1	1								
	2	Very loose, Very dark gray very silty fine SAND, few root fragments, poorly graded.	SM		WOH 1	WOH								
5	3	Very loose, Very dark brown silty fine SAND, poorly graded.	SM		1 1 1 1	2								
	4	Loose, Very dark gray fine SAND with silt, trace roots and organic fines, poorly graded.	SP-SM		1 1 3 3	4								
10	5	Medium dense, Dark gray fine SAND with silt, trace root fragments, poorly graded.	SP-SM		3 4 7 10	11								
15	6	Medium dense, Dark gray fine SAND with silt, poorly graded.	SP-SM		5 6 6	12								
20	7	Medium dense, Olive fine SAND with silt, poorly graded.	SP-SM		10 7 5	12								

NOTES WOH-Sampler advanced by weight of hammer only.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

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BORING BW2

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Medium dense, Olive fine SAND with silt, poorly graded. *(continued)*	SP-SM											
25	8	Medium dense, Pale olive fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		5 7 7	14								
30	9	Medium dense, Dark gray fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		4 9 9	18								
35	10	Loose, Dark greenish gray silty fine SAND, little gravel (shell fragments), poorly graded.	SM		3 3 5	8								
40	11	Stiff, Very dark gray CLAY with sand.	CL		3 4 6	10								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

NEW MAE LOG LAT/LONG-EOD-HA - NEW TEMPLATE 7-30-12.GDT - 2/1/19 17:05 - F:\GINT\GINT FILES\PROJECTS\0194-0003\LAKE MARIA SANCHEZ.GPJ

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BORING BW2

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
		Stiff, Very dark gray CLAY with sand. *(continued)*	CL											
45	12	Medium dense, Dark gray fine SAND with clay.	SP-SC		7 8 10	18								
50	13	Medium dense, Gray fine SAND with silt, some gravel (shell fragments), poorly graded.	SP-SM		8 11 9	20								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

NEW MAE LOG LAT/LONG-EOD-HA - NEW TEMPLATE 7-30-12.GDT - 2/1/19 17:05 - F:\GINT\GINT FILES\PROJECTS\0194-0003\LAKE MARIA SANCHEZ.GPJ

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BORING BW3

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DATE STARTED 11/5/18 **COMPLETED** 11/5/18 **LATITUDE** 29°52'56.27"N **LONGITUDE** 81°18'38.97"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Asphalt (2") Limerock Base (6") Brown fine SAND, little gravel (shell fragments), trace debris (glass), poorly graded.	SP											
	2	▽ Very dark grayish brown fine SAND, few gravel (shell fragments), poorly graded.	SP											
5	3	Loose, Very dark grayish brown fine SAND, few gravel (rock and shell fragments), poorly graded.	SP		2 3 4 4	7	21	3						
	4	Loose, Brown fine SAND with silt, poorly graded.	SP-SM		2 3 3 3	6								
10	5				1 2 3 3	5								
		Loose to medium dense, Brown fine SAND with silt, trace organic fines, poorly graded.	SP-SM											
15	6				3 5 7	12								
20	7	Medium dense, Yellowish red silty fine SAND, poorly graded	SM		4 2 8	10	28	11						

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 3 ft 3 in *▽ **END OF DAY** ---

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BORING BW3

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Medium dense, Yellowish red silty fine SAND, poorly graded. *(continued)*	SM											
25	8	Loose, Yellow fine SAND with silt, poorly graded.	SP-SM		4 2 3	5								
30	9	Medium dense, Yellow fine SAND with silt, few gravel (shell fragments), poorly graded.	SP-SM		4 4 4	8								
35	10	Loose, Gray fine SAND with silt, few gravel (shell fragments), poorly graded.	SP-SM		1 2 3	5								
40	11	Stiff, Dark gray silty CLAY.	CL		3 5 2	7	85	94						

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

(Continued Next Page)

NEW MAE LOG LAT/LONG-EOD-HA - NEW TEMPLATE 7-30-12.GDT - 2/1/19 17:05 - F:\GINT\GINT FILES\PROJECTS\0194-0003\LAKE MARIA SANCHEZ.GPJ

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BORING BW3

PROJECT NO. 0194-0003

PROJECT NAME Lake Maria Sanchez Flood Mitigation and Drainage Project

PROJECT LOCATION St. Augustine, Florida **CLIENT** McKim & Creed

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
		Stiff, Dark gray silty CLAY. *(continued)*	CL											
45	12	Stiff, Dark grayish green silty CLAY.	CL		2 3 3	6								
		Medium dense, Light gray fine SAND with silt, little gravel (shell fragments), poorly graded.	SP-SM											
50	13				3 5 5	8								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** At Surface *▽ **END OF DAY** ---

NEW MAE LOG LAT/LONG-EOD-HA - NEW TEMPLATE 7-30-12.GDT - 2/1/19 17:05 - F:\GINT\GINT FILES\PROJECTS\0194-0003\LAKE MARIA SANCHEZ.GPJ

FIELD EXPLORATION PROCEDURES

Standard Penetration Test (SPT) Borings

The Standard Penetration Test (SPT) boring(s) were performed in general accordance with the latest revision of ASTM D 1586, "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils." The borings were advanced by rotary drilling techniques. A split-barrel sampler was inserted to the borehole bottom and driven 18 to 24 inches into the soil using a 140-pound hammer falling an average of 30 inches per hammer blow. The number of hammer blows for the final 12 inches of penetration (18" sample) or for the sum of the middle 12 inches of penetration (24" sample) is termed the "penetration resistance, blow count, or N-value." This value is an index to several in-situ geotechnical properties of the material tested, such as relative density and Young's Modulus.

After driving the sampler, it was retrieved from the borehole and representative samples of the material within the split-barrel were containerized and sealed. After completing the drilling operations, the samples for each boring were transported to the laboratory where they were examined by a geotechnical engineer to verify the field descriptions and classify the soil, and to select samples for laboratory testing.

Hand Auger Boring

The auger boring(s) were performed manually by the use of a hand-held bucket auger in general accordance with the latest revision of ASTM D 1452, "Standard Practice for Soil Exploration and Sampling by Auger Borings." Representative samples of the soils brought to the ground surface by the auger were placed in sealed containers and transported to our laboratory where they were examined by a geotechnical engineer to verify the field descriptions and classify the soil, and to select samples for laboratory testing.

KEY TO BORING LOGS – USCS

Soil Classification

Soil classification of samples obtained at the boring locations is based on the Unified Soil Classification System (USCS). Coarse grained soils have more than 50% of their dry weight retained on a #200 sieve. Their principal descriptors are: sand, cobbles and boulders. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve. They are principally described as clays if they are plastic and silts if they are slightly to non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

BORING LOG LEGEND

Symbol	Description
N	Standard Penetration Resistance, the number of blows required to advance a standard spoon sampler 12" when driven by a 140-lb hammer dropping 30".
WOR	Split Spoon sampler advanced under the weight of the drill rods
WOH	Split Spoon sampler advanced under the weight of the SPT hammer
50/2”	Indicates 50 hammer blows drove the split spoon 2 inches; 50 Hammer blows for less than 6-inches of split spoon driving is considered “Refusal”.
(SP)	Unified Soil Classification System
-200	Fines content, % Passing No. 200 U.S. Standard Sieve
w	Natural Moisture Content (%)
OC	Organic Content (%)
LL	Liquid Limit
PI	Plasticity Index
NP	Non-Plastic
PP	Pocket Penetrometer in tons per square foot (tsf)

MODIFIERS

SECONDARY CONSTITUENTS
(Sand, Silt or Clay)

Trace	Less than 5%
With	5% to 12%
Sandy, Silty or Clayey	12% to 35%
Very Sandy, Very Silty or Very Clayey	35% to 50%

ORGANIC CONTENT

Trace	Less than 5%
Organic Soils	5% to 20%
Highly Organic Soils (Muck)	20% to 75%
PEAT	Greater than 75%

MINOR COMPONENTS
(Shell, Rock, Debris, Roots, etc.)

Trace	Less than 5%
Few	5% to 10%
Little	15% to 25%
Some	30% to 45%

RELATIVE DENSITY (Coarse-Grained Soils)

Relative Density	N-Value *
Very Loose	Less than 3
Loose	3 to 8
Medium Dense	8 to 24
Dense	24 to 40
Very Dense	Greater than 40

CONSISTENCY (Fine-Grained Soils)

Consistency	N-Value *
Very Soft	Less than 1
Soft	1 to 3
Firm	3 to 6
Stiff	6 to 12
Very Stiff	12 to 24
Hard	Greater than 24

RELATIVE HARDNESS (Limestone)

Relative Hardness	N-Value *
Soft	Less than 50
Hard	Greater than 50

* Using Automatic Hammer

KEY TO BORING LOGS – USCS

Soil Classification

Soil classification of samples obtained at the boring locations is based on the Unified Soil Classification System (USCS). Coarse grained soils have more than 50% of their dry weight retained on a #200 sieve. Their principal descriptors are: sand, cobbles and boulders. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve. They are principally described as clays if they are plastic and silts if they are slightly to non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

BORING LOG LEGEND

Symbol	Description
N	Standard Penetration Resistance, the number of blows required to advance a standard spoon sampler 12" when driven by a 140-lb hammer dropping 30".
WOR	Split Spoon sampler advanced under the weight of the drill rods
WOH	Split Spoon sampler advanced under the weight of the SPT hammer
50/2"	Indicates 50 hammer blows drove the split spoon 2 inches; 50 Hammer blows for less than 6-inches of split spoon driving is considered "Refusal".
(SP)	Unified Soil Classification System
-200	Fines content, % Passing No. 200 U.S. Standard Sieve
w	Natural Moisture Content (%)
OC	Organic Content (%)
LL	Liquid Limit
PI	Plasticity Index
NP	Non-Plastic
PP	Pocket Penetrometer in tons per square foot (tsf)

MODIFIERS

SECONDARY CONSTITUENTS
(Sand, Silt or Clay)

Trace	Less than 5%
With	5% to 12%
Sandy, Silty or Clayey	12% to 35%
Very Sandy, Very Silty or Very Clayey	35% to 50%

ORGANIC CONTENT

Trace	2% or less
With	3% to 5%
Organic Soils	5% to 20%
Highly Organic Soils (Muck)	20% to 75%
PEAT	Greater than 75%

MINOR COMPONENTS
(Shell, Rock, Debris, Roots, etc.)

Trace	Less than 5%
Few	5% to 10%
Little	15% to 25%
Some	30% to 45%

RELATIVE DENSITY (Coarse-Grained Soils)

Relative Density	N-Value
Very Loose	Less than 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

CONSISTENCY (Fine-Grained Soils)

Consistency	N-Value
Very Soft	Less than 2
Soft	2 to 4
Firm	4 to 8
Stiff	8 to 15
Very Stiff	15 to 30
Hard	Greater than 30

RELATIVE HARDNESS (Limestone)

Relative Hardness	N-Value
Soft	Less than 50
Hard	Greater than 50

* Using Safety Hammer

TEN YEARS 10
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Unified Soil Classification System (USCS)
(from ASTM D 2487)

Major Divisions			*Group Symbol*	*Typical Names*
Coarse-Grained Soils More than 50% retained on the 0.075 mm (No. 4) sieve	**Gravels** 50% or more of coarse fraction retained on the 4.75 mm (No. 4) sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands 50% or more of coarse fraction passes the 4.75 (No. 4) sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils More than 50% passes the 0.075 mm (No. 200) sieve	**Silts and Clays** Liquid Limit 50% or less		ML	Inorganic silts, very fine sands, rock four, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly/sandy/silty/lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid Limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays or high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils

Prefix: G = Gravel, S = Sand, M = Silt, C = Clay, O = Organic
Suffix: W = Well Graded, P = Poorly Graded, M = Silty, L = Clay, LL < 50%, H = Clay, LL > 50%

TEN YEARS
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Appendix B

TABLE 1

Summary of Laboratory Index Tests
Lake Maria Sanchez Flood Mitigation and Drainage Project
St. Augustine, Florida
MAE Project No.: 0194-0003

Boring No.	Sample No.	Depth (ft)	Percent Fines (-200)	Natural Moisture Content, %	Organic Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	USCS Classification
BC1b	3	4-6	8	31	---	---	---	---	SP-SM
BC1b	5	8-10	6	21	---	---	---	---	SP-SM
BC1c	3	4-6	6	27	---	---	---	---	SP-SM
BC1d	3	2-4	11	20	---	---	---	---	SP-SM
BC1d	5	8-10	8	30	---	---	---	---	SP-SM
PS1	4	6-8	28	50	---	---	---	---	SM
PS1	7	14	48	67	---	---	---	---	SM
PS1	10	20	7	22	---	---	---	---	SP-SM
PS1	14	40	94	193	---	---	---	---	CL
BHW1b	7	2	5	31	---	---	---	---	SP-SM
BHW1b	11	40	97	88	---	---	---	---	CL
BHW1c	6	15	4	28	---	---	---	---	SP
BHW1d	3	4-6	---	29	1.9	---	---	---	SM
BHW1d	4	6-8	---	25	1.9	---	---	---	SP-SM
BHW1d	11	40	49	59	---	118	27	91	SC
BHW1h	2	2-4	---	115	9.1	---	---	---	SM
BHW1h	4	6-8	---	33	1.6	---	---	---	SM
BHW1h	12	45	23	23	---	---	---	---	SC
BHW1i	3	4-6	---	30	2.5	---	---	---	SM
BHW1i	4	8-10	---	31	1.9	---	---	---	SP-SM

TABLE 1

Summary of Laboratory Index Tests
Lake Maria Sanchez Flood Mitigation and Drainage Project
St. Augustine, Florida
MAE Project No.: 0194-0003

Boring No.	Sample No.	Depth (ft)	Percent Fines (-200)	Natural Moisture Content, %	Organic Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	USCS Classification
BHW1i	6	15	8	24	---	---	---	---	SP-SM
BHW1i	11	40	93	90	---	---	---	---	CL
BHW1i	12	45	44	34	---	45	19	26	SC
BHW3c	4	6-8	8	28	---	---	---	---	SP-SM
BHW3c	11	40	97	89	---	---	---	---	ML
BW1	3	4-6	66	23	---	---	---	---	ML
BW1	7	15	16	25	---	---	---	---	SM
BW1	13	45	94	87	---	---	---	---	CL
BW3	3	4-6	3	21	---	---	---	---	SP
BW3	8	20	11	28	---	---	---	---	SM
BW3	12	40	94	85	---	---	---	---	CL

Summary of Corrosion Series Test Results
Lake Maria Sanchez
MAE Project No.: 0194-0003

Boring No.	GPS Coordinates		Approximate Test Depth[(2)] (ft)	USCS Soil Classification	pH	Resistivity (ohm-cm)	Chlorides (ppm)	Sulfates (ppm)	Environmental Classification	
	Latitiude	Longitude							Steel Substructure	Concrete Substructure
BC1c	29°53'21.60"N	81°18'48.67"W	2 to 8	SP, SP-SM	5.6	36,000	10	3.0	Extremely Aggressive	Moderately Aggressive
BC2a	29°53'26.28"N	81°18'48.13"W	2 to 8	SP, SP-SM, SM	6.4	10,000	55	168.0	Moderately Aggressive	Slightly Aggressive
BC3c	29°53'16.52"N	81°18'43.82"W	2 to 8	SP-SM, SM	6.5	11,000	10	3.0	Moderately Aggressive	Slightly Aggressive
PS1	29°52'58.85"N	81°18'38.17"W	2 to 6	SP, SM	7.4	48,000	40	3.0	Slightly Aggressive	Slightly Aggressive

(1) Feet below existing ground surface.

LABORATORY TEST PROCEDURES

Percent Fines Content

The percent fines or material passing the No. 200 mesh sieve of the sample tested was determined in general accordance with the latest revision of ASTM D 1140. The percent fines are the soil particles in the silt and clay size range.

Natural Moisture Content

The water content of the tested sample was determined in general accordance with the latest revision of ASTM D 2216. The water content is defined as the ratio of "pore" or "free" water in a given mass of material to the mass of solid material particles.

Atterberg Limits

The Atterberg Limits consist of the Liquid Limit (LL) and the Plastic Limit (PL). The LL and PL were determined in general accordance with the latest revision of ASTM D 4318. The LL is the water content of the material denoting the boundary between the liquid and plastic states. The PL is the water content denoting the boundary between the plastic and semi-solid states. The Plasticity Index (PI) is the range of water content over which a soil behaves plastically and is denoted numerically by the difference between the LL and the PL. The water content of the sample tested was determined in general accordance with the latest revision of ASTM D 2216. The water content is defined as the ration of "pore" or "free" water in a given mass of material to the mass of solid material particles.

Organic Loss on Ignition (Percent Organics)

The organic loss on ignition or percent organic material in the sample tested was determined in general accordance with ASTM D 2974. The percent organics is the material, expressed as a percentage, which is burned off in a muffle furnace at 455±10 degrees Celsius.

Appendix C

Soil Design Parameters

Lake Maria Sanchez

MAE Project No. 0194-0003

Borings: BHW1a									
Soil Type	Typical Depth (ft)		Average N-Value	Effective Unit Weight (pcf) [1]	Friction Angle, ϕ (Degrees)	Cohesion (psf)	Recommended Earth Pressure Coefficients		
	From	To					At Rest (K_o)[2]	Active (K_a)[3]	Passive (K_p)[4]
SP-SM	0	13.5	3	41	29	0	0.52	0.35	2.9
SM	13.5	23.5	7	51	30	0	0.50	0.33	3.0
SP-SM	23.5	33.5	15	56	32	0	0.47	0.31	3.3
SM	33.5	38.5	5	49	29	0	0.52	0.35	2.9
SC	38.5	48.5	9	54	30	0	0.50	0.33	3.0
SP-SM	48.5	50	10	50	31	0	0.48	0.32	3.1
Borings: BHW1b									
Soil Type	Typical Depth (ft)		Average N-Value	Effective Unit Weight (pcf) [1]	Friction Angle, ϕ (Degrees)	Cohesion (psf)	Recommended Earth Pressure Coefficients		
	From	To					At Rest (K_o)[2]	Active (K_a)[3]	Passive (K_p)[4]
SM	0	13.5	3	46	29	0	0.52	0.35	2.9
SM	13.5	23.5	6	50	30	0	0.50	0.33	3.0
SP-SM	23.5	28.5	9	49	30	0	0.50	0.33	3.0
CL	38.5	48.5	8	42	0	1200	1.00	1.00	1.0
SP-SM	48.5	50	11	51	31	0	0.48	0.32	3.1

Soil Design Parameters

Lake Maria Sanchez

MAE Project No. 0194-0003

Borings: BHW1c									
Soil Type	Typical Depth (ft)		Average N-Value	Effective Unit Weight (pcf) [1]	Friction Angle, ϕ (Degrees)	Cohesion (psf)	Recommended Earth Pressure Coefficients		
	From	To					At Rest (K_o)[2]	Active (K_a)[3]	Passive (K_p)[4]
SM	0	6	2	40	29	0	0.52	0.35	2.9
SM	6	13.5	5	49	29	0	0.52	0.35	2.9
SP	13.5	33.5	12	53	31	0	0.48	0.32	3.1
SM	33.5	43.5	6	50	30	0	0.50	0.33	3.0
SM	43.5	50	13	59	31	0	0.48	0.32	3.1
Borings: BHW1d									
Soil Type	Typical Depth (ft)		Average N-Value	Effective Unit Weight (pcf) [1]	Friction Angle, ϕ (Degrees)	Cohesion (psf)	Recommended Earth Pressure Coefficients		
	From	To					At Rest (K_o)[2]	Active (K_a)[3]	Passive (K_p)[4]
SM	0	3	2	40	29	0	0.52	0.35	2.9
SP-SM	3	31.5	12	53	31	0	0.48	0.32	3.1
SM	31.5	34.5	5	49	29	0	0.52	0.35	2.9
SC	34.5	41.5	7	51	30	0	0.50	0.33	3.0
SM	41.5	50	11	56	31	0	0.48	0.32	3.1

Soil Design Parameters

Lake Maria Sanchez

MAE Project No. 0194-0003

Borings: BHW1e									
Soil Type	Typical Depth (ft)		Average N-Value	Effective Unit Weight (pcf) [1]	Friction Angle, ϕ (Degrees)	Cohesion (psf)	Recommended Earth Pressure Coefficients		
	From	To					At Rest (K_o)[2]	Active (K_a)[3]	Passive (K_p)[4]
SM	0	11.5	2	45	29	0	0.52	0.35	2.9
SM	11.5	30	17	64	32	0	0.47	0.31	3.3
SM	30	54	10	55	31	0	0.48	0.32	3.1
SP-SM	54	50	14	55	32	0	0.47	0.31	3.3
Borings: BHW1f									
Soil Type	Typical Depth (ft)		Average N-Value	Effective Unit Weight (pcf) [1]	Friction Angle, ϕ (Degrees)	Cohesion (psf)	Recommended Earth Pressure Coefficients		
	From	To					At Rest (K_o)[2]	Active (K_a)[3]	Passive (K_p)[4]
SM	0	3.5	2	45	29	0	0.52	0.35	2.9
SP-SM	3.5	31.5	12	53	31	0	0.48	0.32	3.1
SM	31.5	41.5	5	49	29	0	0.52	0.35	2.9
SM	41.5	50	16	62	32	0	0.47	0.31	3.3

Soil Design Parameters

Lake Maria Sanchez

MAE Project No. 0194-0003

Soil Type	Typical Depth (ft)		Average N-Value	Effective Unit Weight (pcf) [1]	Friction Angle, ϕ (Degrees)	Cohesion (psf)	Recommended Earth Pressure Coefficients		
	From	To					At Rest (K_o)[2]	Active (K_a)[3]	Passive (K_p)[4]
Borings: BHW1g									
SP-SM	0	6	2	45	29	0	0.52	0.35	2.9
SM	6	50	11	56	31	0	0.48	0.32	3.1
Borings: BHW1h									
SM	0	6	2	45	29	0	0.52	0.35	2.9
SM	6	38.5	7	51	30	0	0.50	0.33	3.0
SP-SM	38.5	43.5	38	63	38	0	0.38	0.24	4.2
SC	43.5	50	15	61	32	0	0.47	0.31	3.3
Borings: BHW1i									
SM	0	8	2	45	29	0	0.52	0.35	2.9
SP-SM	8	38.5	8	48	30	0	0.50	0.33	3.0
CL	38.5	43.5	8	42	0	1200	1.00	1.00	1.0
SC	43.5	48.5	10	55	31	0	0.48	0.32	3.1
SP	48.5	50	9	49	30	0	0.50	0.33	3.0

Soil Design Parameters

Lake Maria Sanchez

MAE Project No. 0194-0003

Borings: BHW3a									
Soil Type	Typical Depth (ft)		Average N-Value	Effective Unit Weight (pcf) [1]	Friction Angle, ϕ (Degrees)	Cohesion (psf)	Recommended Earth Pressure Coefficients		
	From	To					At Rest (K_o)[2]	Active (K_a)[3]	Passive (K_p)[4]
SM	0	10	2	45	29	0	0.52	0.35	2.9
SM	10	23.5	15	61	32	0	0.47	0.31	3.3
SM	23.5	53.5	7	51	30	0	0.50	0.33	3.0
SM	53.5	65	19	61	33	0	0.46	0.29	3.4
Borings: BHW3b									
Soil Type	Typical Depth (ft)		Average N-Value	Effective Unit Weight (pcf) [1]	Friction Angle, ϕ (Degrees)	Cohesion (psf)	Recommended Earth Pressure Coefficients		
	From	To					At Rest (K_o)[2]	Active (K_a)[3]	Passive (K_p)[4]
SM	0	16	2	45	29	0	0.52	0.35	2.9
SM	16	48.5	18	65	33	0	0.46	0.29	3.4
SM	48.5	63.5	10	55	31	0	0.48	0.32	3.1
SP-SM	63.5	73.5	23	63	32	0	0.47	0.31	3.3
SM	73.5	80	42	68	38	0	0.38	0.24	4.2

Soil Design Parameters

Lake Maria Sanchez

MAE Project No. 0194-0003

Borings: BHW3c

Soil Type	Typical Depth (ft)		Average N-Value	Effective Unit Weight (pcf) [1]	Friction Angle, ϕ (Degrees)	Cohesion (psf)	Recommended Earth Pressure Coefficients		
	From	To					At Rest (K_o)[2]	Active (K_a)[3]	Passive (K_p)[4]
SM	0	5	3	41	29	0	0.52	0.35	2.9
SP-SM	5	13.5	6	45	37	0	0.40	0.25	4.0
SP-SM	13.5	38.5	11	51	34	0	0.44	0.28	3.5
ML	38.5	48.5	11	47	0	1650	1.00	1.00	1.0
SM	48.5	80	15	61	32	0	0.47	0.31	3.3

Borings: BW1

Soil Type	Typical Depth (ft)		Average N-Value	Effective Unit Weight (pcf) [1]	Friction Angle, ϕ (Degrees)	Cohesion (psf)	Recommended Earth Pressure Coefficients		
	From	To					At Rest (K_o)[2]	Active (K_a)[3]	Passive (K_p)[4]
SM	0	4	9	49	30	0	0.50	0.33	3.0
ML	4	12	10	45	0	1500	1.00	1.00	1.0
SM	12	32	11	56	31	0	0.48	0.32	3.1
SP-SM	32	37	24	63	34	0	0.44	0.28	3.5
SM	37	42.5	4	48	29	0	0.52	0.35	2.9
CL	42.5	47	5	36	0	750	1.00	1.00	1.0
ML	47	50	9	43	0	1350	1.00	1.00	1.0

Soil Design Parameters

Lake Maria Sanchez

MAE Project No. 0194-0003

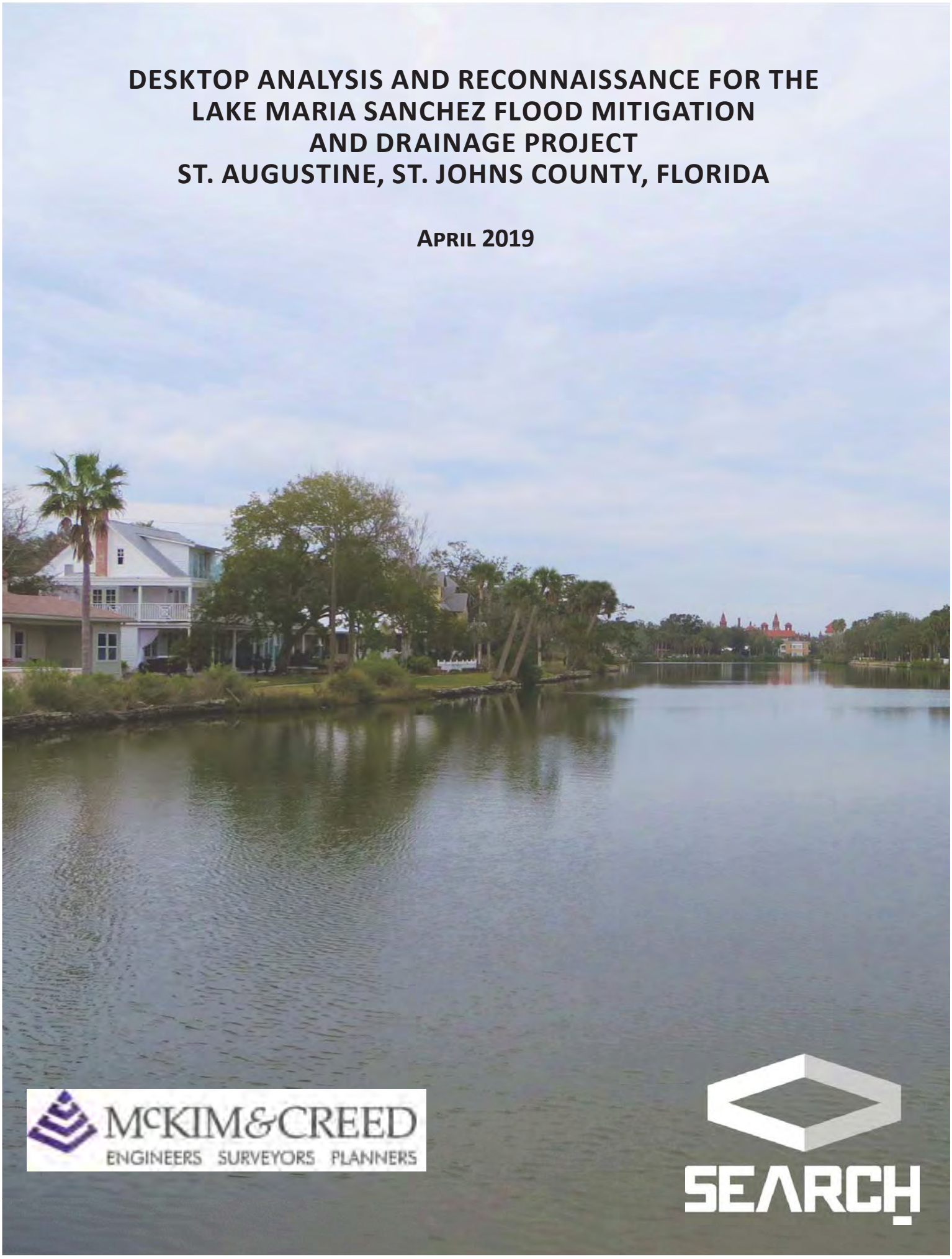
Borings: BW2									
Soil Type	Typical Depth (ft)		Average N-Value	Effective Unit Weight (pcf) [1]	Friction Angle, ϕ (Degrees)	Cohesion (psf)	Recommended Earth Pressure Coefficients		
	From	To					At Rest (K_o)[2]	Active (K_a)[3]	Passive (K_p)[4]
SM	0	9	2	45	29	0	0.52	0.35	2.9
SP-SM	9	38	13	54	31	0	0.48	0.32	3.1
CL	38	43	10	45	0	1500	1.00	1.00	1.0
SP-SM	43	50	19	61	33	0	0.46	0.29	3.4
Borings: BW3									
Soil Type	Typical Depth (ft)		Average N-Value	Effective Unit Weight (pcf) [1]	Friction Angle, ϕ (Degrees)	Cohesion (psf)	Recommended Earth Pressure Coefficients		
	From	To					At Rest (K_o)[2]	Active (K_a)[3]	Passive (K_p)[4]
SP-SM	0	37.5	7	46	30	0	0.50	0.33	3.0
CL	37.5	47	7	40	0	1050	1.00	1.00	1.0
SP-SM	47	50	8	48	30	0	0.50	0.33	3.0

Notes:

1. In accordance with the FDOT *Soils and Foundation Handbook* (2016), the groundwater level was assumed at the ground surface for design purposes.
2. $K_o = 1 - \sin(\phi)$
3. $K_a = \tan^2(45 - \phi / 2)$
4. $K_p = \tan^2(45 + \phi / 2)$

DESKTOP ANALYSIS AND RECONNAISSANCE FOR THE LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT ST. AUGUSTINE, ST. JOHNS COUNTY, FLORIDA

April 2019



McKIM&CREED
ENGINEERS SURVEYORS PLANNERS

SEARCH

DESKTOP ANALYSIS AND RECONNAISSANCE FOR THE LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT ST. AUGUSTINE, ST. JOHNS COUNTY, FLORIDA

PREPARED FOR

MCKIM & CREED

REPORT AUTHORED BY

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APRIL 2019

SEARCH PROJECT NO. 180078

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INTRODUCTION

This report details the results of a cultural resource desktop evaluation and reconnaissance survey in support of the Lake Maria Sanchez Flood Mitigation and Drainage Project in St. Augustine, St. Johns County, Florida (Project). The ground disturbing activities for the Project fall on the north (Area 1) and south (Area 2) sides of Lake Maria Sanchez (**Figure 1**). McKim & Creed is the lead engineering firm on this contract and SEARCH is a subcontractor providing the cultural resource management work. The Project is funded, in part, by a Federal Emergency Management Agency (FEMA) grant (DR-4283-22-R) and is managed by the City of St. Augustine (City).

The desktop evaluation identified previously recorded historic properties that may be present within the Area of Potential Effect (APE) for the Project. The reconnaissance included a walkover survey to identify areas of particular concern for recorded cultural resources (e.g., archaeological sites, historic structures, historic districts) within the study area, and assessed the potential for unrecorded historic resources. The specific goals of this document are to:

- outline the elements of the Project that require archaeological or architectural consideration;
- present background research including the results of a Florida Master Site File (FMSF) search, a historic map and aerial photograph review, and a historical context of the Lake Maria Sanchez area;
- make recommendations for the extent of work to be included in the upcoming Phase I Cultural Resource Assessment Survey (CRAS); and
- make recommendations for archaeological monitoring during the construction phase scheduled in 2020.

This desktop analysis and reconnaissance report will be used to coordinate additional cultural resource work with the City and the State Historic Preservation Officer (SHPO). Portions of the Project fall within or adjacent to the City of St. Augustine Archaeological Zones 1c, IIb, IIc, and IIIa and Historic Preservation Zoning Districts HP-1, HP-2, and HP-4. Construction in these zones is subject to additional scrutiny from the City prior to ground disturbance and require the City of St. Augustine Archaeological Review. Archaeological testing will be designed to ensure compliance with the City of St. Augustine Code of Ordinance Chapter 6 (Archaeological Preservation). SEARCH will coordinate with the City Archaeologist, Andrea White, and the City of St. Augustine Historic Preservation Officer, Jennifer Wolfe, regarding the required cultural resource work for the Project.

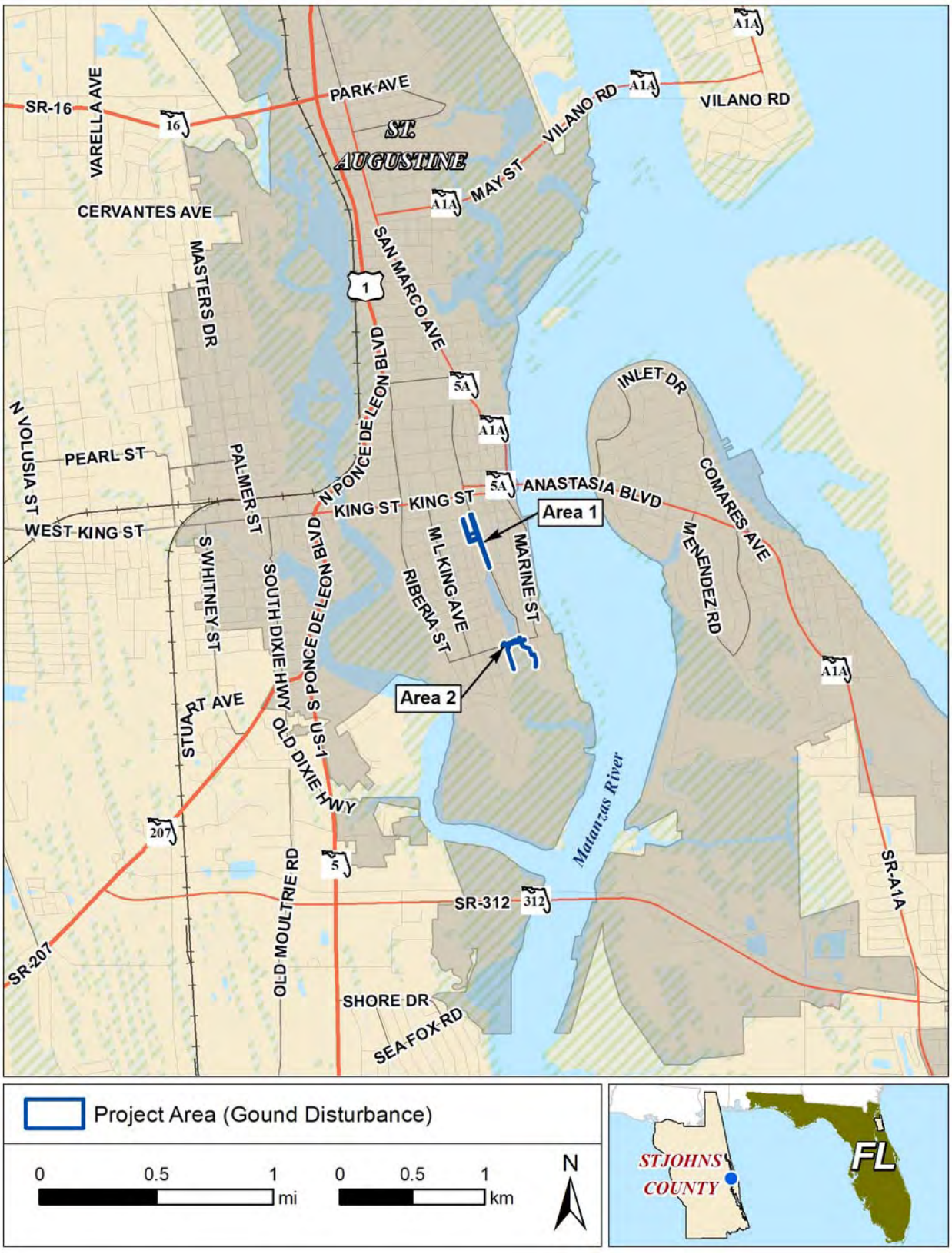


Figure 1. Lake Maria Sanchez Flood Mitigation and Drainage Project location, St. Augustine.

PROJECT DESCRIPTION

The Lake Maria Sanchez Flood Mitigation and Drainage Project consists of the following undertakings, which will require consideration of cultural resources:

(1) Storm water treatment facility construction and associated storm water conveyance and drainage improvement areas (immediately south of Lightner Museum); here referred to as Area 1.
(2) Pump station and storm water outfall construction (south end of Lake Maria Sanchez); here referred to as Area 2.
(3) Bulkhead or retaining wall (1,900 linear feet) construction at south end of Lake Maria Sanchez; also part of Area 2.

STORM WATER TREATMENT FACILITY (AREA 1)

The storm water conveyance improvements will include upsizing the existing pipes and adding box culverts along Cordova Street, Bridge Street, and Granada Street to increase conveyance to Lake Maria Sanchez (**Figure 2**). Construction will require relocations of existing public utilities that lie in conflict with the proposed improvements. All work will be conducted within road right-of-ways or within the City parking lot. Most of Area 1 falls within a fill zone (historic) as mapped by the City. In 1885, Henry Flagler filled in the northern part of Maria Sanchez Creek, which once ran between Cordova and Granada Streets and constructed two large hotels on the reclaimed land. The western boundary of the City of St. Augustine's 1B Archaeological Zone (Colonial City) is Cordova Street, and Zones IID and IIIA extend west and south from Granada Street.

PUMP STATION AND STORM WATER OUTFALL (AREA 2)

A new storm water pump station will be constructed at the existing Lake Maria Sanchez outfall at the south end of the lake along South Street (**Figure 3**). The existing pump station is shown in **Figure 4**. A new gravity discharge will consist of a precast inlet structure approximately 10-feet long by 4-feet wide, by 10-feet deep. The pump station will include three low-head pumps that will be controlled by a local control panel and a float system based on lake water surface elevation. Both systems will be equipped with backflow preventers for low tide/high tide control. Each system will penetrate the proposed bulkhead (see below). The pump station and its control panel will be an aboveground structure at the immediate south end of the lake; it is in the process of being designed. Construction of the outfall system will require ground disturbing work along South Street. All work will be conducted within the road right-of-way. The pump station falls within Archaeological Zone IIB.



Figure 2. Storm Water Treatment Facility Project Area 1 that includes increased storm water conveyance and new box culverts.



Figure 3. Storm Water Pump Station and Bulkhead Project Area 2 on the south end of Lake Maria Sanchez.



Figure 4. Existing pump station and storm water outfall on South Street, facing southeast.

BULKHEAD

A bulkhead to provide storm surge protection will be installed along the foreshore of Maria Sanchez Creek extending for approximately 1,900 linear feet south of South Street (see **Figure 3**). The top of the bulkhead will be at an elevation of 7.0 feet NAVD (North American Vertical Datum88). This aboveground structure is in the process of being designed, but it is expected the bulkhead will extend 3–4 feet into the ground. It will be designed with no openings and will be tied in at either end to a higher elevation existing grade. The easement for the bulkhead is 20 feet wide. The east side of the bulkhead falls on private property and access to the parcels is in the process of being acquired. The west side of the bulkhead falls within the right-of-way for the adjacent roadway. Archaeological Zones IC, IIB, IIC, and IIIA are potentially crossed by the bulkhead.

Maria Sanchez Creek is a wetland characterized by mud, oyster beds, and marsh grass. The mud flats are exposed at low tide and submerged at high tide. Washington Street bounds the western edge of the wetland. Between Washington Street and Maria Sanchez Creek are deep deposits of mud with marsh grasses and oysters. The creek is not navigable, but it was in historic times.

AREA OF POTENTIAL EFFECT

For the purposes of this desktop and reconnaissance survey, the direct Area of Potential Effect (APE) for the Project includes the existing right-of-way for the roads slated for construction, the City parking lot where improved conveyance will be placed, and the bulkhead footprint and its 20-foot easement. The visual or indirect APE, as defined for this document, includes the parcels immediately adjacent to the Project in Area 2.

Aboveground constructions that will require architectural history consideration include the bulkhead at the south end of Lake Maria Sanchez and the new pump station and storm water outfall at the south end of Lake Maria Sanchez (Area 2). At the current state of planning for this project, there is no aboveground construction within Area 1 and the architectural historian will not review adjacent parcels for historic resources. However, as part of the reconnaissance survey the architectural historian surveyed the Project in both Areas 1 and 2 for any extant historic fabric that may be subjected to direct adverse effects from the planned construction.

Below-ground disturbances that will require archaeological consideration include the construction of the storm water conveyance system and box culverts south of the Lightner Museum, the pump station, and the bulkhead at the south end of Lake Maria Sanchez. Only the bulkhead is located on undeveloped property. All the undeveloped property is very poorly drained. The other facilities are to be placed below streets or lots that are currently paved.

HISTORIC CONTEXT

The following brief historic context focusses on the area immediately surrounding Lake Maria Sanchez. Lincolnville is the historically black business and residential district of St. Augustine that covers approximately 50 blocks on the east side of Lake Maria Sanchez. The area began in 1866 as a settlement of freed slaves called "Africa." Much of the land in what would be the Lincolnville neighborhood was reclaimed from the marshlands of Maria Sanchez Creek. The marshlands had previously supported two or three Native American mission and village sites, military defenses, and the Yallaha and Buena Esperanza citrus plantations (Adams 1985).

The Spanish under Pedro Menéndez de Avilés founded St. Augustine in 1565. In doing so, Spain intended to assert their dominance over other European powers in the region. A key component of Spain's strategy was to create a network of missions. In 1566, Catholic priests arrived in St. Augustine to begin proselytizing among the native groups of the region. Over the next century, a thriving mission system, populated by Apalachee, Timucua, Yamasee, Guale, and other groups, spread across northern Florida and southeastern coastal Georgia. In 1704, the mission system came under attack by English mercenaries from Georgia and their native allies, leading to great destruction and death across the mission network. To better protect themselves from the dangers of the frontier, the surviving mission Indians, numbering some 300 persons, reestablished themselves in communities close to the city of St. Augustine (Gannon 1965:74-75). The vicinity of St. Augustine also became a new home for Indian survivors of the Yamasee War (1715-1717) in South Carolina. The Spanish Governors of St. Augustine welcomed the natives on the grounds that they could assist in the defense of the city (White 2002).

One of the survivor settlements was called Palica (8SJ00093), which historic maps place in the northern modern-day Lincolnville area. This mission town was established about 1704 just after the mission network of northern Florida was destroyed. Palica appears in several maps from the eighteenth century. Another community that possibly existed in the environs of southern Lincolnville was Pocotalaca (8SJ03181) (alternatively known as Pocolalaca). The Native American mission town of La Punta (8SJ00094) was established in the 1720s on the east side of Maria Sanchez Creek and just south of the walled city by refugees from the Yamasee War. Generally, the mission towns had a central mission and cemetery with surrounding residences.

St. Augustine's defenses in the eighteenth and early nineteenth centuries included the Castillo de San Marcos and a town wall that was formed by the Cubo and Rosario Lines. These defensive earthworks were interspersed with redoubts. The Cubo Line (completed about 1704) ran westward from the Castillo de San Marcos to San Sebastian Creek, while the Rosario Line ran southward from the Cubo Line and along the south side of the city. The Matanzas River formed the natural eastern barrier to the city. The Rosario Line (completed about 1718) is relevant to the Project because it ran immediately parallel to Maria Sanchez Creek as is illustrated in **Figure 5**. It is likely that through the decades, the Rosario Line earthen

embankment was gradually dismantled as defensive needs and strategies changed. St. Augustine historian Thomas Graham speculated that the Rosario Line may have been destroyed in the 1870s or possibly in the 1880s when the city improved Tolomato Street (present-day Cordova Street). The construction of Henry Flagler's Ponce de Leon and Alcazar hotels in the 1880s also may have caused the final destruction of the Rosario Line (Graham 1978:180).

St. Augustine had a significant black population, both free and slave, since its founding. When the Union Navy took over the city in 1862, enslaved blacks were freed. Following the Civil War, black inhabitants settled into new homes on Charlotte and Spanish Streets, where blacks had resided for many years, and established a new community near marshland on the west side of Maria Sanchez Creek. The founders leased the land for their community, later known as Lincolnville, from the City of St. Augustine in 1866. A newspaper report on this date noted that the residents were "improving and reclaiming the land" with "a highly commendable spirit." Lincolnville materialized through the closing decades of the nineteenth century with formal streets established in the 1870s and several developed subdivisions by the 1890s. An exception to the all-black subdivisions of the community was a white neighborhood called Fountain City, located in the northwest corner of today's Lincolnville.



Figure 5. City defenses shown on the 1764 Map "Plano de la RL Fuerza Baluartes y Linea de la plaza de SN. Agustin de Florida" by Juan José Eligio de la Puente. Source: University of Florida Digital Collections http://ufdc.ufl.edu/USACH00236/00001/1x

In the 1880s, the population of St. Augustine was growing along with the number of tourists. Road work and hotel and neighborhood development impacted the Lincolnville area as well as the natural environment. The City of St. Augustine opened new roads and improved others in this period. Dr. Andrew Anderson and other residents asked the aldermen of the City Council to broaden Tolomato Street. In the more developed area of the city, the street was very narrow and, where it ran along the east shore of Maria Sanchez Creek, it was merely a footpath. The widening and formalization of the street, which was renamed Cordova Street, coincided with the development of the Ponce de Leon and Alcazar hotels (Graham 1978:180).

Henry Flagler, a wealthy partner in Standard Oil along with John D. Rockefeller, developed a hotel, land, and railroad empire along the eastern coast of Florida in the late nineteenth and

early twentieth centuries. He saw St. Augustine as a winter resort for the wealthy and the Ponce de Leon and Alcazar Hotels were premiere destinations. The construction of Flagler's hotels was a substantial process that entailed the reclamation of the northern part of Maria Sanchez Creek. For the Ponce de Leon Hotel complex on the north side of King Street, Dr. Andrew Anderson worked with Flagler's company to successfully obtain permission to reclaim the creek and its adjacent marshland. The reclamation, which marked the start of construction in December 1885, consisted of filling the marsh and creek with railroad cars of sand. Whole tree trunks were driven into the marsh to serve as pilings for the large hotel building. The Ponce de Leon Hotel was completed in May 1887 (Graham 1978:169, 1989:11). Following the completion of the Ponce de Leon, Flagler broke ground on the Alcazar (present-day Lightner Museum). The site, located south of King Street, required the demolition of the Olive Methodist Church and the San Marco roller skating rink. More of Maria Sanchez Creek was reclaimed to make way for this hotel. The hotel opened in December 1888 (Graham 1989:8-12).

William G. Warden, one of Flagler's business partners, aimed to develop a tract of land located at the southern end of modern Lincolnville in the late nineteenth century. To be known as the Buena Esperanza subdivision, the development, which was intended for white winter residents, required Warden to dredge the southern part of Maria Sanchez Creek. In doing so, water was impounded between the southern part of the creek and the Alcazar Hotel grounds to flood the creek and surrounding marsh to create Lake Maria Sanchez (Adams 1985:7-8).

As segregation arose in the late nineteenth and early twentieth centuries, new establishments came to Lincolnville to serve blacks in the Lincolnville community. Businesses arose on Washington, Central, and Riberia Streets. The Florida Normal and Industrial Institute, an all-black college, was established in the late 1910s. Photographs from later in the twentieth century depict Lincolnville as a thriving community with its share of attractive residences and churches (**Figure 6**). In the 1960s, black residents of Lincolnville launched civil rights demonstrations that garnered the support of national movement leaders including Martin Luther King Jr. While a victory for the civil rights movement, desegregation had the effect of a decline in black businesses in Lincolnville. Significant areas of the Lincolnville neighborhood remain intact in the present (Adams 1985:10-11).



Figure 6. A Lincolnville home in the 1920s. Source: Florida Photographic Collection.

BACKGROUND RESEARCH

FLORIDA MASTER SITE FILE REVIEW

The FMSF database, last updated in January 2019, was reviewed to determine if any previously recorded archaeological or historical sites are mapped within or immediately adjacent to the study area and if any previous cultural resource surveys are relevant to the Project.

Previous Cultural Resource Surveys

Due to the high number of previous cultural resource surveys in St. Augustine, only surveys that relate to nearby sites were reviewed for this desktop analysis. Eleven cultural resource surveys on record have been undertaken on land that intersects the Project and recorded cultural resources (**Table 1**). Each is briefly described below.

Table 1. Previous Cultural Resource Surveys Relevant to the Current Project.

Survey #	Title	Date	Author
1015	Historic Sites and Buildings Survey of St. Augustine, Florida	1980	William Adams, Historic Property Associates, Inc.
1515	St. Johns County Historical, Architectural, and Archaeological Survey	1987	St. Augustine Preservation Board
1912	Determination of Eligibility for the Lincolnville Neighborhood	1985	William Adams, Historic Property Associates, Inc.
5705	Historic Building Survey Update of the City of St. Augustine (1930-1953 structures)	1999	William Adams, Historic Property Associates, Inc.
9709	Living on the Periphery: A Study of an Eighteenth-Century Yamasee Mission Community in Colonial St. Augustine	2002	Andrea White
10711	A Survey of 46 Historical Cemeteries in St. Johns County, FL	2004	ESI, Inc.
17091	First Coast Maritime Archaeology Program 2007-2009: Report on Archaeological and Historical Investigations and Other Project Activities	2010	LAMP
22000	Inventory of Archaeological Sites and Past Archaeological Investigations in St. Augustine, Florida	2015	ACI, Inc.
22120	Archaeological Project Status Report, May, July, August 1994	1994	Carl Halbirt
22121	Archaeological Investigations at 242 St. George Street (SA36-7) in Response to the Construction of a Drainage System and Associated Retention Pond	1996	Carl Halbirt
22144	A Sub-Surface Survey of the St. Augustine City Environs	1976	K. Deagan et al.

Survey #1015

The original historic structure survey of St. Augustine was conducted for the Historic St. Augustine Preservation Board from 1978–1980 (Adams 1980). Over 2,700 properties were documented and each resource was placed within its local historical context including neighborhood history and individual resource histories. The survey recorded buildings with construction dates up to 1930.

Survey #1515

This 1987 general survey of St. Johns County recorded 65 new sites for the county and revisited 54 previously recorded sites. The survey focused on archaeological resources and produced a site predictive model for the region. Following this investigation, a St. Johns County protective archaeological ordinance was recommended along with the establishment of a County Archaeologist position.

Survey #1912

This 1985 survey was the determination of eligibility for the Lincolnville Neighborhood (Adams 1985). As discussed in the Historic Context, Lincolnville (8SJ03248) is the historically black business and residential district of St. Augustine that covers approximately 50 blocks on the east side of Lake Maria Sanchez. The area began as a settlement of freed slaves in 1866, and following the Civil War, Lincolnville developed into a major part of the city. The survey identified 678 historic resources in the Lincolnville Neighborhood within a period of significance from 1871 to 1964.

Survey #5705

This 1999 survey updated the 1978-1981 Historic Structure Survey of St. Augustine (#1015) conducted for the Historic St. Augustine Preservation Board survey. This follow-up survey addressed structures built after 1930 and prior to 1953. A total of 151 buildings were recorded.

Survey #9709

This 2004 report is a Master's Thesis on excavations at the La Punta (8SJ00094) mission site (White 2002). Excavations from 1996 were conducted by the City of St. Augustine Archaeology Program as part of new construction of the Bayview Nursing and Assisted Living Facility (now Bayview Healthcare at 161 Marine Street). The work produced over 16,000 artifacts and 43 features related to the eighteenth-century Yamasee mission town. The town abutted the east side of Maria Sanchez Creek and covered a much greater area than has been tested.

Survey #10711

In 2004, Environmental Services, Inc. (ESI) conducted a survey of cemeteries across St. Johns County and recorded 35 new historic cemetery sites, in addition to visiting seven previously recorded cemeteries. This survey recorded the Nuestra Señora de la Soledad Cemetery (8SJ04900) that is just east of Area 1 near the Lightner Museum. This cemetery is currently capped by a parking lot.

Survey #17091

In 2010, the St. Augustine Lighthouse Archaeological Maritime Program (LAMP) reported on their Archaeological and Historical Investigations from 2007–2009. They recorded four new sites in that period including the Lincolnville Landing (8SJ05020) in the marsh edge of Maria Sanchez Creek.

Survey #22000

As a result of the 2015 Inventory of Archaeological Sites and Past Archaeological Investigations in St. Augustine (ACI 2015), 40 city blocks were recorded as individual sites. The FMSF was reorganized so that the archaeological resources of St. Augustine were designated with each city block recorded as its own site and FMSF number. Many blocks within the urban St. Augustine district contain abundant archaeological remains crossing the 450-year range of the City's history. Block 36 (8SJ05683) and Block 38 (8SJ05684) are adjacent to the Project.

Surveys #22120 and #22121

Surveys #22120 and #22121 (Halbirt 1994a, 1996a) were conducted as part of the City Archaeology Program in response to permit requests to construct a retention pond and a perimeter fence on the property containing the Soledad Cemetery (8SJ04900) (between Cordova Street and St. George Street east of the Lightner Museum).

In the 1994 survey for fence construction (#22120), testing on the western portion of the lot exposed deposits post-dating the 1885 filling of Maria Sanchez Creek by Henry Flagler. In addition, post holes exposed a whitish/gray sand deposit 35 feet wide and 3-12 cm thick that was interpreted as the possible base of the Rosario Line earthen embankment. The possible Rosario Line deposits are 20-30 meters east of Cordova Street.

In the 1996 survey for the construction of a retention pond (#22121), testing on the lot's west end were found to be disturbed and outside the cemetery. The cemetery boundary was found to align with the current edge of the parking lot. Halbirt concluded that the burials were capped beneath 35–40 cm of recent fill dirt and a clay lens (former tennis court).

Survey #22144

In 1976, Kathleen Deagan conducted a close-interval auger test survey across many blocks of colonial St. Augustine. The survey included much of the area east of Cordova Street as far south as St. Francis Street. In total, 530 holes were dug across the colonial core of the town. Deagan identified the Rosario Wall in sediments just east of Cordova Street.

Previously Recorded Cultural Resources

The FMSF review identified six archaeological sites, one historic cemetery (archaeological), two NRHP-listed historic districts, one National Historic Landmark (NHL), and eight historic structures. The structures are on parcels adjacent to Area 2. These resources are detailed in **Table 2**.

Table 2. FMSF Recorded Resources Within or Adjacent to the Project.

Archaeological Sites				
FMSF No.	**Name**	**Time Period**	**Site Type**	**SHPO NRHP Evaluation**
8SJ00093	Palica	1720s-1750s	Mission	Not evaluated
8SJ00094	La Punta	1720s-1750s	Mission	Not evaluated
8SJ03181	Pocotalaca	1717-1750s	Mission	Not evaluated
8SJ05020	Lincolnville Landing	19th-20th centuries	Maritime	Not evaluated
8SJ05683	Block 36	ca. 1565 to the 19th c.	Colonial St. Augustine	Not evaluated; but within the National Historic Landmark
8SJ05684	Block 38	ca. 1565 to the 19th c.	Colonial St. Augustine	Not evaluated; but within the National Historic Landmark

Cemeteries				
FMSF No.	**Name/Address**	**Type**	**Year**	**SHPO NRHP Evaluation**
8SJ04900	Nuestra Senora de la Soledad Cemetery; East of Cordova St.	Church/Cemetery, site is archaeological	1565-1783	Not evaluated

Historic Districts				
FMSF No.	**Name**	**Period of Significance**	**Resources**	**NRHP Evaluation**
8SJ00010	St. Augustine Historic District	ca. 1565-1935	299 (226 contributing)	Listed (April 15, 1970)
8SJ03248	Lincolnville Historic District	1871-1964	678 (548 contributing)	Listed (Nov. 29, 1991)
8SJ05567	St. Augustine Town Plan Historic District	1598-1800	NA	National Historic Landmark (April 15, 1970)

Historic Structures				
FMSF No.	**Name/Address**	**Style**	**Year**	**SHPO NRHP Evaluation**
8SJ00567	350 Charlotte Street	Frame Vernacular	1924	Not evaluated
8SJ02200	6 South Street	Frame Vernacular	1905	Not evaluated
8SJ02201	3 South Street – Parker/ Dewhurst House	Mediterranean Revival	1917	Not evaluated
8SJ02202	24 South Street	Bungalow	1924	Not evaluated
8SJ02203	72 South Street	Bungalow	1917	Contributing to 8SJ03248
8SJ02363	157 Washington Street	Mediterranean Revival	1924	Individually Eligible, contributing to 8SJ03248
*8SJ02364	161 Washington Street	Bungalow	1930	Not evaluated -- destroyed
8SJ03697	156 Marine Street	Masonry Vernacular	1930	Not evaluated

*Currently vacant lot

Archaeological Sites

Six archaeological sites have been recorded with the FMSF that fall within or immediately adjacent to the footprint of Areas 1 and 2 (**Figures 7 and 8**). Two sites are resource groups that comprise the collective archaeological resources of two historical blocks of St. Augustine, three



Figure 7. Previously recorded archaeological sites and a cemetery adjacent to Area 1. The City of St. Augustine Archaeological Zones are provided on this map.

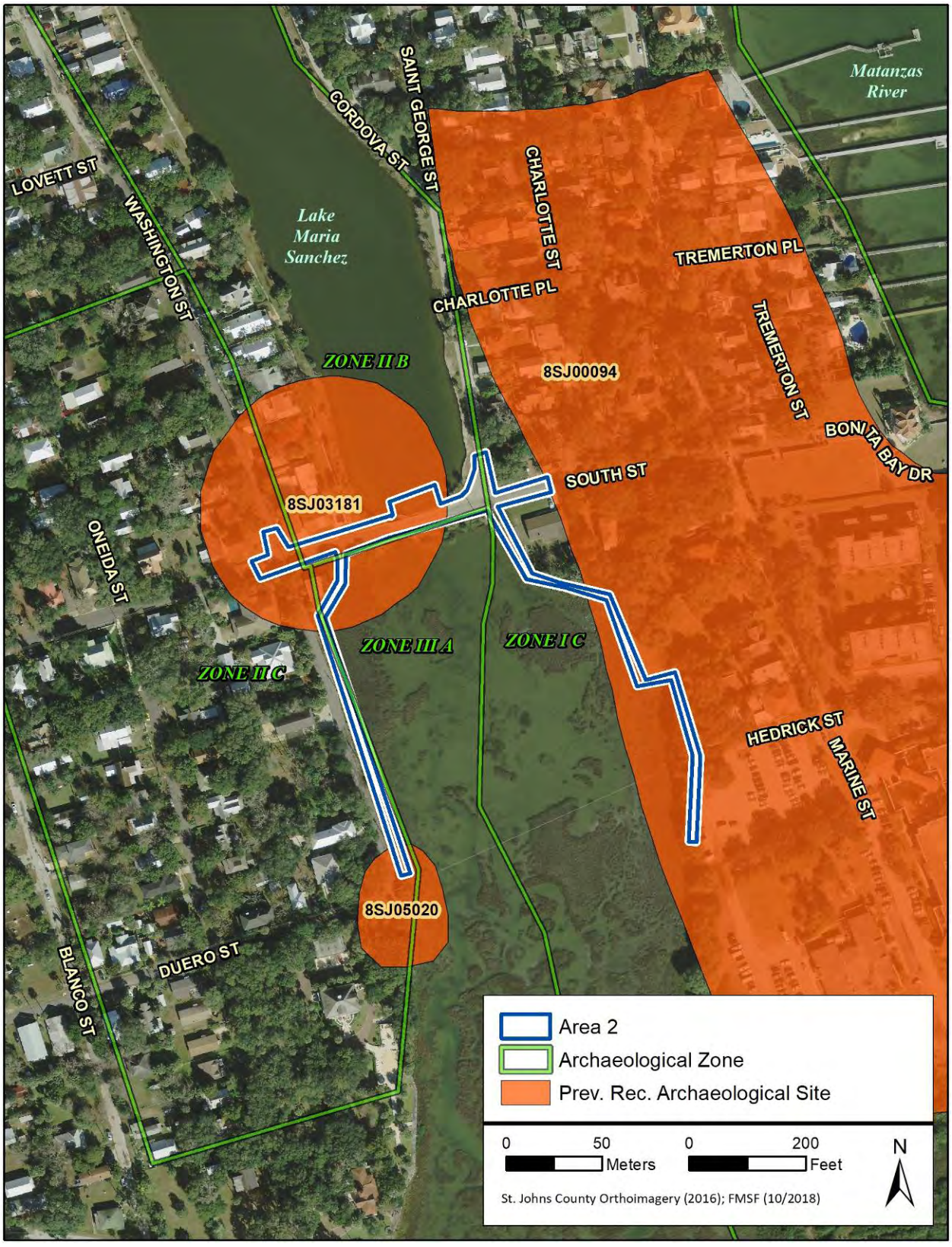


Figure 8. Previously recorded archaeological sites that intersect Area 2. The City of St. Augustine Archaeological Zones are provided on this map.

are late Mission-period Native American settlements, and one is a feature (landing) associated with the community of Lincolnville. The three Native American towns (Punta, Palica, Pocotalaca) were located just outside the city walls. These Native American settlements are broadly mapped by the FMSF.

8SJ05683 – Block 36

As noted above, the 2015 Inventory of Archaeological Sites and Past Archaeological Investigations in St. Augustine (ACI 2015) recorded 40 city blocks as individual sites carrying their own site file numbers. Block 36 (8SJ05683) is bound by King Street to the north, St. George Street to the east, Bridge Street to the south, and Cordova Street to the west. The eighteenth-century Rosario Line, which marked the western edge of the Colonial City, ran north–south along the western edge of Block 36.

8SJ05684 – Block 38

Block 38 (8SJ05684) is immediately south of Block 36, bound by Bridge Street to the north, St. George Street to the east, St. Francis Street to the south, and Cordova Street to the west. The Rosario Line ran through the western portion of Block 38. Prior archaeological work in Block 38 identified a slight ridge and the previous shoreline at the edge of Maria Sanchez Creek (Halbirt 1994b).

8SJ00093 – Palica

Palica is a Native American mission town that is mapped on eighteenth-century maps (Arredondo 1737; Castella 1763) in the general location of modern-day Lincolnville in the vicinity of what is now Bridge Street. The original Palica mission was founded in the sixteenth century, likely at a location farther from St. Augustine. The mission was re-established just outside the City walls by displaced Native Americans after the 1704 destruction of the mission chain. Palica (8SJ00093) is mapped in the FMSF as a General Vicinity (G.V.) site across more than 15 blocks of the Lincolnville neighborhood. In 1994, Stan Bond recorded and broadly mapped the site in the FMSF noting that the 1987 auger survey (#1515) in the area did not identify a concentration of First Spanish Period (1565-1763) materials that could be related to a mission. The site location has not been definitely identified and has not been evaluated for its significance.

8SJ00094 – La Punta

The Nuestra Señora del Rosario de la Punta mission town was settled in the early 1720s by displaced Yamasees, refugees of the Yamasee War in South Carolina. This was one of the last missions in the once extensive Spanish mission system, abandoned in the 1750s (White 2002). The site is located on the narrow peninsula south of the town center. It is surrounded by water on three sides with Maria Sanchez Creek to the west and south. Also in this area was the site of Fort St. Francis and an associated Powder House.

8SJ00094, La Punta, was recorded in the FMSF in 1994 by Stan Bond. In 1996, a post hole survey was conducted across the site by Carl Halbirt with 300 tests excavated. Artifacts were concentrated along the crest of a central ridge (Halbirt 1996b). In 1997, an excavation was conducted closer to the southern end of La Punta (White 2002) at 161 Marine Street where currently there is a nursing home. The stratigraphy was recorded as follows:

- 0-7 cm, asphalt
- 7-17 cm, construction fill
- 17-32 cm, dark gray sandy loam with mixed late nineteenth/early twentieth cultural midden deposits (Zone 1)
- 32-42/47 cm, brown sand, sheet midden, La Punta cultural horizon (Zone 2)
- 42/47+ cm, sterile soil (except for features)

Excavations uncovered a walk-in well, at least one circular structure (wattle and daub), 23 pits, and two agricultural ditches (White 2002). The most common ceramic type at La Punta was San Marcos. Minor evidence of prior indigenous occupations on the peninsula was uncovered. European artifacts were also recovered with inexpensive British tablewares (e.g., Delft, slipwares) being the most common. Trash disposal did not follow the Spanish practice of disposal in large trash pits. In general, there was a lack of refuse recovered with most material coming from the sheet midden. No shell midden was identified. White (2002) contends that refuse was likely dumped into the adjacent marsh area of Maria Sanchez Creek.

The cemetery associated with the La Punta church was identified and investigated in the early 2000s by Carl Halbirt and the City Archaeology program. The cemetery was preserved in place and is located at 11 Tremerton Street, which is due east of South Street nearly to the seawall. The boundaries of the La Punta archaeological cemetery have been relatively well established.

8SJ03181 – Pocotalaca

Pocotalaca is an eighteenth-century Native American mission town site similar to La Punta; however, no archaeological work has been conducted on Pocotalaca. The mission town was established prior to 1717 and abandoned in the 1750s. The site was recorded in 1987 by Stan Bond following Survey #1515. The site location was mapped based on a surface survey and a neighborhood informant. San Marcos pottery indicative of late mission period occupation was recovered. Native American structures, a mission, and a redoubt were once in this area. 8SJ03181 is mapped by the FMSF along South, Washington, and Oneida Streets, parallel to the southern half of Lake Maria Sanchez in the Lincolnville Neighborhood. Very little is known about the site. In the early nineteenth century this neighborhood was an orange grove owned by Bernardo Segui, and by the late nineteenth century the area became the Buena Esperanza residential development.

8SJ05020 – Lincolnville Landing

The Lincolnville Landing is an underwater site located along the edge of Maria Sanchez Creek at the corner of Washington and Duero Streets. At low tide in the mudflats along the foreshore of the creek, four 12- to 24-cm-diameter timbers laid out parallel to the shore were recorded in 2009. Possible planks running perpendicular to the shore were noted between the timbers (LAMP 2010). This configuration appears to have once been a ramp to launch boats or pull them from the creek. The FMSF maps 8SJ05020 as intersecting the southwest end of the proposed bulkhead; however, based on the original field maps and the current reconnaissance, the planned bulkhead stops short of this resource (**Figure 9**).

Cemeteries

8SJ04900 – Nuestra Señora de la Soledad Cemetery

The Soledad Cemetery was recorded with the FMSF in 2004 (ESI 2004). It is capped beneath a parking lot for the Sisters of St. Joseph (a Roman Catholic Convent) located between St. George Street and Cordova Street. The cemetery is within Block 36 of the Colonial City. The property is the site of the Nuestra Senora de La Soledad (1565-1763) and St. Peter's Church (1764-1783). La Soledad was one of the earliest cemetery/church/hospital complexes in St. Augustine. The church was demolished in the 1790s. The site was studied in the 1970s as part of a master's thesis (Koch 1980) at Florida State University.

In 1994 and 1996, Carl Halbirt monitored the building of a parking area, and tested prior to construction of a perimeter fence and a retention pond on the west end of this property (Surveys #22120 and #22121). Post holes along the fenceline encountered disturbed fragments of human bone, but Halbirt found the cemetery stopped 25 meters east of Cordova Street. Testing of the western edge of the parcel, adjacent to Cordova Street, encountered only post-1880s material, showing that disturbed sediments from the 1885 filling of the creek extend beyond the east side of Cordova Street. Halbirt reiterated that the west end of this property is fill based on his and Deagan's prior investigations and that the parking lot project would not impact human burials.

Historic Districts

8SJ00010, St. Augustine Historic District

The St. Augustine Historic District (8SJ00010) is generally bound by the Castillo de San Marcos to the north, Maria Sanchez Creek to the west, St. Francis Street to the south, and Matanzas Bay (**Figure 10**). The District was listed on the NRHP in 1970 and includes 299 historic properties. For the current phase of this Project, there is no concern for visual (indirect) effects to the district. However, the District crosses Area 1 where subsurface disturbances are planned, so the current concern is with direct impacts to aboveground historic fabric and potential archaeological components of this Historic District.

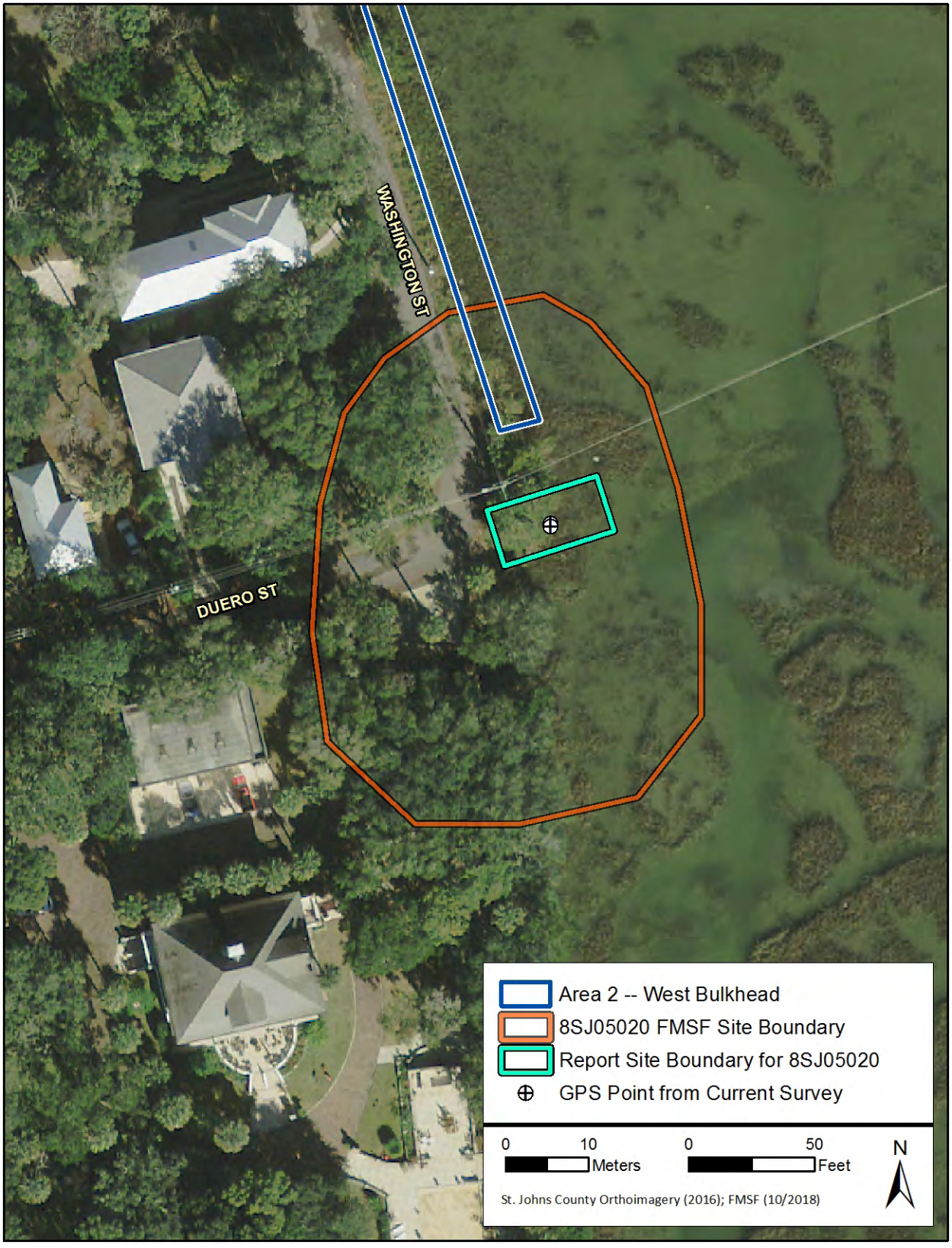


Figure 9. Lincolnville Landing (8SJ05020) location as mapped with the FMSF and as shown in the LAMP (2010) field report.



Figure 10. NRHP-Listed Historic Districts and National Historic Landmarks within or adjacent to the Project.

8SJ03248, Lincolnville Historic District

The Lincolnville Historic District (8SJ03248) is bound to the east by Washington and Granada Streets and Lake Maria Sanchez (see **Figure 10**). The northern boundary is DeSoto Place and the southern boundary is Cerro Street. The District includes 678 business and residential buildings, of which 548 are considered contributing elements to the significance of the District. Its period of significance is 1870-1930. The District was listed on the NRHP in 1991. The District falls within the APE for the pump station and bulkhead aboveground construction (Area 2).

8SJ05567, St. Augustine Town Plan Historic District

The St. Augustine Town Plan Historic District (8SJ05567) is generally bound by the Castillo de San Marcos to the north, the St. Francis Barracks/St. Francis Street to the south, the Matanzas River to the east, and Cordova Street to the west (see **Figure 10**). This is the boundary of the original walled city. The District was listed as a National Historic Landmark (NHL) in 1970. Its period of significance is 1598-1800. For the current phase of this Project, there is no concern for visual (indirect) effects to the District. However, the District abuts Area 1 along Cordova Street where aboveground historic fabric and potential subsurface archaeological components may be disturbed by the current Project.

Historic Structures

For the current stage of the Project, only Area 2 at the southern end of Lake Maria Sanchez has aboveground work that has the potential to adversely affect the viewshed of historic structures. There are eight previously recorded historic resources that are adjacent to the Area 2 boundary and fall within the indirect APE (**Figure 11,** see **Table 3**). There is one NRHP-eligible historic structure within the indirect APE, and seven that have not been evaluated for their significance. Area 1 has no aboveground construction planned at this phase.

In ca. 1897, William Warden's St. Augustine Improvement Company converted Maria Sanchez Creek into the narrow Lake Maria Sanchez. The dredge from the lake built up a ridge along the shoreline on both sides of the waterway. The houses on the east side of Maria Sanchez Creek are constructed on filled, previously marshy land. Lots were sold on these dredge fill parcels starting in 1905.

8SJ00567

The house at 350 Charlotte Street was built between 1917 and 1924. The house is not part of any recognized historic district.

8SJ02200

The house at 6 South Street is immediately south of 8SJ00567 and was constructed in 1905. It is not part of any recognized historic district.

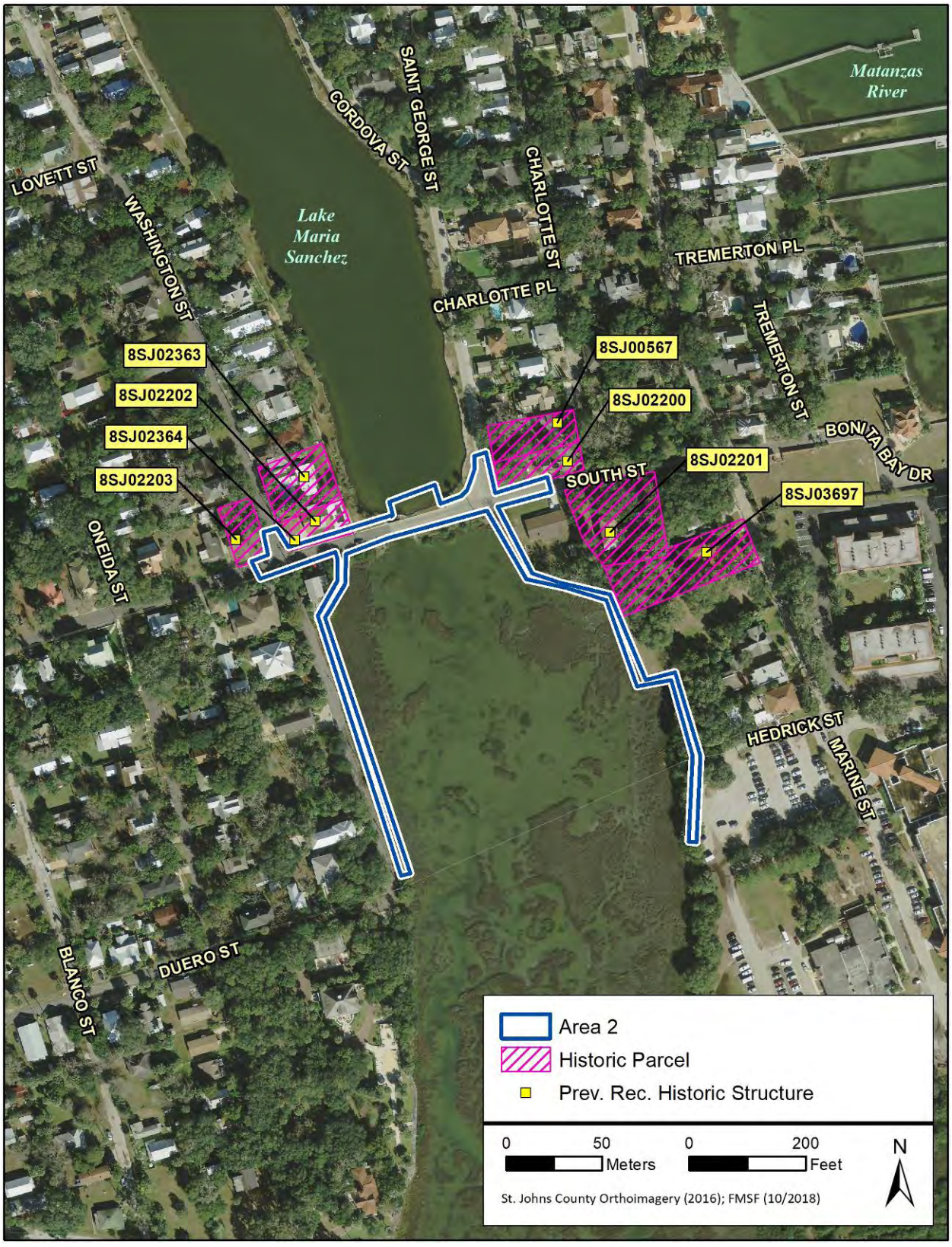


Figure 11. Previously recorded historic structures recorded with the FMSF on parcels adjacent to Area 2.

8SJ02201

The Parker-Dewhurst House is located at 3 South Street and was constructed between 1910 and 1917. The prominent local citizen, and former Mayor of St. Augustine from 1888-1889, W. W. Dewhurst owned this property and his daughter lived in the house with her husband Grosvenor Parker. It is not part of any recognized historic district.

8SJ02202

The house at 24 South Street was constructed in ca. 1924. This area of development on the west side of Lake Maria Sanchez was originally called Water Park. Each house faces the lake with the road running on the west (back) side. The lakeside trail is called Venancio. 8SJ02202 is not listed as one of the structures contributing to the Lincolnville Historic District.

8SJ02203

The house at 72 South Street was constructed in ca. 1917. This house is part of the Buena Esperanza (Good Hope) Subdivision, which contains a mix of Victorian nineteenth-century homes (mainly along Oneida Street) and more modest one-story homes. During the Spanish period, Buena Esperanza was the name for the plantation covering the southwestern tip of the St. Augustine peninsula. 8SJ02203 is a contributing resource to the Lincolnville Historic District.

8SJ02363

The house at 157 Washington Street is an excellent example of a Mediterranean Revival style structure and dates to 1924. The architect is F.A. Hollingsworth and the house was originally built for a prominent St. Augustine merchant, J.A. Lew (1877-1937). 8SJ02363 is both individually NRHP eligible and a contributing resource to the Lincolnville Historic District.

8SJ02364

The house at 161 Washington Street was constructed in 1930. It was destroyed sometime after the 1985 Lincolnville survey, during which it was found to be a contributing resource to the historic district.

8SJ03697

The house at 156 Marine Street was built around 1930. It is not part of any recognized district.

HISTORIC MAP AND AERIAL REVIEW

A selection of historical maps and aerial photographs were reviewed in order to understand the changing setting of the study area. The Arredondo Map of 1737 is the earliest map found that provides information on the Native American mission towns located immediately outside the city walls. This map shows a stylized representation of the walled town, and outside the walls are regularly spaced structures clustered around a larger structure (**Figure 12**). These structures are considered to be representations of Native American mission towns (White 2002). From the south end of the walled city is a road leading to the end of the peninsula. The structures on either side of this road represent the La Punta mission town. Immediately across Maria Sanchez Creek from La Punta is another road leading south from the city and surrounded by regularly spaced structures. This cluster represents the Pocotalaca mission town. The Palica mission town was north of Pocotalaca and closer to the city wall. Structures that are part of Palica are shown on the Arredondo map adjacent to the road leading west to the Sebastian River and generally corresponding with modern-day Bridge Street.

Figure 13 is a map of St. Augustine and its environs created by an unknown cartographer in 1782 that generally illustrates prominent rivers, creeks, and other landscape features such as defensive structures. The original configuration of Maria Sanchez Creek is illustrated. A road that crosses Area 1, depicted as a double-dashed line, leads westward to the San Sebastian River and generally corresponds with modern-day Bridge Street. At the eastern end of this road and adjacent to Area 1 is a structure identified as "Church." This is St. Peter's Church, formerly the Nuestra Señora de La Soledad. To the north is a cluster of structures that mark the center of the Colonial City. Further south on the Matanzas River are a cluster of structures identified as "New Barracks," "Old Barracks," and an associated wharf and wood yard. To the immediate east of Area 2 is a group of three structures identified as "Dr. Wright." Several unidentified structures are shown to the west of Maria Sanchez Creek in the area that would become Lincolnville.

In 1879, the US Coast and Geodetic Survey published a chart of the waters about St. Augustine (**Figure 14**) that also provides illustrations of shoreline features. In the vicinity of Area 1 the map shows Maria Sanchez Creek and a road leading westward to the San Sebastian River (present-day Bridge Street). Much of Area 1 appears as marshland, indicated by darkly-shaded areas. A number of structures are shown along the eastern border of Area 1. There are also a few structures to the west but much of the area to the south and west is shown as agricultural. Another road, absent on the 1782 map, is illustrated along the southern border of Area 1 and appears to be a precursor to modern St. Francis Street. Further south, the area is less developed with a mix of marshland and cultivated zones. There are two isolated structures near the southeast end of the Area 2 bulkhead.

The Sanborn Map Company created detailed maps of St. Augustine in 1910 for fire insurance companies. The maps were issued in several sheets and these various sheets have been stitched together to provide figures for Area 1 (**Figure 15**) and Area 2 (**Figure 16**). The blue

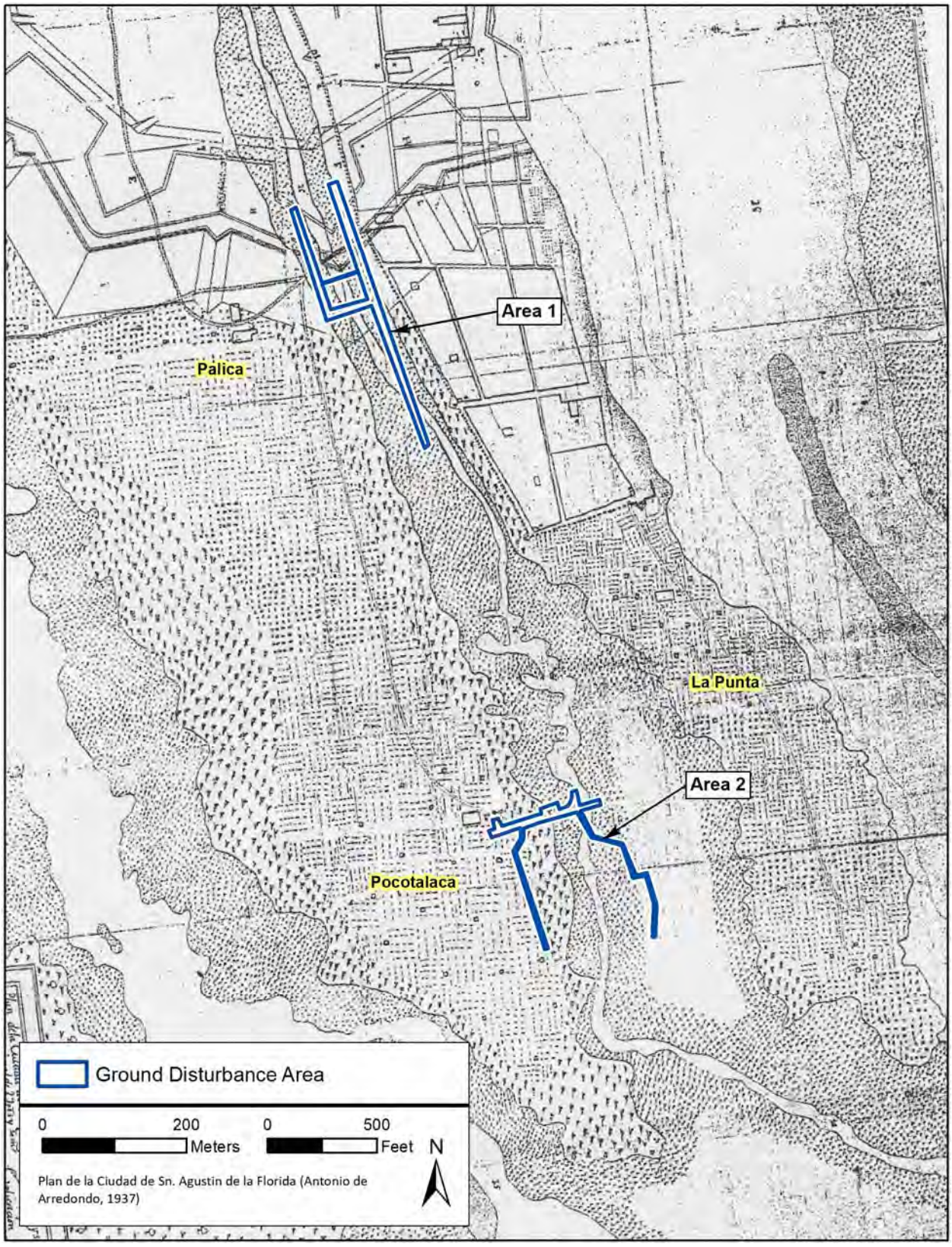


Figure 12. 1737 Arredondo map of St. Augustine showing settlement outside the city walls. Source: St. Augustine Historical Society.



Figure 13. 1782 map of St. Augustine. Source: "St. Augustine and Its Environs," 1782.



Figure 14. 1879 chart of St. Augustine Harbor. Source: US Coast and Geodetic Survey, 1879.



Figure 15. 1910 Sanborn map of St. Augustine (Area 1). Source: Sanborn Map Company, 1910.

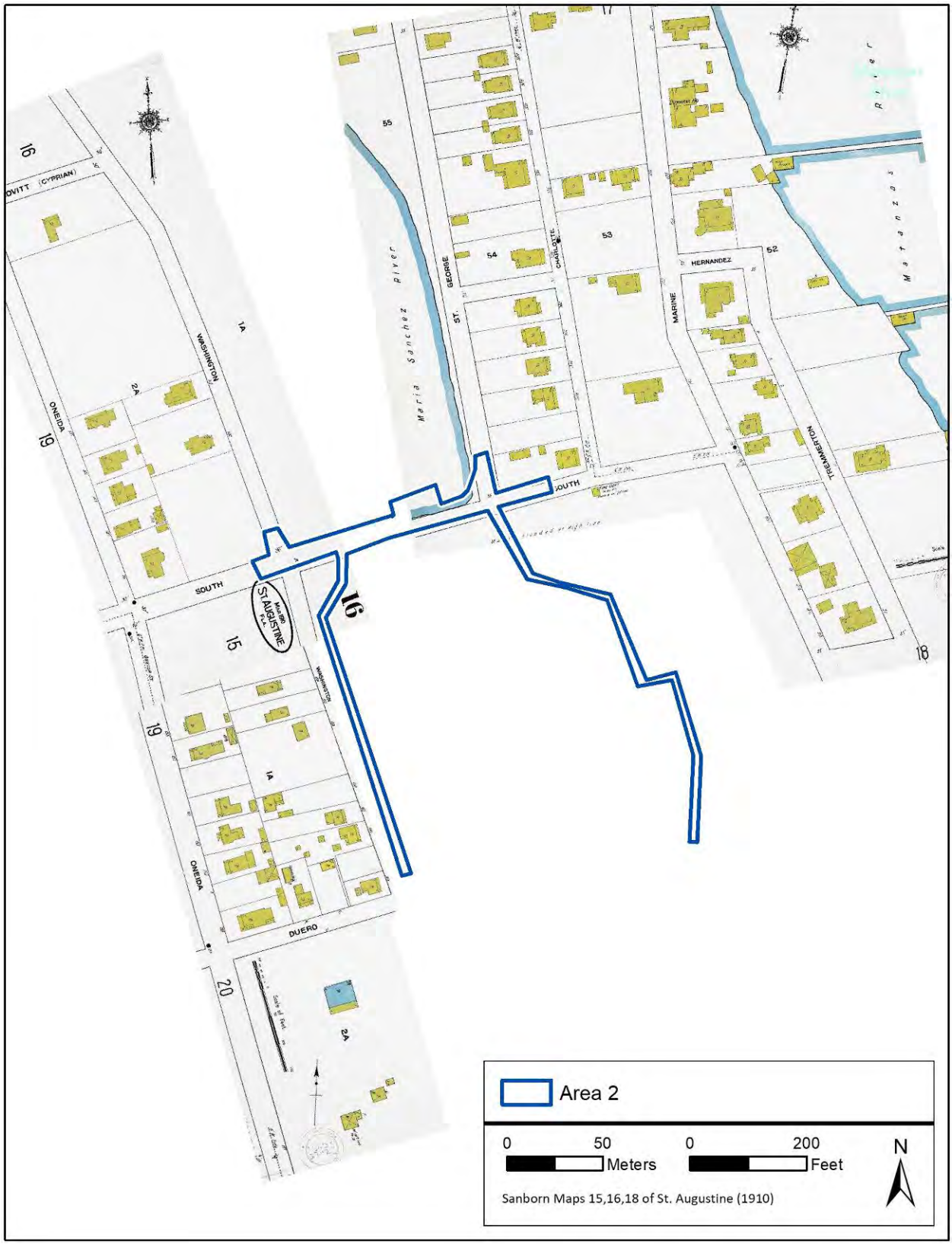


Figure 16. 1910 Sanborn map of St. Augustine (Area 2). Source: Sanborn Map Company, 1910.

buildings are stone, the red are brick, and the yellow are wood frame. Perhaps the most notable change in the landscape since 1879 was the creation of Lake Maria Sanchez, which occurred with the reclamation of the northern part of the creek to make way for the Alcazar Hotel and the 1897 dredging for residential development. The map labels the lake "Maria Sanchez River" and notes that the adjacent marsh (not illustrated) floods at high tide. Area 1 (Granada, Cordova, and Bridge Streets) abuts the south end of the prominent Alcazar Hotel and its detached powerhouse. Compared to Area 1 which features commercial as well as residential structures, Area 2 at this date appears to feature only residential structures to the west and northeast. There is no development west of Marine Street adjacent to the eastern proposed bulkhead (see **Figure 16**), but there are historic parcels on Washington Street adjacent to the western proposed bulkhead.

In 1923, cartographer Goold T. Butler created a detailed map of the City of St. Augustine, noting prominent landscape features, streets, and other features (**Figure 17**). Lake Maria Sanchez is identified as "Maria Sanchez Water Park." The marsh near Area 2 is well illustrated. On the southeast tip of the landform is a large parcel of undeveloped land identified as "Government Property Lewis Field Base Ball Grounds." On the southwest tip of the landform is the "St. Augustine Country Club."

The US Geological Survey (USGS) published a topographical map of the St. Augustine area in 1937 (**Figure 18**). The map clearly illustrates that development of St. Augustine had spread southward from the historic center around King Street and to the environs of Area 2. However, the property near the southeast bulkhead is still undeveloped.

The earliest available aerial photography of St. Augustine comes from the ca. 1943. Images of the study area from 1952 are provided in **Figures 19 and 20**, which highlight the degree of development and the amount of construction upon reclaimed land in the former marshlands of Maria Sanchez Creek. The southeastern corner of Area 2, which appeared undeveloped in the 1937 topographic map, is more developed by 1952, with the construction appearing to be residential in nature.

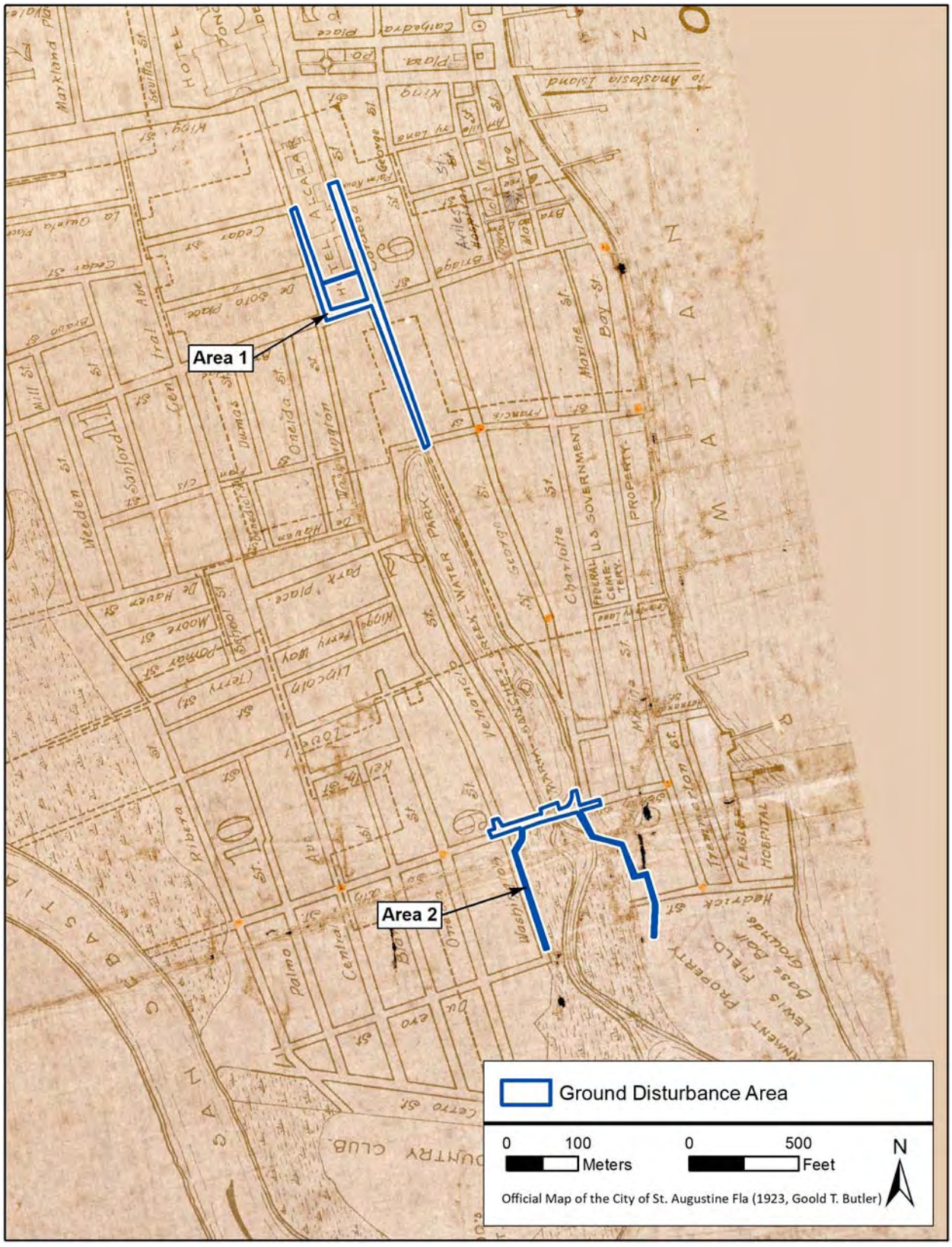


Figure 17. 1923 Butler map of St. Augustine. Source: Butler 1923.

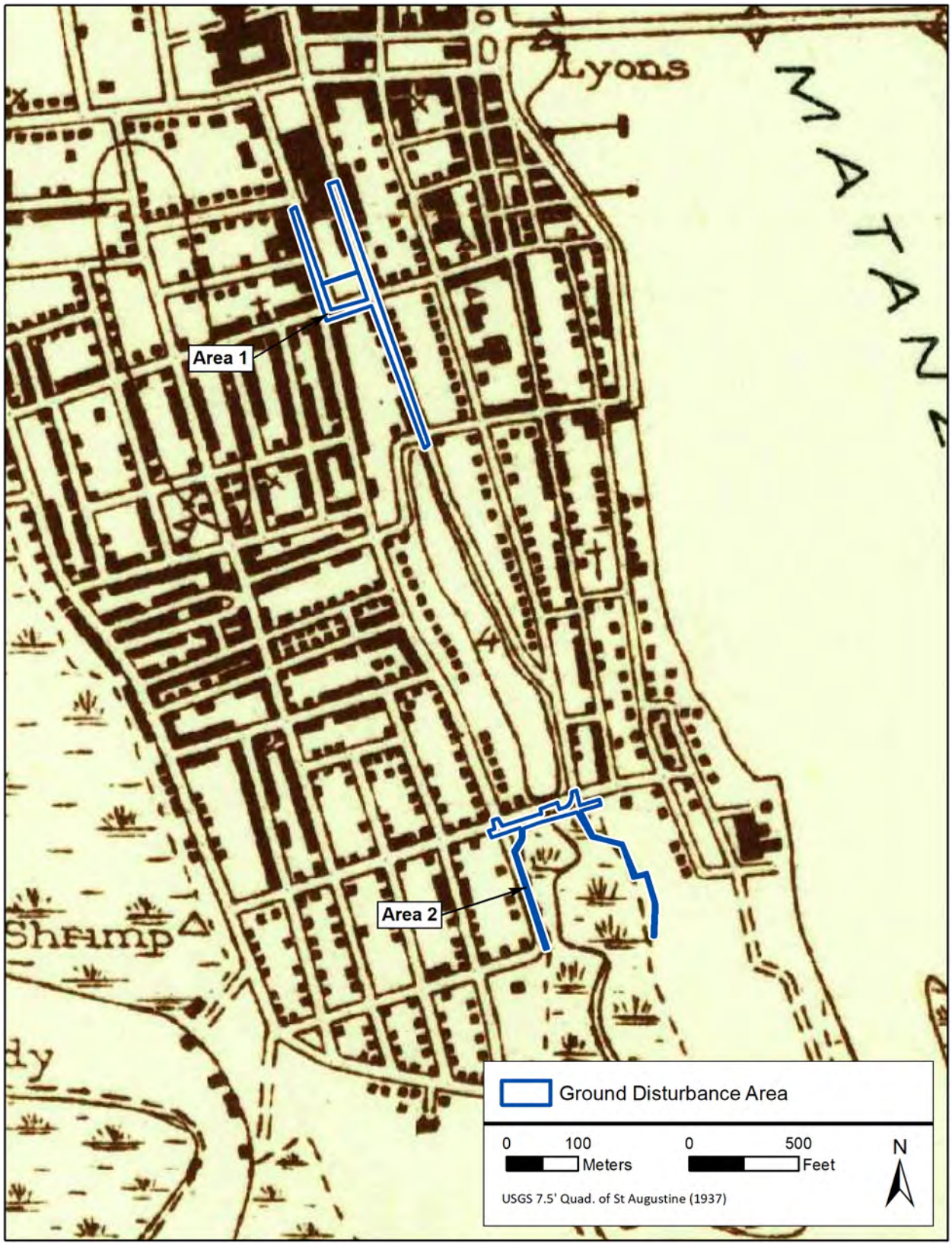


Figure 18. 1937 US Geological Survey of St. Augustine. Source: USGS 1937.



Figure 19. 1952 aerial photograph of St. Augustine (Area 1). Source: USDA 1952.

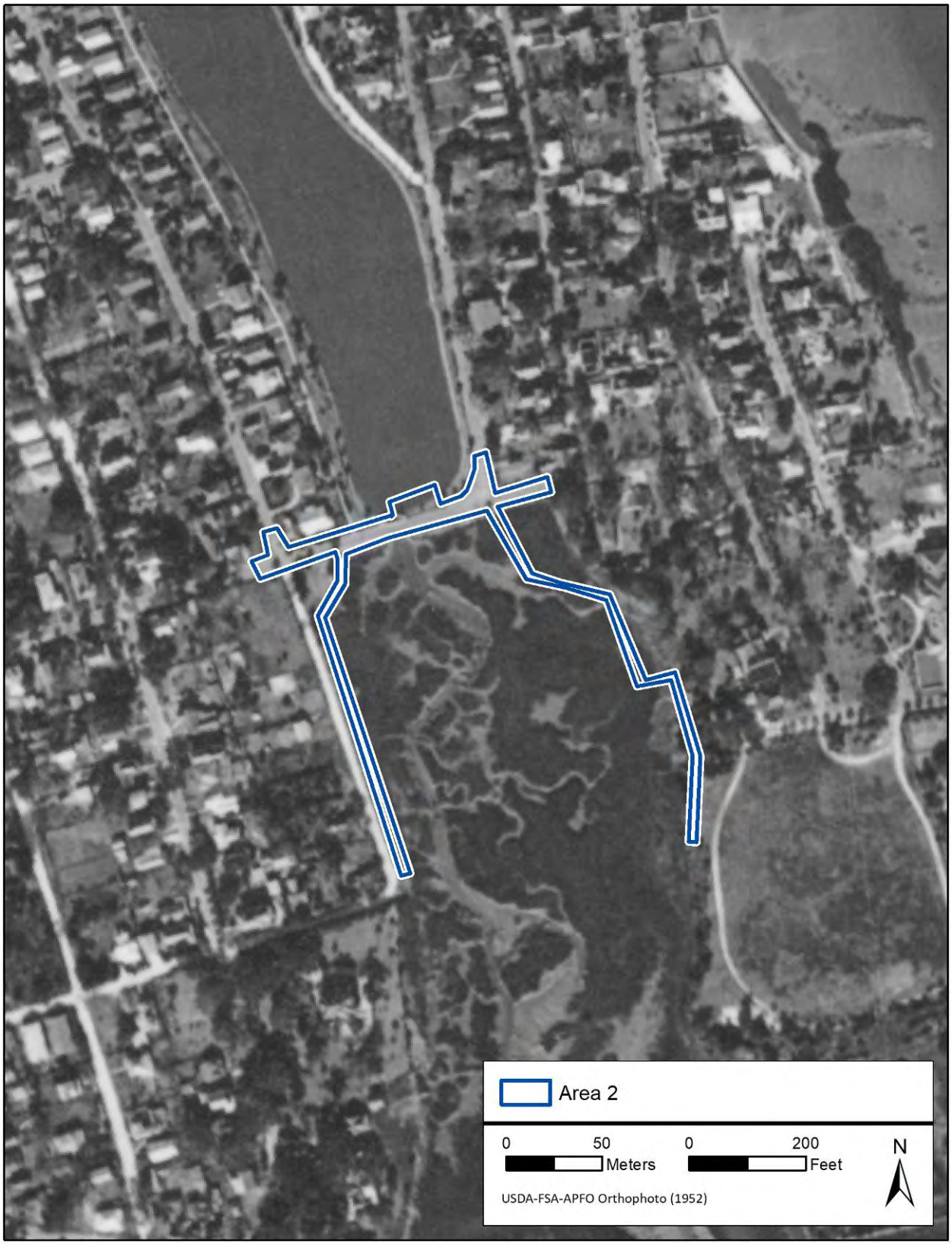


Figure 20. 1952 aerial photograph of St. Augustine (Area 2). Source: USDA 1952.

RESULTS

A reconnaissance of Area 1 and 2 was conducted by both an archaeologist and architectural historian. The fieldwork resulted in an understanding of the historic properties of the area and potential direct effects to these resources from the current undertaking. The potential for indirect effects to historic properties were considered for the adjacent parcels to the pump station and bulkhead (Area 2) because these will be aboveground structures. Through background research and environmental considerations, the archaeological probability of both Areas 1 and 2 was assessed. The following discussion presents the results of the reconnaissance survey and provides recommendations for the next phase of work in order to complete a Phase I CRAS for this Project.

ARCHAEOLOGY PEDESTRIAN SURVEY

SEARCH performed a reconnaissance-level, pedestrian survey in order to better understand potential effects to archaeological resources, and to decide moving forward which areas should be recommended for subsurface shovel testing, which areas may require no archaeological testing, and which areas would require for monitoring during future ground disturbing activities. Area 1 is covered in asphalt (**Figure 21**, top). Area 2 has two components: the pump station APE is under asphalt (see **Figure 4**), and the bulkhead APE is within marshlands (**Figure 21**, bottom).

Archaeological Potential

Overall, the potential for intact prehistoric archaeological sites to be present across the archaeological APE is anticipated to be limited due to disturbance or very poorly drained soils. Much of the APE falls within areas that have been historically filled. In Area 1, the former Maria Sanchez Creek was filled in the nineteenth century to support construction efforts. Also along the east edge of Maria Sanchez Creek was the earthen berm known as the Rosario Line. This was one of the original city walls. It has been sporadically mapped just east of Cordova Street, but may have extended more to the west in some areas. Subsurface construction in Area 1 has the potential to encounter evidence of the Rosario Line and its destruction, and evidence of trash deposition and other activities along the creek edge on the outside of the wall. In addition, various fill episodes including the major filling undertaken by Henry Flagler in 1885 with the construction of the Alcazar Hotel will be encountered subsurface in Area 1. The fill activities in this area are historic episodes with the potential to provide information on St. Augustine's history. Although intact sites are highly unlikely, there is still historic information to be gathered in this area and, therefore, Area 1 retains archaeological potential.



Figure 21. Images of the study areas. Top: Area 1, parking lot south of Lightner Museum, looking north. Bottom: Area 2, bulkhead location on the east side of Maria Sanchez Creek, looking south.

The pump station component of Area 2 has low archaeological potential due to disturbance from construction of previous waterworks and utility infrastructure. The bulkhead component of Area 2 has the potential to encounter historic trash deposition in the former edges of Maria Sanchez Creek. Particularly on the east side of the bulkhead APE, refuse from the La Punta mission site and later occupations may have been deposited in this area.

Lastly, there is potential for underwater resources such as docks or landing sites to be present in the marshlands south of South Street. For example, the Lincolnville Landing site (8SJ05020) is located immediately south of the mapped Area 2 APE.

Reconnaissance Results and Recommendations

Area 1

The pedestrian survey of Area 1 found no potential areas for subsurface testing as the project area is covered with either asphalt or brick paving. The historic brickwork is discussed as part of the architectural history survey. Based on background research, it is anticipated that fill deposits will be encountered subsurface that relate to the filling of Maria Sanchez Creek, trash deposition on the edges of the creek prior to its being filled, and perhaps evidence of the destruction of the Rosario Line earthwork. SEARCH recommends that archaeological monitoring take place during ground disturbing activities in this area with the goal of being able to document exposed wall profiles. Ideally, an east/west profile across Area 1 would be able to document and re-create the various activities related to "outside the city wall" actions and to the activities related to filling prior to construction of the Lightner Museum. It should be noted that profiling may be prohibited in deeply cut areas due to safety concerns.

Area 2

The pedestrian survey of Area 2 found the potential for subsurface testing in the area of the proposed bulkhead. The easement for the bulkhead is 20 feet wide. The east side of the bulkhead extends from the marsh onto private property and access is in the process of being acquired. SEARCH recommends shovel testing at 25-meter intervals where feasible along the east side of the bulkhead APE. There is the potential to uncover refuse deposition along the creek's edge that relates to the occupation of the La Punta mission village, in addition to later activities.

The west side of the bulkhead falls within the right-of-way for the adjacent roadway, and because of the roadway, the only areas for subsurface testing are currently marshland. Shovel testing is not possible within the inundated marsh. During the reconnaissance survey SEARCH relocated the Lincolnville Landing site (8SJ05020). At low tide the remnants of the landing were visible and a GPS point was taken (see **Figure 9**). The southern end of the mapped bulkhead is 12 meters north of the Lincolnville Landing site. At low tide one upright post was visible (**Figure 22**). None of the horizontal planks that made up the ramp as they were described in the 2010



Figure 22. Photograph of Lincolnville Landing site (8SJ05020) showing a single upright post (red arrow), facing east.

survey could be seen. Comparing photographs from 2010 (LAMP 2010), at low tide the water levels are higher today suggesting the landing planks may be buried.

SEARCH recommends that no ground disturbing or staging activities occur south of the mapped bulkhead location in the area of the Lincolnville Landing. The Landing is a contributing resource to the NRHP-listed Lincolnville Historic District and should be avoided during Project construction. Due to the nature of the bulkhead construction which is limited to sinking the protective wall 3-4 feet into the marsh, no monitoring is recommended during bulkhead installation on the west side. Recommendations for potential monitoring or further testing will be made following the Phase I shovel testing on the east side of the bulkhead installation.

The pump station APE is currently covered with asphalt, mostly along South Street, while the pump apparatus is within the south end of Lake Maria Sanchez. Based on background research, it is anticipated that fill deposits will be encountered subsurface that relate to the filling of Maria Sanchez Creek and the creation of Lake Maria Sanchez. SEARCH does not recommend monitoring in this area due to the low probability of discovering intact deposits or significant information on the history of St. Augustine.

ARCHITECTURAL HISTORY PEDESTRIAN SURVEY

SEARCH performed a reconnaissance-level, pedestrian survey in order to better understand the historic properties adjacent to the Project and to develop a plan for Phase I recordation moving forward. Eight previously recorded structures and one historic district are located within the direct or indirect APE for Area 2, while three historic districts cross the direct APE of Area 1 (**Table 3**, **Figure 23**). As a result of the reconnaissance, two new resources were recorded within the direct APE for the Project (**Table 4**, see **Figure 23**). These resources are discussed below starting with historic fabric from the St. Augustine districts that falls within Area 1, followed by the Area 2 historic structures on parcels within or adjacent to the APE. Lastly, the two newly recorded resources are discussed.

Table 3. Previously Recorded Historic Resources within the Area 1 Direct and Area 2 Indirect APEs.

FMSF #	Address/Name	Architectural Style	Date	NRHP Status
Area 1				
8SJ00010	St. Augustine Historic District	No Style	ca. 1565-1935	NRHP-listed
8SJ05567	St. Augustine Town Plan Historic District	No Style	ca. 1598-1800	NHL
Area 2				
8SJ03248	Lincolnville Historic District	No Style	1871-1964	NRHP-listed
8SJ00567	350 Charlotte Street	Frame Vernacular	ca. 1924	Ineligible
8SJ02200	6 South Street	Frame Vernacular	ca. 1905	Ineligible
8SJ02201	Parker-Dewhurst House/ 3 South Street	Mediterranean Revival	ca. 1917	Ineligible
8SJ02202	24 South Street	Bungalow	ca. 1924	Ineligible
8SJ02203	72 South Street	Craftsman	ca. 1917	Eligible as contributing to 8SJ03248
8SJ02363	157 Washington Street	Mediterranean Revival	ca. 1924	Individually eligible, and eligible as contributing to 8SJ03248
8SJ02364	161 Washington Street	Bungalow	1930	DESTROYED
8SJ03697	156 Marine Street	Masonry Vernacular	1930	DESTROYED

Table 4. Newly recorded Historic Resources within the Area 1 and Area 2 Direct APEs.

FMSF #	Address/Name	Architectural Style	Date	NRHP Status	Area
8SJ06609	Cordova Street	No Style	ca. 1884	Ineligible	1
8SJ06610	South Street Culvert	No Style	ca. 1919	Ineligible	2

Area 1 – Historic Fabric and Historic Districts

There are three historic districts that fall within Area 1 (see **Figure 23**). The St. Augustine Historic District (8SJ00010) covers all of Area 1 except for the Bridge Street roadway. The St. Augustine Town Plan Historic District (8SJ05567) abuts the east side of Cordova Street. The Lincolnville Historic District (8SJ03248) includes Granada Street, Bridge Street, and the western side of Cordova Street. The Lincolnville District will be addressed in the Area 2 discussion.

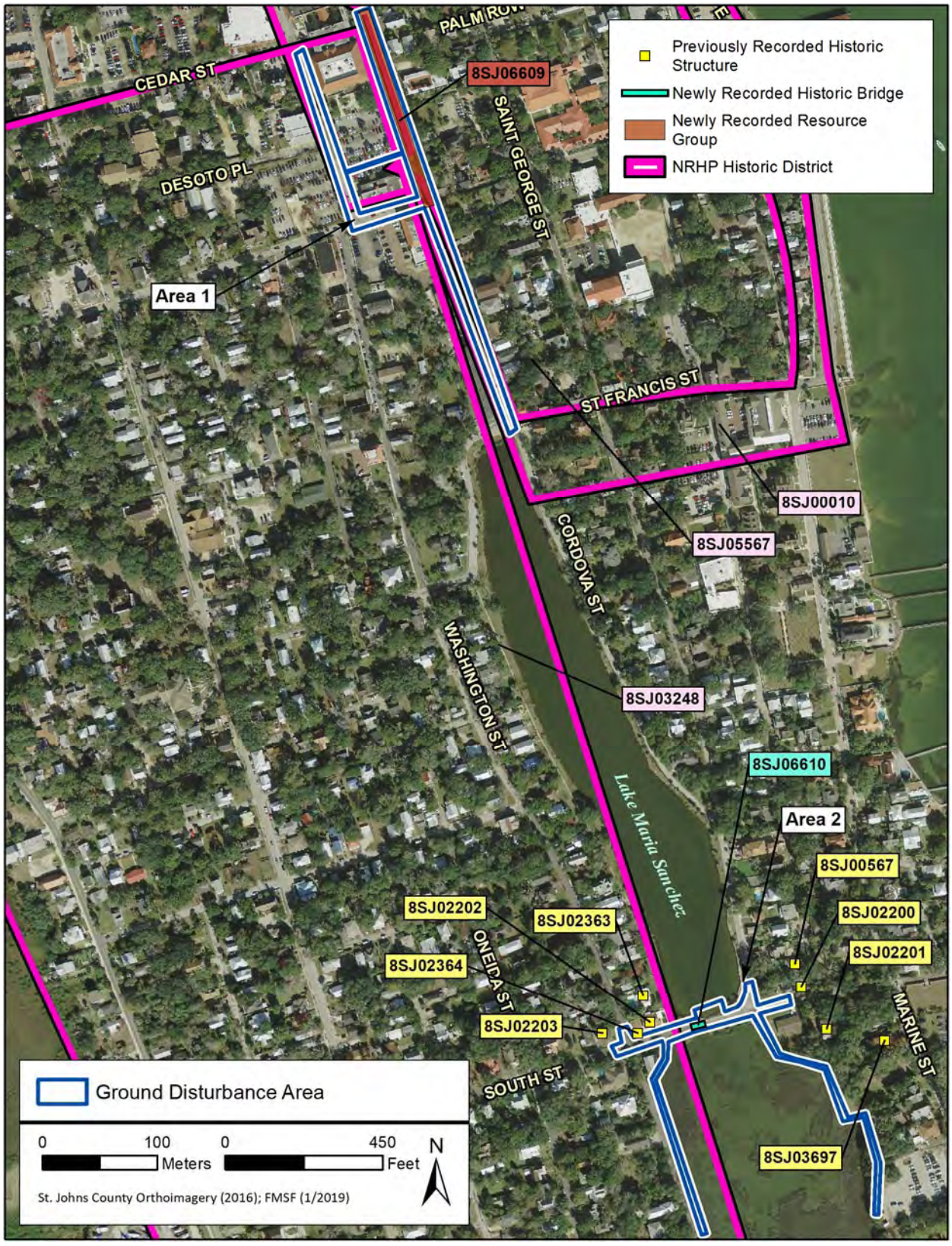


Figure 23. Historic resources recorded within the Area 1 direct and Area 2 indirect APEs.

The roadway and accompanying sidewalks of both Cordova Street and Granada Street are included within the boundaries of 8SJ00010 and the Area 1 direct APE. The roadway of Cordova Street and the accompanying eastern sidewalks are included within the boundaries of 8SJ05567. Historic fabric is present in four locations along these streets (**Figure 24-25**):

- brick sidewalks on either side of the Lightner Museum on the west side of Cordova Street and the east side of Granada Street;
- brick sidewalk associated with Palm Avenue where it crosses Cordova Street; and
- brick topped coquina bench that extends onto the Cordova Street sidewalk.

Discussions of the two Historic Districts are provided individually.

St. Augustine Historic District (8SJ00010)

The St. Augustine Historic District (8SJ00010) is bounded by the Castillo de San Marcos to the north, Maria Sanchez Creek to the west, St. Francis Street to the south, and the Matanzas River to the east (see **Figure 23**). The boundary includes the Lightner Museum. 8SJ00010 was listed in the NRHP in April of 1970 with significance related to commerce, military, exploration and settlement, politics and government, architecture, historic archaeology, and religion (Historic Property Associates 1986). The district dates begin ca. 1565, when Pedro Menendez de Aviles founded the town. The physical development began ca. 1603, when Governor Mendez Canco ordered the laying out of the town. The oldest structure within the district, the Castillo de San Marcos, dates to 1672-1690s. It also includes structures through the Florida Land Boom of the 1920s. Due to the long period of significance, there is a large variety of architectural styles including Colonial, Vernacular, Carpenter Gothic, Queen Anne, and Second Empire. There is also a mixture of residential, commercial, and religious buildings considered contributing to the historic district (Adams 1980). There are 226 contributing historic resources and 73 non-contributing historic resources included within 8SJ00010. The Area 1 direct APE does not incorporate any contributing resources within 8SJ00010.

The roadways of Cordova and Granada Streets and their accompanying sidewalks are included within the boundaries of 8SJ00010 and the Area 1 direct APE. The Project proposes storm water conveyance improvements, including upsizing the existing pipes along both streets within the road right-of-way. Historic brick pavers are located on the sidewalks adjacent to both Granada and Cordova Streets on either side of the Lightner Museum, and along Palm Row where it intersects Cordova Street (**Figure 25**). In order to avert Project-related effects, care should be taken to avoid the areas with historic brickwork or the use of historic coquina, which is present as part of a bench on the east side of Cordova Street and as walls that line portions of the sidewalk edge. It is the opinion of SEARCH that ongoing consultation with the Project team should be carried out to avoid and protect the brick pavers and coquina work within the St. Augustine Historic District (8SJ00010). If avoidance of the historic brick and coquina components during construction is not possible, additional work will be required including consultation with the St. Augustine, Historic Architectural Review Board (HARB) approved sidewalk plan.



Figure 24. Historic fabric present in several locations in Area 1 near the Lightner Museum.

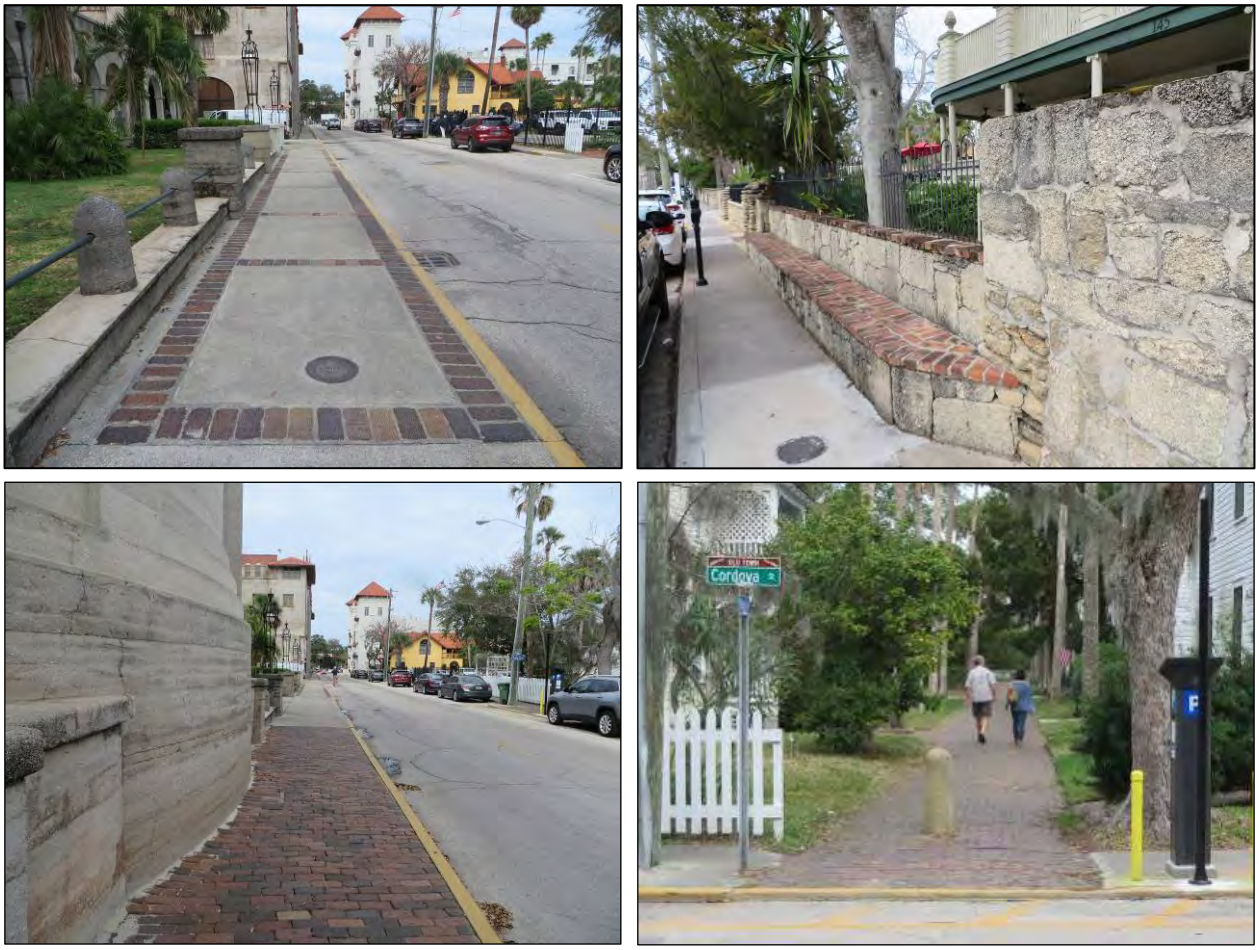


**Figure 25. Representative views of historic fabric within St. Augustine Historic Districts.
Top left: decorative use of brick on the west sidewalk of Cordova Street, facing north.
Top right: brick-topped coquina bench on the east sidewalk of Cordova Street, facing north.
Bottom right: Palm Row where the brick street intersects the Cordova Street east sidewalk, facing east.
Bottom left: brick sidewalk along the west side of Cordova Street, facing north.**

St. Augustine Town Plan Historic District (8SJ05567)

The St. Augustine Town Plan Historic District (8SJ05567) is located in Section 18 of Township 7 South, 30 East, as depicted on the 2018 *St. Augustine, Fla.* USGS quadrangle map. 8SJ05567 was listed as a National Historic Landmark (NHL) on April 15, 1970 for its national significance as the "oldest continuously occupied European settlement in the US founded as a Spanish military base in 1565" (City of St. Augustine 2017:4.17). There are no surveys evaluating 8SJ05567 in the FMSF database as the documentation submitted for the designation of the St. Augustine Historic District (8SJ00010) in the NRHP was also used in the designation of the St. Augustine Town Plan Historic District (8SJ05567) as an NHL (National Park Service 1970). A FMSF number was provided to the resource for the following reason:

> The Boundaries for the NR St. Augustine Historic District and the NHL St. Augustine Town Plan Historic District are not the same. Therefore, the NHL

St. Augustine Town Plan Historic District has been assigned a new number (FMSF database n.d.a.).

The St. Augustine Town Plan Historic District is bound by the Castillo de San Marcos to the north, the St. Francis Barracks/St. Francis Street to the south, the Matanzas River to the east, and Cordova Street to the west (NPS n.d.a.; NPS n.d.b., see **Figure 23**). The St. Augustine Town Plan Historic District only includes the Colonial resources and is limited to the walled Colonial City.

A document provided in the FMSF database suggests that there was a boundary change recommendation in 1977, as well as a change in the National Register District in 1986. Documentation regarding the various sets of boundaries suggests that the discrepancies have not been entirely resolved. In the FMSF database, email correspondence between the NPS and the City of St. Augustine state that the NHL district boundary was not clearly defined by 2011. One email, dated April 26, 2010, between Jennifer Wolfe, Historic Preservation Planner in the City of St. Augustine, and the NPS states, "…it is clear that we need to confirm what is the correct/most recently adopted boundary. At that point, it may be necessary to reevaluate the boundary" (FMSF database n.d.a.).

The focus of 8SJ05567 is not the historic structures, but the distinctive appearance and charm of the sixteenth-century town plan. The NHL description states that the historic buildings are widely scattered and are nowhere sufficiently concentrated to constitute a historic district (NPS 1970). Based on this description and the lack of discussion of the importance of specific streets, the current Area 1 direct APE does not contain any recorded resources related to the St. Augustine Town Plan Historic District.

The roadway of Cordova Street and the accompanying sidewalk is included within the boundaries of 8SJ05567 and the Area 1 direct APE. Historic brick pavers are located on the sidewalks adjacent to Cordova Street and along Palm Row, which intersects with Cordova Street (see **Figure 25**). Care should be taken to avoid the areas with brick pavers or the use of historic coquina. It is the opinion of SEARCH that ongoing consultation with the Project team should be carried out to avoid and protect the brick pavers and coquina work within the St. Augustine Town Plan Historic District (8SJ05567). If avoidance of the historic brick and coquina components during construction is not possible, additional work will be required.

Area 2 – Structures and the Lincolnville District

There are eight previously recorded historic structures that fall within the indirect APE of Area 2 (see **Figure 23**). One structure (8SJ02363) has been determined individually NRHP-eligible and also is a contributing resource to the Lincolnville Historic District (8SJ03248). Another structure, 8SJ02203, is contributing to the Lincolnville Historic District (see **Table 3**). The remaining six structures were unevaluated prior to the current survey. Of the eight previously recorded structures, two have been destroyed. As a result of the current survey, two structures (8SJ02203, 8SJ02363) are recommended to remain NRHP eligible as contributing resources to

the Lincolnville Historic District. The remaining four structures have been evaluated as not eligible for the NRHP (see **Table 4**). None of these four structures fall within the Lincolnville District.

The Project proposes a new storm water pump station located at the existing Lake Maria Sanchez outfall at the south end of the lake along South Street. Water pipes will be replaced under South Street. In addition, a bulkhead will be constructed along the foreshore of the Maria Sanchez Creek. Both the pump station and bulkhead will be aboveground structures. The new pump station will be in the location of the current culvert on South Street (see **Figure 4**). The following discussion begins with the two significant structures – 8SJ02203 and 8SJ02363.

72 South Street (8SJ02203)

Resource 8SJ02203 is a previously recorded structure at 72 South Street in St. Augustine, Florida (**Figure 26**, see **Figure 23**). 8SJ02203 is a Craftsman style home, ca. 1917, with wood board and shingle siding, and a gable roof with wide overhangs and exposed rafters. The windows are a combination of vinyl and wood frames, with various configurations. 8SJ02203 displays a variety of characteristics of the Craftsman style, such as a porch with thick tapered porch supports, a mix of natural materials, wide eave overhangs, multi-pane windows, and a partially paned door.



Figure 26. Resource 8SJ02203, facing northwest.

Assessment

Based on the results of the current survey, it is the opinion of SEARCH that 8SJ02203 is NRHP-eligible as a contributing resource to the Lincolnville Historic District (8SJ03248) due to its significance related to architecture (Criterion C). 8SJ02203 is reflective of the architectural trends and the eclectic collection of architecture throughout the historic district. A historic resource must maintain its historic integrity to be considered eligible for NRHP listing and 8SJ02203 retains its original location, most of its historic residential setting, and its historic design in terms of form, plan, space, structure, and style. The materiality of 8SJ02203 remains in its mix of natural materials and thick tapered porch supports, although windows and roofing materials have changed. 8SJ02203 possesses its integrity of workmanship, as seen in the overhanging eaves and porch supports. The feeling of 8SJ02203 remains intact, as the resource has continued to be a private residence near the waterfront of Lake Maria Sanchez. Finally, 8SJ02203 retains its association with its past through building technique and design, use of natural materials, and being one of the homes within the Lincolnville Historic District. It is the

opinion of SEARCH that 8SJ02203 retains enough historic integrity to convey its significance under NRHP Criterion C and is recommended NRHP eligible as a contributing resource to the Lincolnville Historic District (8SJ03248).

8SJ02203 falls within the Area 2 indirect APE. Once the aboveground pump station and bulkhead is designed, the potential visual effect to this structure will be assessed.

157 Washington Street (8SJ02363)

Resource 8SJ02363 is a previously recorded structure at 157 Washington Street in St. Augustine, Florida (**Figure 27,** see **Figure 23**). This structure was previously determined eligible for listing in the NRHP in 1989 under Criterion C, for its association with prominent St. Augustine architect F.A. Hollingsworth and as an excellent example of the Mediterranean Revival style.



Figure 27. Resource 8SJ02363, facing southwest.

8SJ02363 is a Mediterranean Revival style home, ca. 1924, with a rough stucco finish, arched windows and doors, and a flat roof with crenulation. The windows are vinyl frame with a six-over-one configuration. Windows on the left and right sides of façades are generally grouped in sets of three or two. Along the second story are Spanish tile awnings on each façade. Second story windows on the east façade have iron grilles. The main entry is a double wood door with an exterior double wood and glass door (**Figure 28**). Above the arched doorway is a terracotta coat of arms for Castile and León, a heraldry design used by the Spanish and their colonies since the reign of Fernando III The Saint, which ties the building to the town's overall history as part of Spain's colonial expansion (Junta de Castilla y León n.d.). Embedded in the arch of the doorway and above central windows are glazed tiles. The garage to the west of the house is original to the



Figure 28. Door detail of resource 8SJ02363, facing west.

overall design and was created for the house. This is reflected in the flat roof with crenulation and the rough stucco exterior of the garage, matching that of the main house (**Figure 29**).



Figure 29. Garage to Resource 8SJ02363, facing east.

Assessment

Based on the results of the current survey, it is the opinion of SEARCH that 8SJ02363 meets Criteria B and C and remains eligible for listing in the NRHP. 8SJ02363 is significant under Criterion B as it has a connection with two historically significant people within the community of St. Augustine. Contractor Charles Leyvrez constructed the home and also built the St. Augustine Civic Center (8SJ00396) (Weaver 2001). Merchant J.A. Lew originally owned the house. He was one of the founding members of the oldest synagogue in St. Augustine at 161 Cordova Street, a member of one of the first Jewish families known to be living in St. Augustine, and he sold clothing on the corner of King and Aviles Streets at the Lew Shoppe. Lew Boulevard on Anastasia Island is named in honor of J.A. Lew (*St. Augustine Record* 2014a; *St. Augustine Record* 2015a; First Congregation Sons of Israel 2016; University of Florida 1989). Significance under Criterion B is met through the connection of the builder and the original owner of the house; both men had significant roles within the community of St. Augustine during the 1920s.

8SJ02363 is significant under Criterion C as an excellent example of the Mediterranean Revival style designed by prominent St. Augustine architect F.A. Hollingsworth. Hollingsworth also designed the bank building on the plaza (24 Cathedral Place, 8SJ00400), the Florida East Railway headquarters on Malaga Street (now the F.E.C. Towers on the Flagler College campus, 8SJ01263), and the synagogue on Cordova Street (161 Cordova Street, 8SJ00662). Hollingsworth also worked on the St. Francis Barracks after the 1916 fire, making him among the first restoration architects in St. Augustine (FMSF database n.d.b; Nolan 1995; *St. Augustine Record* 2014b; *St. Augustine Record* 2015b; *St. Augustine Record* 2018). The house was originally designed to have a Mediterranean Revival style, as seen in a newspaper article from 1924 (**Figure 30**). The design and form of the current building correlates to the picture from the newspaper, indicating that any improvements to the structure have been done in-kind; accordingly, there are no visible additions. Mediterranean Revival style was one of the most popular styles in Florida during the 1920s and often combined elements from Spanish, Italian, and Moorish architecture. Common features for Mediterranean Revival homes include flat built-up roofs, red roof tiles, arches, stucco covered walls, iron grilles, and chimneys. Resource 8SJ02363 possesses all of the above-mentioned features.

In addition to significance, a historic resource must maintain its integrity to be considered eligible for listing in the NRHP. Resource 8SJ02363 retains its location and its historic design in form, plan, space, structure, and style. 8SJ02363 retains most of its historic setting even though St. Augustine has modernized its roads and the surrounding structures have changed over time. The materiality of 8SJ02363 remains in its built-up roof, Spanish tile awnings, terracotta and glazed tile ornamentations, and rough stucco, although the windows have been replaced. 8SJ02363 possesses its integrity of workmanship, as seen in the crenulations, rough stucco exterior, and tile work and the terracotta coat of arms for Castile and León. The feeling of 8SJ02363 remains intact as the resource has continued to be a private residence on the waterfront of Lake Maria Sanchez. Finally, 8SJ02363 retains its association with its past through building technique and design, the terracotta coat of arms, and being one of the houses within the Lincolnville Historic District (8SJ03248). 8SJ02363 retains enough historic integrity to convey its significance related to architecture and community planning and development and is recommended NRHP individually eligible and eligible as a contributing resource to the Lincolnville Historic District (8SJ03248).



A. LEW GIVES CONTRACT FOR SPANISH TYPE HOME

Charles Leyvrez To Build Water Park Dwelling Planned By Hollingsworth

Another handsome Spanish house is to be added to the number of pretty residences of this type in St. Augustine. J. A. Lew has given a contract to Charles Leyvrez for a lovely home on Water Park, which will be built at a cost of about $20,000. The plans which have been drawn by Architect F. A. Hollingsworth, are very artistic as well as complete and modern in every detail.

The house, which has a large number of windows, will be finished in two tone rose stucco with a rough finish. Fiance tile will be used over the doors and between the windows, and roofing tile will form a border overhanging the upper part of the building. Wrought iron grills will be used with effect on the front doors, over which will be a Spanish coat of arms in the correct colors of terra cotta.

The first floor of the dwelling will include a sun parlor, living room, in which is a fireplace, with mantel of imported tile, hall, dining room, breakfast room, pantry, kitchen with tiled floor and walls. Upstairs there will be three bed rooms and two baths. The bathrooms will also be finished with tiled floors and walls.

All of the floors will be hardwood, and the doors will be of birch with a mahogany finish. The woodwork will be ivory tinted and the walls will be of plaster. A hot water heating plant is to be installed.

A one-story, two car garage and laundry will be placed in the rear of the house. Everything in the way of convenience and beauty has been included in the plans, to make it one of the most modern of St. Augustine's handsome homes.

Handsome New Residence in Water Park

Figure 30. St. Augustine Evening Record Newspaper clipping regarding 8SJ02363 from June 7, 1924.
Source: FMSF database n.d.b.

8SJ02363 falls within the Area 2 indirect APE. Once the aboveground pump station and bulkhead is designed, the potential visual effect to this structure will be assessed.

8SJ02202, 24 South Street

The house at 24 South Street (8SJ02202) falls within the Lincolnville Historic District but is not a contributing structure to that district (**Figure 32**). 8SJ02202 is a rectangular plan Bungalow style house built ca. 1924. It features a stucco exterior, a gable roof covered with composition shingles, and a shed dormer with wood shingles. The windows are one-over-one double-hung vinyl frames. A small white metal fence atop a masonry wall surrounds the residence. An enclosed glass patio addition is attached to the west façade. The structure has undergone significant remodeling and does not retain its historic value. It is the opinion of SEARCH that Resource 8SJ02202 be considered ineligible for listing in the NRHP.



Figure 32. Resource 8SJ02202, facing northwest.

8SJ00567, 350 Charlotte Street

The house at 350 Charlotte Street (8SJ00567) is a rectangular plan Frame Vernacular style house built ca. 1924 (**Figure 33**). It falls outside the boundary of the Lincolnville Historic District. The house features wood siding and a gable roof sheathed with composition shingles. The windows are double-hung one-over-one vinyl frames. One picture window is located at the west façade. The main entry is sheltered by a partial width porch featuring a metal shed roof and is supported by wood posts. There is a second entry on the south façade sheltered by a hipped roof. 8SJ00567 is of a common style and does not have exceptional historic significance. It is the opinion of SEARCH that due to a lack architectural distinction, Resource 8SJ00567 be considered ineligible for listing in the NRHP.



Figure 33. Resource 8SJ00567, facing northwest.

8SJ02200, 6 South Street



Figure 34. Resource 8SJ02200, facing north.

The house at 6 South Street (8SJ02200) is an irregular plan Frame Vernacular style house built ca. 1905 (**Figure 34**). It falls outside the boundary of the Lincolnville Historic District. The house features wood siding and a cross gabled composition shingle roof. The windows are six-over-six wood frames and casements. The main entry is a wood door with a fan light. The building features three brick chimneys. The house is surrounded by brick paving. 8SJ02200 is of a common style and does not have exceptional historic significance. It is the opinion of SEARCH that due to a lack significance and architectural distinction, Resource 8SJ02200 be considered ineligible for listing in the NRHP.

8SJ02201, Parker-Dewhurst House



Figure 35. Resource 8SJ02201, facing southeast.

The Parker-Dewhurt House (8SJ02201) is a rectangular plan Mediterranean Revival style residence built ca. 1917 (**Figure 35**). It falls outside the boundary of the Lincolnville Historic District. The house features a stucco exterior and hipped metal roof. The windows are double-hung wood frames and feature two pane styles: diamond-over-one and two-over-two. The main entrance is a recessed archway on the west façade leading to a paneled wood door. The house is surrounded by a brick path that leads to a garage on the east side on the property. A low rusticated concrete block wall surrounds the yard. It is the opinion of SEARCH that due to a lack of significance and architectural distinction, 8SJ02201 be considered ineligible for listing in the NRHP.

8SJ02364, 161 Washington Street

The house at 161 Washington Street was constructed in 1930. It was destroyed sometime after the 1985 Lincolnville survey, during which it was found to be a contributing resource to the historic district. The building was previously recorded in the FMSF as destroyed.

8SJ03697, 156 Marine Street

The house at 156 Marine Street was constructed in 1930 and was part of the Lincolnville Historic District. As a result of the current survey, the house was found to be destroyed. The demolition of 8SJ03697 occurred between 2011 and 2013, because the original dwelling is no longer visible on the subsequent Google Earth aerial images.

Lincolnville Historic District (8SJ03248)

The Lincolnville Historic District (8SJ03248) crosses both Areas 1 and 2. 8SJ03248 was listed in the NRHP in 1991, with significance for architecture, ethnic heritage, and exploration and settlement (Shiver 1991). The architecture of Lincolnville encompasses Vernacular, Mediterranean Revival, Queen Anne, Craftsman, and Bungalow styles. There is a mixture of residential, commercial, and religious structures in the District, with extensive residential development beginning in the late nineteenth century. There are 548 contributing historic resources and 130 non-contributing historic resources included within the District.

Within the boundaries of 8SJ03248 and the Area 1 direct APE, historic brick pavers are located in the sidewalks adjacent to Granada Street (see **Figures 24-25**; **Figure 36**). In order to avert Project-related effects to the Lincolnville Historic District, care should be taken to avoid the areas with brick pavers. If avoidance of the historic brickwork during construction is not possible, additional work will be required.

Within the boundaries of 8SJ03248 and the Area 2 indirect APE are two properties that are NRHP eligible as contributing resources: 72 South Street (8SJ02203) and 157 Washington Street (8SJ02363) (see **Figure 36**). Although a full assessment of the visual effect of the new pump station to these resources will have to be assessed once the facility has been designed, both properties have a clear view of the pump station from the west down South Street or across Lake Maria Sanchez. Ongoing consultation with the project team regarding the design of the pump station is recommended.



Figure 36. Representative views of historic brick pavers and historic structures within Lincolnville Historic District (8SJ03248). Top left: facing north along the east side of Granada Street. Top right: 8SJ02203, facing northwest. Middle left: 8SJ02203, facing northeast. Middle right: 8SJ02363, facing southwest. Bottom left: 8SJ02363, facing west. Bottom right: 8SJ02363, facing southwest.

Newly Recorded Historic Resources

South Street Culvert (8SJ06610)

The South Street Culvert (8SJ06610) is the current South Street bridge across Lake Maria Sanchez (see **Figure 23**). This resource is within the direct APE of Area 2 and will undergo direct effects due to the creation of the new pump station and storm water outfall. 8SJ06610 is a newly recorded historic bridge located in Section 20 of Township 7 South, Range 30 East, as depicted on the 2018 *Saint Augustine, Fla.* USGS quadrangle map.



Figure 37. Resource 8SJ06610, facing northeast.

The South Street Culvert was constructed ca. 1919. 8SJ06610 (**Figure 37**) is an example of a common bridge type in Florida, representing about 30 percent of pre-1971 bridges and only 6 percent of NRHP-listed bridges (ACI 2012). The South Street Culvert has one barrel and measures roughly 23 feet (7 meters). The culvert is made of concrete block with a smooth concrete surface, which is typical for earlier examples of culverts. There is a metal grate on the south side and a pump station surrounded by metal picket fencing on the north side. There are concrete block side walls on the north and south sides and concrete abutments. The design of the South Street Culvert is typical in material, size, and construction method, according to *Historic Highway Bridges of Florida* report updated in 2012.

The South Street Culvert was designed and built to replace the old tide gate, providing better service and allowing water to flow freely twice per day (*St. Augustine Evening Record* February 27, 1919; *St. Augustine Evening Record* March 28, 1919). The old tide gate was built as a result of the expansion of St. Augustine in the 1880s and 1890s that saw Maria Sanchez Creek turned into a lake. The original plan was to create a water park featuring three lakes in a 1.25-mile-long by 800-ft-wide area; however, due to a lack of funds the water park was not completed. The St. Augustine Improvement Company widened and deepened the creek in 1893 and the bridge construction was to start in 1894 (*Tatler* January 27, 1894). However, it was not until 1910 that the South Street bridge construction began moving rapidly with the installation of iron rods and the start of the concrete process. The *St. Augustine Evening Record* stated on July 13, 1910 that "The bridge will be a practically permanent affair and this demonstrates the wisdom of the city in building a structure that will not require continual expense for maintenance." The cement fill was made partially from old, broken stone from the Valencia Street paving (*St. Augustine Evening Record* July 13, 1910). The original design, built by John

Reyes, featured wooden doors blocking the two tunnels, which could be easily removed during low tide (*St. Augustine Evening Record* February 27, 1919; *St. Augustine Evening Record* March 28, 1919). These wooden doors allowed 4 feet of water during low tide and up to 6 feet of water at high tide into the lake (*St. Augustine Evening Record* February 27, 1919). The construction of the South Street Culvert was completed around March 28, 1919 (*St. Augustine Evening Record* March 28, 1919).

Assessment

Resource 8SJ06610, the South Street Culvert, was not included in the 2004 edition of *Historic Highway Bridges of Florida*, nor was it included in the 2012 edition (ACI 2012; Jackson 2004). Based on the historic context and the results of the present survey, 8SJ06610 does not appear to meet the minimum criteria for listing in the NRHP. 8SJ06610 is not significant under NRHP Criterion A, because it is not indicative of a particular era and is not associated with any significant period, event, or theme. 8SJ06610 is not significant under Criterion B, because it lacks association with any person(s) significant in history. As a modest example of a concrete culvert, 8SJ06610 is not significant under Criterion C and does not possess high artistic value. Furthermore, 8SJ06610 does not possess any architectural or engineering innovations or aesthetic achievements, nor does it embody any distinctive methods of construction. Because of its lack of sufficient historical association and engineering significance, it is the opinion of SEARCH that 8SJ06610, the South Street Culvert, is not NRHP eligible individually or as a contributing resource to an existing or potential historic district or resource group.

Cordova Street (8SJ06609)

Cordova Street (8SJ06609) is a newly recorded linear resource located in Section 18 of Township 7 South, Range 30 East, as depicted on the 2018 *Saint Augustine, Fla.* USGS quadrangle map. Cordova Street is located just east of the original western boundary for the Colonial city of St. Augustine, known as the Rosario Line (see **Figure 5**). It falls within the Area 1 direct APE (see **Figure 23**). Originally this street was named Tolomato, and as seen on an 1885 bird's eye view map of St. Augustine, the street was adjacent to Maria Sanchez Creek (**Figure 38**). The growing population of St. Augustine and booming tourism industry, road work, hotel, and neighborhood development impacted this area. Tolomato Street was widened and renamed Cordova Street around 1885, when the Maria Sanchez Creek was reclaimed by Henry Flagler, marking the start of construction on the Ponce de Leon and Alcazar hotels (Graham 1978, 1989). At this time, Cordova Street was most likely extended to its current termination point of St. George Street.

Assessment

8SJ06609, Cordova Street, is a newly recorded linear resource within the St. Augustine Town Plan Historic District (8SJ05567) and the St. Augustine Historic District (8SJ00010). Based on the results of the current survey, it is the opinion of SEARCH that 8SJ06609 is NRHP ineligible, as it lacks the integrity required to convey its historic significance within the Area 1 direct APE.

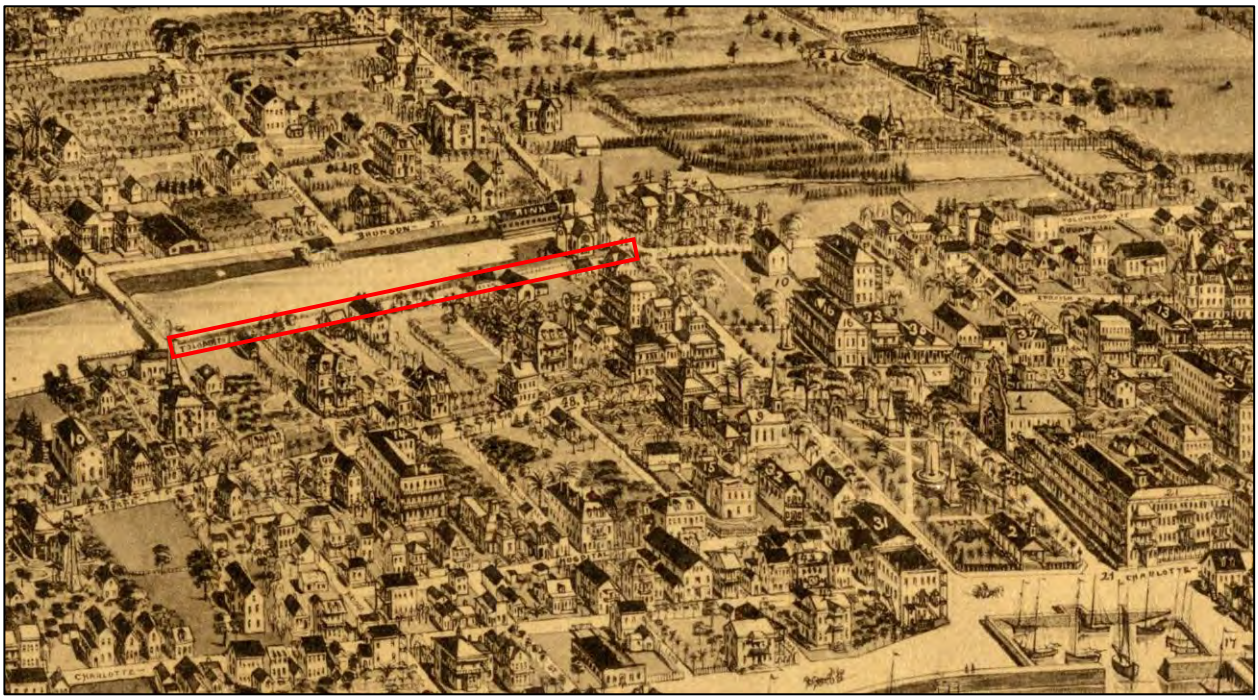


Figure 38. Bird's-eye view of St. Augustine, 1885. Tolomato Street highlighted in red. Source: Florida Memory, n.d.b.

8SJ06609 is only significant under Criterion A as it is connected to the original town plan of St. Augustine. As a typical, asphalt paved road within the City of St. Augustine, 8SJ06609 is not significant under Criterion C, as it no longer retains any of its nineteenth-century characteristics. In addition to historic significance, a historic resource must maintain its historic integrity to be considered eligible for listing in the NRHP. Cordova Street lacks its historic integrity, due to changes in size, material, and overall modern improvements within the past 100 years. The narrow dirt street has been widened at least once, paved with asphalt, and underground utilities have been installed below it. The street is also no longer along the Maria Sanchez waterway, which was part of its original historic setting. 8SJ06609 no longer retains its historic design, setting, materials, feeling or association. As a result of these changes, it no longer retains enough historic integrity to convey its significance under NRHP Criterion A and is recommended ineligible for NRHP listing.

CONCLUSIONS AND RECOMMENDATIONS

This report presents the results of the desktop and reconnaissance survey of a multi-phased Flood Mitigation project for the Lake Maria Sanchez area of St. Augustine. This document will be used to coordinate additional cultural resource work with the City and the State Historic Preservation Officer (SHPO). The desktop study provides the results of background research for the Project. The reconnaissance included a walkover survey to help identify areas of particular concern for cultural resources (e.g., archaeological sites, historic structures, historic districts) within the Project. As a result of this initial phase of work, recommendations can be made regarding the completion of a full Phase I CRAS and the amount of archaeological monitoring that can be anticipated during the 2020 construction phase. Discussion of replacement sidewalks, possible lighting improvements, and public outreach aspects of this Project are beyond the scope of work for this phase of work.

Within the archaeological APE, disturbance is extensive with existing buildings, utility infrastructure, roads, and other elements of a consistently occupied area. Historic construction impacts include the filling of Maria Sanchez Creek, the installation of roads and utilities, and the construction and demolition of prior structures. Disturbed historic deposits dating as early as the seventeenth century through the twentieth century could be present across the Project APE for both Areas 1 and 2. Because of the deep time frame of occupation, past disturbances in themselves, such as the filling of Maria Sanchez Creek or the destruction of the Rosario Line, could be considered historic archaeological sites. Although intact sites are highly unlikely in either Area 1 or Area 2, there is still historic information to be gathered and, therefore, portions of these areas retain archaeological potential.

The following archaeological work is recommended moving forward for this Project:

- Phase I testing is recommended at low tide along the 20-foot easement for the eastern leg of the proposed bulkhead, after official access to these private properties is gained. If shovel testing proves impossible due to inundation, SEARCH recommends using a piston core to test the saturated soils along the eastern bulkhead. The eastern edge of Maria Sanchez Creek has the potential to contain refuse deposition related to the La Punta mission town eighteenth-century occupation.
- The southwest end of the bulkhead extends to within 12 meters of the currently visible remnants of the Lincolnville Landing site (8SJ05020). SEARCH recommends that no ground disturbing or staging activities occur south of the mapped bulkhead location in the area of the Lincolnville Landing. The Landing is a contributing resource to the NRHP-listed Lincolnville Historic District and should be avoided during Project construction.
- Due to the nature of the bulkhead construction which is anticipated to be limited to sinking a protective wall 3-4 feet into the marsh, no monitoring is recommended during bulkhead installation on the west side. However, following the design phase for the bulkhead, this recommendation may have to be revisited. For the east side of the

bulkhead, recommendations for potential monitoring or further testing will be made in the Phase I CRAS following subsurface testing.

- Monitoring is not recommended during construction of the pump station and storm water outfall along South Street within Area 2, due to the low probability of discovering intact deposits or significant information on the history of St. Augustine.
- Monitoring is not recommended during sidewalk removal in Area 1 as this falls outside the City of St. Augustine's Archaeological Zones and will encounter recent fills. However, it is important that the planned sidewalk removal not impact historic fabric (i.e., brick pavers, coquina).
- Monitoring is recommended during construction of the storm water conveyance improvements and box culverts within Area 1. Although this area falls outside the City's Archaeological Zones, the area was filled historically (in ca. 1885) and deeper excavation may encounter information related to the filling of Maria Sanchez Creek and may expose evidence of the defensive Rosario Line, which is mapped along Cordova Street. The goal of the monitoring within Area 1 is to document an exposed wall profile, ideally running east–west between Cordova and Granada Streets; however, profiling may be prohibited in deeply cut areas due to safety concerns.

The architectural history survey resulted in the identification and assessment of 11 historic resources within the Area 1 and Area 2 APEs. These historic resources include six previously recorded historic structures, three previously recorded Historic Districts, one newly recorded historic linear resource (Cordova Street), and one newly recorded bridge (South Street Culvert) (see **Figure 23;** see **Tables 4 and 5**). Two of the previously recorded Historic Districts, 8SJ00010 and 8SJ03248, are NRHP listed and one of the previously recorded Historic Districts, 8SJ05567, is a National Historic Landmark. The focus of the architectural history survey was to identify historic fabric within the direct APE, assess previously recorded structures within the indirect APE of Area 2, and to determine if there are any unrecorded historic resources within the direct or indirect APEs.

As a result of this survey, SEARCH recommends 8SJ02203, 72 South Street, NRHP eligible under Criterion C as an exceptional example of Craftsman style as part of the Lincolnville Historic District. SEARCH also recommends 8SJ02363, 157 Washington Street, individually NRHP eligible and eligible as a contributing resource to the Lincolnville Historic District (8SJ03248) under Criterion B for its association with contractor Charles Leyvrez and prominent St. Augustine merchant J.A. Lew, and under Criterion C as an exceptional example of the Mediterranean Revival style within 8SJ03248, and as an example of the work of prominent St. Augustine architect F.A. Hollingsworth.

The remaining four historic structures (8SJ00567, 8SJ02200, 8SJ02201, 8SJ02202), one historic linear resource (8SJ06609, Cordova Street), and one historic bridge (8SJ06610, South Street Culvert) within the Area 1 and Area 2 APEs all lack the architectural or engineering distinction and significant historical associations necessary to be considered for listing in the NRHP and are recommended ineligible. Resources 8SJ03697 and 8SJ02364 have been demolished.

The next phase of cultural resource work for the Lake Maria Sanchez Flood Mitigation Project will include a full Phase I survey report that presents the results of the recommended subsurface testing and a review of the 30 percent plans for the pump station and storm water outfall and bulkhead in Area 2, prior to submission of these plans to the Historic Preservation Review Board. The pump station and bulkhead plans will be used to assess indirect impacts to NRHP eligible structures within the APEs for the Project.

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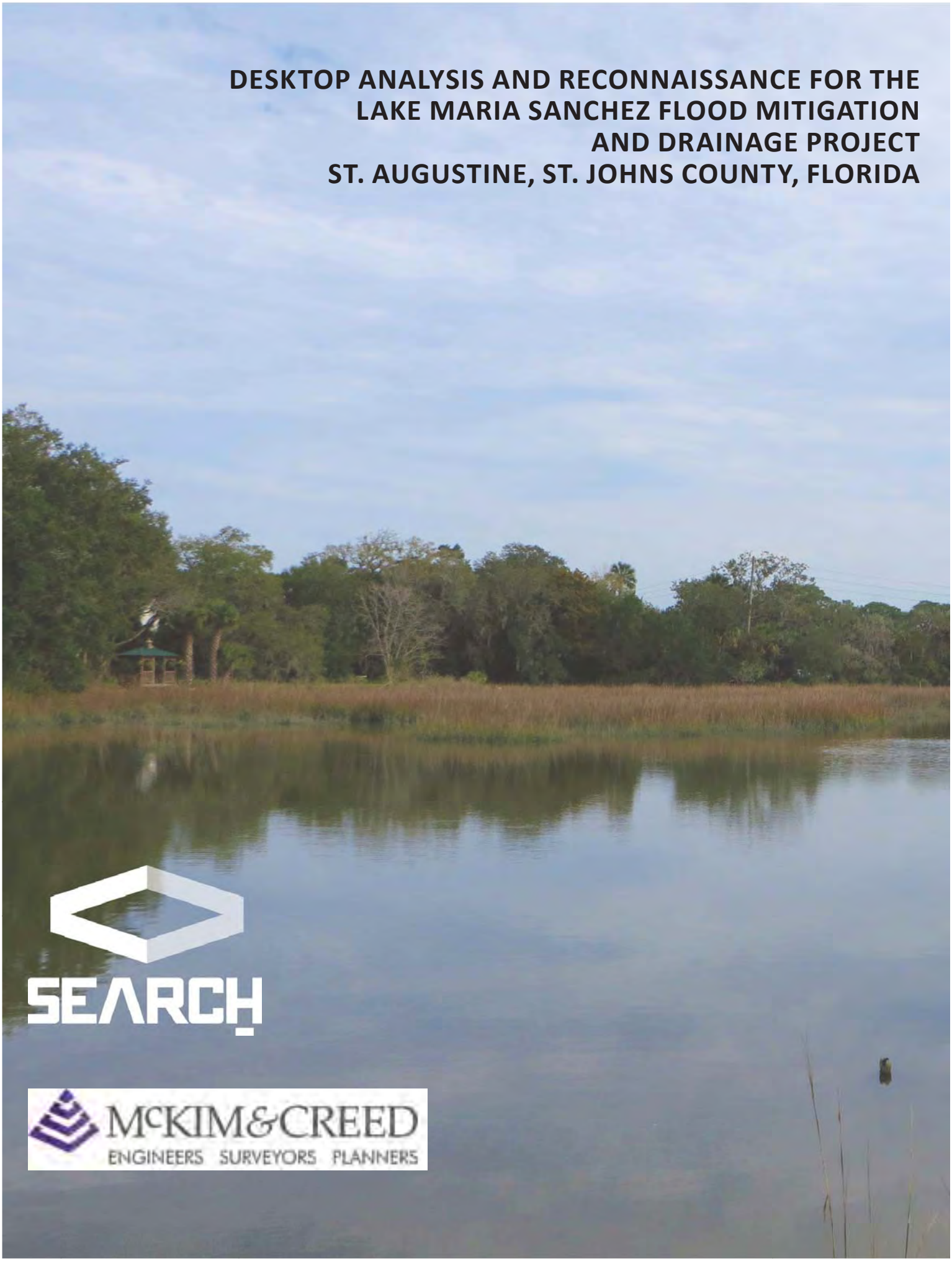
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DESKTOP ANALYSIS AND RECONNAISSANCE FOR THE LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT ST. AUGUSTINE, ST. JOHNS COUNTY, FLORIDA



SEARCH

McKIM&CREED
ENGINEERS SURVEYORS PLANNERS

APPENDIX II

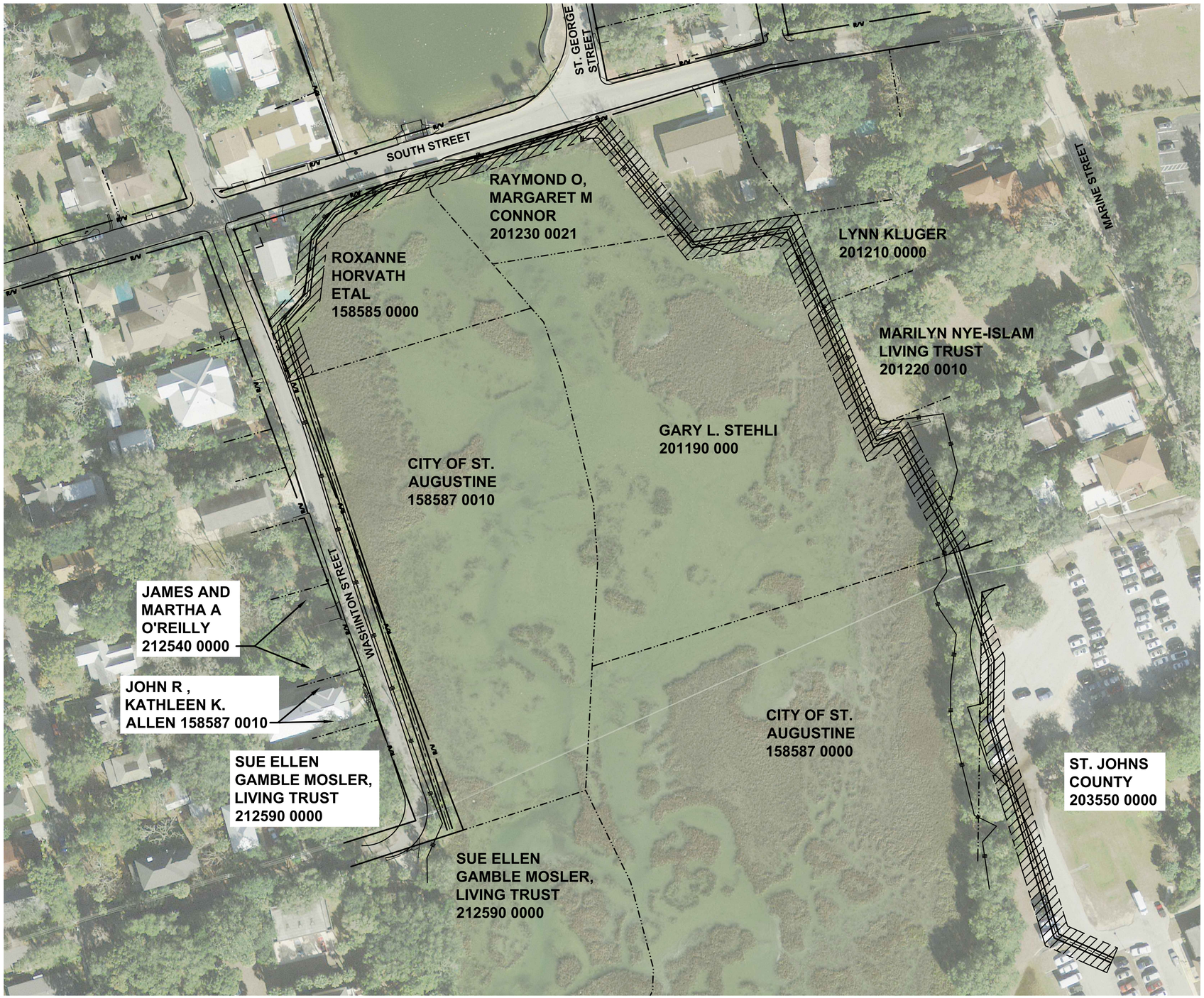
Property Owners

CITY OF ST. AUGUSTINE

LAKE MARIA SANCHEZ FLOOD MITIGATION

Basis of Design Report

September 2019



N

50' 0 50' 100'

SCALE: 1"=50' (Horiz.)

LEGEND

- SUGGESTED BULKHEAD LOCATION
- WETLANDS AND MARKERS
- R/W RIGHT OF WAY
- PROPERTY LINES
- REQUIRED PERMANENT AND TEMPORARY CONSTRUCTION EASEMENT AREA

REV.NO	DESCRIPTION	DATE
-	---	

REVISIONS

McKIM&CREED
139 Executive Circle, Suite 201
Daytona Beach, FL 32114-7102
Phone: (386) 274-2828, Fax: (386) 274-1393
CA Lic. No. 29588
www.mckimcreed.com

CITY OF ST AUGUSTINE EST. 1565

THE CITY OF ST. AUGUSTINE

LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT

GENERAL

BULKHEAD ALIGNMENT EASEMENT OWNERSHIP MAP

PROJ. START DATE:	2019/JAN
MCE PROJ. #	072050002
DRAWN	DMP
DESIGNED	CHH
CHECKED	-
PROJ. MGR.	-

SCALE
HORIZONTAL: AS NOTED
VERTICAL: N/A

B-1A
DRAWING NUMBER
-
REVISION

STATUS: 30% DESIGN SUBMITTAL NOT FOR CONSTRUCTION

S:\07205\0002\80-DRAWINGS\86-DESIGN\BULKHEAD\BH001-072050002.DWG 08/13/2019 10:02:34 DOREEN PADGETT

APPENDIX III

Figures and Supporting Hydrologic & Hydraulic Information

CITY OF ST. AUGUSTINE

LAKE MARIA SANCHEZ FLOOD MITIGATION

Basis of Design Report

September 2019

FIGURES



AppliedSciences

N
W E
S

0 400 800 Feet

1 inch = 800 feet

Figure 1. Location Map
Lake Maria Sanchez Flood Mitigation and Drainage Improvement Project
City of St. Augustine, FL

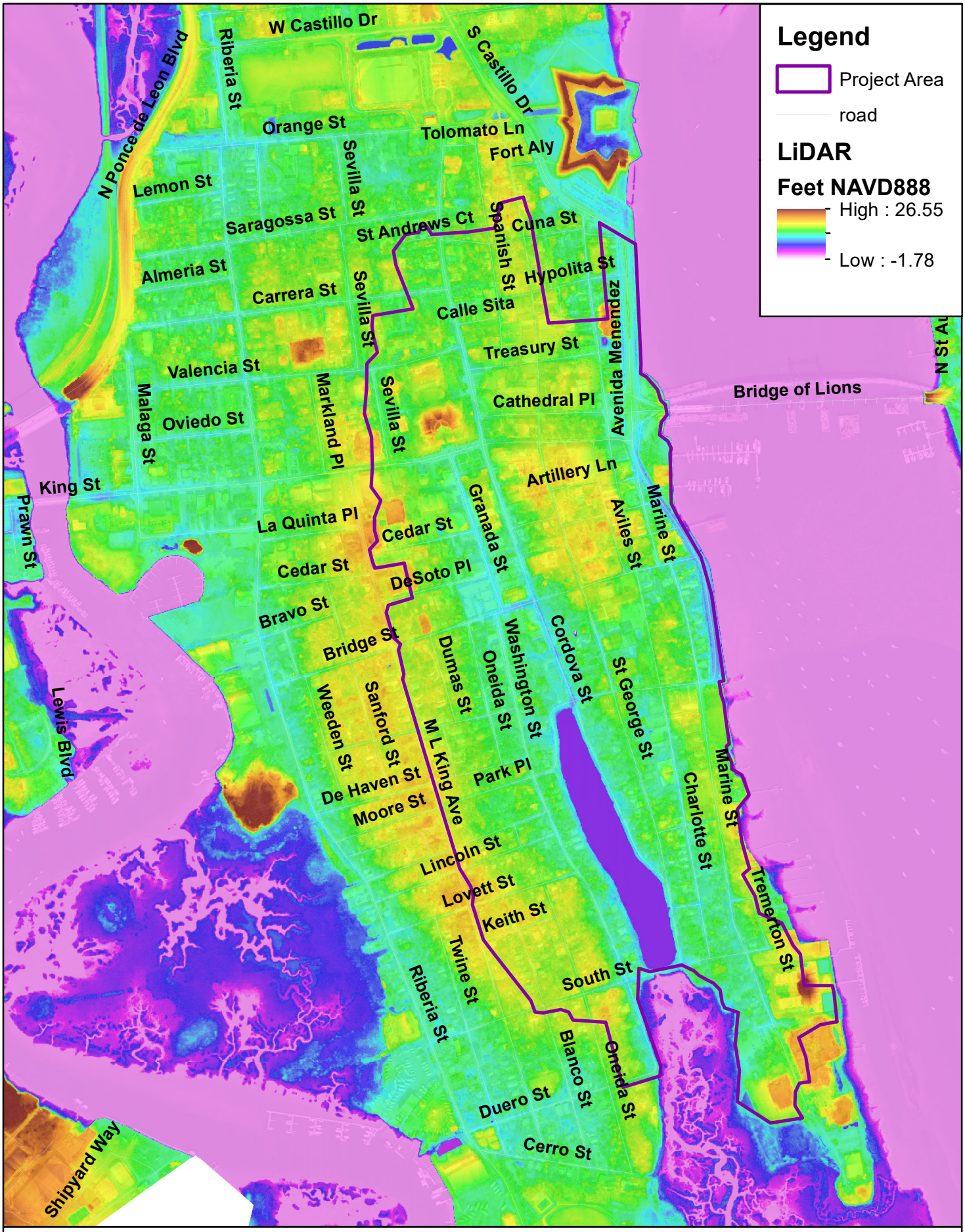


Figure 2. Project Area Topography
Lake Maria Sanchez Flood Mitigation and Drainage Improvement Project
City of St. Augustine, FL

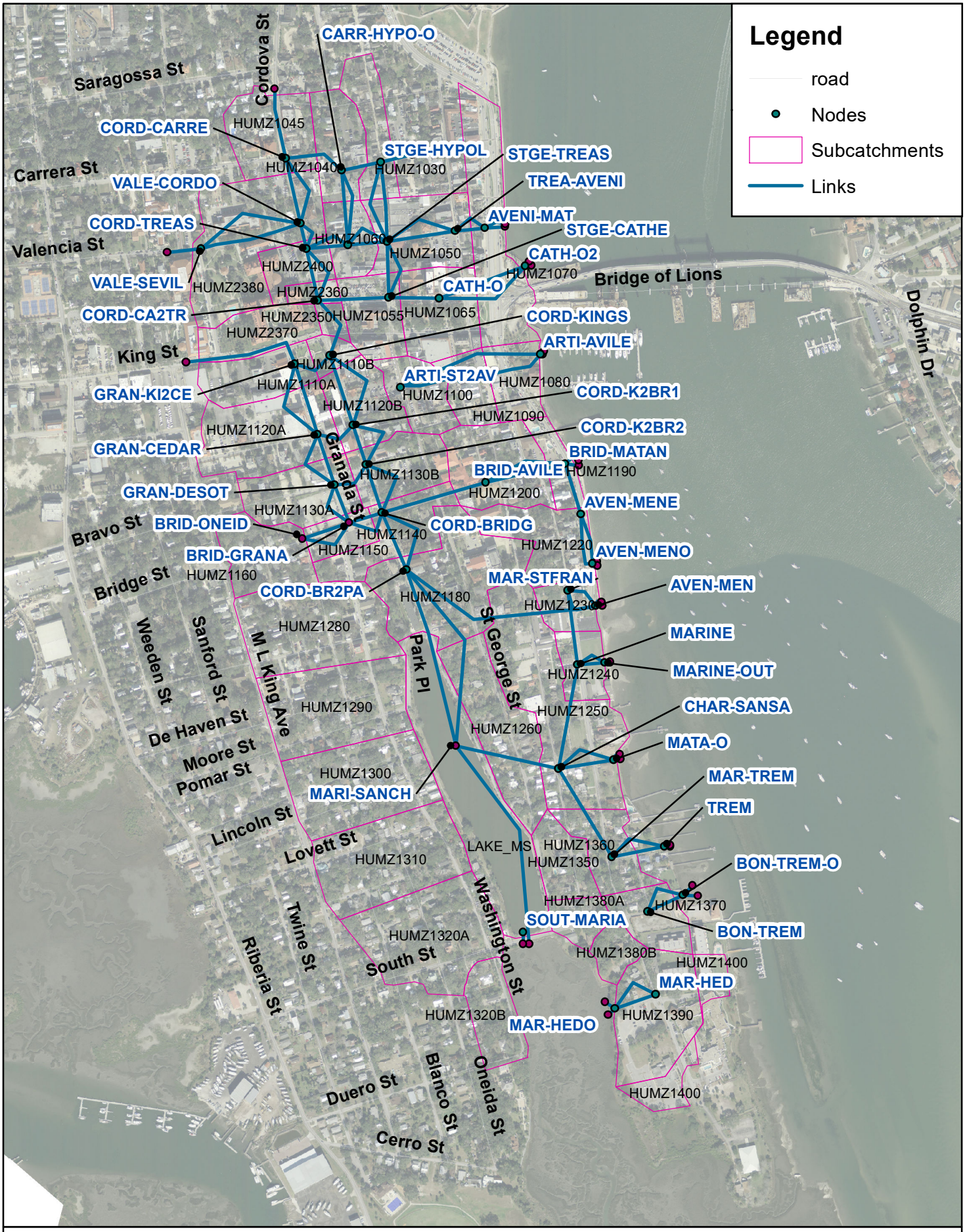


Figure 3. Revised Existing Model Schematic
Lake Maria Sanchez Flood Mitigation
and Drainage Improvement Project
City of St. Augustine, FL

APPENDIX A

SUPPORTING HYDROLOGIC AND HYDRAULIC INFORMATION

Reference:

-Basis of Design Report
-30P Design Plans
-ERP 82626
-Maria Sanchez Lake Flood Control Feasibility Study Hydrology and Hydraulics Modeling Report

APPENDIX B

Complete SWMM Model Node Comparison Results Summary

Table B1. Original Existing Conditions vs Revised Existing Conditions Model Peak Stage Comparison Summary

	Mean Annual			5 Year			10 Year			25 Year			50 Year			100 Year		
Node ID	Existing Stage (ft)	Rev. Existing Stage (ft)	Δ (ft)	Existing Stage (ft)	Rev. Existing Stage (ft)	Δ (ft)	Existing Stage (ft)	Rev. Existing Stage (ft)	Δ (ft)	Existing Stage (ft)	Rev. Existing Stage (ft)	Δ (ft)	Existing Stage (ft)	Rev. Existing Stage (ft)	Δ (ft)	Existing Stage (ft)	Rev. Existing Stage (ft)	Δ (ft)
ARTI-AVILE	4.4	4.4	0.0	5.0	5.0	0.0	5.4	5.9	0.5	5.5	6.0	0.5	5.6	6.1	0.5	5.6	6.1	0.5
ARTI-ST2AV	5.7	5.7	0.0	5.9	5.9	0.0	6.1	6.3	0.1	6.2	6.3	0.1	6.5	6.4	0.0	6.5	6.5	0.0
AVENI-MAT	5.2	5.5	0.3	5.5	5.9	0.4	5.9	6.2	0.3	6.1	6.3	0.2	6.2	6.4	0.1	6.2	6.4	0.2
AVEN-MEN	3.3	3.3	0.0	3.6	3.6	0.0	5.3	5.3	0.0	5.5	5.5	0.0	5.7	5.7	-0.1	5.7	5.7	0.0
AVEN-MENE	4.4	4.8	0.4	4.5	5.2	0.6	4.8	5.7	0.9	4.9	6.0	1.1	5.0	6.1	1.1	5.0	6.1	1.1
AVEN-MENO	4.4	4.8	0.4	4.5	5.2	0.6	4.8	5.7	0.9	4.9	6.0	1.1	5.0	6.0	1.1	5.0	6.1	1.1
BON-TREM	5.4	5.4	0.0	5.5	5.5	0.0	5.7	5.6	0.0	5.7	5.7	0.0	5.8	5.8	0.0	5.8	5.8	0.0
BON-TREM-O	5.1	5.1	0.0	5.1	5.1	0.0	5.2	5.2	0.0	5.3	5.3	0.0	5.3	5.3	0.0	5.3	5.3	0.0
BRID-AVILE	5.0	5.0	0.0	5.1	5.2	0.0	5.2	5.7	0.5	5.2	6.0	0.7	5.3	6.1	0.8	5.3	6.1	0.8
BRID-MATAN	4.4	4.8	0.4	4.5	5.2	0.6	4.7	5.7	0.9	4.8	6.0	1.1	4.9	6.1	1.1	4.9	6.1	1.2
CATH-O	5.6	5.6	0.0	5.7	5.7	0.0	5.8	5.8	0.0	5.9	5.9	0.0	5.9	5.9	0.0	5.9	5.9	0.0
CATH-O2	3.9	3.9	0.0	4.5	4.5	0.0	5.3	5.3	0.1	5.6	5.7	0.0	5.8	5.8	0.0	5.8	5.8	0.0
CHAR-SANSA	4.9	4.9	0.0	5.1	5.1	0.0	5.3	5.3	0.0	5.5	5.5	0.0	5.7	5.7	0.0	5.7	5.7	0.0
BRID-ONEID	5.7	5.7	0.0	5.7	5.7	0.0	5.8	5.8	0.0	5.8	5.8	0.0	5.9	5.8	0.0	5.9	5.8	0.0
CORD-BR2PA	4.7	4.5	-0.2	4.9	4.7	-0.2	5.0	4.8	-0.2	5.1	5.0	-0.2	5.3	5.1	-0.2	5.3	5.1	-0.2
CORD-BRIDG	4.9	4.7	-0.2	5.1	4.8	-0.2	5.3	5.1	-0.2	5.4	5.2	-0.2	5.6	5.3	-0.3	5.6	5.4	-0.2
CORD-CARRE	5.9	5.6	-0.3	6.1	5.7	-0.4	6.7	5.9	-0.8	16.6	6.0	-10.6	16.6	6.1	-10.6	16.6	6.1	-10.5
CORD-K2BR1	5.1	5.2	0.0	5.2	5.2	0.0	5.4	5.4	0.0	5.5	5.5	-0.1	5.7	5.6	-0.2	5.7	5.6	-0.1
CORD-K2BR2	5.0	4.8	-0.1	5.1	4.9	-0.2	5.3	5.1	-0.2	5.5	5.3	-0.2	5.6	5.4	-0.2	5.6	5.4	-0.2
CORD-KINGS	5.5	5.4	0.0	5.6	5.5	-0.1	5.7	5.7	-0.1	5.8	5.8	-0.1	6.0	5.8	-0.1	6.0	5.9	-0.1
CORD-TREAS	5.5	5.5	-0.1	5.7	5.6	-0.1	5.8	5.7	-0.1	6.0	5.9	-0.1	6.1	5.9	-0.2	6.1	6.0	-0.1
CORD-CA2TR	5.5	5.5	-0.1	5.7	5.6	-0.1	5.8	5.7	-0.1	5.9	5.8	-0.1	6.1	5.9	-0.2	6.1	6.0	-0.1
GRAN-DESOT	5.0	4.8	-0.2	5.1	4.9	-0.2	5.3	5.1	-0.2	5.5	5.3	-0.2	5.6	5.4	-0.2	5.6	5.4	-0.2
GRAN-KI2CE	5.1	4.9	-0.1	5.2	5.0	-0.2	5.4	5.2	-0.2	5.5	5.3	-0.2	5.7	5.5	-0.2	5.7	5.5	-0.2
MAR-HED	5.7	5.7	0.0	5.9	5.9	0.0	6.1	6.1	0.0	6.2	6.2	0.0	6.3	6.3	0.0	6.3	6.3	0.0
MAR-HEDO	5.7	5.7	0.0	5.9	5.9	0.0	6.0	6.0	0.0	6.1	6.1	0.0	6.2	6.2	0.0	6.2	6.2	0.0
MARINE	4.9	4.9	0.0	5.1	5.1	0.0	5.3	5.3	0.0	5.5	5.5	0.0	5.7	5.7	-0.1	5.7	5.7	0.0
GRAN-CEDAR	5.0	4.8	-0.2	5.2	5.0	-0.2	5.4	5.2	-0.2	5.5	5.3	-0.2	5.7	5.4	-0.2	5.7	5.5	-0.2
MARINE-OUT	3.7	3.7	0.0	3.8	3.8	0.0	3.8	3.8	0.0	4.5	4.4	0.0	5.7	5.7	-0.1	5.7	5.7	0.0
MAR-OUT-A	3.2	3.2	0.0	3.2	3.2	0.0	3.2	3.2	0.0	3.3	3.3	0.0	3.4	3.4	0.0	3.4	3.4	0.0
MAR-STFRAN	4.9	4.9	0.0	5.1	5.1	0.0	5.3	5.3	0.0	5.5	5.5	0.0	5.7	5.7	-0.1	5.7	5.7	0.0
MAR-TREM	4.9	4.9	0.0	5.1	5.1	0.0	5.3	5.3	0.0	5.5	5.5	0.0	5.7	5.7	0.0	5.7	5.7	0.0
MATA-O	3.4	3.4	0.0	3.4	3.4	0.0	3.5	3.5	0.0	3.5	3.5	0.0	3.6	3.6	0.0	3.6	3.6	0.0
SOUT-MARIA	3.6	3.6	-0.1	3.9	3.8	-0.1	4.3	4.2	-0.1	4.6	4.4	-0.2	4.9	4.6	-0.2	4.9	4.7	-0.1
SOUT-OUTFA	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
STFRAN-O-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
STFRAN-O-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
STGE-CATHE	6.4	6.4	0.0	6.4	6.4	0.0	6.4	6.4	0.0	6.5	6.4	0.0	6.5	6.5	0.0	6.5	6.5	0.0
VALE-SEVIL	5.7	5.7	0.0	5.8	5.8	0.0	5.9	5.9	0.0	6.0	6.0	0.0	6.1	6.1	-0.1	6.1	6.1	0.0
ARTI-OUT-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
ARTI-OUT-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
AVEN-MEN-O-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
AVEN-MEN-O-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
BON-TREM-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
BON-TREM-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
BRID-MATAN2-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
BRID-MATAN2-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
BRID-MATAN-O-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
BRID-MATAN-O-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
CATH-OUT-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
CATH-OUT-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
MAR-HED-O-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
MAR-HED-O-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
STGE-HYPOL	6.1	6.3	0.2	6.3	6.4	0.1	6.6	6.4	-0.2	7.0	6.5	-0.5	7.2	6.5	-0.7	7.2	6.5	-0.7
MAR-OUT-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
MATA-OUT-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
MATA-OUT-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
NON-CONTRIB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SOUT-OUTF2	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
STGE-TREAS	5.7	6.0	0.3	5.8	6.0	0.3	5.9	6.2	0.3	6.1	6.3	0.3	6.2	6.4	0.2	6.2	6.5	0.2
TREA-AVENI	5.2	5.5	0.3	5.5	5.9	0.4	5.9	6.2	0.3	6.1	6.3	0.3	6.2	6.4	0.2	6.2	6.5	0.2
TREM	4.8	4.8	0.0	5.1	5.1	0.0	5.3	5.3	0.0	5.5	5.5	0.0	5.6	5.6	0.0	5.6	5.6	0.0
TREM-OUT-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
TREM-OUT-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
BRID-GRANA	5.0	4.7	-0.2	5.1	4.9	-0.2	5.3	5.1	-0.2	5.5	5.3	-0.2	5.6	5.4	-0.3	5.6	5.4	-0.2
VALE-CORDO	5.5	5.5	-0.1	5.7	5.6	-0.1	5.8	5.8	-0.1	6.0	5.9	-0.1	6.1	6.0	-0.2	6.1	6.0	-0.1
MARI-SANCH	3.8	3.8	0.0	4.1	4.0	0.0	4.5	4.4	-0.1	4.8	4.7	-0.1	5.0	4.9	-0.1	5.0	4.9	0.0

Table B2. Revised Existing Conditions vs Proposed Conditions Model Peak Stage Comparison Summary

	Mean Annual			5 Year			10 Year			25 Year			50 Year			100 Year		
Node ID	Rev. Existing Stage (ft)	Proposed Stage (ft)	Δ (ft)	Rev. Existing Stage (ft)	Proposed Stage (ft)	Δ (ft)	Rev. Existing Stage (ft)	Proposed Stage (ft)	Δ (ft)	Rev. Existing Stage (ft)	Proposed Stage (ft)	Δ (ft)	Rev. Existing Stage (ft)	Proposed Stage (ft)	Δ (ft)	Rev. Existing Stage (ft)	Proposed Stage (ft)	Δ (ft)
ARTI-AVILE	4.4	4.4	0.0	5.0	5.0	0.0	5.9	5.4	-0.5	6.0	5.5	-0.5	6.1	5.6	-0.5	6.1	5.6	-0.5
ARTI-OUT-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
ARTI-OUT-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
ARTI-ST2AV	5.7	5.7	0.0	5.9	5.9	0.0	6.3	6.2	-0.1	6.3	6.2	-0.1	6.4	6.4	-0.1	6.5	6.6	0.1
AVENI-MAT	5.5	5.5	0.0	5.9	5.9	0.0	6.2	6.2	0.0	6.3	6.3	0.0	6.4	6.4	0.0	6.4	6.4	0.0
AVEN-MEN	3.3	3.3	0.0	3.6	3.6	0.0	5.3	5.3	0.0	5.5	5.5	0.0	5.7	5.7	0.0	5.7	5.7	0.0
AVEN-MENE	4.8	4.8	0.0	5.2	5.1	0.0	5.7	5.6	0.0	6.0	6.0	0.0	6.1	6.1	0.0	6.1	6.1	0.0
AVEN-MENO	4.8	4.8	0.0	5.2	5.1	0.0	5.7	5.6	0.0	6.0	6.0	0.0	6.0	6.0	0.0	6.1	6.1	0.0
AVEN-MEN-O-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
AVEN-MEN-O-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
BON-TREM	5.4	5.4	0.0	5.5	5.5	0.0	5.6	5.6	0.0	5.7	5.7	0.0	5.8	5.8	0.0	5.8	5.8	0.0
BON-TREM-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
BON-TREM-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
BON-TREM-O	5.1	5.1	0.0	5.1	5.1	0.0	5.2	5.2	0.0	5.3	5.3	0.0	5.3	5.3	0.0	5.3	5.3	0.0
BRID-AVILE	5.0	5.0	0.0	5.2	5.1	0.0	5.7	5.6	0.0	6.0	6.0	0.0	6.1	6.1	0.0	6.1	6.1	0.0
BRID-GRANA	4.7	4.4	-0.3	4.9	4.6	-0.3	5.1	4.8	-0.3	5.3	4.9	-0.3	5.4	5.1	-0.3	5.4	5.1	-0.3
BRID-MATAN	4.8	4.8	0.0	5.2	5.1	0.0	5.7	5.6	0.0	6.0	6.0	0.0	6.1	6.1	0.0	6.1	6.1	0.0
BRID-MATAN2-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
BRID-MATAN2-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
BRID-MATAN-O-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
BRID-MATAN-O-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
BRID-ONEID	5.7	5.3	-0.4	5.7	5.3	-0.4	5.8	5.4	-0.4	5.8	5.4	-0.4	5.8	5.5	-0.4	5.8	5.5	-0.4
CARR-HYPO	5.0	5.0	0.0	5.2	5.2	0.0	5.5	5.5	0.0	5.8	5.8	0.0	5.9	5.9	0.0	6.0	5.9	0.0
CATH-O	5.6	5.6	0.0	5.7	5.7	0.0	5.8	5.8	0.0	5.9	5.9	0.0	5.9	5.9	0.0	5.9	5.9	0.0
CATH-O2	3.9	3.9	0.0	4.5	4.5	0.0	5.3	5.3	0.0	5.7	5.7	0.0	5.8	5.8	0.0	5.8	5.8	0.0
CATH-OUT-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
CATH-OUT-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
CHAR-SANSA	4.9	4.9	0.0	5.1	5.1	0.0	5.3	5.3	0.0	5.5	5.5	0.0	5.7	5.7	0.0	5.7	5.7	0.0
CORD-BR2PA	4.5	3.3	-1.3	4.7	3.7	-1.0	4.8	4.2	-0.6	5.0	4.5	-0.5	5.1	4.7	-0.4	5.1	4.7	-0.4
CORD-BRIDG	4.7	3.6	-1.1	4.8	4.1	-0.8	5.1	4.5	-0.5	5.2	4.8	-0.4	5.3	4.9	-0.4	5.4	5.0	-0.4
CORD-CA2TR	5.5	5.5	0.0	5.6	5.6	0.0	5.7	5.7	0.0	5.8	5.8	0.0	5.9	5.9	0.0	6.0	5.9	0.0
CORD-CARRE	5.6	5.6	0.0	5.7	5.7	0.0	5.9	5.9	0.0	6.0	6.0	0.0	6.1	6.1	0.0	6.1	6.1	0.0
CORD-K2BR1	5.2	4.6	-0.6	5.2	4.8	-0.4	5.4	5.1	-0.3	5.5	5.2	-0.2	5.6	5.4	-0.2	5.6	5.4	-0.2
CORD-K2BR2	4.8	4.4	-0.4	4.9	4.6	-0.3	5.1	4.9	-0.3	5.3	5.0	-0.3	5.4	5.1	-0.3	5.4	5.1	-0.3
CORD-KINGS	5.4	5.4	0.0	5.5	5.5	0.0	5.7	5.6	0.0	5.8	5.7	0.0	5.8	5.8	0.0	5.9	5.9	0.0
CORD-TREAS	5.5	5.5	0.0	5.6	5.6	0.0	5.7	5.7	0.0	5.9	5.8	0.0	5.9	5.9	0.0	6.0	6.0	0.0
FreeOutfall01	6.2	6.2	0.0	6.2	6.2	0.0	6.3	6.3	0.0	6.3	6.3	0.0	6.3	6.3	0.0	6.3	6.3	0.0
FreeOutfall02	5.5	5.5	0.0	5.5	5.5	0.0	5.5	5.5	0.0	5.5	5.5	0.0	5.5	5.5	0.0	5.5	5.5	0.0
FREEOUTFALL03	6.0	6.0	0.0	6.0	6.0	0.0	6.0	6.0	0.0	6.0	6.0	0.0	6.0	6.0	0.0	6.0	6.0	0.0
FreeOutfall04	5.9	5.9	0.0	5.9	5.9	0.0	5.9	5.9	0.0	5.9	5.9	0.0	5.9	5.9	0.0	6.0	5.9	0.0
GRAN-CEDAR	4.8	4.6	-0.3	5.0	4.7	-0.3	5.2	4.9	-0.2	5.3	5.1	-0.2	5.4	5.2	-0.3	5.5	5.2	-0.3
GRAN-DESOT	4.8	4.5	-0.3	4.9	4.6	-0.3	5.1	4.9	-0.3	5.3	5.0	-0.3	5.4	5.1	-0.3	5.4	5.2	-0.3
GRAN-KI2CE	4.9	4.9	-0.1	5.0	4.9	-0.1	5.2	5.1	-0.1	5.3	5.2	-0.2	5.5	5.3	-0.2	5.5	5.3	-0.2
MAR-HED	5.7	5.7	0.0	5.9	5.9	0.0	6.1	6.1	0.0	6.2	6.2	0.0	6.3	6.3	0.0	6.3	6.3	0.0
MAR-HEDO	5.7	5.7	0.0	5.9	5.9	0.0	6.0	6.0	0.0	6.1	6.1	0.0	6.2	6.2	0.0	6.2	6.2	0.0
MAR-HED-O-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
MAR-HED-O-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
MARINE	4.9	4.9	0.0	5.1	5.1	0.0	5.3	5.3	0.0	5.5	5.5	0.0	5.7	5.7	0.0	5.7	5.7	0.0
MARINE-OUT	3.7	3.7	0.0	3.8	3.8	0.0	3.8	3.8	0.0	4.4	4.4	0.0	5.7	5.7	0.0	5.7	5.7	0.0
MARI-SANCH	3.8	2.6	-1.2	4.0	3.0	-1.1	4.4	3.6	-0.8	4.7	4.1	-0.6	4.9	4.4	-0.5	4.9	4.5	-0.4

Table B2. Revised Existing Conditions vs Proposed Conditions Model Peak Stage Comparison Summary (CONTINUED)

	Mean Annual			5 Year			10 Year			25 Year			50 Year			100 Year		
Node ID	Rev. Existing Stage (ft)	Proposed Stage (ft)	Δ (ft)	Rev. Existing Stage (ft)	Proposed Stage (ft)	Δ (ft)	Rev. Existing Stage (ft)	Proposed Stage (ft)	Δ (ft)	Rev. Existing Stage (ft)	Proposed Stage (ft)	Δ (ft)	Rev. Existing Stage (ft)	Proposed Stage (ft)	Δ (ft)	Rev. Existing Stage (ft)	Proposed Stage (ft)	Δ (ft)
MAR-OUT-A	3.2	3.2	0.0	3.2	3.2	0.0	3.2	3.2	0.0	3.3	3.3	0.0	3.4	3.4	0.0	3.4	3.4	0.0
MAR-OUT-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
MAR-STFRAN	4.9	4.9	0.0	5.1	5.1	0.0	5.3	5.3	0.0	5.5	5.5	0.0	5.7	5.7	0.0	5.7	5.7	0.0
MAR-TREM	4.9	4.9	0.0	5.1	5.1	0.0	5.3	5.3	0.0	5.5	5.5	0.0	5.7	5.7	0.0	5.7	5.7	0.0
MATA-O	3.4	3.4	0.0	3.4	3.4	0.0	3.5	3.5	0.0	3.5	3.5	0.0	3.6	3.6	0.0	3.6	3.6	0.0
MATA-OUT-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
MATA-OUT-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
NON-CONTRIB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SOUT-MARIA	3.6	1.5	-2.1	3.8	1.5	-2.3	4.2	1.5	-2.6	4.4	3.0	-1.5	4.6	3.0	-1.6	4.7	3.1	-1.7
SOUT-OUTF2	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
SOUT-OUTFA	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
STFRAN-O-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
STFRAN-O-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
STGE-CATHE	6.4	6.4	0.0	6.4	6.4	0.0	6.4	6.4	0.0	6.4	6.4	0.0	6.5	6.5	0.0	6.5	6.5	0.0
STGE-HYPOL	6.3	6.3	0.0	6.4	6.4	0.0	6.4	6.4	0.0	6.5	6.5	0.0	6.5	6.5	0.0	6.5	6.5	0.0
STGE-TREAS	6.0	6.0	0.0	6.0	6.0	0.0	6.2	6.2	0.0	6.3	6.3	0.0	6.4	6.4	0.0	6.5	6.5	0.0
TREA-AVENI	5.5	5.5	0.0	5.9	5.9	0.0	6.2	6.2	0.0	6.3	6.3	0.0	6.4	6.4	0.0	6.5	6.5	0.0
TREA-SPANI	5.8	5.8	0.0	5.9	5.9	0.0	6.0	6.0	0.0	6.1	6.1	0.0	6.2	6.2	0.0	6.3	6.3	0.0
TREM	4.8	4.8	0.0	5.1	5.1	0.0	5.3	5.3	0.0	5.5	5.5	0.0	5.6	5.6	0.0	5.6	5.6	0.0
TREM-OUT-A	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
TREM-OUT-B	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0	2.9	2.9	0.0
VALE-CORDO	5.5	5.5	0.0	5.6	5.6	0.0	5.8	5.7	0.0	5.9	5.8	0.0	6.0	5.9	0.0	6.0	6.0	0.0
VALE-SEVIL	5.7	5.7	0.0	5.8	5.8	0.0	5.9	5.9	0.0	6.0	6.0	0.0	6.1	6.1	0.0	6.1	6.1	0.0

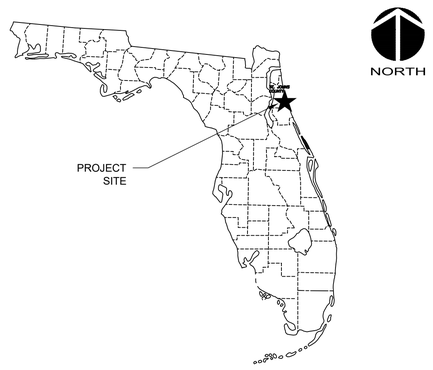
APPENDIX C

SWMM Model Input and Output Reports

Input/Output Available Upon Request

LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT

MCE PROJ. NO. 072050002
FEMA GRANT NO. DR-4283-22-R
60% CLIENT SUBMITTAL
SEPTEMBER 2019 NOT FOR CONSTRUCTION



VICINITY MAP NOT TO SCALE

PROJECT NAME: LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT

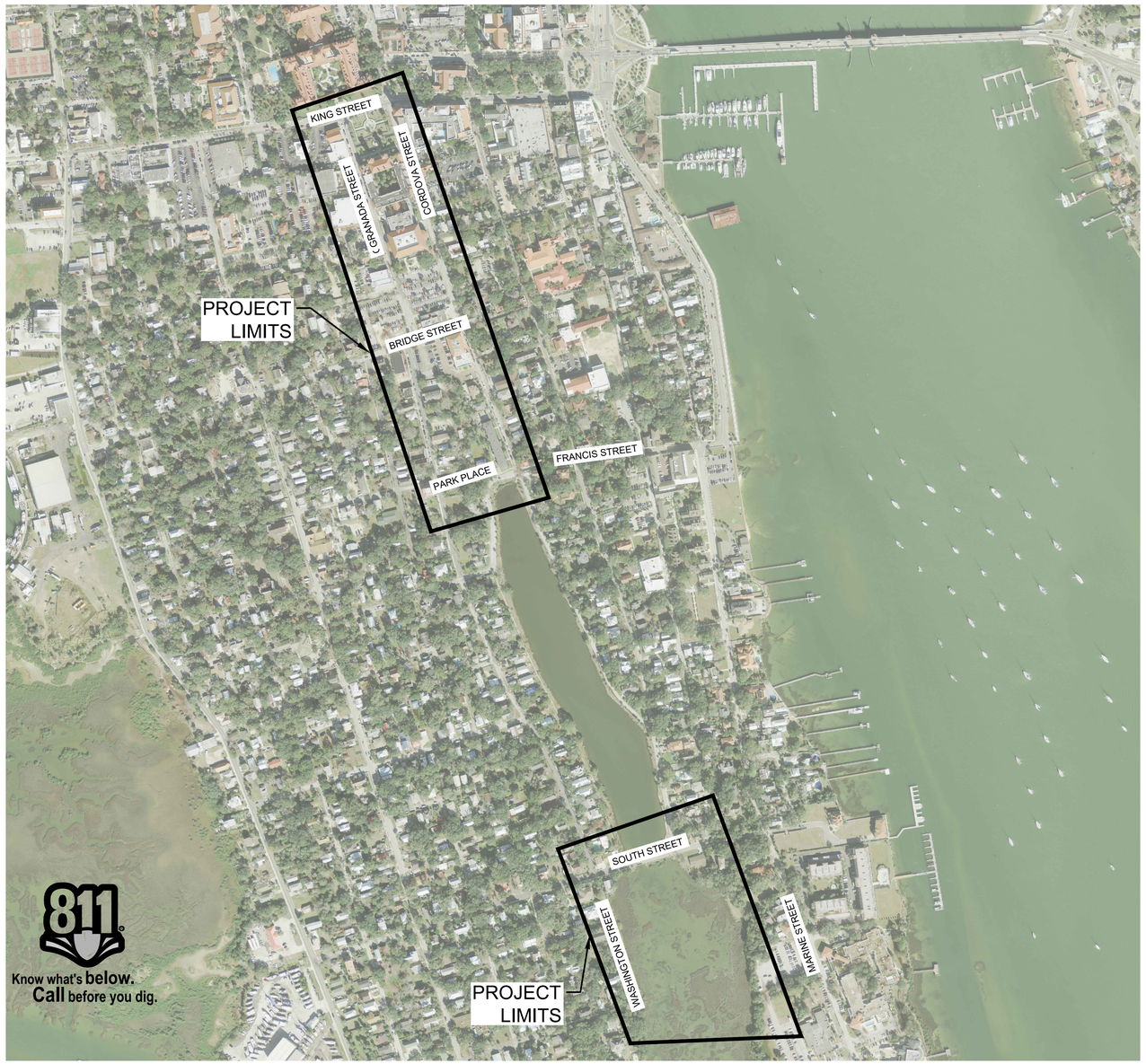
OWNER/DEVELOPER:
CITY OF ST.AUGUSTINE, FLORIDA

CITY OF ST AUGUSTINE EST. 1565

McKIM & CREED
139 Executive Circle, Suite 201
Daytona Beach, FL 32114-7102
Phone: (386) 274-2828, Fax: (386) 274-1393

CA Lic. No. 29588
www.mckimcreed.com

PROJECT INFORMATION



SITE MAP SCALE: 1" = 300'

PROJ. NO. 072050002 LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT

SUBMITTAL DATE: SEPTEMBER 2019



REV NO.	DESCRIPTION	DATE
-	----	

REVISIONS

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Daytona Beach, FL 32114-7102
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CITY OF ST AUGUSTINE EST. 1565

THE CITY OF
ST. AUGUSTINE

LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT

GENERAL

KEY MAP

PROJ. START DATE:	2019/JAN
MCE PROJ. #	072050002
DRAWN	DMP
DESIGNED	CHH
CHECKED	-
PROJ. MGR.	-

SCALE
HORIZONTAL: AS NOTED
VERTICAL: N/A

G-2
DRAWING NUMBER
A
REVISION

STATUS: 30% DESIGN SUBMITTAL NOT FOR CONSTRUCTION



Line Table: Alignments

Line #	Length	Direction	Start Point	End Point
L1	600.627	N73° 56' 03.34"E	(557546.29,2017424.39)	(558123.46,2017590.61)
L2	61.761	N23° 04' 37.21"E	(557241.53,2019137.75)	(557265.74,2019194.57)
L3	714.674	N20° 50' 22.75"W	(557265.74,2019194.57)	(557011.49,2019862.48)
L4	150.564	N19° 22' 19.01"W	(557011.49,2019862.48)	(556961.55,2020004.52)
L5	907.233	N18° 35' 15.00"W	(556961.55,2020004.52)	(556672.37,2020864.43)
L6	300.002	N71° 28' 28.22"E	(556759.99,2019786.27)	(557044.45,2019881.59)
L7	1074.995	N18° 32' 49.77"W	(556825.43,2019778.97)	(556483.49,2020798.13)
L8	300.207	N71° 26' 17.29"E	(556728.03,2019926.09)	(557012.62,2020021.66)

REV.NO.	DESCRIPTION	DATE
-	---	

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THE CITY OF ST. AUGUSTINE

LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT

GENERAL

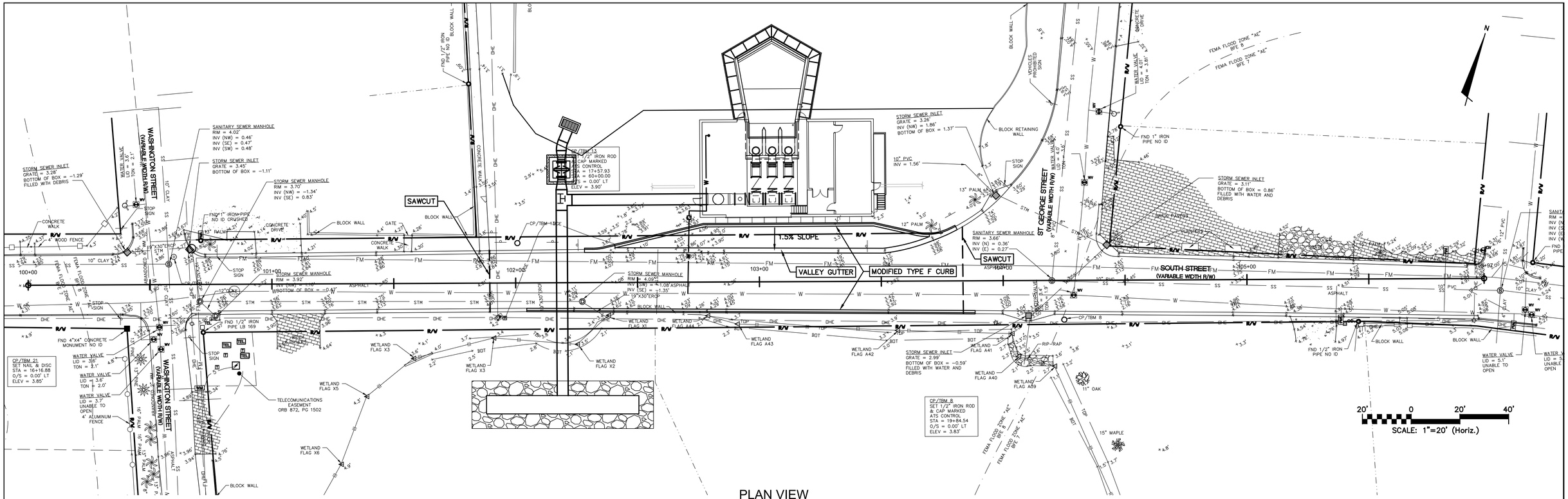
HORIZONTAL CONTROL PLAN

PROJ. START DATE:	2019/JAN
MCE PROJ. #	072050002
DRAWN	DMP
DESIGNED	CHH
CHECKED	-
PROJ. MGR.	-

SCALE
HORIZONTAL: AS SHOWN
VERTICAL: N/A

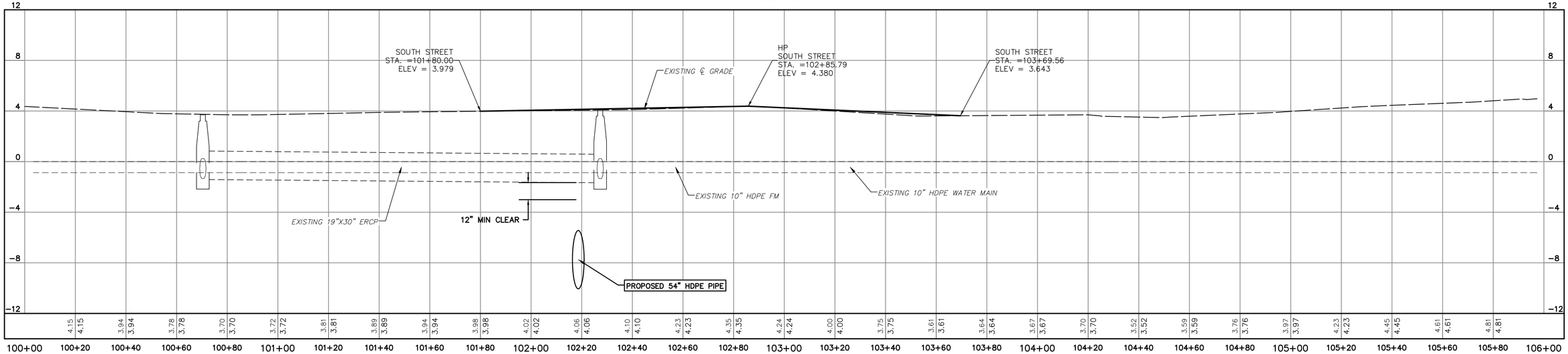
DRAWING NUMBER: G-3
REVISION: A

STATUS: 30% DESIGN SUBMITTAL NOT FOR CONSTRUCTION



PLAN VIEW

HORIZ: 1"=20'



PROFILE VIEW

VERT: 1"=4'

REV.NO.	DESCRIPTION	DATE
A	ISSUED FOR BID - NOT FOR CONSTRUCTION	16 SEP 2019

REVISIONS

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CITY OF ST AUGUSTINE EST. 1565

THE CITY OF
ST. AUGUSTINE

LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT

CIVIL

SOUTH STREET STA. 100+00 TO 104+00

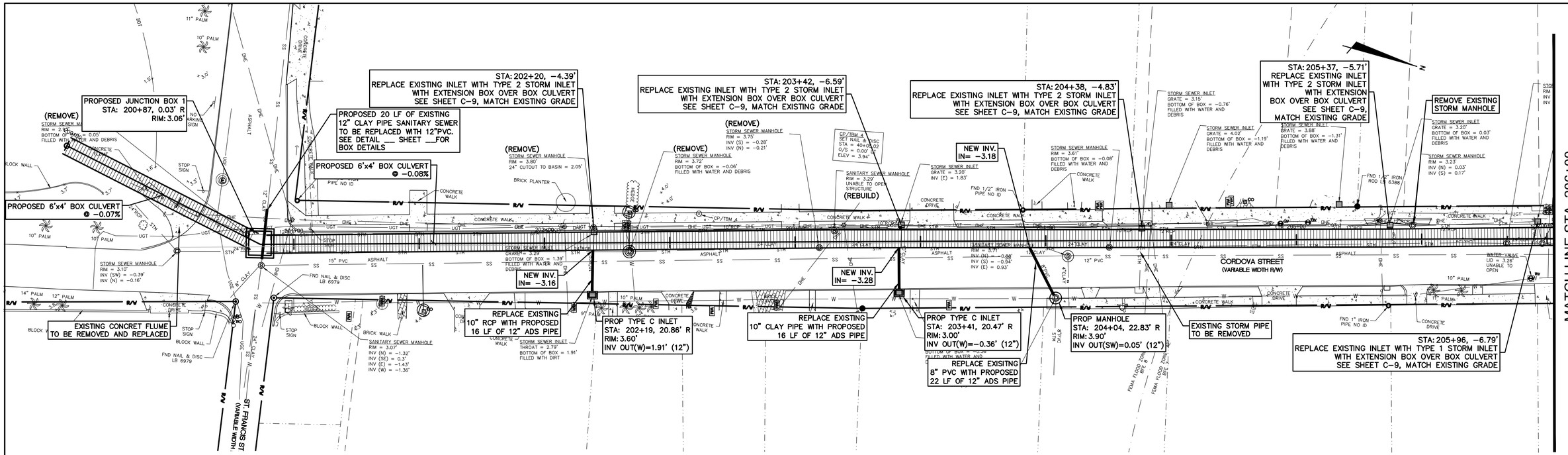
PROJ. START DATE:	2019/SEPT
MCE PROJ. #	072050002
DRAWN	DMP
DESIGNED	CHH
CHECKED	-
PROJ. MGR.	-

SCALE
HORIZONTAL: AS NOTED
VERTICAL: AS NOTED

C-1
DRAWING NUMBER
A
REVISION

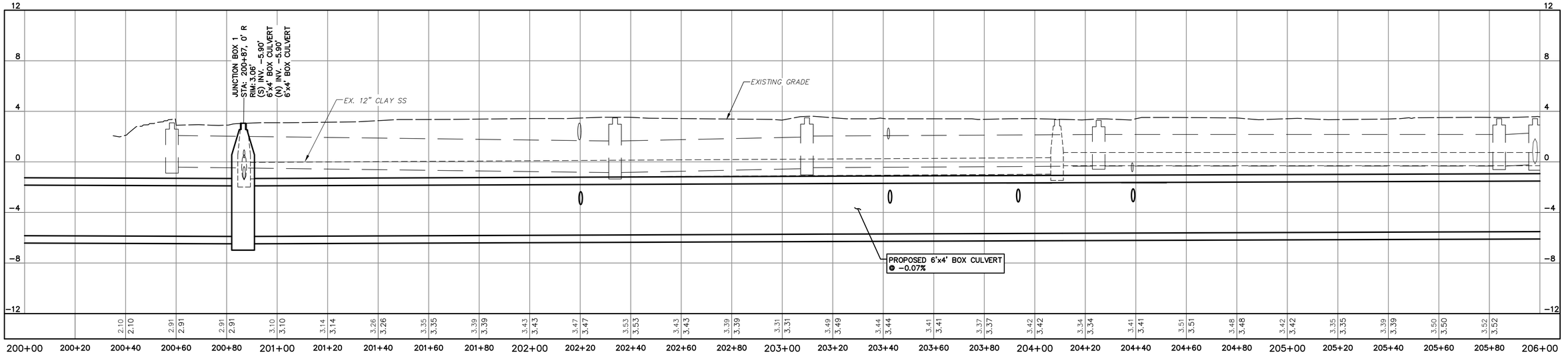
STATUS: ISSUE FOR PERMIT
NOT FOR CONSTRUCTION

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PLAN VIEW
HORIZ: 1"=20'

NOTES:
1. REMOVE AND DISPOSE OF ALL EXISTING STORM DRAIN PIPES IN THE VICINITY OF THE BOX CULVERT CONSTRUCTION.



PROFILE VIEW
VERT: 1"=4'

REV.NO.	DESCRIPTION	DATE
A	ISSUED FOR BID - NOT FOR CONSTRUCTION	16 SEP 2019

REVISIONS

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THE CITY OF
ST. AUGUSTINE

LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT

CIVIL

CORDOVA STREET STA. 200+00 TO 206+00

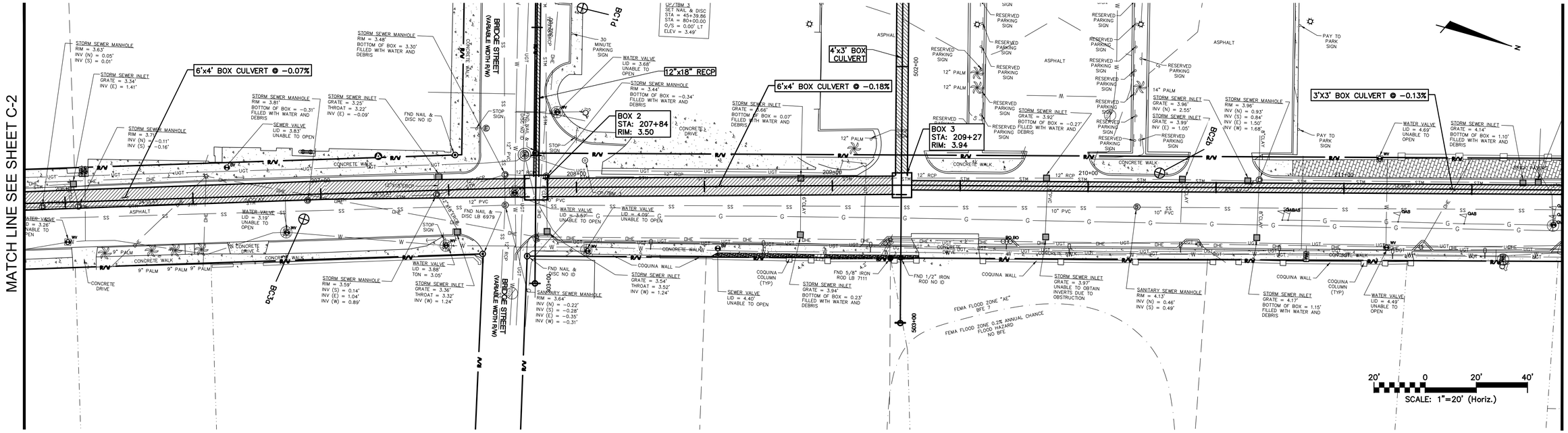
PROJ. START DATE:	2019/SEPT
MCE PROJ. #	072050002
DRAWN	DMP
DESIGNED	CHH
CHECKED	.
PROJ. MGR.	.

SCALE
HORIZONTAL: AS NOTED
VERTICAL: AS NOTED

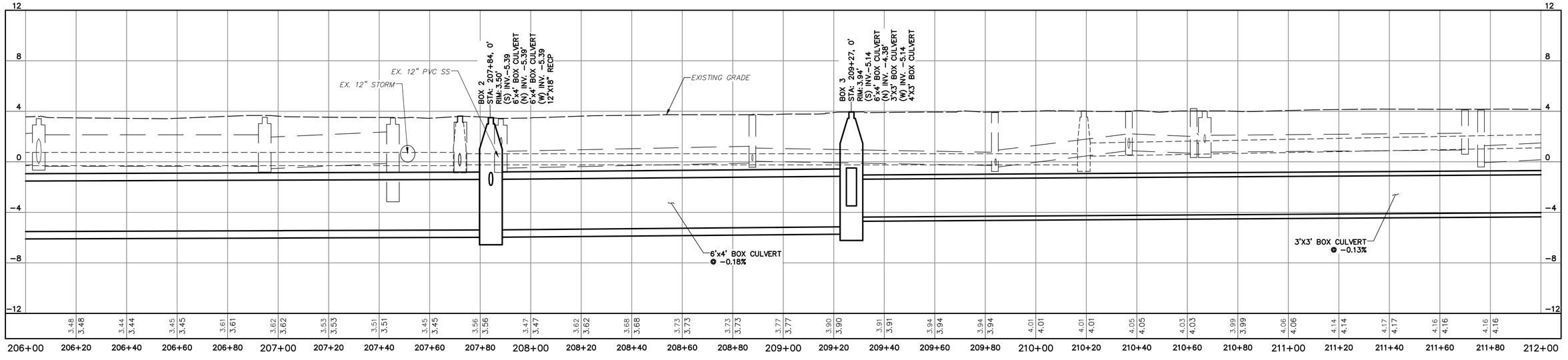
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REVISION

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PLAN VIEW
HORIZ: 1"=20'



PROFILE VIEW
VERT: 1"=4'

REV.NO.	DESCRIPTION	DATE
.	---	

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CITY OF ST AUGUSTINE EST. 1565

THE CITY OF ST. AUGUSTINE

LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT

CIVIL

CORDOVA STREET STA. 206+00 TO 212+00

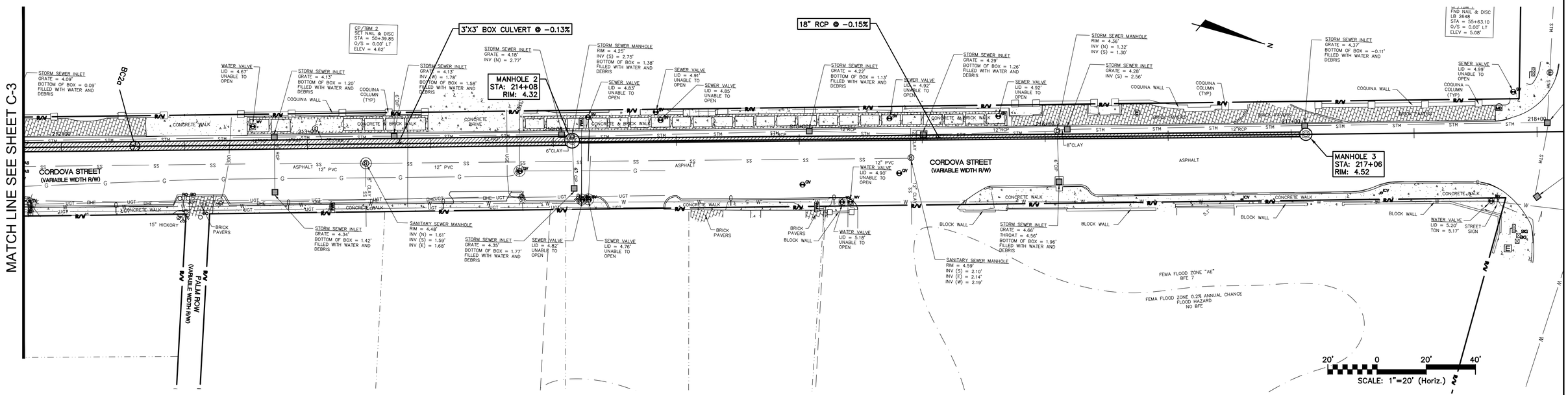
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MCE PROJ. #	072050002
DRAWN	DMP
DESIGNED	CHH
CHECKED	.
PROJ. MGR.	.

SCALE
HORIZONTAL: AS NOTED
VERTICAL: AS NOTED

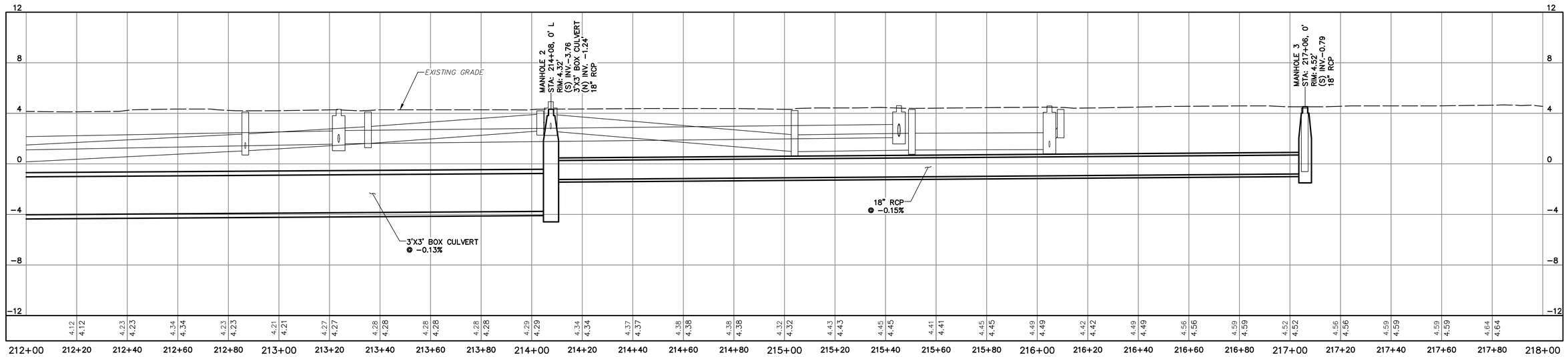
C-3
DRAWING NUMBER
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PLAN VIEW
HORIZ: 1"=20'



PROFILE VIEW
VERT: 1"=4'

REV.NO.	DESCRIPTION	DATE
-	---	

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CIVIL

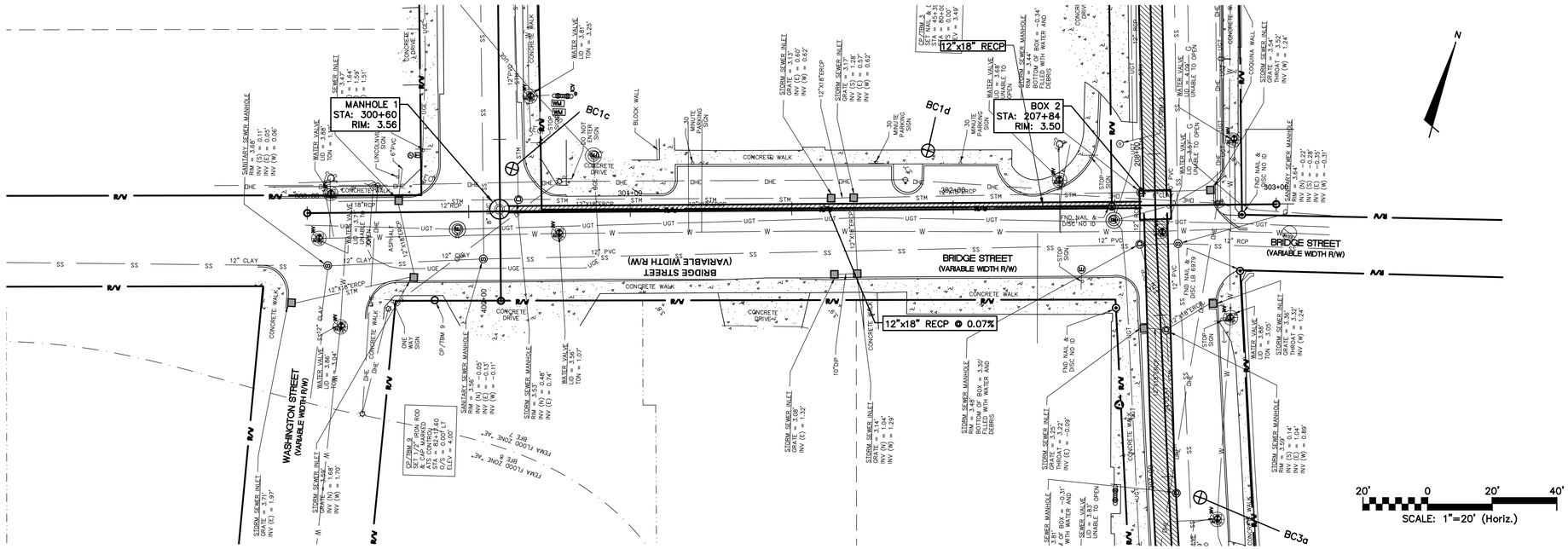
CORDOVA STREET STA. 212+00 TO 217+00

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DRAWN	DMP
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PROJ. MGR.	-

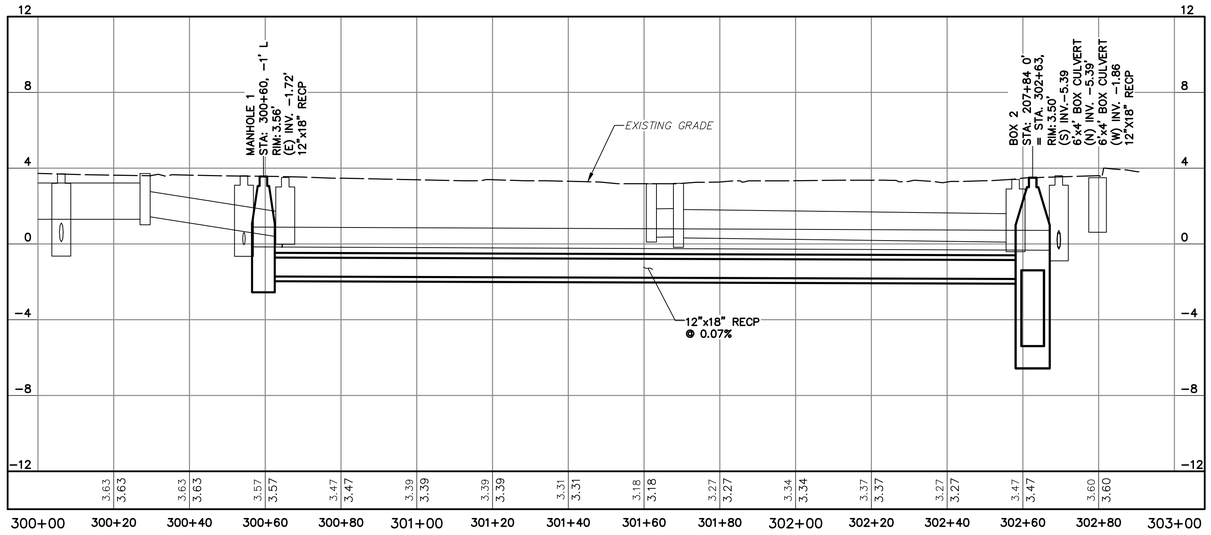
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VERTICAL: AS NOTED

C-4
DRAWING NUMBER
-
REVISION

STATUS: 30% CLIENT SUBMITTAL NOT FOR CONSTRUCTION



PLAN VIEW
HORIZ: 1"=20'



PROFILE VIEW
VERT: 1"=4'

REV.NO.	DESCRIPTION	DATE
---	---	---

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LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT

CIVIL

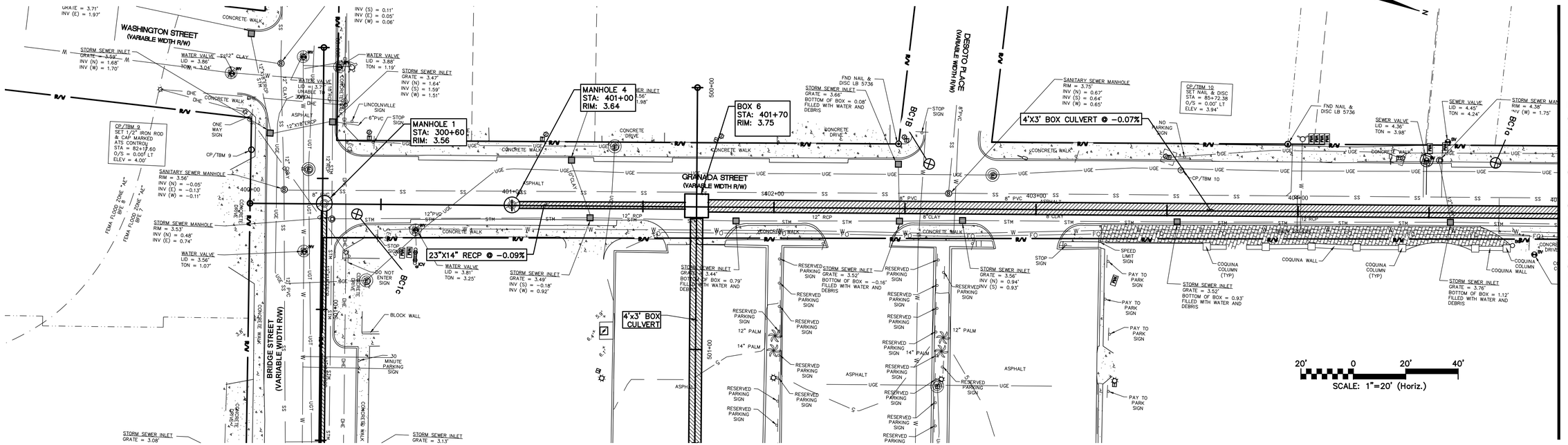
BRIDGE STREET STA. 300+00 TO 306+00

PROJ. START DATE:	2019/JAN
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DRAWN	DMP
DESIGNED	CHH
CHECKED	.
PROJ. MGR.	.

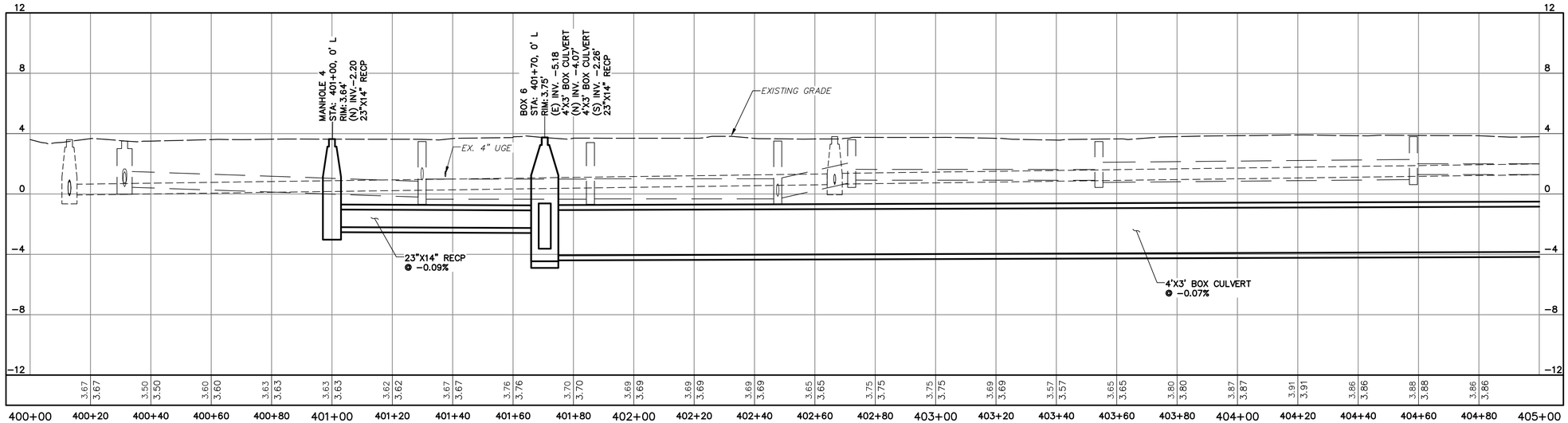
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HORIZONTAL: AS NOTED
VERTICAL: AS NOTED

C-5
DRAWING NUMBER
.
REVISION

STATUS: 30% CLIENT SUBMITTAL NOT FOR CONSTRUCTION



PLAN VIEW
HORIZ: 1"=20'



PROFILE VIEW
VERT: 1"=4'

REV.NO.	DESCRIPTION	DATE
-	---	

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LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT

CIVIL

GRANADA STREET STA. 400+00 TO 405+00

PROJ. START DATE:	2019/JAN
MCE PROJ. #	072050002
DRAWN	DMP
DESIGNED	CHH
CHECKED	-
PROJ. MGR.	-

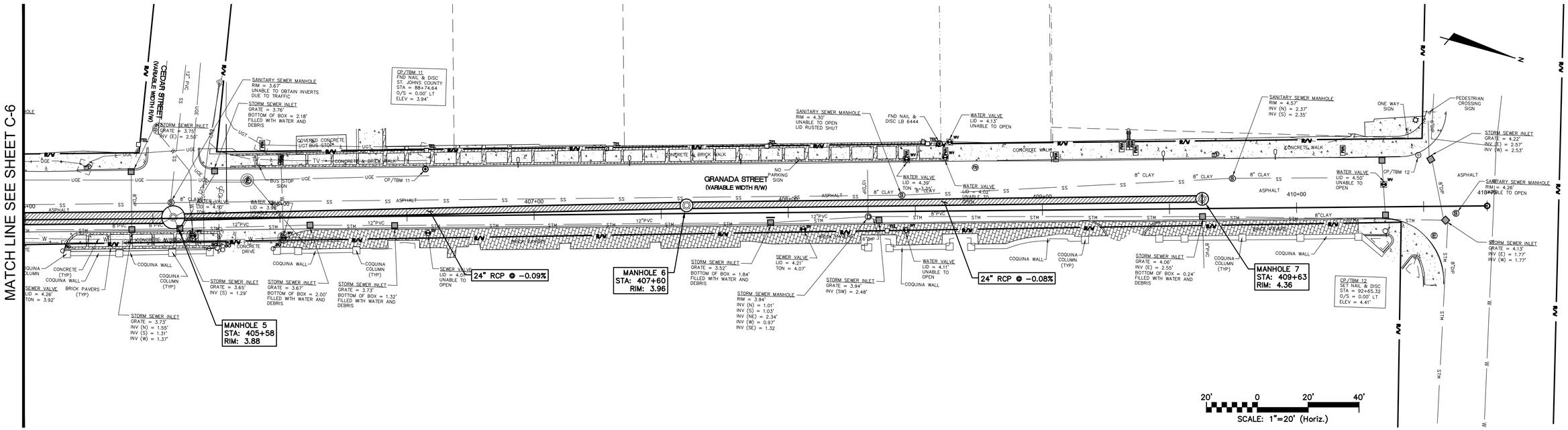
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HORIZONTAL: AS NOTED
VERTICAL: AS NOTED

C-6
DRAWING NUMBER
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REVISION

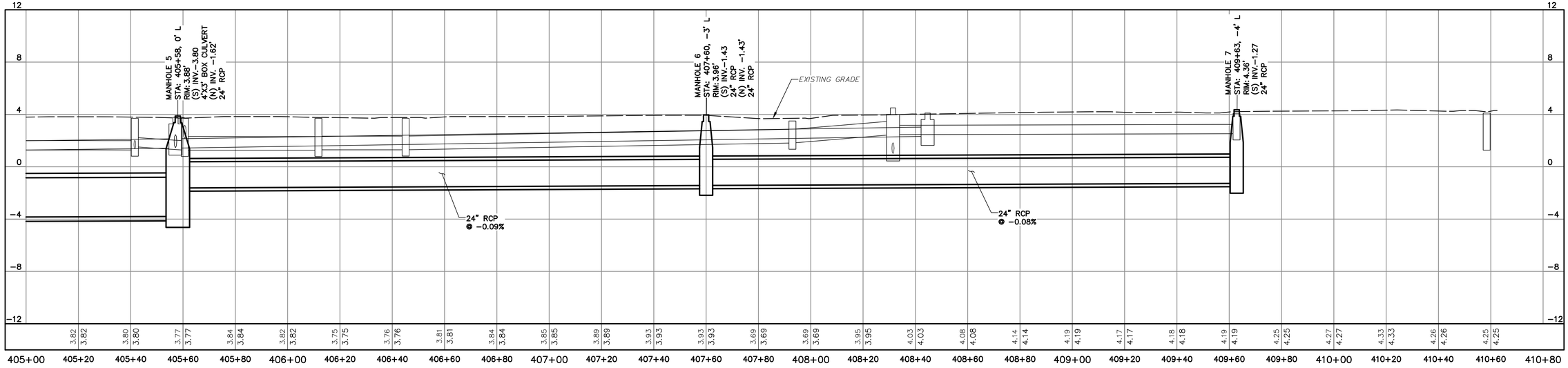
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S:\07205\0002\80-DRAWINGS\CIVIL\CS101-072050002.DWG 08/14/2019 10:23:53 DOREEN PADGETT

MATCH LINE SEE SHEET C-6



PLAN VIEW
HORIZ: 1"=20'



PROFILE VIEW
VERT: 1"=4'

REV.NO.	DESCRIPTION	DATE
-	---	

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CIVIL

GRANADA STREET STA. 405+00 TO 410+50

PROJ. START DATE:	2019/JAN
MCE PROJ. #	072050002
DRAWN	DMP
DESIGNED	CHH
CHECKED	-
PROJ. MGR.	-

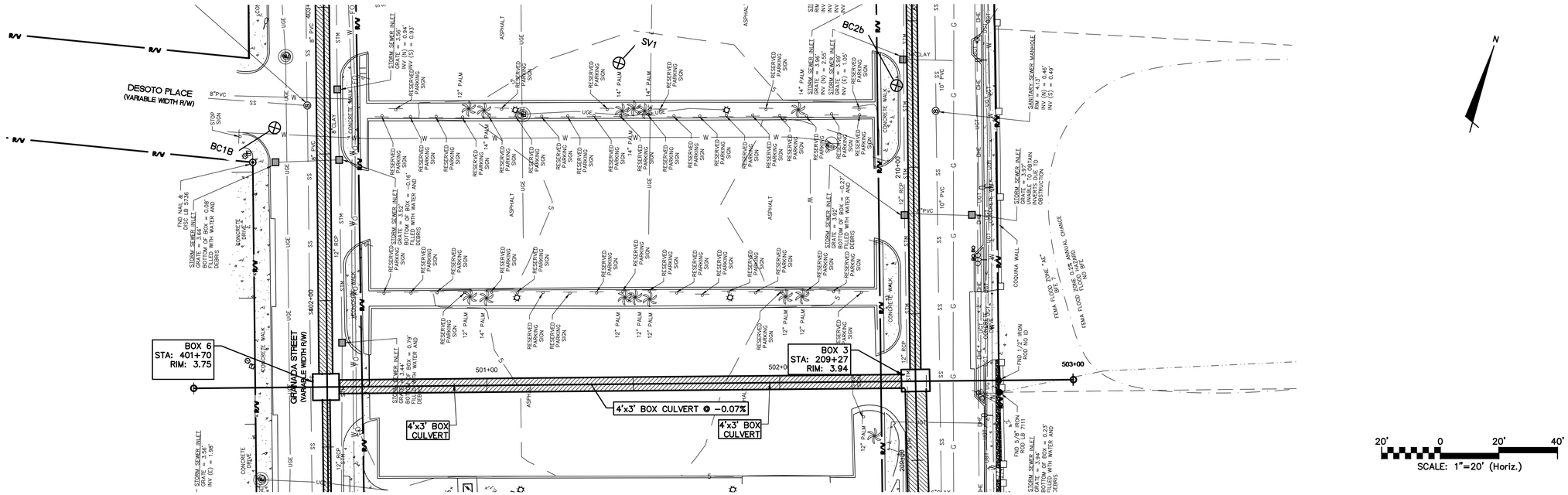
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HORIZONTAL: AS NOTED
VERTICAL: AS NOTED

C-7
DRAWING NUMBER
-
REVISION

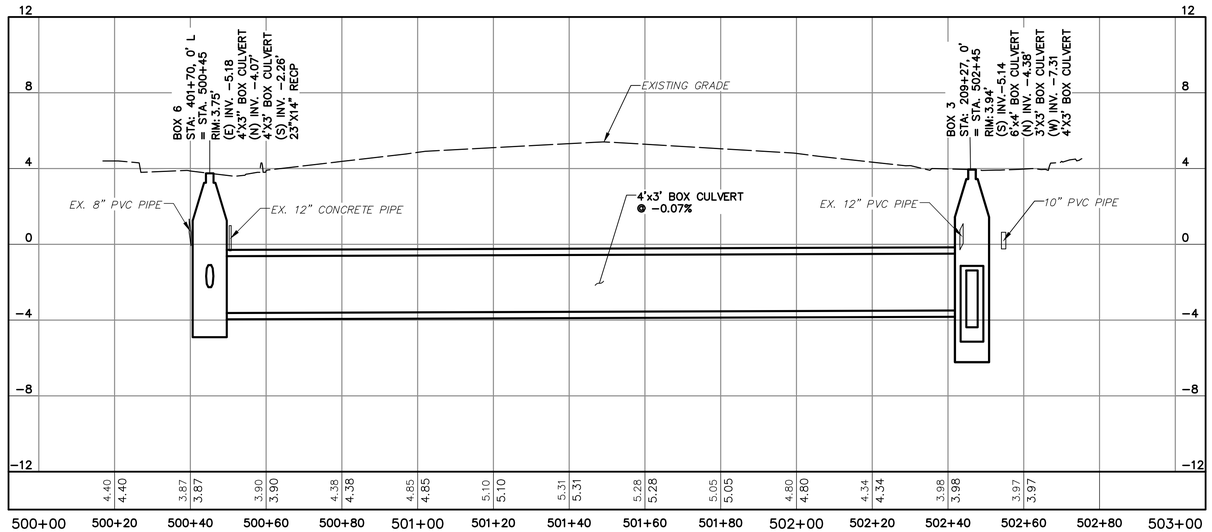
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S:\07205\0002\80-DRAWINGS\CIVIL\CS101-072050002.DWG 07/24/2019 08:43:36 CATHY WALKER



PLAN VIEW
HORIZ: 1"=20'



PROFILE VIEW
VERT: 1"=4'

REV.NO.	DESCRIPTION	DATE
-	---	

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LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT

CIVIL

PARKING LOT STA. 500+00 TO 505+00

PROJ. START DATE:	2019/JAN
MCE PROJ. #	072050002
DRAWN	DMP
DESIGNED	CHH
CHECKED	-
PROJ. MGR.	-

SCALE
HORIZONTAL: AS NOTED
VERTICAL: AS NOTED

C-8
DRAWING NUMBER
-
REVISION

STATUS: 30% CLIENT SUBMITTAL NOT FOR CONSTRUCTION

APPENDIX IV

Outfall Evaluation

CITY OF ST. AUGUSTINE

LAKE MARIA SANCHEZ FLOOD MITIGATION

Basis of Design Report

September 2019

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**	*Project Name:* **Lake Maria Sanchez FEMA Project**
Time: **12:35 PM**	*City Project /FEMA Project#:* **ENG2017-1008 / DR-4283-22-R**
Location: **Multiple**	*Project Location:* **Multiple**

- City staff evaluated in the field the various stormwater outfalls that were identified in the Lake Maria Sanchez project scope (Table 1-2) in the HMGP Engineers Report.

- Staff took measurements and identified conditions of the existing infrastructure to determine and/or assess feasibility of an end of pipe valve installation as part of the project design. This was primarily to verify the GIS data that was available was consistent with the field evaluation.

Photographs of Outfall Areas



OF-0054 – Artillery Lane/Marina. Two, plastic/PVC pipes. We were not able to access to measure.

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0054. Upstream manhole that is deep (20-feet). Could see 2 pipes from this MH running east.



OF-0054. Upstream inlet in Avenida Menendez and Vault box (locked, not able to access) but did note standing water in inlet, suspect valve if there is not working and would need to be replaced.

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0062. Avenida Menendez @ Bravo Lane. Confirmed no pipe or discharge point/outfall in this location.



OF-0063. Marine Street. Upstream inlet in Marine Street. 10-inch PVC pipe in the inlet basin discharging to the east. Basin would need to be replaced to accommodate valve if did upstream retrofit.

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0063. Marine Street. Upstream inlet in Marine Street. 10-inch PVC pipe in the inlet basin discharging to the east. Basin would need to be replaced to accommodate valve if did upstream retrofit.

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0063. Marine Street. Outfall area. Noted it was an 8-inch clay pipe at outfall. Could not locate the 10-inch PVC, possibly buried under shell mound. Will need to flush the line to determine if more than one outfall.



OF-0063. Marine Street. Outfall area. Noted it was an 8-inch clay pipe at outfall. Could not locate the 10-inch PVC, possibly buried under shell mound. Will need to flush the line to determine if more than one outfall.

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0071. San Salvador. Existing duckbill that could be replaced. Recent work done to provide outfall/discharge path.

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0072. Tremerton Place. Outfall is located just past the marsh grass. Will need to access at low tide to confirm measurements and condition.

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0072. Tremerton Place. Upstream manhole is 24-inch diameter. Possible location for valve.

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0074. Bonita Bay Drive. Outfall area.

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0074. Bonita Bay Drive. Outfall pipe.

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0074. Bonita Bay Drive. Upstream manhole, inside.

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0074. Bonita Bay Drive. Upstream manhole at Tremerton Place – Stormceptor system inside.

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0074. Bonita Bay Drive. Upstream storm inlet at Tremerton Place.

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0075. South Street storm inlet upstream of outfall. Needs to be replaced (corroded/warped from salt water).

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0075. South Street outfall area.

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0075. South Street outfall pipe. 15-inch plastic pipe.

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0077. South Street outfall area.

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0078. Upstream inlet of outfall area.

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0078. Upstream inlet of outfall area.

NOTE TO PROJECT FILE ▪ PUBLIC WORKS DEPARTMENT

Date: **3/14/2019**
Time: **12:35 PM**
Location: **Multiple**

Project Name: **Lake Maria Sanchez FEMA Project**
City Project /FEMA Project#: **ENG2017-1008 / DR-4283-22-R**
Project Location: **Multiple**



OF-0078. Outfall pipe. May consider integrating into bulkhead design.



OF-0078. Outfall area.

Lake Maria Sanchez Project - Outfalls for Tide Check Valve Retroftting

Outfall ID	Project Component/Location	Included in the Master Outfall Data Collection Notebook		Included in the Lake Maria Sanchez Scope (HMGP Report Table 1-2)		Inspected in the field		COSA Comments	ASCI Comments	COSA Follow up Comments	COSA Add'l Field Notes See Field Notes with Maps
		Yes	No	Yes	No	Yes	No				
TBD	LMS Outlet Structure		X	X			X	Part of the new structure for the project, 2 @24"	Acknowledged	None	
SWGM000446	Bridge St @ Sanford St		X	X			X	This would be part of the existing storm infrastructure and not an outfall. GIS shows this as an elliptical RCP pipe.	Acknowledged	Per discussion, this may not need a valve in this location	
SWGM000848 (N) SWGM000854 (S)	Carrera St		X	X			X	This would be part of the storm infrastructure and not an outfall. Is this at Carrera and Sevilla or Carrera and Cordova? There is a double storm pipe shown at Sevilla, which would match up with Table 1-2	Carrera Street Between Riberia and Sevilla	This may need a valve, ties into FDOT outfall w/o valve, per discussion with ASCI depending on the level of projection desired this would determine exact location, would need to install to prevent intrusion of water from outside project limits that could impact this project.	NW IB # 0456, 8" clay, lateral pipe coming out from IB - from bottom to top of pipe 16"; SW IB# 0458 10" clay, from bottom to top of pipe 11"; SE IB # 0459 - 10" lined, has new grate, from bottom to top of pipe, 16"; NE IB # 0461 8" clay, lateral pipe coming out from IB - from bottom to top of pipe 17"; IB # 0460 (north of IB 0461), 10" clay, needs cleaning;
SWGM000270	Valencia St		X	X			X	This would be part of the storm infrastructure and not an outfall.	Valencia Street Near Markland PL	Depending on the level of projection desired this would determine exact location, would need to install to prevent intrusion of water from outside project limits that could impact this project	NE IB# 0422 - 12" main line, from bottom to top of pipe 19"; SE IB# 0423, lateral out pipe 6" PVC; from bottom to top of pipe 19"; NW IB# 0424 - 12" main line, from bottom to top of pipe 24"
OF-0046	Avenida Menendez @ Fort		X	X			X	Very northern outfall (FDOT?) at the Fort parking lot	Likely FDOT	FDOT has plans to install Tideflex Valves along the Bayfront, currently underway, confirm with FDOT which outfalls are being retrofitted and the schedule	
OF-0050 OF-0051	Avenida Menendez @ Hypolita St		X	X			X	2, 24" pipes in this area (FDOT)	Agreed	FDOT has plans to install Tideflex Valves along the Bayfront, currently underway, confirm with FDOT which outfalls are being retrofitted and the schedule	
OF-0047	Avenida Menendez just North of Treasury St		X	X			X	Table 1-2 shows this as 1, 48" RCP pipe (FDOT), but our GIS shows this as a 12-inch clay outfall (mis-referenced with OF-0045?)	Agreed, flipped with 0045	FDOT has plans to install Tideflex Valves along the Bayfront, currently underway, confirm with FDOT which outfalls are being retrofitted and the schedule	
OF-0045	Avenida Menendez @ Treasury St		X	X			X	Table 1-2 shows this as 1, 12" pipe (FDOT), but our GIS shows this as a 48-inch –pipe (mis-referenced with OF-0047?)	Agreed, flipped with 0047	FDOT has plans to install Tideflex Valves along the Bayfront, currently underway, confirm with FDOT which outfalls are being retrofitted and the schedule	
OF-0053 OF-0157	Bridge of Lions		X	X			X	Two outfalls located directly north of the Bridge of Lions (FDOT)	Correct	FDOT has plans to install Tideflex Valves along the Bayfront, currently underway, confirm with FDOT which outfalls are being retrofitted and the schedule	
OF-0052	King Street		X	X			X	Notebook may have labeled this one as OF-0213? Did not see this one while we were in the field, may need to go back and verify it is there. Shows up in our GIS under the "old storm" data (FDOT)	Acknowledged verification is needed	Did not see this outfall, will need to go back at low tide to confirm if it exists or not.	There was evidence in the field that the pipe/outfall may be there, crew will go back out to verify and take measurements

OF-0054	Artillery Lane/Municipal Marina	X		X		X		Did note in the field that there were two outfall pipes (not one as shown in our current GIS layout). Table 1-2 shows this as 1, 12" PVC, but in the field there are two. The "old storm" data set shows this as two outfalls that tie into the upstream manhole (MH-0570). We located a manhole (shown in location on current GIS, not in the "old storm" location) that is under a tree that would have to be removed or trimmed to gain access into the MH. May be easier to retrofit in the upstream system along Avenida Menendez (IB-1637)	Looks like there is an upstream backflow preventer in the inventory, at avenida Menendez. Verification is needed. Note that if backflow preventer is installed too far upstream, water may bubble out of inlets/manholes downstream.	We could not access the vault system, required a special key that we did not have. Scheduled for follow up inspection. Did note standing water in the street inlet, if there is a valve in place, it may not be functioning or needs replacement. We were able to access the manhole, it is very deep (20 feet?) and would not be easily accessible. Need to consider upstream retrofit in the vault or inlet.	Crew was able to access, there is a flap 18" (similar style to the Seawall outfalls) inside the vault located near the street, on the side closest to sidewalk, pipe going out is 17" PVC I.D., see sketch on field notes; also the twin outfall pipes at the Marina are 11-inch I.D. PVC
OF-0062	Avenida Menendez @ Bravo Lane		X	X			X	Listed in Table 1-2 as 24-inch concrete with valve, on "old storm" data set this is shown as an old outfall (OF-0062, 24-inch), need to verify if there is an outfall here or not and determine if this really needs to be retrofitted or not. The current GIS shows this as an inlet basin (SWIN000553) and not an outfall (part of the Seawall project, inlet P-5, 18 inch RCON), the outfall that this ties into is an 18-inch RCON pipe (SWGM001047) at the Bridge St and Aven. Men. Outfall that has a valve (flap gate) that needs to be replaced with an inline check valve.	Acknowledged verification is needed	AM as builts show "existing pipe to remain" that may be the "old storm" pipe. Inspected in the field and there is no storm outfall here. Only the 3 outfalls along the AM Seawall. As Built Plans also show 18-inch RCP pipe (AB sheet 2 of 7). Also, plans indicate it is connected to the main system that would outfall near Bridge street (S-106). Need to replace flap gate with inline style check valve.	Measurements of the outfall pipe at the seawall differ than As Builts; OF-0159 is 24" I.D. corrugated plastic (not 18")
OF-0159	Avenida Menendez @ Bridge Street		X	X			X	Listed in Table 1-2 as 24-inch concrete with valve, on "old storm" data set this is shown as an old outfall (OF-0159, 24-inch), The current GIS data for this location this would be SWGM001047, 18-inch RCON with valve (flap gate), that would need to be replaced with an inline check valve.	Likley 18" RCON with flap gate	As built shows outfall at S-106, 18-inch RCP with flap gate. (AB Sheet 3 of 7). Need to replace flap gate with inline style check valve.	Measurements of the outfall pipe at the seawall differ than As Builts; OF-0159 is 24" I.D. corrugated plastic (not 18")
OF-0056	Avenida Menendez		X	X			X	Listed in Table 1-2 as 10-inch PVC with valve, on "old storm" data set this is shown as an old outfall (OF-0056), The current GIS data for this location this would be SWGM006972, 18-inch RCON with valve (flap gate), that would need to be replaced with an inline check valve.	Likley 18" RCON with flap gate	As built shows outfall at S-207, 18-inch RCP with flap gate. (AB Sheet 4 of 7). Need to replace flap gate with inline style check valve.	Measurements of the outfall pipe at the seawall differ than As Builts; OF-0156 is 24" I.D. corrugated plastic (not 18"), see also hand sketch of pipe, slightly out of round
OF-0061	Avenida Menendez @ St. Francis Street		X	X			X	Listed in Table 1-2 as 8-inch clay with valve, on "old storm" data set this is shown as an old outfall (OF-0061), The current GIS data for this location this would be SWGM007372, 18-inch RCP with valve (flap gate), that would need to be replaced with an inline check valve.	Likley 18" RCON with flap gate	As built shows outfall at S-303, 18-inch RCP with flap gate. (AB Sheet 5 of 7). Need to replace flap gate with inline style check valve.	Measurements of the outfall pipe at the seawall differ than As Builts; OF-0061 is 12" I.D. corrugated plastic (not 18")
OF-0063	Marine Street	X		X		X		Inspected, will need permission from Armory to access the outfall at the waterfront, we did inspect the upstream inlet in the Marine Street ROW, may be possible to install in the road ROW/inlet as the pipe is listed as a 8-inch clay; the box around the inlet top will need to be demolished and replaced to install the valve	Acknowledged, inline at upstream inlet may be alternative	We were able to access outfall with Armory permission. It is an 8-inch clay pipe at the headwall that can get blocked/clogged with oyster shells. No valve present in existing pipe. Storm crew can jet upstream to determine if there is a second outfall location. The GIS shows a different pipe outfall location with a 10-inch PVC that we did not locate at the headwall. It could have been buried under the shell mound.	Crew located second pipe that is connected to the inlet basin. It is located where shown in the current GIS layout. The old pipe that was initially found (8" clay) is disconnected from the inlet basin; actual outfall was not able to be measured because the end of pipe is damaged and needs replacement and/or repairs
OF-0071	San Salvador	X		X		X		Inspected outfall, has an existing duck bill valve in place in fair condition, would need to replace with inline style; recent work around outfall with headwall and trenching	Acknowledged	Same comment, was able to access, outfall area had been recently cleaned out. Would be best to plan to replace the old style duck bill with the new inline design.	

OF-0072	Tremerton Place	X		X		X		Inspected outfall but could not locate the pipe, would need to probe in the area to locate (likely buried) and determine pipe condition (listed as 12-inch clay) and if it would need to be replaced, extended etc. May need to look at the upstream inlet and/or manhole. We saw one manhole that was close by but was listed as "sanitary sewer" and not storm. There are two storm sewer manholes that we could look at possibly installing a valve. Can't install valve in the the storm inlets upstream as they are connected to the manhole and that is the location where the valve needs to be installed.	Shown at different locations in old inventory vs current gis inventory	Would need to go back at low tide to locate the outfall. Storm crew confirmed that it is there, likely near the mangrove stand just beyond the marsh grass.	Crew located the outfall pipe, its shown in the current GIS layout, 12-inch clay I.D.
OF-0074	Bonita Bay Drive	X		X		X		Inspected, will need permission from property owner to access the outfall at the waterfront, we did inspect the upstream inlet in the Street ROW, may be possible to install in the road ROW/inlet, the pipe is listed as a 24-inch RCP; pipe comes in at an angle in the box, would need to replace the box/structure to facilitate valve install and access. Need to check ROW limits, close proximity to several very large palm trees that are part of the landscaping for the private property.	Acknowledged, verification needed.	We were able to access the outfall. There is an old style flap gate on the end of pipe that is rusted and missing the seal. Would need to be replaced with updated design (inline). Confirmed that the pipe size is 24-inch RCP. Pipe also needs cleaning, had sediment, leaves build up inside. No oyster growth. Upstream we accessed the manhole at Tremerton. There is a stormceptor manhole system in place that is not mapped as such. Needs maintenance (build up of sediment that needs to be removed).	
OF-0078	Hedrick Street	X		X		X		Probably best to go upstream and retrofit the existing inlet to accommodate the valve. Table 1-2 lists this as a 10-inch clay. The end of the pipe is in a very overgrown area adjacent to property that may not be easily accessed and would require us to contact the property owner for full access	Will need to be installed where stages wont be able to bubble out of any downstream inlet/manhole	We were able to access the downstream outfall area. It may be best to consider integrating this outfall into the bulkhead design as this would be located near the proposed bulkhead.	
OF-0048	Cordova Street Outfall 2	X			X		X	This is one of the outfalls into Lake Maria Sanchez from St Francis Street. We assumed that a valve would not be needed for this location as the pump station and those associated improvements would address any tidal flooding.	Agreed	None	
OF-0057	Cordova Street Outfall 2	X			X		X	This is one of the outfalls into Lake Maria Sanchez from St Francis Street. We assumed that a valve would not be needed for this location as the pump station and those associated improvements would address any tidal flooding.	Agreed	None	
OF-0060	Park Place Outfall	X			X		X	This is one of the outfalls into Lake Maria Sanchez from Park Place. We assumed that a valve would not be needed for this location as the pump station and those associated improvements would address any tidal flooding.	Agreed	None	
OF-0068	St Francis Street Outfall	X			X		X	This is one of the outfalls into Lake Maria Sanchez from St Francis Street/Park Place. We assumed that a valve would not be needed for this location as the pump station and those associated improvements would address any tidal flooding.	Agreed	None	

OF-0069	Park Place Outfall	X			X		X	This is one of the outfalls into Lake Maria Sanchez from Park Place. We assumed that a valve would not be needed for this location as the pump station and those associated improvements would address any tidal flooding.	Agreed	None	
OF-0070	Cordova Street Outfall 3	X			X		X	This is one of the outfalls into Lake Maria Sanchez from Cordova Street. We assumed that a valve would not be needed for this location as the pump station and those associated improvements would address any tidal flooding.	Agreed	None	
OF-0075	Cordova Street Outfall 4	X			X	X		This is one of the outfalls into the marsh, south of Lake Maria Sanchez from St. George Street. This was not identified in the Table 1-2 but would need to be addressed because we have had tidal flooding at this location. The outfall is a 15-inch round plastic pipe.	Agreed	Confirmed that it needs retrofitting with valve.	
OF-0076	Cordova Street Outfall 4	X			X	X		This is one of the outfalls from the SE corner of Lake Maria Sanchez from St. George Street that connects to OF-0075. This was not identified in the Table 1-2 but may need to be addressed depending on the hydraulics of the design with the pump station.	Not Needed	None	
OF-0077	South Street Outfall	X			X	X		This is one of the outfalls into the marsh, south of Lake Maria Sanchez from Washington Street. This was not identified in the Table 1-2 but would need to be addressed because we have had tidal flooding at this location. The outfall is an elliptical shape, RCP, not clear on the size/diameter, was silted in about 50%.	Agreed	Confirmed that it needs retrofitting with valve. Noted the pipe had silting, needs to be cleaned and is elliptical shape.	

OUTFALL FIELD RECON SHEET

Location Description: Cordova St Outfall 2

OF-0048

Action Required:

Take multiple photos of outfall including a 1) upstream photo looking out toward outfall and 2) downstream photo looking at the face of the outfall. Record outfall ID on each photo. Collect missing Structure Information including diameter, shape, relative depth to top of outfall, and invert. Select material type, presence of valve, and condition of valve. Document any relevant notes and sketches in the area provided below.

Site Information

Latitude: 29.887488° Longitude: -81.312151°

Structure Information

Outfall Diameter (in): ~~24~~ 18

Outfall Shape: ~~round~~ round

Outfall Material: RCP Metal ~~Plastic~~

Photo of Outfall: Yes No

Relative Depth from Ground to Top of Outfall Pipe (ft):

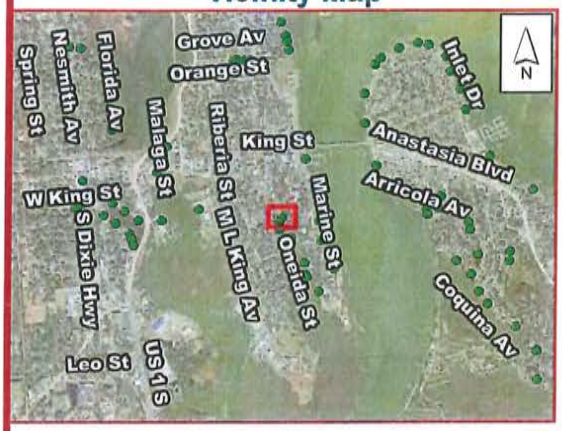
Outfall Invert (ft):

Vertical Datum: NAVD88

Valve Present: Yes ~~No~~

Condition of Valve: ~~Good~~ Fair Poor N/A

Vicinity Map



- Outfall Recon Location
- Outfall
- Storm Inlet
- Manhole
- Storm Sewer

Location Map



Notes and Sketches

OF-0048 - high water level - can't access dwn upstream >24" - assume pipe upstream - 16" ~ ft. top of pipe & rim elev. of nearest upstream manhole

Date: _____ Time: _____ Staff: _____

OUTFALL FIELD RECON SHEET

Location Description: Artillery Ln Outfall

OF-0054

Action Required:

Take multiple photos of outfall including a 1) upstream photo looking out toward outfall and 2) downstream photo looking at the face of the outfall. Record outfall ID on each photo. Collect missing Structure Information including diameter, shape, relative depth to top of outfall, and invert. Select material type, presence of valve, and condition of valve. Document any relevant notes and sketches in the area provided below.

Site Information

Latitude: 29.891829° Longitude: -81.310139°

Structure Information

Outfall Diameter (in):

Outfall Shape:

Outfall Material: RCP Metal (Plastic)

Photo of Outfall: Yes No

Relative Depth from Ground to Top of Outfall Pipe (ft):

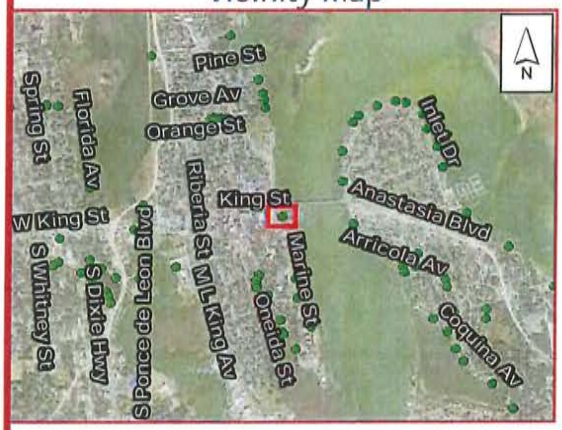
Outfall Invert (ft):

Vertical Datum: NAVD88

Valve Present: Yes No

Condition of Valve: Good Fair Poor N/A

Vicinity Map



Outfall Recon Location

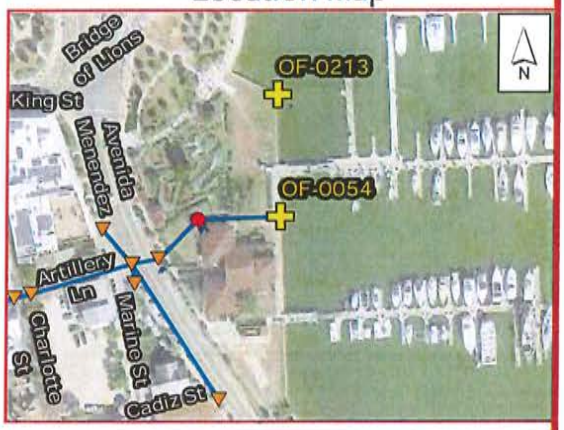
Outfall

Storm Inlet

Manhole

Storm Sewer

Location Map



Notes and Sketches

- two pipes in parallel at fall @ Marina
- can perhaps access upstream
- manhole is covered & would require tree removal or trimming to access
- maybe easier to access in the road on Aven. Men.
- not clear why there are two pipes @ outfall
OF-0213 - no pipe network shown - FDOT future King St outfall?

Date: _____ Time: _____ Staff: _____

OUTFALL FIELD RECON SHEET

Location Description: Cordova St Outfall 2

OF-0057

Action Required:

Take multiple photos of outfall including a 1) upstream photo looking out toward outfall and 2) downstream photo looking at the face of the outfall. Record outfall ID on each photo. Collect missing Structure Information including diameter, shape, relative depth to top of outfall, and invert. Select material type, presence of valve, and condition of valve. Document any relevant notes and sketches in the area provided below.

Site Information

Latitude: 29.88743° Longitude: -81.312157°

Structure Information

Outfall Diameter (in):

Outfall Shape:

Outfall Material: RCP Metal Plastic

Photo of Outfall: Yes No

Relative Depth from Ground to Top of Outfall Pipe (ft):

Outfall Invert (ft):

Vertical Datum: NAVD88

Valve Present: Yes No

Condition of Valve: Good Fair Poor N/A

Vicinity Map



- Outfall Recon Location
- Outfall
- Storm Inlet
- Manhole
- Storm Sewer

Location Map



Notes and Sketches

Not to be retrofitted for LMS
b/c of pump station

Date: _____ Time: _____ Staff: _____

OUTFALL FIELD RECON SHEET

Location Description: Park Pl Outfall

OF-0060

Action Required:

Take multiple photos of outfall including a 1) upstream photo looking out toward outfall and 2) downstream photo looking at the face of the outfall. Record outfall ID on each photo. Collect missing Structure Information including diameter, shape, relative depth to top of outfall, and invert. Select material type, presence of valve, and condition of valve. Document any relevant notes and sketches in the area provided below.

Site Information

Latitude: 29.88653° Longitude: -81.312314°

Structure Information

Outfall Diameter (in):

Outfall Shape:

Outfall Material: RCP Metal Plastic

Photo of Outfall: Yes No

Relative Depth from Ground to Top of Outfall Pipe (ft):

Outfall Invert (ft):

Vertical Datum: NAVD88

Valve Present: Yes No

Condition of Valve: Good Fair Poor N/A

Vicinity Map



- Outfall Recon Location
- Outfall
- Storm Inlet
- Manhole
- Storm Sewer

Location Map



Notes and Sketches

- not to be retrofitted w- outfall blc of LMS pump sta.

Date: _____ Time: _____ Staff: _____

OUTFALL FIELD RECON SHEET

Location Description: Marine St Outfall

OF-0063

Action Required:

Take multiple photos of outfall including a 1) upstream photo looking out toward outfall and 2) downstream photo looking at the face of the outfall. Record outfall ID on each photo. Collect missing Structure Information including diameter, shape, relative depth to top of outfall, and invert. Select material type, presence of valve, and condition of valve. Document any relevant notes and sketches in the area provided below.

Site Information

Latitude: 29.887193° Longitude: -81.308971°

Structure Information

Outfall Diameter (in): 811

Outfall Shape: clay

Outfall Material: RCP Metal Plastic

Photo of Outfall: Yes No

Relative Depth from Ground to Top of Outfall Pipe (ft):

Outfall Invert (ft):

Vertical Datum: NAVD88

Valve Present: Yes No

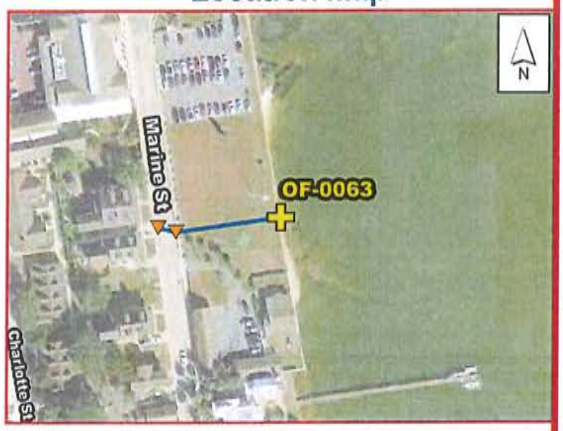
Condition of Valve: Good Fair Poor N/A

Vicinity Map



- Outfall Recon Location
- Outfall
- Storm Inlet
- Manhole
- Storm Sewer

Location Map



Notes and Sketches

- need to get permission to access headwall
- can likely access upstream
- would need to replace upstream inlet to install valve upstream
- was in MS report

Date: _____ Time: _____ Staff: _____

OUTFALL FIELD RECON SHEET

Location Description: St Francis St Outfall

OF-0068

Action Required:

Take multiple photos of outfall including a 1) upstream photo looking out toward outfall and 2) downstream photo looking at the face of the outfall. Record outfall ID on each photo. Collect missing Structure Information including diameter, shape, relative depth to top of outfall, and invert. Select material type, presence of valve, and condition of valve. Document any relevant notes and sketches in the area provided below.

Site Information

Latitude: 29.887104° Longitude: -81.312393°

Structure Information

Outfall Diameter (in):

Outfall Shape:

Outfall Material: RCP Metal Plastic

Photo of Outfall: Yes No

Relative Depth from Ground to Top of Outfall Pipe (ft):

Outfall Invert (ft):

Vertical Datum: NAVD88

Valve Present: Yes No

Condition of Valve: Good Fair Poor N/A

Vicinity Map



Outfall Recon Location

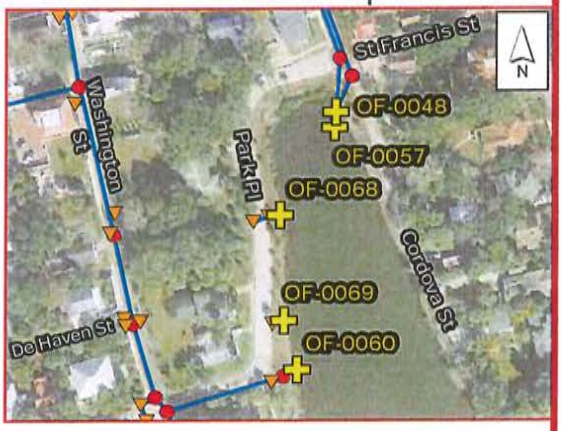
Outfall

Storm Inlet

Manhole

Storm Sewer

Location Map



Notes and Sketches

- Not to be retrofitted as we are tackling the outfall

Date: _____ Time: _____ Staff: _____

OUTFALL FIELD RECON SHEET

Location Description: St Francis St Outfall 2

OF-0069

Action Required:

Take multiple photos of outfall including a 1) upstream photo looking out toward outfall and 2) downstream photo looking at the face of the outfall. Record outfall ID on each photo. Collect missing Structure Information including diameter, shape, relative depth to top of outfall, and invert. Select material type, presence of valve, and condition of valve. Document any relevant notes and sketches in the area provided below.

Site Information

Latitude: 29.886712° Longitude: -81.312372°

Structure Information

Outfall Diameter (in):

Outfall Shape:

Outfall Material: RCP Metal Plastic

Photo of Outfall: Yes No

Relative Depth from Ground to Top of Outfall Pipe (ft):

Outfall Invert (ft):

Vertical Datum: NAVD88

Valve Present: Yes No

Condition of Valve: Good Fair Poor N/A

Vicinity Map



Outfall Recon Location

Outfall

Storm Inlet

Manhole

Storm Sewer

Location Map



Notes and Sketches

- not to be retrofitted w- LMS pump stati

Date: _____ Time: _____ Staff: _____

OUTFALL FIELD RECON SHEET

Location Description: Cordova St Outfall 3

OF-0070

Action Required:

Take multiple photos of outfall including a 1) upstream photo looking out toward outfall and 2) downstream photo looking at the face of the outfall. Record outfall ID on each photo. Collect missing Structure Information including diameter, shape, relative depth to top of outfall, and invert. Select material type, presence of valve, and condition of valve. Document any relevant notes and sketches in the area provided below.

Site Information

Latitude: 29.885944° Longitude: -81.311312°

Structure Information

Outfall Diameter (in):

Outfall Shape:

Outfall Material: RCP Metal Plastic

Photo of Outfall: Yes No

Relative Depth from Ground to Top of Outfall Pipe (ft):

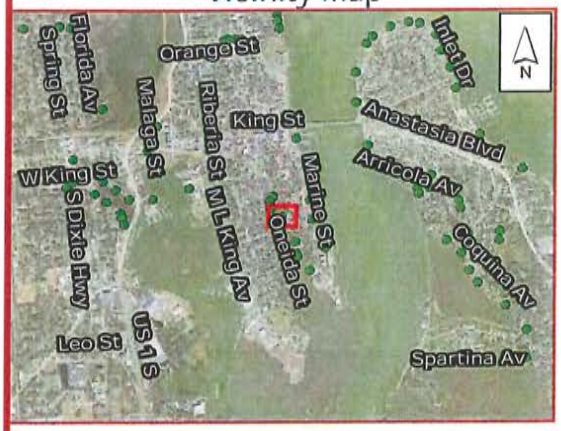
Outfall Invert (ft):

Vertical Datum: NAVD88

Valve Present: Yes No

Condition of Valve: Good Fair Poor N/A

Vicinity Map



- Outfall Recon Location
- Outfall
- Storm Inlet
- Manhole
- Storm Sewer

Location Map



Notes and Sketches

Not to be retrofitted w- LMS pump station

Date: _____ Time: _____ Staff: _____

OUTFALL FIELD RECON SHEET

Location Description: San Salvador St Outfall

OF-0071

Action Required:

Take multiple photos of outfall including a 1) upstream photo looking out toward outfall and 2) downstream photo looking at the face of the outfall. Record outfall ID on each photo. Collect missing Structure Information including diameter, shape, relative depth to top of outfall, and invert. Select material type, presence of valve, and condition of valve. Document any relevant notes and sketches in the area provided below.

Site Information

Latitude: 29.885728° Longitude: -81.308753°

Structure Information

Outfall Diameter (in): 18" GIS

Outfall Shape:

Outfall Material: RCP Metal (Plastic)

Photo of Outfall: (Yes) No

Relative Depth from Ground to Top of Outfall Pipe (ft):

Outfall Invert (ft):

Vertical Datum: NAVD88

Valve Present: (Yes) No

Condition of Valve: Good (Fair) Poor N/A

Vicinity Map



Outfall Recon Location

Outfall

Storm Inlet

Manhole

Storm Sewer

Location Map



Notes and Sketches

- in LMS table but not flagged w valve
- has old style duckbill present that is in fair condition
- probably replace w- in line
- we have done recent work to trench + sandbag around outfall

Date: _____ Time: _____ Staff: _____

OUTFALL FIELD RECON SHEET

Location Description: Tremerton Pl Outfall

OF-0072

Action Required:

Take multiple photos of outfall including a 1) upstream photo looking out toward outfall and 2) downstream photo looking at the face of the outfall. Record outfall ID on each photo. Collect missing Structure Information including diameter, shape, relative depth to top of outfall, and invert. Select material type, presence of valve, and condition of valve. Document any relevant notes and sketches in the area provided below.

Site Information

Latitude: 29.884387° Longitude: -81.307857°

Structure Information

Outfall Diameter (in): not visible

Outfall Shape:

Outfall Material: RCP Metal Plastic

Photo of Outfall: Yes No

Relative Depth from Ground to Top of Outfall Pipe (ft): 12" clay per GIS

Outfall Invert (ft):

Vertical Datum: NAVD88

Valve Present: Yes No

Condition of Valve: Good Fair Poor N/A

Vicinity Map



Outfall Recon Location

Outfall

Storm Inlet

Manhole

Storm Sewer

Location Map



Notes and Sketches

- need to probe the pipe
- determine if its buried + if we need to trench & extend or go upstream in the manhole - 12" clay (24" larger lake)
- ~~max~~ look @ upstream manhole

Date: _____ Time: _____ Staff: _____

OUTFALL FIELD RECON SHEET

Location Description: Bonita Bay Outfall

OF-0074

Action Required:

Take multiple photos of outfall including a 1) upstream photo looking out toward outfall and 2) downstream photo looking at the face of the outfall. Record outfall ID on each photo. Collect missing Structure Information including diameter, shape, relative depth to top of outfall, and invert. Select material type, presence of valve, and condition of valve. Document any relevant notes and sketches in the area provided below.

Site Information

Latitude: 29.8836° Longitude: -81.307615°

Structure Information

Outfall Diameter (in): ~24"

Outfall Shape: round

Outfall Material: (RCP) Metal Plastic

Photo of Outfall: Yes No

Relative Depth from Ground to Top of Outfall Pipe (ft):

Outfall Invert (ft):

Vertical Datum: NAVD88

Valve Present: Yes (No)

Condition of Valve: Good Fair Poor N/A

Vicinity Map



Outfall Recon Location

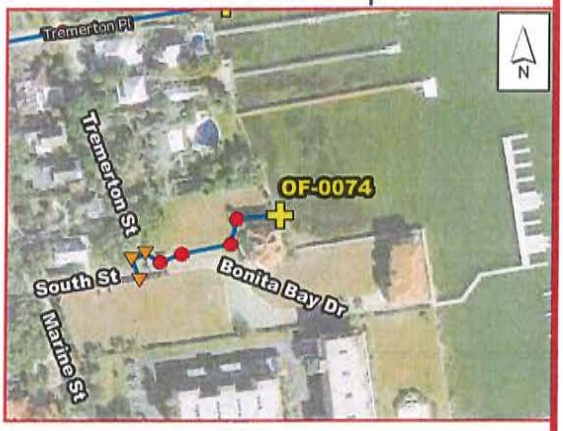
Outfall

Storm Inlet

Manhole

Storm Sewer

Location Map



Notes and Sketches

- In Lake Maria Table
- if go upstream inlet, replace w- larger box to fit valve
- need to contact property owner to access end of pipe - 6 Tremerton Dr.
- look @ Palm trees - remove & replant?

Date: _____ Time: _____ Staff: _____

OUTFALL FIELD RECON SHEET

Location Description: Cordova St Outfall 4

OF-0075

Action Required:

Take multiple photos of outfall including a 1) upstream photo looking out toward outfall and 2) downstream photo looking at the face of the outfall. Record outfall ID on each photo. Collect missing Structure Information including diameter, shape, relative depth to top of outfall, and invert. Select material type, presence of valve, and condition of valve. Document any relevant notes and sketches in the area provided below.

Site Information

Latitude: 29.882999° Longitude: -81.309934°

Structure Information

Outfall Diameter (in): 15

Outfall Shape: round

Outfall Material: RCP Metal (Plastic)

Photo of Outfall: (Yes) No

Relative Depth from Ground to Top of Outfall Pipe (ft): TBD

Outfall Invert (ft):

Vertical Datum: NAVD88

Valve Present: Yes (No)

Condition of Valve: Good Fair Poor N/A

Vicinity Map



Outfall Recon Location

Outfall

Storm Inlet

Manhole

Storm Sewer

Location Map



Notes and Sketches

- not on table in Lake Maria Report but we do have tidal floods here may need to add?
- rob - crew survey rod to get relative depths (with 6")

Date: _____ Time: _____ Staff: _____

OUTFALL FIELD RECON SHEET

Location Description: Cordova St Outfall 4

OF-0076

Action Required:

Take multiple photos of outfall including a 1) upstream photo looking out toward outfall and 2) downstream photo looking at the face of the outfall. Record outfall ID on each photo. Collect missing Structure Information including diameter, shape, relative depth to top of outfall, and invert. Select material type, presence of valve, and condition of valve. Document any relevant notes and sketches in the area provided below.

Site Information

Latitude: 29.883203° Longitude: -81.310066°

Structure Information

Outfall Diameter (in):

Outfall Shape:

Outfall Material: RCP Metal Plastic

Photo of Outfall: Yes No

Relative Depth from Ground to Top of Outfall Pipe (ft):

Outfall Invert (ft):

Vertical Datum: NAVD88

Valve Present: Yes No

Condition of Valve: Good Fair Poor N/A

Vicinity Map



Outfall Recon Location

Outfall

Storm Inlet

Manhole

Storm Sewer

Location Map



Notes and Sketches

not to be retrofitted

Date: _____ Time: _____ Staff: _____

OUTFALL FIELD RECON SHEET

OF-0077

Location Description: South St Outfall

Action Required:

Take multiple photos of outfall including a 1) upstream photo looking out toward outfall and 2) downstream photo looking at the face of the outfall. Record outfall ID on each photo. Collect missing Structure Information including diameter, shape, relative depth to top of outfall, and invert. Select material type, presence of valve, and condition of valve. Document any relevant notes and sketches in the area provided below.

Site Information

Latitude: 29.882924° Longitude: -81.310455°

Structure Information

Outfall Diameter (in):

Outfall Shape: elliptical

Outfall Material: (RCP) Metal Plastic

Photo of Outfall: (Yes) No

Relative Depth from Ground to Top of Outfall Pipe (ft):

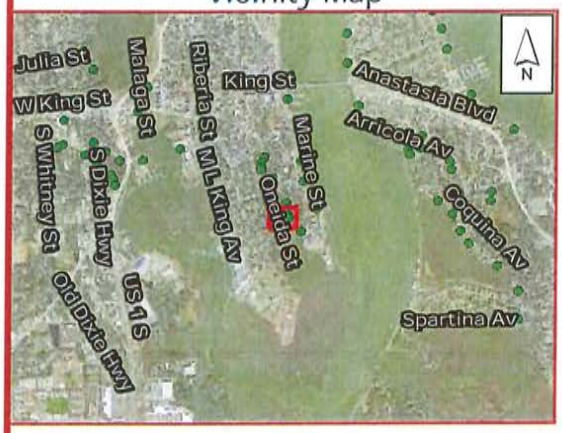
Outfall Invert (ft):

Vertical Datum: NAVD88

Valve Present: Yes (No)

Condition of Valve: Good Fair Poor N/A

Vicinity Map



Outfall Recon Location

Outfall

Storm Inlet

Manhole

Storm Sewer

Location Map



Notes and Sketches

- Not in Fema table but we will need to address due to flooding
- measure for tidal depth

Date: _____ Time: _____ Staff: _____

OUTFALL FIELD RECON SHEET

Location Description: Hedrick St Outfall

OF-0078

Action Required:

Take multiple photos of outfall including a 1) upstream photo looking out toward outfall and 2) downstream photo looking at the face of the outfall. Record outfall ID on each photo. Collect missing Structure Information including diameter, shape, relative depth to top of outfall, and invert. Select material type, presence of valve, and condition of valve. Document any relevant notes and sketches in the area provided below.

Site Information

Latitude: 29.881922° Longitude: -81.308871°

Structure Information

Outfall Diameter (in): 10"

Outfall Shape: round

Outfall Material: RCP Metal Plastic clay

Photo of Outfall: Yes No

Relative Depth from Ground to Top of Outfall Pipe (ft):

Outfall Invert (ft):

Vertical Datum: NAVD88

Valve Present: Yes (No)

Condition of Valve: Good Fair Poor N/A

Vicinity Map



Outfall Recon Location

Outfall

Storm Inlet

Manhole

Storm Sewer

Location Map



Notes and Sketches

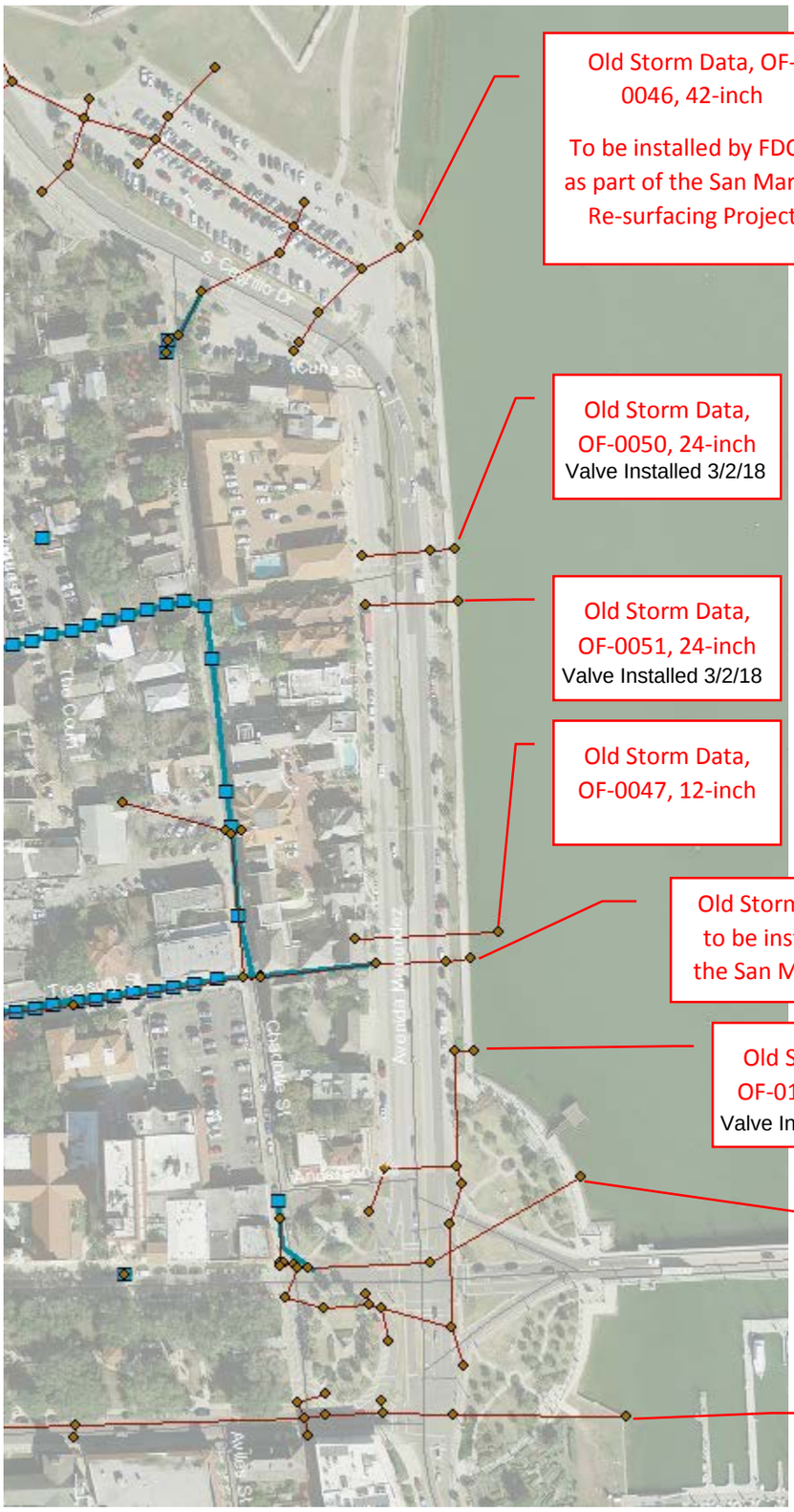
- may be able to install in upstream inlet 10" clay
- we accessed in inlet upstream
- minimize equipment impact to area w. upstream

in LMS table ✓

Date: _____ Time: _____ Staff: _____

Lake Maria Sanchez Flood Mitigation and Drainage Project –

Locations of Tide Check Valves Needed – FDOT Outfalls



Bayfront, Avenida Menendez

- Needed to confirm size of outfall pipes shown and if a Tideflex valve has been installed yet, or projected schedule/planned for a future installation

APPENDIX V

Previous Lake Maria Sanchez Planning

CITY OF ST. AUGUSTINE

LAKE MARIA SANCHEZ FLOOD MITIGATION

Basis of Design Report

September 2019

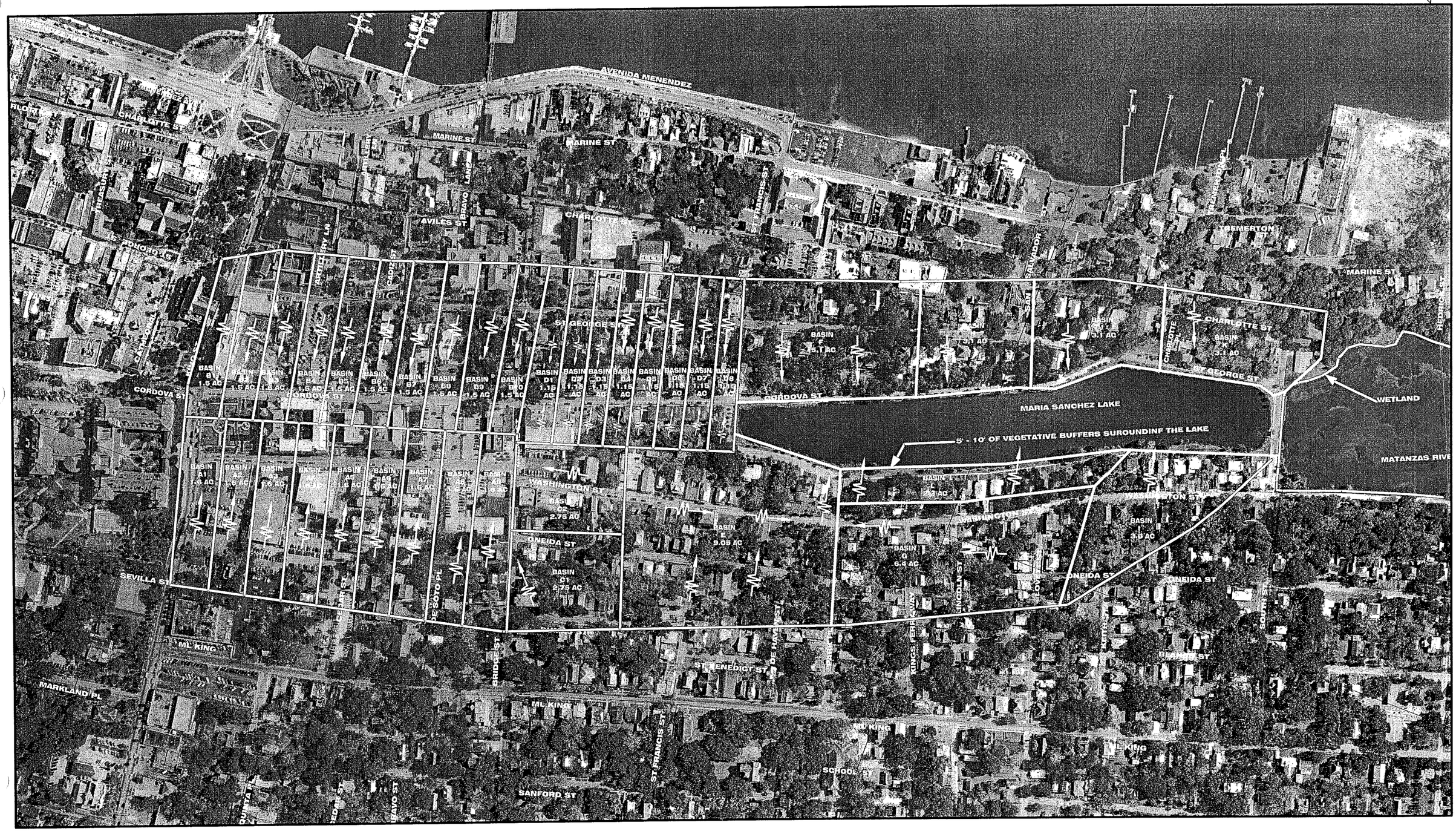
FIGURE1: PROJECT BOUNDARY AND DRAINAGE AREA



PLAN

SCALE: 1" = 300'

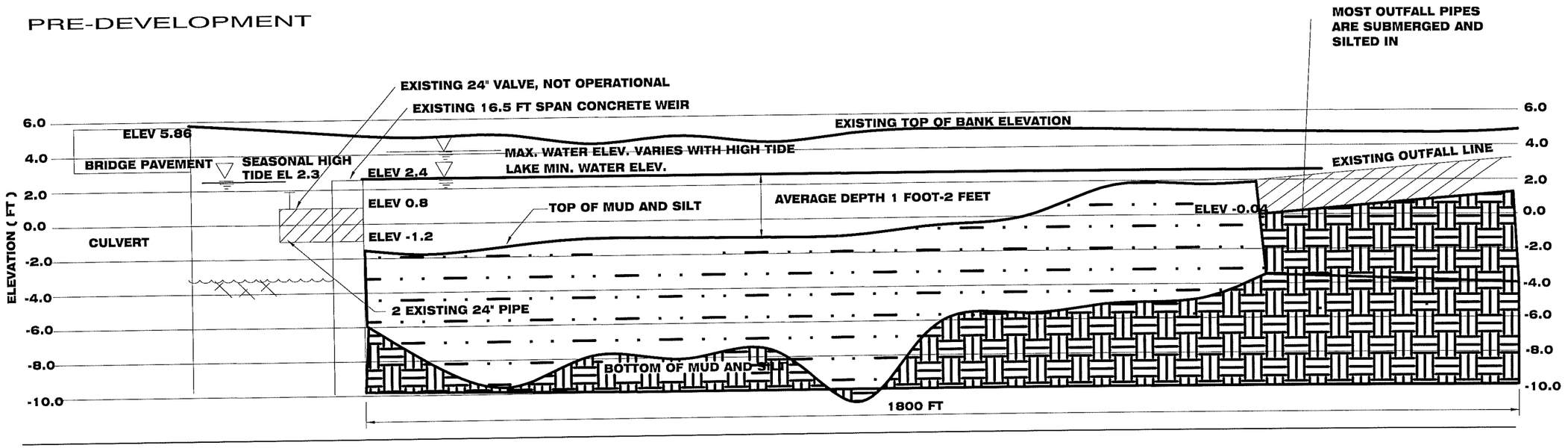
FIGURE 2: DRAINAGE PATTERN AND SUB-BASINS



PLAN

SCALE: 1"=300'

FIGURE 3: MARIA SANCHEZ LAKE PRE-POST PROFILE CONDITIONS



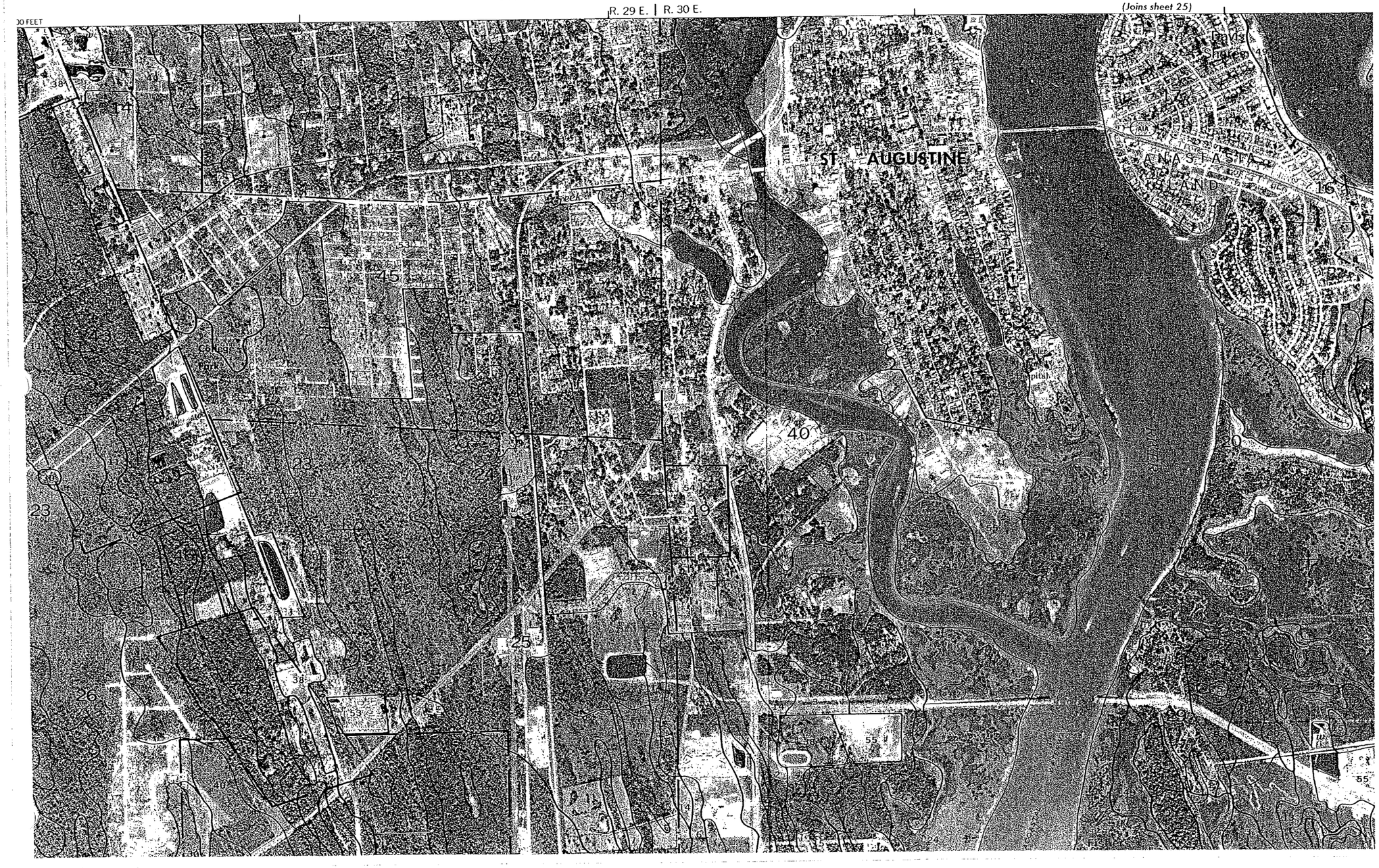
PLAN

HORIZONTAL 1"=200', VERTICAL IS SHOWN

FIGURE 4: SOIL TYPE

NORTH

ST. JOHNS COUNTY, FLORIDA — SHEET NUMBER 29



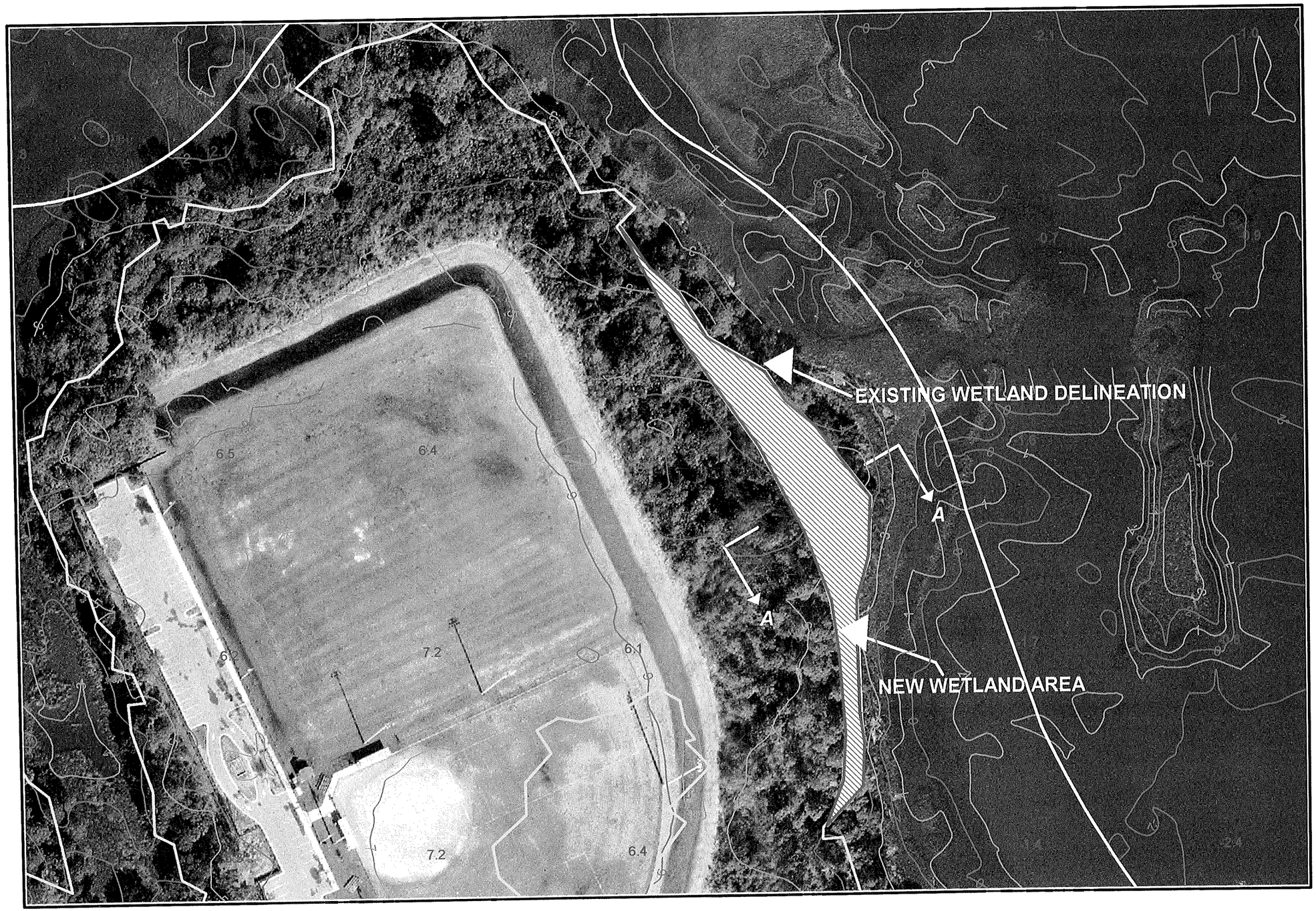
SOIL LEGEND

The map symbols are numeric. Numbers 10, 17, 20, 37, 39, 43, 56, 59, and 60 are not used in the legend. If slope is not given in the mapping unit name, the soil is level to nearly level.

SYMBOL	NAME
1	Adamsville fine sand
2	Astatula fine sand, 0 to 8 percent slopes
3	Myakka fine sand
4	Myakka fine sand, depressional
5	St. Johns fine sand, depressional
6	Tavares fine sand, 0 to 5 percent slopes
7	Immokalee fine sand
8	Zolfo fine sand
9	Pomona fine sand
11	Smyrna fine sand
12	Ona fine sand
13	St. Johns fine sand
14	Cassia fine sand
15	Pomello fine sand, 0 to 5 percent slopes
16	Orsino fine sand, 0 to 5 percent slopes
18	Floridana fine sand, frequently flooded
19	Pompano fine sand
21	Wabasso fine sand
22	Manatee fine sandy loam, frequently flooded
23	Paola fine sand, 0 to 8 percent slopes
24	Pellicer silty clay loam, frequently flooded
25	Parkwood fine sandy loam, frequently flooded
26	Samsula muck
27	St. Augustine fine sand
28	Beaches
29	Satellite fine sand
30	Wesconnett fine sand, frequently flooded
31	Fripp-Satellite complex
32	Palm Beach sand, 0 to 5 percent slopes
33	Jonathan fine sand
34	Tocoi fine sand
35	Hontoon muck
36	Riviera fine sand, frequently flooded
38	Pits
40	Pottsburg fine sand
41	Tomoka muck
42	Bluff sandy clay loam, frequently flooded
44	Sparr fine sand, 0 to 5 percent slopes
45	St. Augustine fine sand, clayey substratum
46	Holopaw fine sand
47	Holopaw fine sand, frequently flooded
48	Winder fine sand, frequently flooded
49	Moultrie fine sand, frequently flooded
50	Narcoossee fine sand, shelly substratum
51	St. Augustine-Urban land complex
52	Durbin muck, frequently flooded
53	Immokalee-Urban land complex
54	Astatula-Urban land complex
55	Arents, 0 to 2 percent slopes
57	Adamsville Variant fine sand
58	EauGallie fine sand
61	Riviera fine sand, depressional
62	Floridana fine sand
63	Placid fine sand
64	Ellzey fine sand
65	Riviera fine sand
66	Terra Ceia muck, frequently flooded
67	Tisonia mucky peat, frequently flooded
68	Winder fine sand
69	Bakersville muck

PLAN
RE MORE

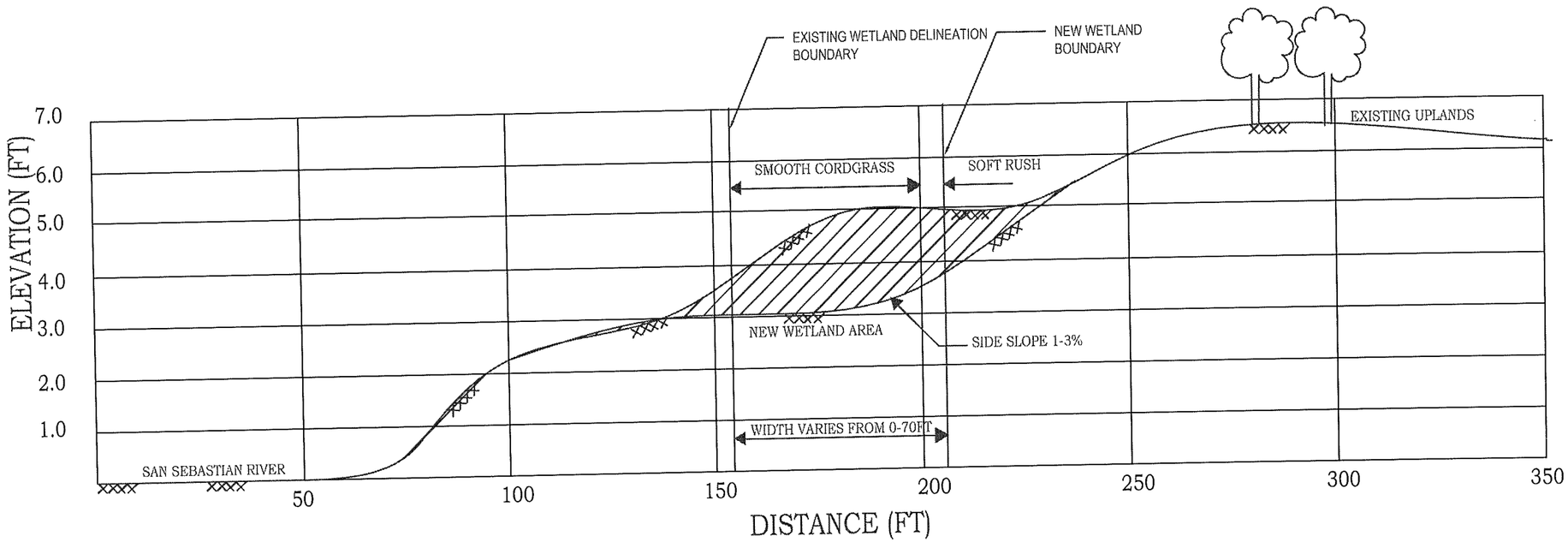
FIGURE 5: MITIGATION PLAN POMAR PARK

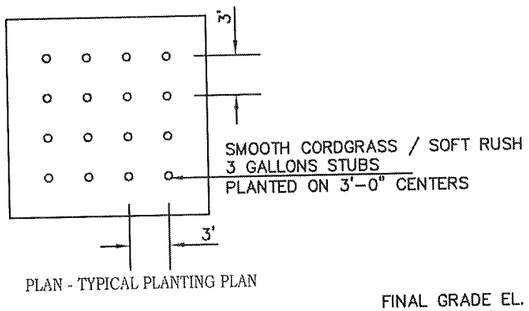


PLAN
SCALE: 1" =100'

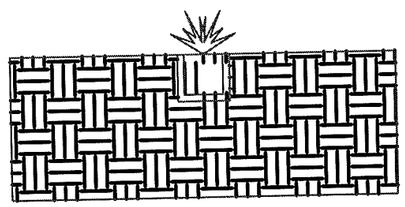
GENERAL NOTES:
1. CROSS SECTION A-A IS SHOWN IN FIGURE 6
2. WIDTH OF THE AREA VARIES FROM 0-70FT
3. TOTAL AREA OF NEW WETLAND IS 0.5 ACRE.

FIGURE 6: CROSS SECTION FOR WETLAND MITIGATION AREA AT POMAR PARK





PLAN - TYPICAL PLANTING PLAN



FINAL GRADE EL.
VARIES FROM
3.0' TO 3.5' AMSL

SECTION: TYPICAL PLANTING PLAN

GENERAL NOTES:

1. THIS MITIGATION PLAN IS FOR MARIA SANCHEZ STORMWATER IMPROVEMENT PROJECT
2. WIDTH OF THE CROSS SECTION VARIES FROM 0-70FT
3. TOTAL NEW WETLAND AREA IS 0.5 ACRE
4. SLOPE OF BANK SHALL MEET REQUIREMENT OF 1 TO 3 %
5. EROSION CONTROL BARRIER SUCH AS SILT-FENCE SHALL BE INSTALL DURING AND AFTER THE EXCAVATION.
6. NEW CORDGRASS SHALL BE PLANTED TO CREATE SIMILAR WETLAND CHARACTERISTIC AS THOSE OF SURROUNDING.

PLAN
SCALE ARE SHOWN

FIGURE 7: PRE-DEVELOPMENT NODE/LINK DIAGRAM FOR ICPR MODELING

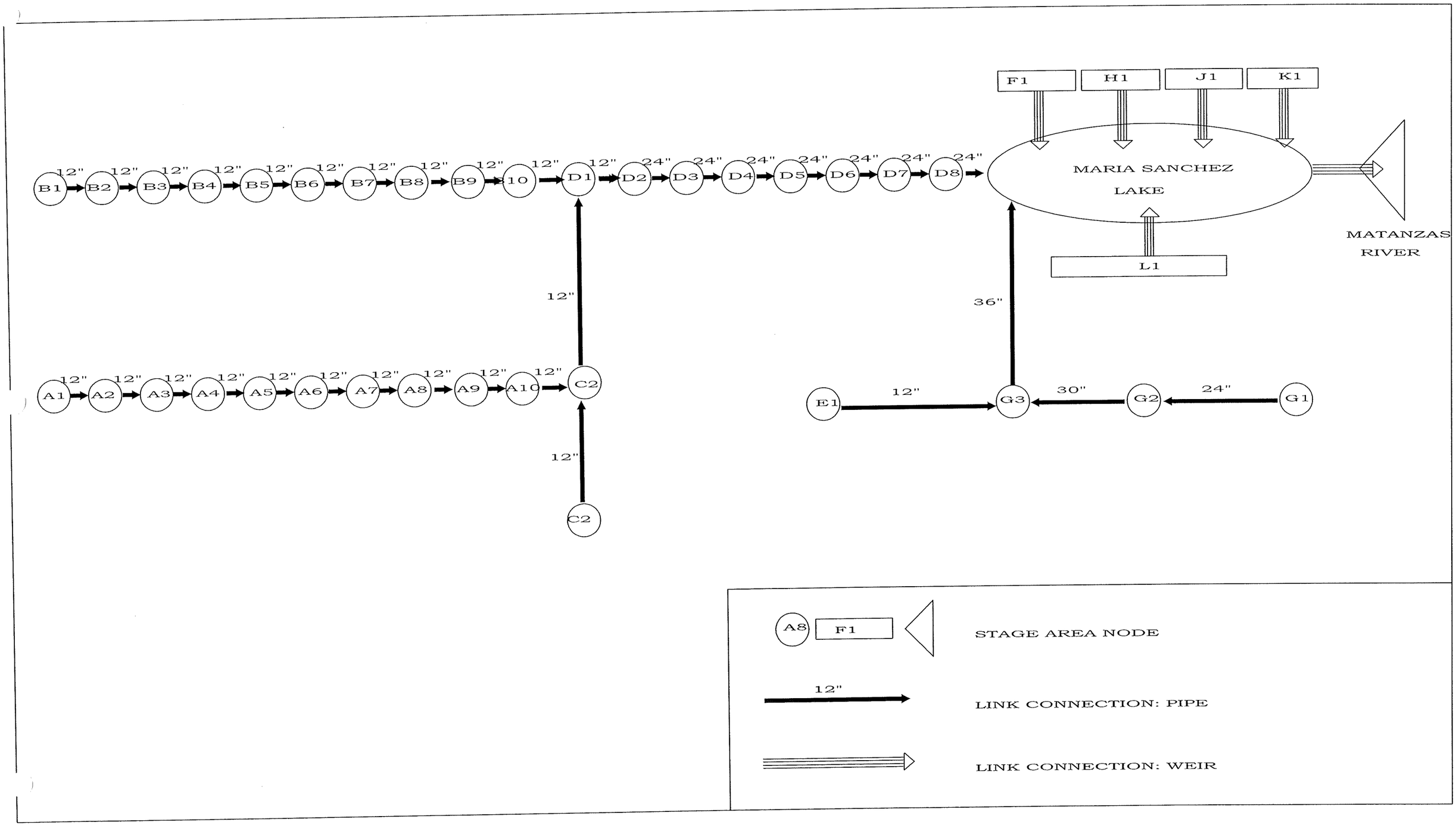
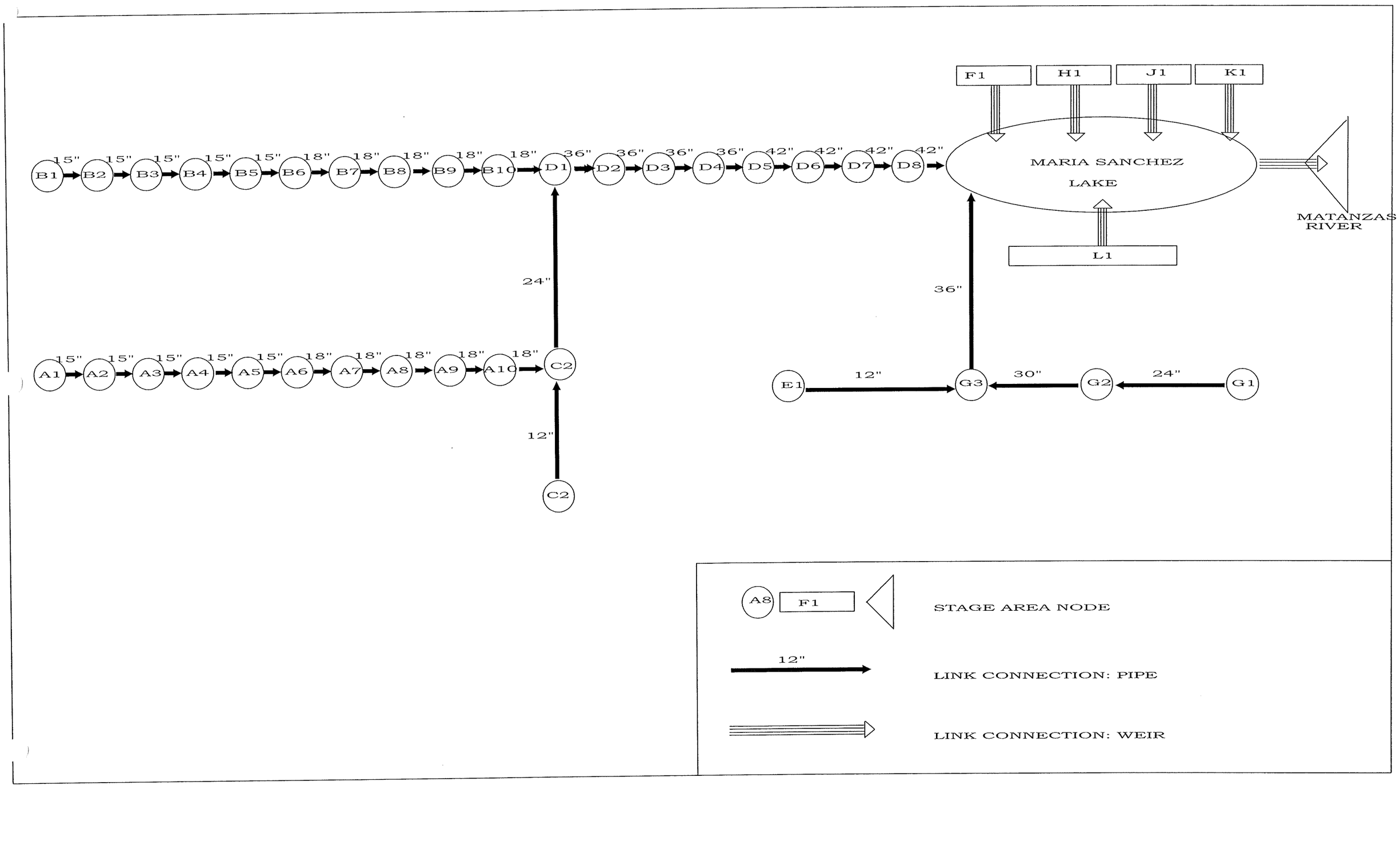


FIGURE 8: POST-DEVELOPMENT NODE/LINK DIAGRAM FOR ICPR MODELING





CITY OF ST. AUGUSTINE

MAYOR	MARK ALEXANDER
VICE-MAYOR	RAYMOND CONNOR
COMMISSIONER	WILLIAM J. LENNON, Sr.
COMMISSIONER	SUSAN M. BURK
COMMISSIONER	ALEXANDER "ALEX" CHRISTINE, JR.

Maria Sanchez Basin Stormwater Improvement

INDEX TO PLANS

SHEET TITLE	SHEET No.	SHEET TITLE	SHEET No.
TITLE	1	WEIR CONTROL STRUCTURE	11
AERIAL AND PROJECT BOUNDARY	2	EROSION CONTROL MEASURE	12
TOPOGRAPHY	3	MITIGATION PLAN	13
DRAINAGE PATTERN	4	CROSS SECTION FOR MITIGATION AREA	14
LAKE CROSS SECTION	5	DISPOSAL SITE	15
CORDOVA ST. PLAN & PROFILE	6	EXCAVATION DETAIL	EP1
GRANADA ST. PLAN & PROFILE	7	STANDARD DETAIL	SD1
BRIDGE ST. PLAN & PROFILE	8	STANDARD DETAIL	SD2
S. CORDOVA ST. PLAN & PROFILE	9		
S. CORDOVA ST. PLAN & PROFILE	10		

NOTE:

THESE DRAWINGS ARE INTENDED FOR APPLICATION PURPOSES ONLY

CITY OF ST. AUGUSTINE, FLORIDA STANDARD PLANS AND SPECIFICATIONS FOR:
- EXCAVATION AND BACKFILL
- WATERMAIN, SANITARY SEWER, FORCE MAIN AND STORMWATER INSTALLATION

ARE ON FILE WITH THE FOLLOWING ORGANIZATIONS:
- FLORIDA DEPARTMENT OF TRANSPORTATION
- FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
- ST. JOHNS COUNTY – ENGINEERING DIVISION
- BELLSOUTH
- TIME WARNER CABLE
- FLORIDA POWER AND LIGHT

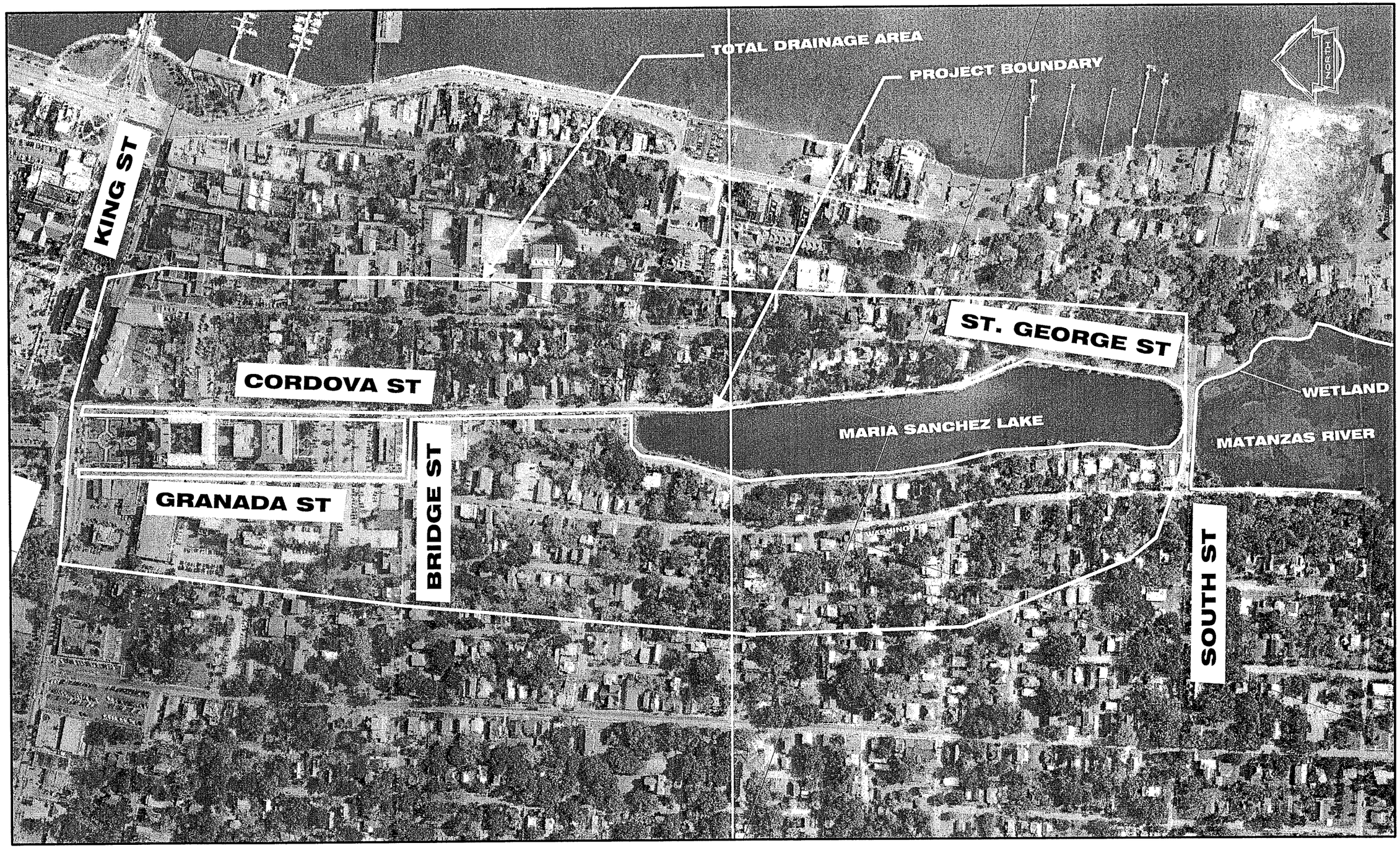
WILLIAM B. HARRISS
CITY MANAGER

JOHN P. REGAN, P.E.
ULTILITIES DIRECTOR

PREPARED BY
UTILITIES DEPARTMENT
ENGINEERING DIVISION

APPROVED BY: _____
WILLIAM G. MENDEZ, P.E.#20542
DATE: 4/9/02

S:\StormwaterProjects\MariaSanchez\Plan for application



PLAN

SCALE: 1" = 300'

LEGEND											
PROPOSED W.M. ---------	EXISTING W.M. ———	STATION LINE 10+00 — 11+00	R/W LINE ———	PROPERTY LINE ———	PAVED ROAD ———	DIRT ROAD ----------	JACK & BORE UNDER PAVED ROAD SEE DET. WD-2	DIG, CUT & REPAIR DIRT ROAD	DIG, CUT & REPAIR PAVED ROAD	PROP. HYDRANT PROP. VALVE EX. HYDRANT EX. VALVE FLUSHING PLUG	

M.J. – MECHANICAL JOINT P.V.C. – POLYVINYL CHLORIDE H.D.P.E. – HIGH DENSITY POLYETHYLENE D.I.P. – DUCTILE IRON PIPE C.L.F. – CHAIN LINK FENCE E.O.P. – EDGE OF PAVEMENT
W.M. – WATER MAIN PROP. – PROPOSED EX. – EXISTING C/L – CENTER LINE

APPROVED BY: _____
WILLIAM G. MENDEZ, P.E. #20842
DATE: 4/9/02

SHEET 2

DATE: 2-5-02
REV:
FILE: StormwaterProjects\MariaSanchez\Plan for application

CITY OF ST. AUGUSTINE
UTILITIES DEPARTMENT
P.O. BOX 210, ST. AUGUSTINE, FL. 32085-0210 PHONE: (904)825-1040

MARIA SANCHEZ STORMWATER IMPROVEMENT
AIREAL AND PROJECT BOUNDARY



PLAN

SCALE: 1" = 300'

LEGEND											
PROPOSED W.M. ----------	EXISTING W.M. ————	STATION LINE 10+00 11+00	R/W LINE — — — —	PROPERTY LINE ————	PAVED ROAD	DIRT ROAD	JACK & BORE UNDER PAVED ROAD SEE DET. WD-2	DIG, CUT & REPAIR DIRT ROAD	DIG, CUT & REPAIR PAVED ROAD	PROP. HYDRANT PROP. VALVE EX. HYDRANT EX. VALVE FLUSHING PLUG	

M.J. – MECHANICAL JOINT P.V.C. – POLYVINYL CHLORIDE H.D.P.E. – HIGH DENSITY POLYETHYLENE D.I.P. – DUCTILE IRON PIPE C.L.F. – CHAIN LINK FENCE E.O.P. – EDGE OF PAVEMENT

W.M. – WATER MAIN PROP. – PROPOSED EX. – EXISTING C/L – CENTER LINE

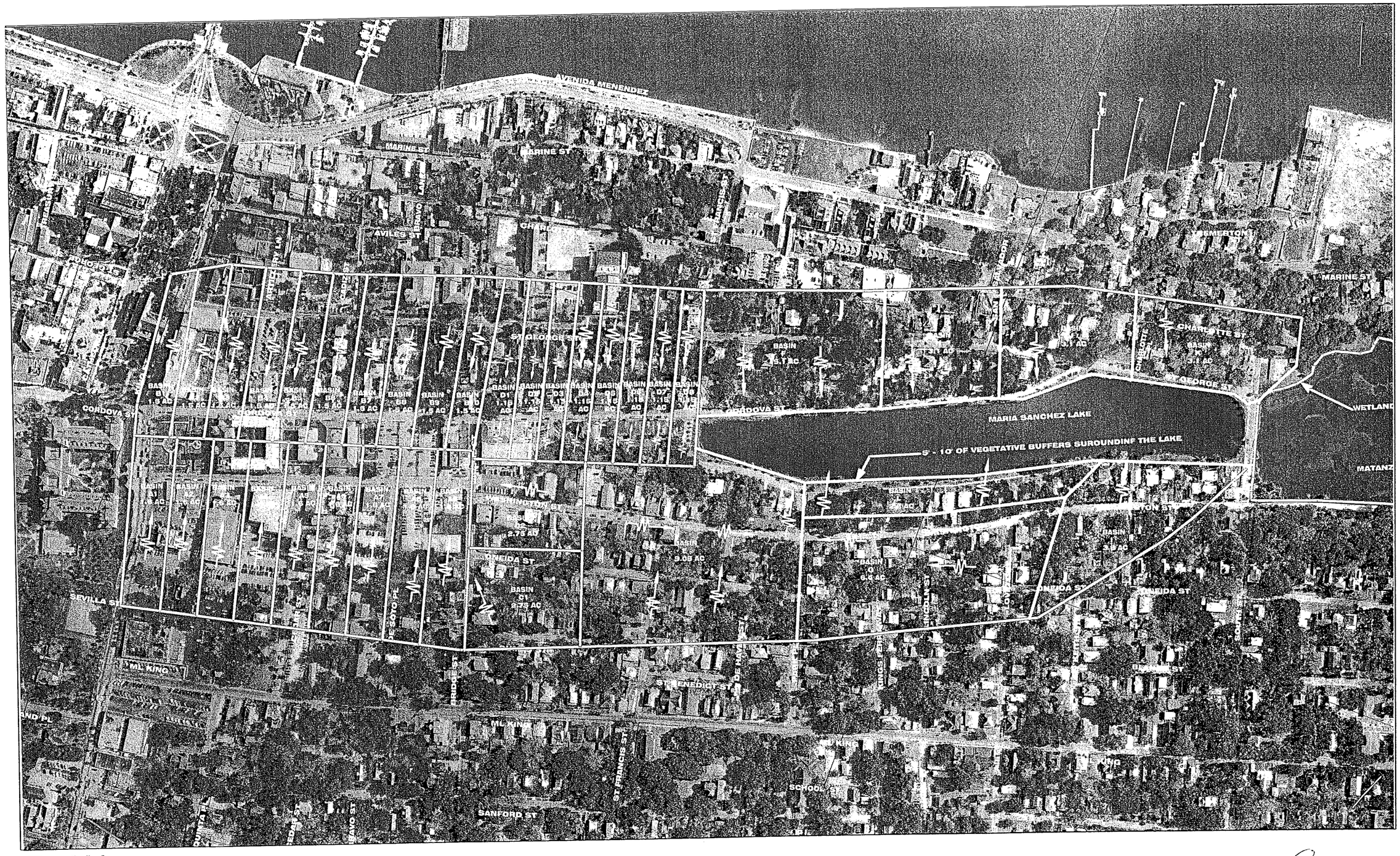
APPROVED BY: G. Mendez
WILLIAM G. MENDEZ, P.E. #20542
DATE: 4/9/02

SHEET 3

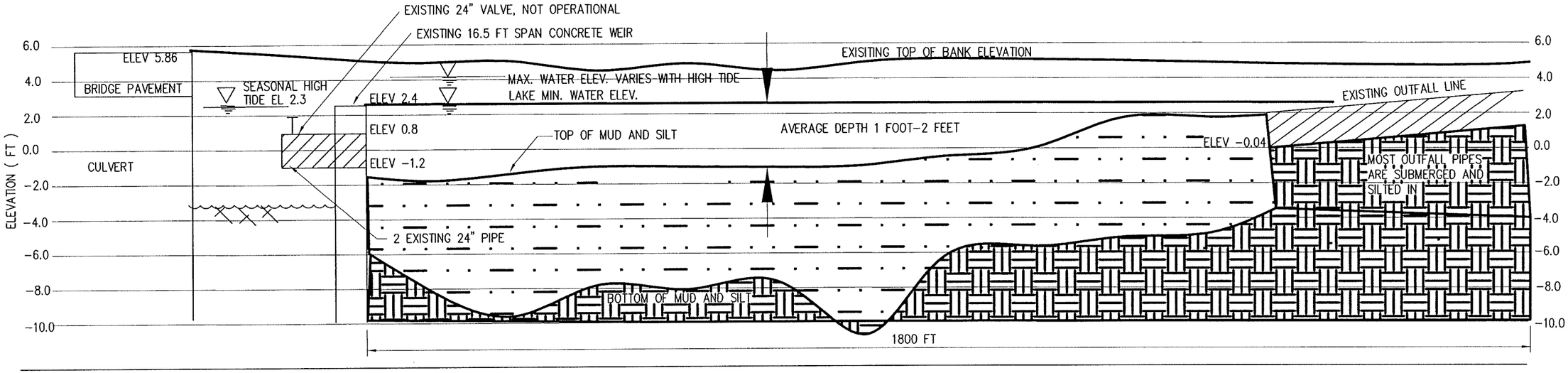
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REV:
FILE: I:\UTILITIES\Tommy-Neville\~\

CITY OF ST. AUGUSTINE
UTILITIES DEPARTMENT
P.O. BOX 210, ST. AUGUSTINE, FL. 32085-0210 PHONE: (904)825-1040

MARIA SANCHEZ STORMWATER IMPROVEMENT
TOPOGRAPHY


MARINE ST
AVILES ST
CHARLOTTE ST
MARIA SANCHEZ LAKE
9' - 10' OF VEGETATIVE BUFFERS SURROUNDING THE LAKE
WETLAND
CORDOVA ST
SEVILLA ST
ML KING
ST FRANCIS ST
SANFORD ST
SCHOOL ST
MATANZ
BASIN D1 1.15 AC
BASIN D2 1.15 AC
BASIN D3 1.15 AC
BASIN D4 1.15 AC
BASIN D5 1.15 AC
BASIN D6 1.15 AC
BASIN D7 1.15 AC
BASIN D8 1.15 AC
BASIN D9 1.15 AC
BASIN D10 1.15 AC
BASIN

PRE-DEVELOPMENT



POST-DEVELOPMENT

PLAN

NO SCALE

LEGEND

PROPOSED W.M. ---------	EXISTING W.M. ———	STATION LINE 10+00 — 11+00	R/W LINE — — —	PROPERTY LINE ———	PAVED ROAD ———	DIRT ROAD ----------	JACK & BORE UNDER PAVED ROAD SEE DET. WD-2	DIG, CUT & REPAIR DIRT ROAD	DIG, CUT & REPAIR PAVED ROAD	PROP. HYDRANT PROP. VALVE EX. HYDRANT EX. VALVE FLUSHING PLUG

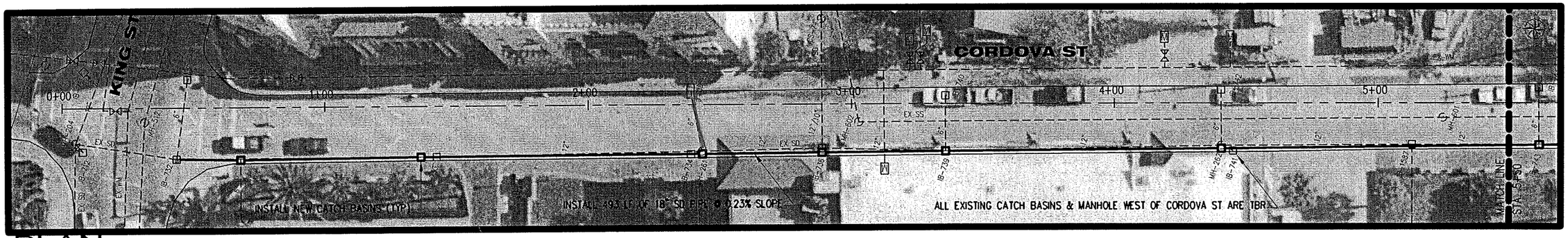
M.J. – MECHANICAL JOINT P.V.C. – POLYVINYL CHLORIDE H.D.P.E. – HIGH DENSITY POLYETHYLENE D.I.P. – DUCTILE IRON PIPE C.L.F. – CHAIN LINK FENCE E.O.P. – EDGE OF PAVEMENT
W.M. – WATER MAIN PROP. – PROPOSED EX. – EXISTING C/L – CENTER LINE

APPROVED BY: _____
WILLIAM G. MENDEZ, P.E. #20542
DATE: 4/9/02

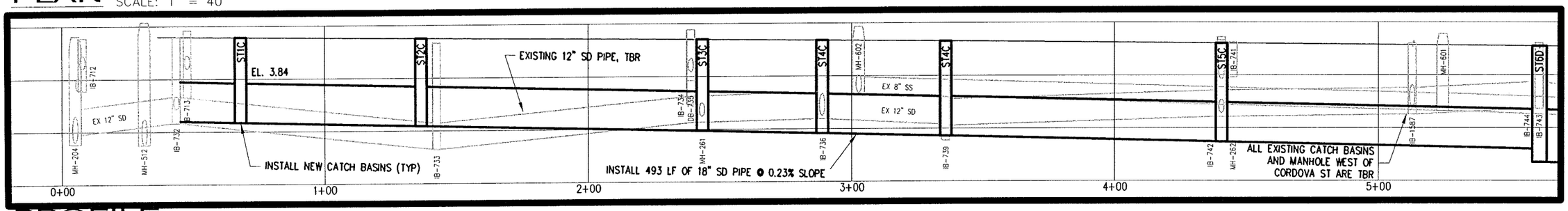
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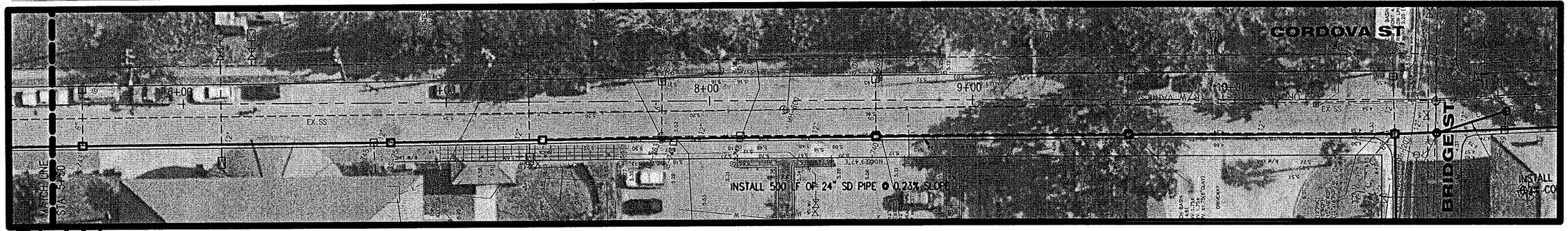
MARIA SANCHEZ STORMWATER IMPROVEMENT
LAKE CROSS SECTION



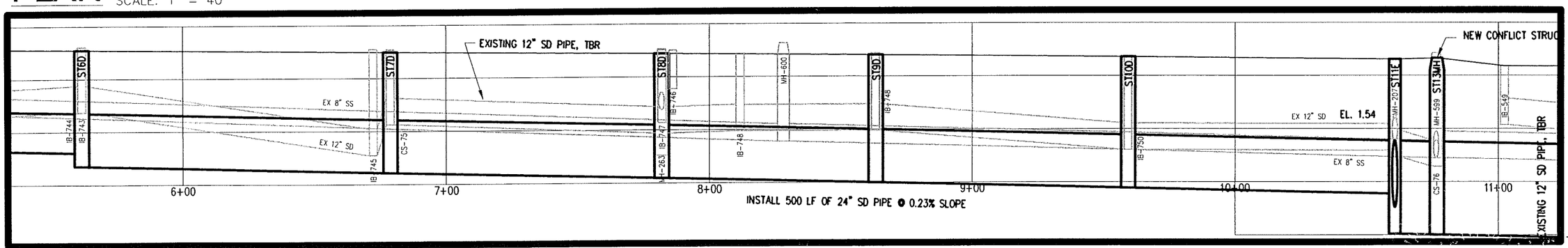
PLAN SCALE: 1" = 40'



PROFILE SCALE: 1"= 40' HORIZ., 1"= 4' VERT.



PLAN SCALE: 1" = 40'



PROFILE SCALE: 1"= 40' HORIZ., 1"= 4' VERT.

LEGEND

EXISTING UTILITY	PROPOSED SD	STATION LINE 10+00 11+00	R/W LINE	PROPERTY LINE	PAVED ROAD	DIRT ROAD	JACK & BORE UNDER PAVED ROAD SEE DET. WD-2	DIG, CUT & REPAIR DIRT ROAD	DIG, CUT & REPAIR PAVED ROAD
---------	———	———	— — —	——— ———	———	----------			

EX. HYDRANT
EX. VALVE
PROP. HYDRANT
PROP. VALVE
FLUSHING
PLUG

M.J. – MECHANICAL JOINT P.V.C. – POLYVINYL CHLORIDE H.D.P.E. – HIGH DENSITY POLYETHYLENE D.I.P. – DUCTILE IRON PIPE C.L.F. – CHAIN LINK FENCE E.O.P. – EDGE OF PAVEMENT
PROP. – PROPOSED EX. – EXISTING C/L – CENTER LINE SD – STORM DRAINAGE SS – SANITARY SEWER W.M. – WATER MAIN TBR – TO BE REMOVE

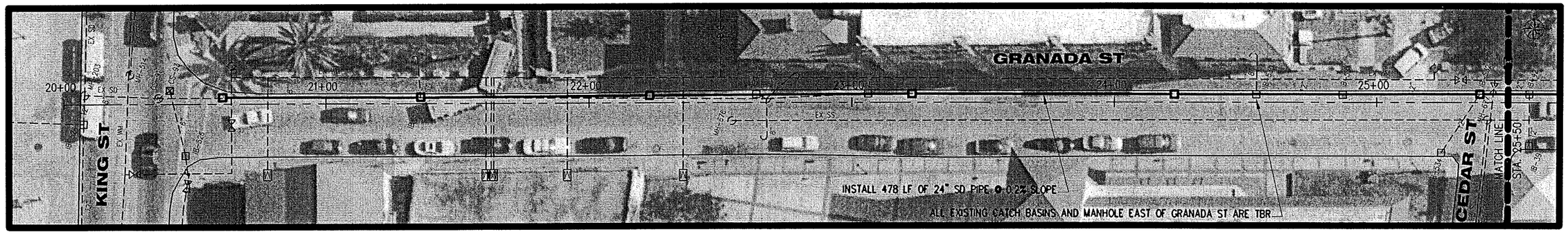
APPROVED BY: _____
WILLIAM G. MENDEZ, P.E. #20542
DATE: 4/9/02

SHEET 6

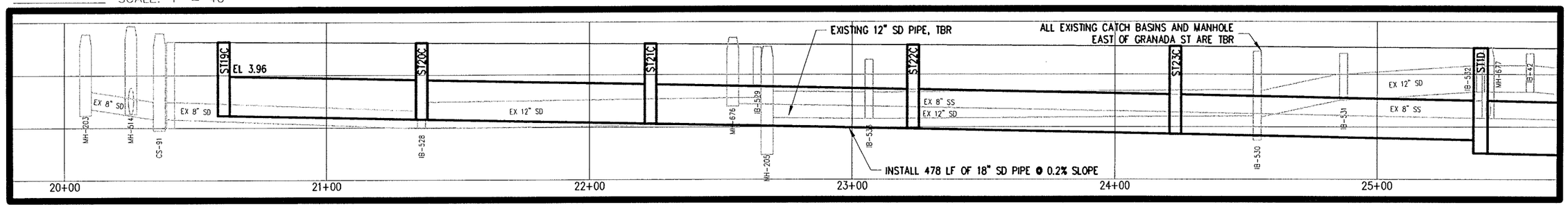
DATE: 2-5-02
REV:
FILE: StormwaterProjects\MariaSanchez\Plan for application

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UTILITIES DEPARTMENT
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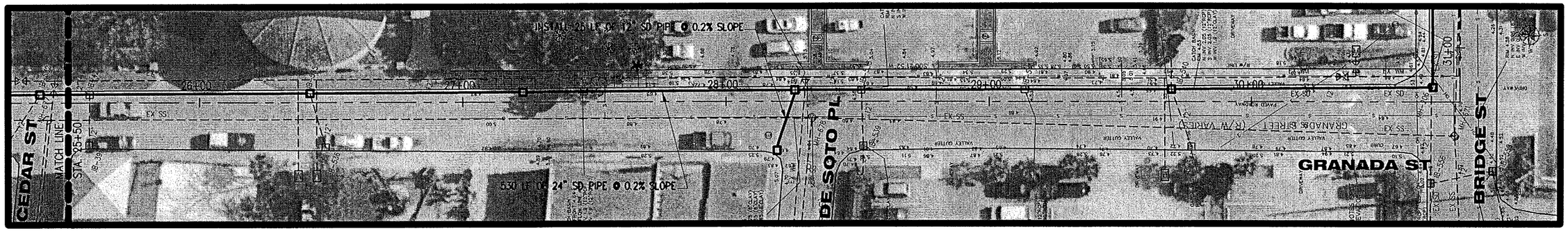
MARIA SANCHEZ BASIN STORMWATER IMPROVEMENT
CORDOVA STREET PLAN & PROFILE



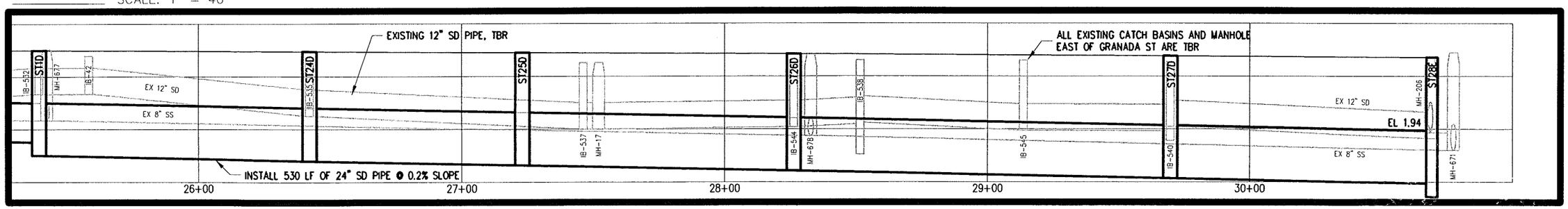
PLAN SCALE: 1" = 40'



PROFILE SCALE: 1"= 40' HORIZ., 1"= 4' VERT.



PLAN SCALE: 1" = 40'



PROFILE SCALE: 1"= 40' HORIZ., 1"= 4' VERT.

LEGEND

EXISTING UTILITY	PROPOSED SD	STATION LINE 10+00 11+00	R/W LINE	PROPERTY LINE	PAVED ROAD	DIRT ROAD	JACK & BORE UNDER PAVED ROAD SEE DET. WD-2	DIG, CUT & REPAIR DIRT ROAD	DIG, CUT & REPAIR PAVED ROAD
---------	———	——+———	——— — ———	——— ———	———	----------			

- EX. HYDRANT
- EX. VALVE
- PROP. HYDRANT
- PROP. VALVE
- FLUSHING
- PLUG

M.J. – MECHANICAL JOINT P.V.C. – POLYVINYL CHLORIDE H.D.P.E. – HIGH DENSITY POLYETHYLENE D.I.P. – DUCTILE IRON PIPE C.L.F. – CHAIN LINK FENCE E.O.P. – EDGE OF PAVEMENT
PROP. – PROPOSED EX. – EXISTING C/L – CENTER LINE SD – STORM DRAINAGE SS – SANITARY SEWER W.M. – WATER MAIN TBR – TO BE REMOVE

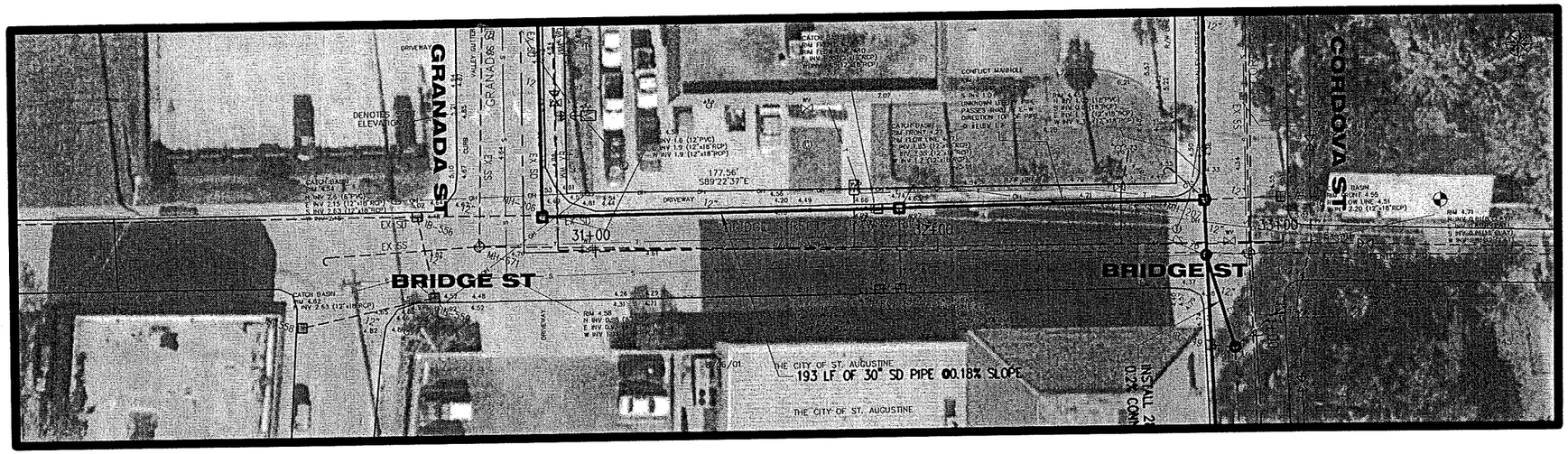
APPROVED BY: William G. Mendez
WILLIAM G. MENDEZ, P.E. #20542
DATE: 4/9/02

SHEET 7

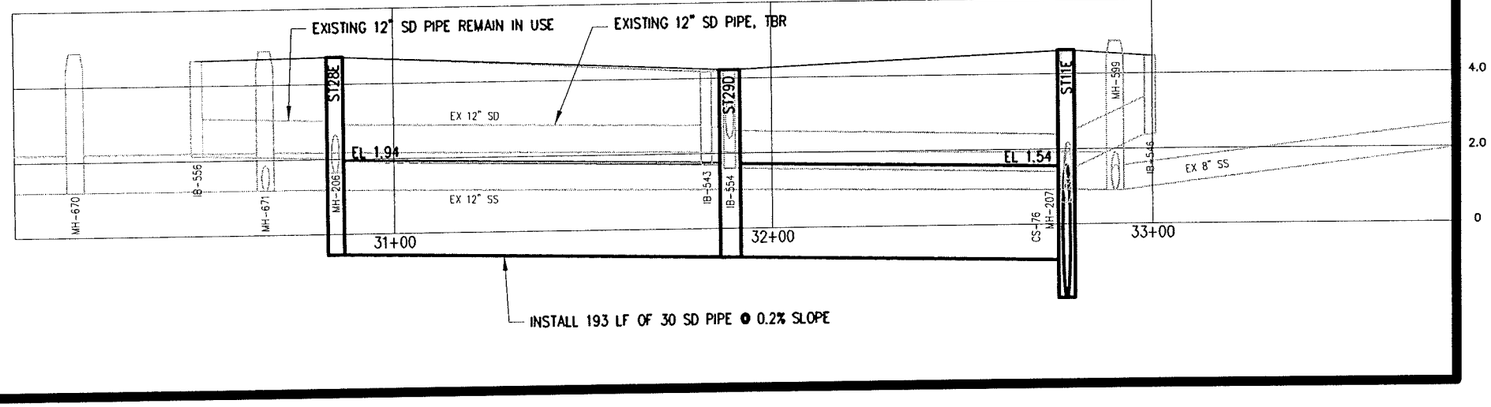
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REV:
FILE: StormwaterProjects\MariaSanchez\Plan for application

CITY OF ST. AUGUSTINE
UTILITIES DEPARTMENT
P.O. BOX 210, ST. AUGUSTINE, FL. 32085-0210 PHONE: (904)825-1040

MARIA SANCHEZ BASIN STORMWATER IMPROVEMENT
GRANADA STREET PLAN & PROFILE



PLAN SCALE: 1" = 40'



PROFILE SCALE: 1"= 40' HORIZ., 1"= 4' VERT.

LEGEND											
	EXISTING UTILITY	PROPOSED SD	STATION LINE 10+00 11+00	R/W LINE	PROPERTY LINE	PAVED ROAD	DIRT ROAD	JACK & BORE UNDER PAVED ROAD SEE DET. WD-2	DIG, CUT & REPAIR DIRT ROAD	DIG, CUT & REPAIR PAVED ROAD	EX. HYDRANT EX. VALVE PROP. HYDRANT PROP. VALVE FLUSHING PLUG

M.J. – MECHANICAL JOINT P.V.C. – POLYVINYL CHLORIDE H.D.P.E. – HIGH DENSITY POLYETHYLENE D.I.P. – DUCTILE IRON PIPE C.L.F. – CHAIN LINK FENCE E.O.P. – EDGE OF PAVEMENT
PROP. – PROPOSED EX. – EXISTING C/L – CENTER LINE SD – STORM DRAINAGE SS – SANITARY SEWER W.M. – WATER MAIN TBR – TO BE REMOVE

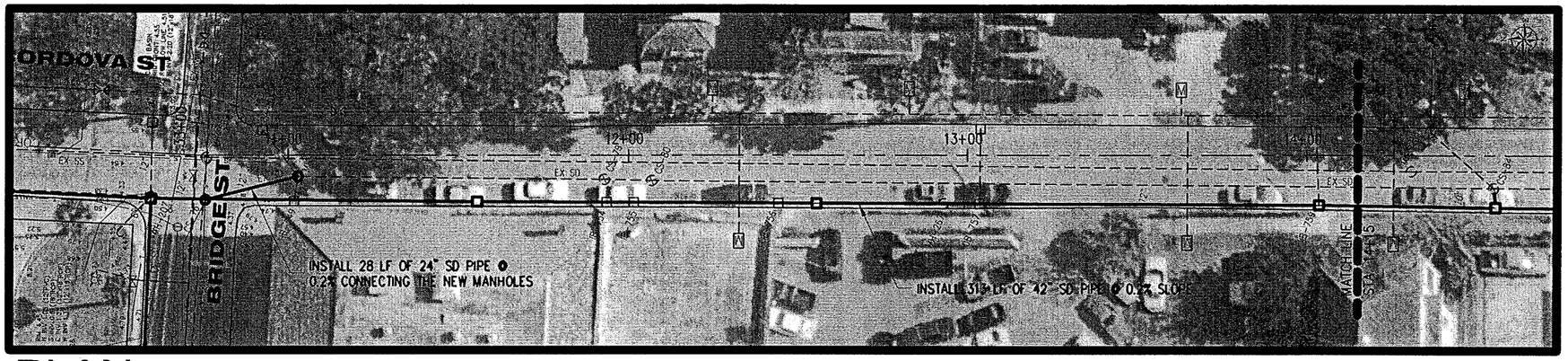
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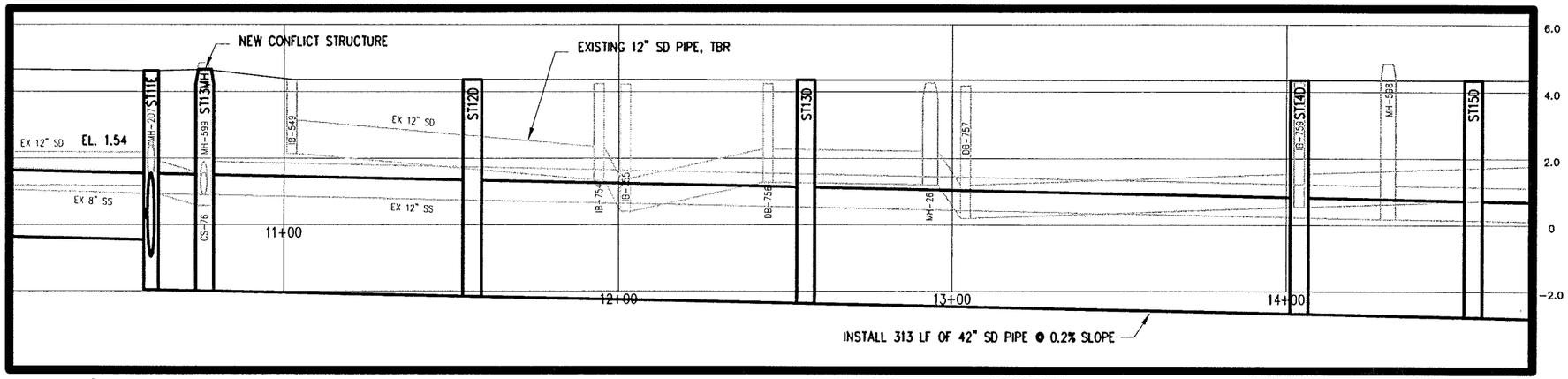
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MARIA SANCHEZ BASIN STORMWATER IMPROVEMENT
BRIDGE STREET PLAN & PROFILE



PLAN SCALE: 1" = 40'



PROFILE SCALE: 1" = 40' HORIZ., 1" = 4' VERT.

LEGEND											
	EXISTING UTILITY	PROPOSED SD	STATION LINE 10+00 11+00	R/W LINE	PROPERTY LINE	PAVED ROAD	DIRT ROAD	JACK & BORE UNDER PAVED ROAD SEE DET. WD-2	DIG, CUT & REPAIR DIRT ROAD	DIG, CUT & REPAIR PAVED ROAD	EX. HYDRANT EX. VALVE PROP. HYDRANT PROP. VALVE FLUSHING PLUG

M.J. – MECHANICAL JOINT P.V.C. – POLYVINYL CHLORIDE H.D.P.E. – HIGH DENSITY POLYETHYLENE D.I.P. – DUCTILE IRON PIPE C.L.F. – CHAIN LINK FENCE E.O.P. – EDGE OF PAVEMENT
PROP. – PROPOSED EX. – EXISTING C/L – CENTER LINE SD – STORM DRAINAGE SS – SANITARY SEWER W.M. – WATER MAIN TBR – TO BE REMOVE

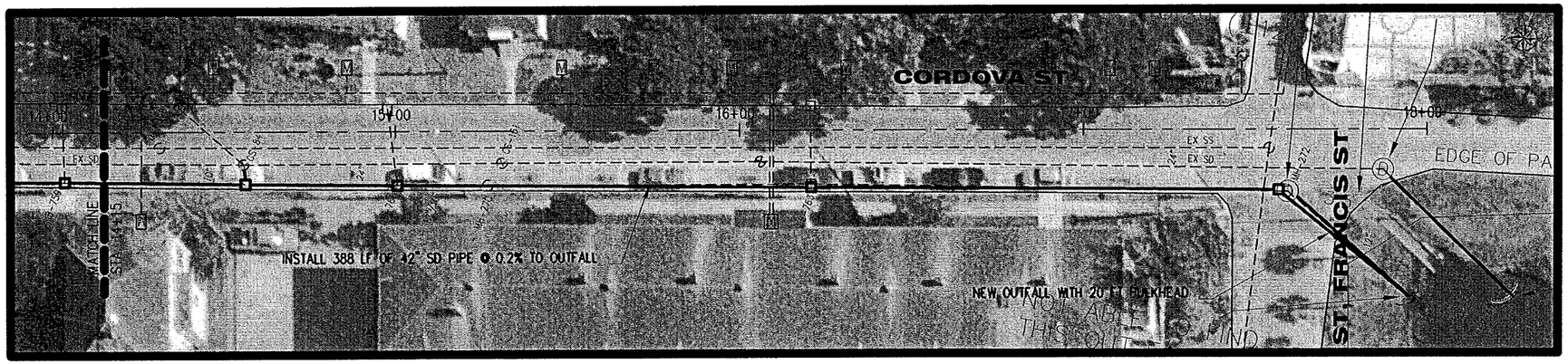
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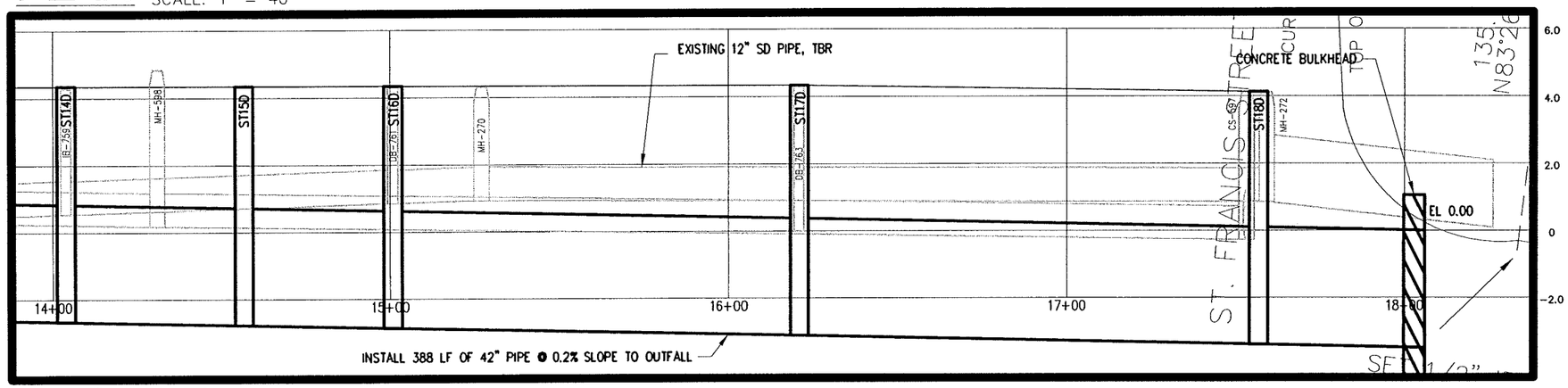
DATE: 2-5-02
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MARIA SANCHEZ BASIN STORMWATER IMPROVEMENT
S. CORDOVA STREET PLAN & PROFILE



PLAN SCALE: 1" = 40'



PROFILE SCALE: 1" = 40' HORIZ., 1" = 4' VERT.

LEGEND

EXISTING UTILITY ----------	PROPOSED SD ————	STATION LINE 10+00 — 11+00	R/W LINE	PROPERTY LINE	PAVED ROAD	DIRT ROAD	JACK & BORE UNDER PAVED ROAD SEE DET. WD-2	DIG, CUT & REPAIR DIRT ROAD	DIG, CUT & REPAIR PAVED ROAD	EX. HYDRANT EX. VALVE PROP. HYDRANT PROP. VALVE FLUSHING PLUG

M.J. – MECHANICAL JOINT P.V.C. – POLYVINYL CHLORIDE H.D.P.E. – HIGH DENSITY POLYETHYLENE D.I.P. – DUCTILE IRON PIPE C.L.F. – CHAIN LINK FENCE E.O.P. – EDGE OF PAVEMENT
PROP. – PROPOSED EX. – EXISTING C/L – CENTER LINE SD – STORM DRAINAGE SS – SANITARY SEWER W.M. – WATER MAIN TBR – TO BE REMOVE

APPROVED BY: _____
WILLIAM G. MENDEZ, P.E. #20542
DATE: 4/9/02

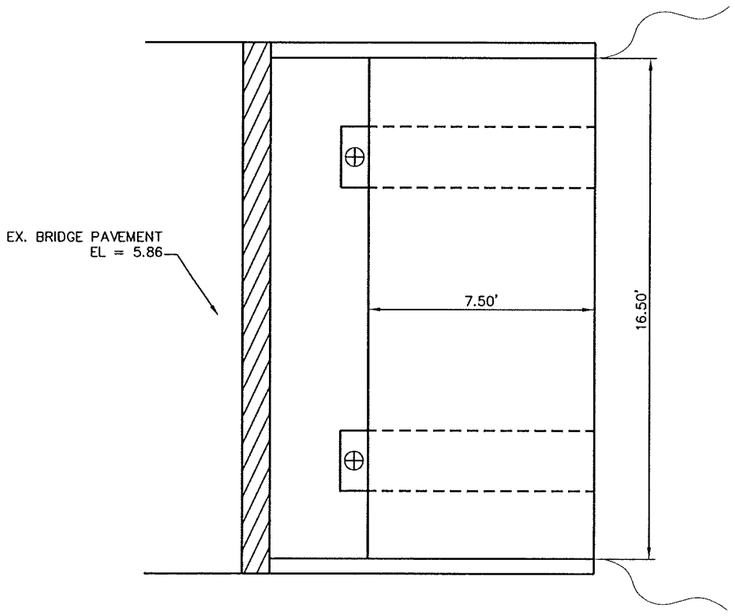
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MARIA SANCHEZ BASIN STORMWATER IMPROVEMENT

S. CORDOVA STREET PLAN & PROFILE



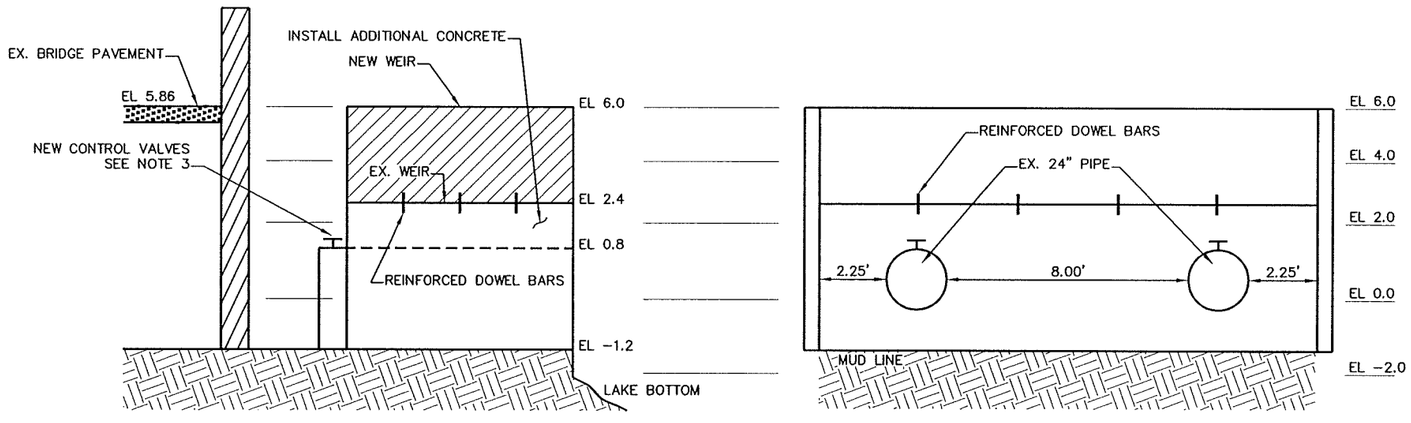
NOTES:

1. THE ADDITIONAL CONCRETE WEIR WILL BE POUR IN PLACE ON TOP OF EXISTING WEIR.

2. NUMBER 10 DOWEL BARS WILL BE USED TO CONNECT NEW CONCRETE WEIR TO EXISTING.

3. VALVES WILL BE CONTROLLED BY COMPUTER TO MAINTAIN THE TIDAL SURGE AND WATER LEVELS OF LAKE AT APPROPRIATE ELEVATION.

EL = −1.2 @ LOW TIDE
EL = 1.0 FT @ HIGH TIDE



PLAN

SCALE: 1" = 5'

LEGEND

EXISTING UTILITY	PROPOSED SD	STATION LINE 10+00 — 11+00	R/W LINE	PROPERTY LINE	PAVED ROAD	DIRT ROAD	JACK & BORE UNDER PAVED ROAD SEE DET. WD-2	DIG, CUT & REPAIR DIRT ROAD	DIG, CUT & REPAIR PAVED ROAD

EX. HYDRANT
EX. VALVE
PROP. HYDRANT
PROP. VALVE
FLUSHING
PLUG

M.J. – MECHANICAL JOINT P.V.C. – POLYVINYL CHLORIDE H.D.P.E. – HIGH DENSITY POLYETHYLENE D.I.P. – DUCTILE IRON PIPE C.L.F. – CHAIN LINK FENCE E.O.P. – EDGE OF PAVEMENT
PROP. – PROPOSED EX. – EXISTING C/L – CENTER LINE SD – STORM DRAINAGE SS – SANITARY SEWER W.M. – WATER MAIN

APPROVED BY: _____
WILLIAM G. MENDEZ, P.E. #20542
DATE: 4/9/02

SHEET 11

DATE: 2-5-02
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MARIA SANCHEZ BASIN STORMWATER IMPROVEMENT
WEIR CONTROL STRUCTURE



PLAN

SCALE: 1" = 100'

LEGEND										
EXISTING UTILITY ----------	PROPOSED SD ———	STATION LINE 10+00 — 11+00	R/W LINE — — —	PROPERTY LINE ———	PAVED ROAD ———	DIRT ROAD ----------	JACK & BORE UNDER PAVED ROAD SEE DET. WD-2	DIG, CUT & REPAIR DIRT ROAD	DIG, CUT & REPAIR PAVED ROAD	EX. HYDRANT EX. VALVE PROP. HYDRANT PROP. VALVE FLUSHING PLUG

M.J. – MECHANICAL JOINT P.V.C. – POLYVINYL CHLORIDE H.D.P.E. – HIGH DENSITY POLYETHYLENE D.I.P. – DUCTILE IRON PIPE C.L.F. – CHAIN LINK FENCE E.O.P. – EDGE OF PAVEMENT
PROP. – PROPOSED EX. – EXISTING C/L – CENTER LINE SD – STORM DRAINAGE SS – SANITARY SEWER W.M. – WATER MAIN

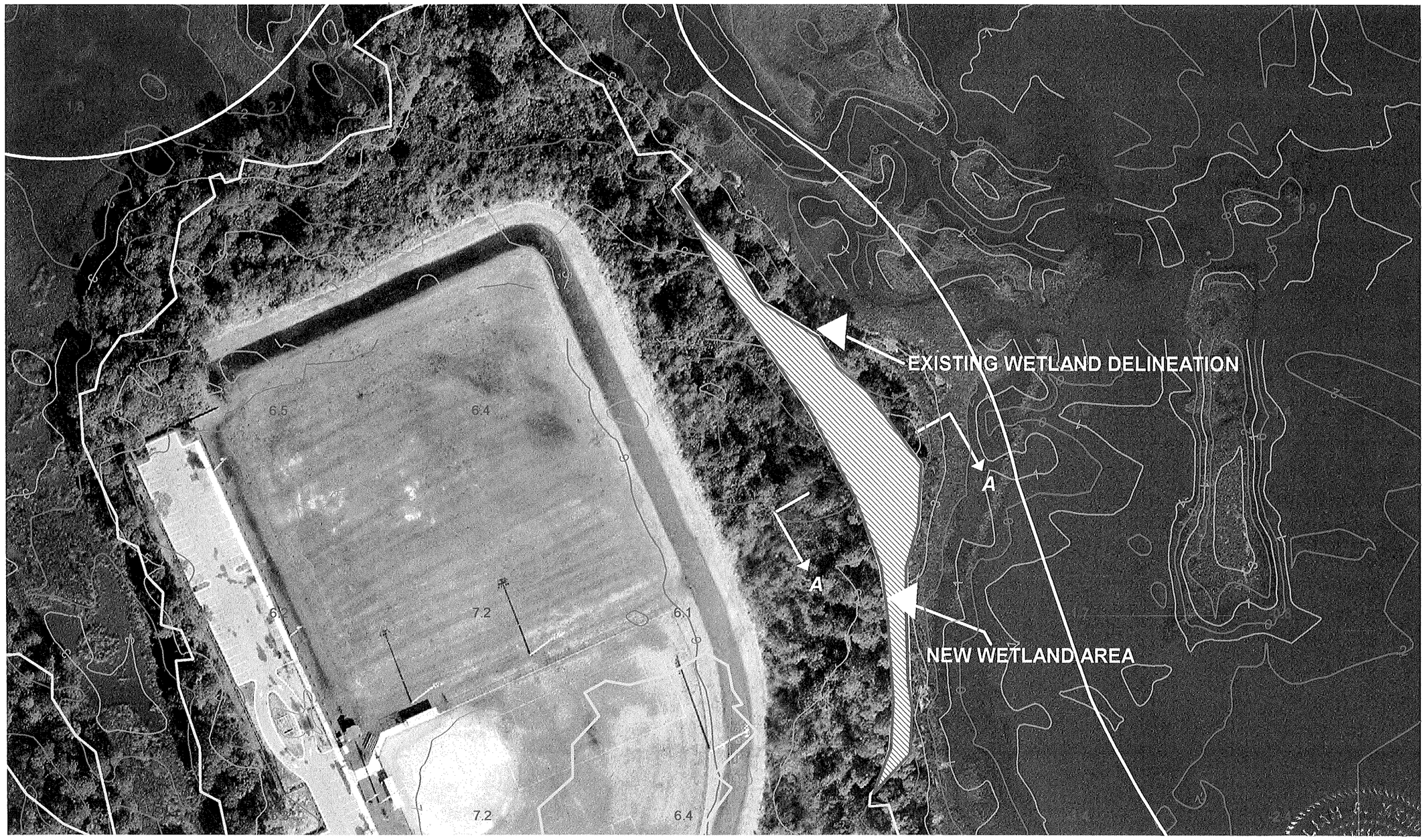
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MARIA SANCHEZ BASIN STORMWATER IMPROVEMENT
EROSION CONTROL MEASURE



PLAN

SCALE: 1" = 100'

LEGEND

EXISTING UTILITY	PROPOSED SD	STATION LINE	R/W LINE	PROPERTY LINE	PAVED ROAD	DIRT ROAD	JACK & BORE UNDER PAVED ROAD SEE DET. WD-2	DIG, CUT & REPAIR DIRT ROAD	DIG, CUT & REPAIR PAVED ROAD
----------	————	10+00 — 11+00	—— — — ——	———— ————	————	----------			

EX. HYDRANT
EX. VALVE
PROP. HYDRANT
PROP. VALVE
FLUSHING
PLUG

M.J. – MECHANICAL JOINT P.V.C. – POLYVINYL CHLORIDE H.D.P.E. – HIGH DENSITY POLYETHYLENE D.I.P. – DUCTILE IRON PIPE C.L.F. – CHAIN LINK FENCE E.O.P. – EDGE OF PAVEMENT

PROP. – PROPOSED EX. – EXISTING C/L – CENTER LINE SD – STORM DRAINAGE SS – SANITARY SEWER W.M. – WATER MAIN

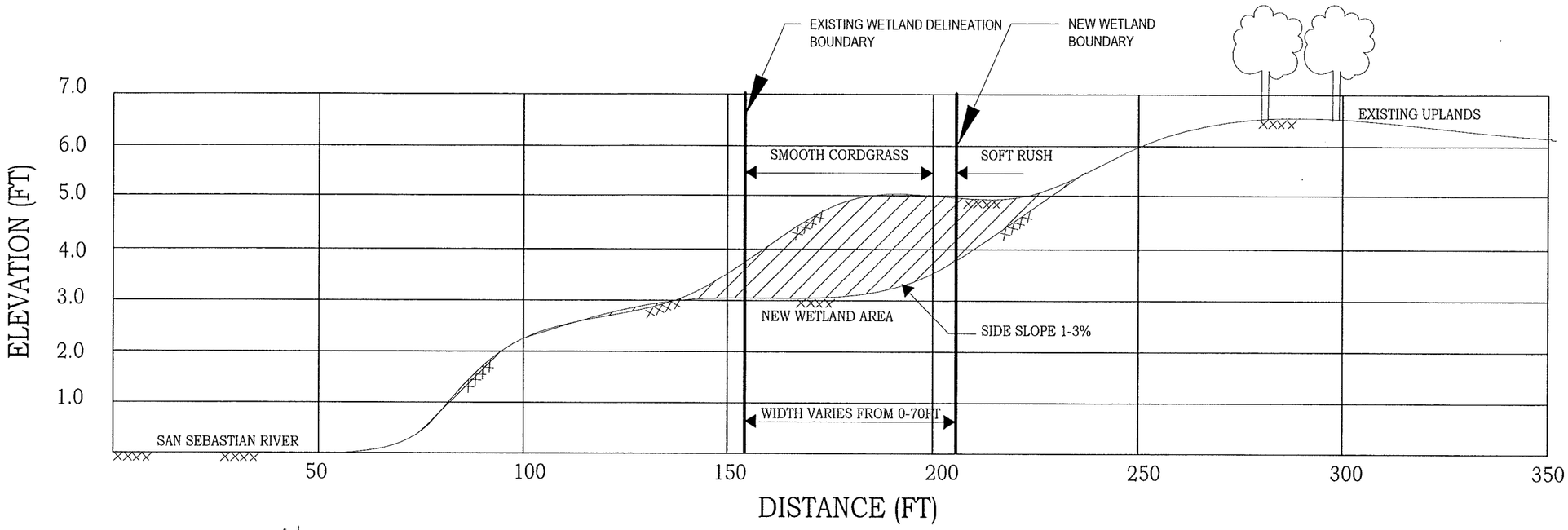
APPROVED BY: G. Mendez
WILLIAM G. MENDEZ, P.E.#20542
DATE: 4/9/02

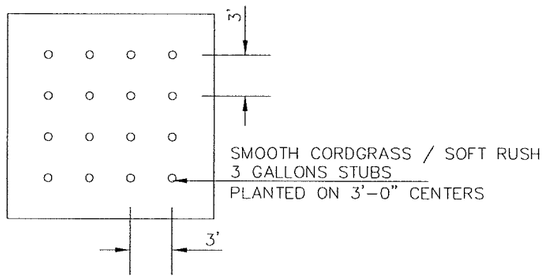
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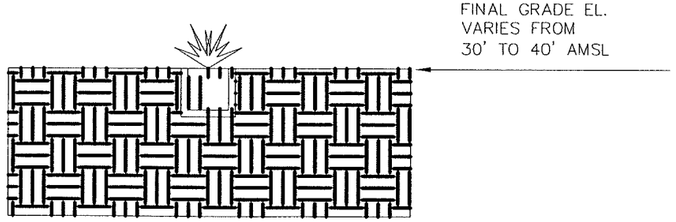
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MARIA SANCHEZ BASIN STORMWATER IMPROVEMENT
MITIGATION PLAN AT POMAR PARK





PLAN - TYPICAL PLANTING PLAN



SECTION: TYPICAL PLANTING PLAN

GENERAL NOTES:

1. THIS SITE IS LOCATED ON NORTH EAST CORNER OF POMAR PARK SECTION N 1/2 12, TOWNSHIP 7S, RANGE 29 E WITHIN CITY OF ST. AUGUSTINE CITY LIMITS.
2. THIS MITIGATION PLAN IS FOR WETLAND IMPUT FROM MARIA SANCHEZ STORMWATER IMPROVEMENT
3. PROJECT WIDTH OF THE CROSS SECTION VARIES FROM 0-70FT
4. TOTAL NEW WETLAND AREA IS 0.5 ACRE
5. SLOPE OF BANK SHALL MEET REQUIREMENT OF 1 TO 3 %
6. EROSION CONTROL BARRIER SUCH AS SILT-FENCE SHALL BE INSTALL DURING AND AFTER THE EXCAVATION AROUND THE CREATION AREA.
7. NEW CORDGRASS SHALL BE PLANTED TO CREATE SIMILAR WETLAND CHARACTERISTIC AS THOSE OF SURROUNDING.

PLAN
SCALE: 1" = 100'

LEGEND

PROPOSED W.M.	EXISTING W.M.	STATION LINE 10+00 11+00	R/W LINE	PROPERTY LINE	PAVED ROAD	DIRT ROAD	JACK & BORE UNDER PAVED ROAD SEE DET. WD-2	DIG, CUT & REPAIR DIRT ROAD	DIG, CUT & REPAIR PAVED ROAD

PROP. HYDRANT
PROP. VALVE
EX. HYDRANT
EX. VALVE
FLUSHING
PLUG

M.J. – MECHANICAL JOINT P.V.C. – POLYVINYL CHLORIDE H.D.P.E. – HIGH DENSITY POLYETHYLENE D.I.P. – DUCTILE IRON PIPE C.L.F. – CHAIN LINK FENCE E.O.P. – EDGE OF PAVEMENT
W.M. – WATER MAIN PROP. – PROPOSED EX. – EXISTING C/L – CENTER LINE

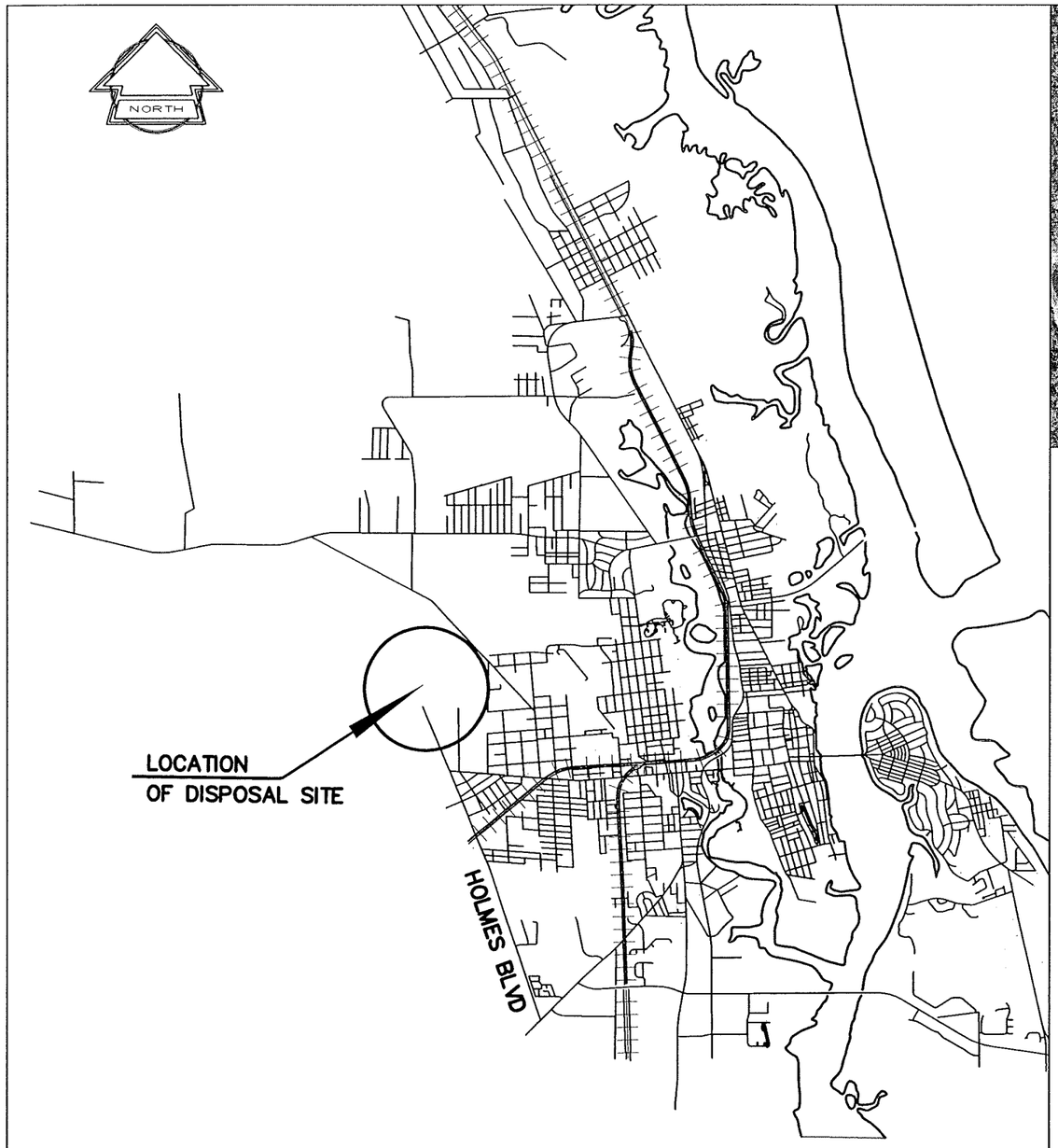
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WILLIAM G. MENDEZ, P.E. #20542
DATE: 4/9/02

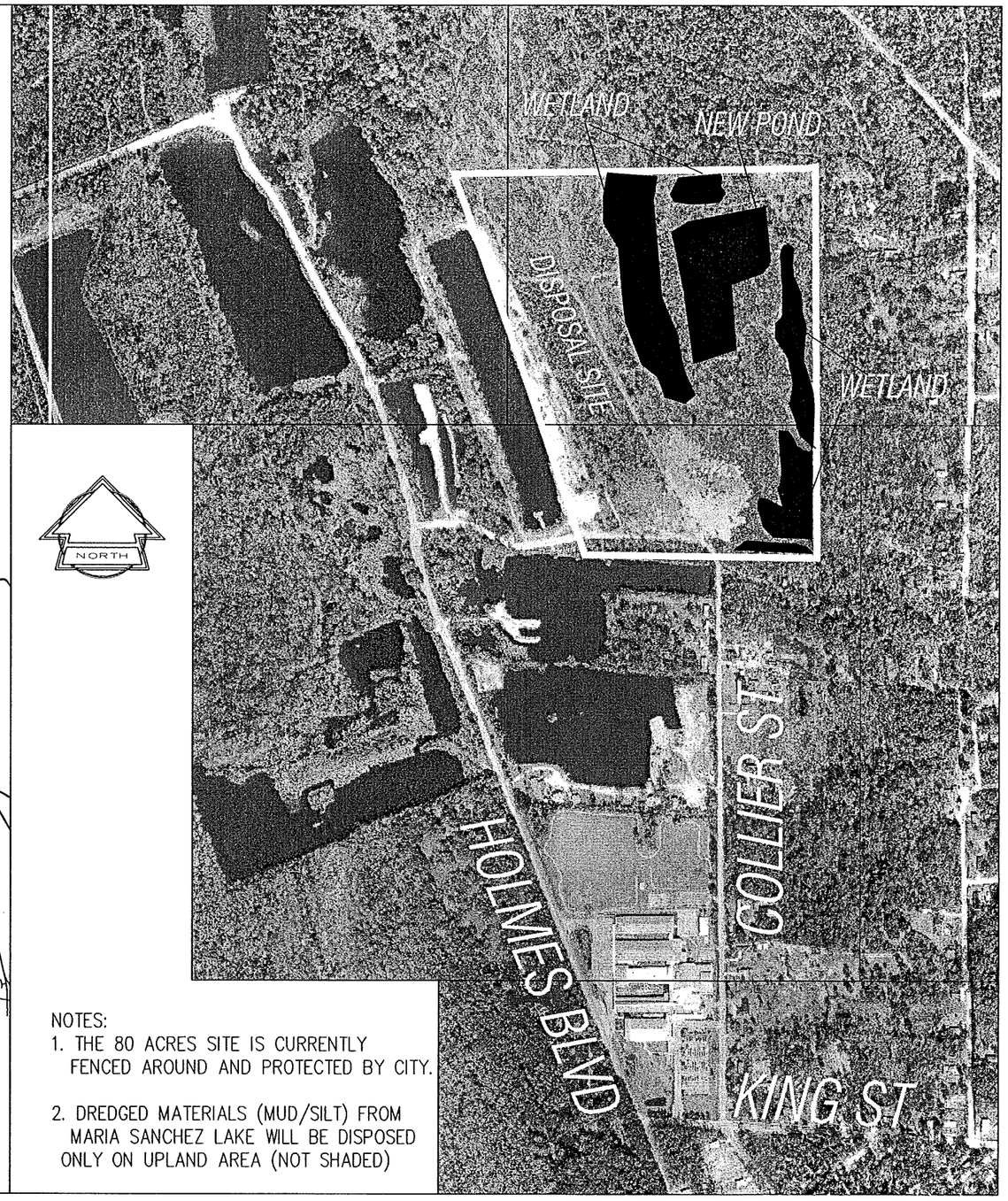
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MARIA SANCHEZ BASIN STORMWATER IMPROVEMENT
MITIGATION AREA CROSS SECTION





NOTES:
1. THE 80 ACRES SITE IS CURRENTLY FENCED AROUND AND PROTECTED BY CITY.

2. DREDGED MATERIALS (MUD/SILT) FROM MARIA SANCHEZ LAKE WILL BE DISPOSED ONLY ON UPLAND AREA (NOT SHADED)

LEGEND	PAVED ROAD _____	DIRT ROAD ----------	SURFACE WATER/ WETLAND ■		APPROVED BY: W. G. Mendez WILLIAM G. MENDEZ, P.E. #20542 DATE: 4/9/02

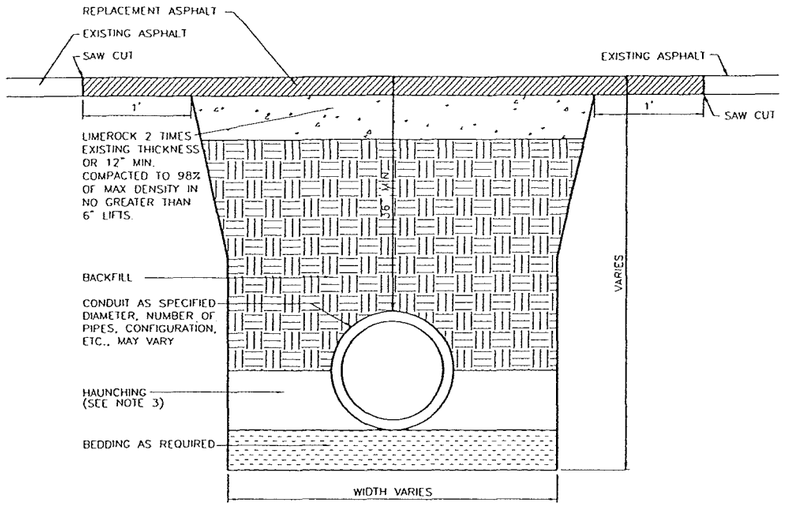
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MARIA SANCHEZ BASIN STORMWATER IMPROVEMENT

DISPOSAL SITE



UTILITY TRENCH/ASPHALT PATCHING DETAIL

NOTES:

1. TRENCH WIDTH SHALL BE A MINIMUM OF TWO FEET PLUS THE DIAMETER OF THE PIPE.
2. THE ASPHALT PATCH WIDTH SHALL BE THE TRENCH WIDTH PLUS 2 FEET.
3. HAUNCHING SHALL BE OF CLEAN, MOIST FILL MATERIAL, MANUALLY PLACED AND MANUALLY COMPACTED FROM THE TOP OF BEDDING TO THE HORIZONTAL CENTERLINE OF THE PIPE.
4. ASPHALT PATCHING SHALL BE DONE IN ACCORDANCE WITH "THE ASPHALT INSTITUTE" MANUAL SERIES No. 16.
5. THE ASPHALT THICKNESS SHALL BE MATCHED TO THE EXISTING THICKNESS OR 1 1/2" MIN.

ARTICLE 2B

EXCAVATION AND BACKFILL

1. SCOPE

1.1 THIS ARTICLE OF THE SPECIFICATIONS DESIGNATES THE REQUIREMENTS FOR STRUCTURES, PIPING, ELECTRICAL CONDUIT, AND DUCT BANKS; PLACING AND COMPACTING BACKFILL; REPLACING BACKFILL AND RESTORING GRADE IN REMOVED STRUCTURES AND PIPES; STOCKPILING OF MATERIALS AND DISPOSING OF UNSUITABLE MATERIAL; AND CONSTRUCTING AND REMOVING PROTECTIVE SHEETING; ALL IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS.

2. GENERAL REQUIREMENTS

2.1 THE CONTRACTOR'S ATTENTION IS DIRECTED TO THE REQUIREMENTS OF THE "GENERAL CONDITIONS" IF APPLICABLE IN REGARDS TO THIS ARTICLE.

2.2 UNLESS PERMITTED OTHERWISE, ALL WORK AND INSPECTION SHALL BE DONE IN A DRY CONDITION. SEE THE SECTION OF THESE SPECIFICATIONS ENTITLED DEWATERING SYSTEM.

2.3 KEEP THE EXTENT OF EXCAVATION, OPEN AT ANY TIME, TO A MINIMUM CONSISTENT WITH THE NORMAL EXECUTION OF THE WORK.

2.4 MATERIAL STOCKPILES SHALL NOT INTERFERE WITH NATURAL SURFACE DRAINAGE OR PRESENT AN UNSIGHTLY APPEARANCE. OBTAINING CONSENT FOR PLACING STOCKPILES ON PRIVATE PROPERTY SHALL BE THE CONTRACTOR'S RESPONSIBILITY.

2.5 EXCAVATED MATERIALS, SUITABLE FOR TOPSOIL OR BACKFILL MATERIAL, SHALL BE PLACED, PROTECTED, AND MAINTAINED IN SEPARATE STOCKPILES FOR LATER USE.

2.6 REMOVE AND DISPOSE OF, OFF THE PROJECT SITE, ANY EXCAVATED MATERIAL CLASSIFIED AS UNSUITABLE MATERIAL.

2.7 USE MECHANICAL SOIL COMPACTION EQUIPMENT SUITABLE FOR THE AREA BEING WORKED AND CAPABLE OF OBTAINING THE DENSITIES SPECIFIED. HYDRAULIC JETTING OR FLOODING OF SOIL, TO OBTAIN DENSIFICATION, WILL NOT BE PERMITTED.

2.8 MAXIMUM DENSITY AND OPTIMUM MOISTURE CONTENT REFER TO VALUES DETERMINED BY THE STANDARD TEST AASHTO T-99-LATEST. MOISTURE CONTENT OF BACKFILL MATERIAL, AS IT IS BEING PLACED AND COMPACTED, SHALL BE WITHIN 2% OF OPTIMUM MOISTURE CONTENT.

2.9 EXCAVATION IS DEFINED AS THE REMOVAL OF MATERIALS OF WHATEVER NATURE ENCOUNTERED.

3. MATERIALS

3.1 UNSUITABLE MATERIAL - UNSUITABLE MATERIAL IS SOIL WHICH IS UNSUITABLE FOR THE SUPPORT OF STRUCTURES, PIPING, OR OTHER MATERIALS. UNSUITABLE MATERIAL SHALL BE SOILS CONTAINING MUCK, CLAY, EXCESSIVE AMOUNTS OF ORGANIC MATERIAL, STUMPS, BRUSH, ROOTS, RUBBISH AND BUILDING MATERIAL RUBBLE.

3.2 BACKFILL MATERIAL - BACKFILL MATERIAL SHALL BE A GRANULAR SOIL, NOT CLASSIFIED AS UNSUITABLE MATERIAL, AND CAPABLE OF BEING PLACED AND COMPACTED TO THE DENSITIES AND AT THE MOISTURE CONTENTS SPECIFIED. BACKFILL MATERIAL SHALL HAVE A MINIMUM OF 50% OF ITS PARTICLES PASS A NO. 4 SIEVE. NO MORE THAN 10% OF ITS PARTICLES SHALL PASS A NO. 200 SIEVE. THE MAXIMUM SIZE ROCK PERMITTED IN BACKFILL MATERIAL SHALL BE A 3-1/2" WITH SUCH ROCK BEING UNIFORMLY DISPERSED IN THE SOIL. ROCK OR OTHER HARD, LUMPY, OR UNYIELDING MATERIALS, HOWEVER, SHALL NOT BE PERMITTED IN BACKFILL MATERIAL WITHIN 1' OF EXTERNAL DIAMETERS OF PIPE AND CONDUIT, OR AGAINST STRUCTURES HAVING PROTECTIVE COATINGS AND COVERINGS. THE CONTRACTOR SHALL PROVIDE BACKFILL MATERIAL WHEN THIS MATERIAL IS NOT AVAILABLE FROM EARTHWORK OPERATIONS ON THE PROJECT SITE. BACKFILL MATERIAL USED FOR PIPE BEDDING SHALL HAVE ALL PARTICLES PASS A 3/8" SIEVE.

3.3 SAND BEDDING MATERIAL - THIS BEDDING MATERIAL SHALL BE A CLEAN CONCRETE SAND HAVING APPROXIMATELY UNIFORM GRADATION BETWEEN SIEVE SIZES NO. 4 AND NO. 50. ALL PARTICLES SHALL PASS A 3/8" SIEVE AND NO PARTICLES SHALL PASS A NO. 100 SIEVE.

3.4 GRAVEL BEDDING MATERIAL - THIS BEDDING MATERIAL SHALL MEET THE REQUIREMENTS OF ASTM C33-LATEST AND SHALL BE COARSE AGGREGATE, SIZE NO. 67 (3/4" TO NO. 4).

3.5 SUBDRAIN AGGREGATE - SUBDRAIN AGGREGATE, WHEN NOTED ON THE DRAWINGS, SHALL CONSIST OF CLEAN STONE OR GRAVEL AND SHALL CONFORM TO THE FOLLOWING GRADATION REQUIREMENTS:

SIEVE SIZE	PERCENT PASSING
1-1/2"	100
1"	90-100
3/8"	25-60
NO. 4	5-40
NO. 8	0-20

4. TRENCH EXCAVATION

4.1 PIPE TRENCH

4.1.1 EXCAVATION SHALL BE BY OPEN CUT UNLESS SPECIFIED OTHERWISE OR PERMITTED BY THE ENGINEER. TRENCH WIDTH SHALL BE KEPT NARROW WHERE POSSIBLE.

4.1.2 TRENCH SIDES SHALL BE VERTICAL FROM THE HORIZONTAL PIPE CENTERLINE TO A LEVEL 1' ABOVE THE TOP OF THE PIPE. TRENCH WIDTH WITHIN THIS AREA SHALL NOT EXCEED THE EXTERNAL PIPE DIAMETER BY MORE THAN 12", EACH SIDE OF THE PIPE.

4.1.3 BOTTOM OF TRENCH SHALL BE CAREFULLY EXCAVATED AND SHAPED TO ALLOW THE PIPE BARREL TO REST FIRMLY ON UNDISTURBED IN-PLACE SOIL. EXCAVATE FOR PIPE JOINTS AS REQUIRED.

4.1.4 WHEN UNSUITABLE MATERIALS, ROCK OR OTHER HARD, LUMPY, OR UNYIELDING MATERIALS ARE ENCOUNTERED IN THE TRENCH BOTTOM, THEY SHALL BE REMOVED TO A DEPTH OF 2' MINIMUM BELOW THE TRENCH BOTTOM AND REPLACED WITH BACKFILL MATERIAL. THE BACKFILL MATERIAL SHALL BE COMPACTED TO THE DENSITY OF THE SOIL IN WHICH THE TRENCH IS CUT. BEDDING MATERIAL SHALL THEN BE USED TO FIRMLY SUPPORT THE PIPE BARREL AND SHALL EXTEND UP TO THE HORIZONTAL CENTERLINE OF THE PIPE. SAND OR GRAVEL BEDDING MATERIALS SHALL ONLY BE USED WHEN SO AUTHORIZED BY THE ENGINEER.

5. TRENCH BACKFILL

5.1 ATTENTION IS CALLED TO THE VARIOUS TESTING REQUIREMENTS OF THE PARTICULAR PIPE TO BE INSTALLED AS SPECIFIED UNDER THE PIPE SECTIONS OF THESE SPECIFICATIONS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING THE NECESSARY INSPECTIONS BEFORE, DURING, AND AFTER BACKFILLING AND SHALL RE-EXCAVATE, REFILL, AND PERFORM ALL SUCH RELATED WORK TO OBTAIN SATISFACTORY TEST RESULTS.

5.2 BACKFILL IN TRENCHES UNDER PAVED AREAS SHALL BE PLACED IN 6" MAXIMUM LAYERS AND COMPACTED TO 95% OF THE MAXIMUM DENSITY.

5.3 BACKFILL IN TRENCHES UNDER NON-PAVED AREAS SHALL BE PLACED IN 12" LAYERS AND COMPACTED TO 95% OF MAXIMUM DENSITY.

5.4 ALL BACKFILL IN TRENCHES SHALL BE COMPACTED WITH LIGHTWEIGHT TAMPING EQUIPMENT. COMPACTION BY PASSAGE OF HEAVY CONSTRUCTION EQUIPMENT WILL NOT BE PERMITTED.

5.5 DO NOT PERMIT HEAVY CONSTRUCTION EQUIPMENT TO CROSS OVER THE TRENCH UNTIL BACKFILLING HAS BEEN COMPLETED.

5.6 THE CONTRACTOR SHALL REFILL FOR SETTLEMENT ALL BACKFILLED AREAS. THE SURFACES OF BACKFILLED TRENCHES SHALL BE MAINTAINED IN A SAFE AND SATISFACTORY CONDITION AT ALL TIMES AFTER BEING OPENED TO TRAFFIC UNTIL THE FINAL ACCEPTANCE OF THE CONTRACT WORK BY THE OWNER.

6. PROTECTIVE SHEETING

6.1 THE CONTRACTOR SHALL PROVIDE AND MAINTAIN PROTECTIVE SHEETING (INCLUDING SHORING AND BRACING) AS MAY BE REQUIRED TO RETAIN SOIL, PROTECT WORKERS, PROTECT EXISTING FACILITIES (STRUCTURES, UTILITIES, PAVEMENT, ETC.) OR CONFINE THE CONSTRUCTION TO A REQUIRED AREA. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PROVIDE SAFE PROTECTIVE SHEETING, WHEN REQUIRED, WITHOUT BEING INSTRUCTED TO DO SO. DETAILED PLANS AND CALCULATIONS FOR PROTECTIVE SHEETING SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW.

6.2 ALL PROTECTIVE SHEETING SHALL BE REMOVED BY THE CONTRACTOR UNLESS SPECIFIED OTHERWISE OR PERMITTED BY THE ENGINEER. THE REMOVAL SHALL BE COMPLETED IN A MANNER WHICH WILL NOT DISTURB OR DAMAGE THE FINISHED WORK OR EXISTING FACILITIES. ALL BACKFILL REQUIREMENTS SHALL BE MET. PROTECTIVE SHEETING MATERIAL PERMITTED TO REMAIN IN PLACE SHALL BE 30" BELOW FINISHED GRADE.

6.3 PORTIONS OF TIMBER SHEETING FOR PIPE TRENCHES, BELOW A LEVEL OF 1' ABOVE THE TOP OF THE PIPE, SHALL REMAIN IN PLACE.

6.4 STEEL DRAG SHIELDS OR TRENCH BOXES MAY BE USED AND SHALL BE STEEL SAFETY SHIELD AS MANUFACTURED BY SAFETY SHORING SHIELDS, INC.; EFFICIENCY TRENCH BOX AS MANUFACTURED BY EFFICIENCY PRODUCTION, INC.; OR EQUIVALENT. VOIDS LEFT BY THE ADVANCEMENT OF THE SHIELD SHALL BE CAREFULLY BACKFILLED AND COMPACTED IN ACCORDANCE WITH TRENCH BACKFILL REQUIREMENTS.

7. TESTING

7.1 THE TESTING AGENCY RETAINED BY THE OWNER WILL PERFORM ALL REQUIRED SOILS TESTING FOR THE WORK. THE COST OF TESTING WILL BE PAID FOR BY THE OWNER, UNLESS SPECIFIED OTHERWISE HEREIN.

7.2 IN-PLACE DENSITY TESTS - BACKFILL MATERIAL WHICH FAILS DENSITY TESTS SHALL BE REWORKED AND RE-COMPACTED. ADDITIONAL DENSITY TESTS FOR THE REWORKED SOIL SHALL BE AT THE CONTRACTOR'S EXPENSE. INITIAL DENSITY TESTS FOR UNDISTURBED IN-PLACE SOILS PLUS TESTS AFTER FIRST COMPACTION, IF REQUIRED, WILL BE PAID FOR BY THE OWNER. TESTS REQUIRED FOR ANY ADDITIONAL COMPACTION OF THE SOIL SHALL BE AT THE CONTRACTOR'S EXPENSE.

7.3 THE ENGINEER WILL JUDGE SOILS TO BE SUITABLE OR UNSUITABLE. IF THE CONTRACTOR DOES NOT AGREE WITH THE JUDGMENT OF THE ENGINEER, SOIL TESTS WILL BE PERFORMED ON THE MATERIAL IN QUESTION. THESE TESTS SHALL BE AT THE CONTRACTOR'S EXPENSE WHEN TEST RESULTS CONFIRM THE ENGINEER'S JUDGMENT.

END OF ARTICLE 2B

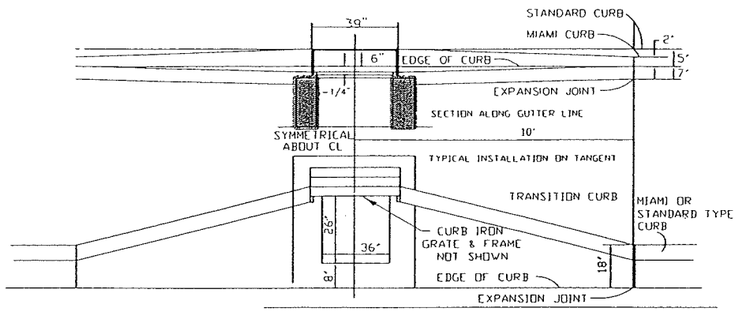
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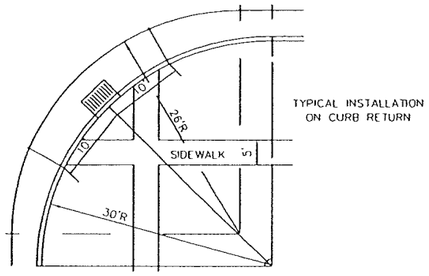
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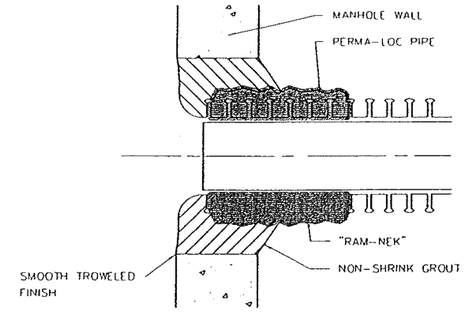
CITY OF ST. AUGUSTINE
UTILITIES DEPARTMENT
P.O. DRAWER 210, ST. AUGUSTINE, FL. 32085-0210 PHONE: (904)825-1040

EXCAVATION AND BACKFILL
SPECIFICATIONS



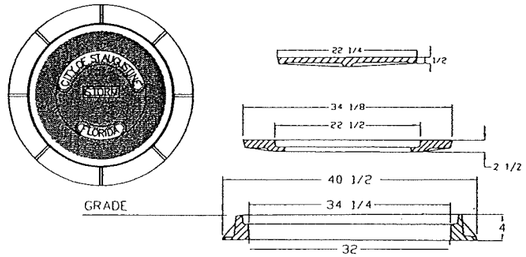


STANDARD CURB INLET INSTALLATION



MANHOLE OR INLET BASIN
CONNECTION - GROUT TO "RAM-NEK"

PERMA-LOC PVC PIPE CONNECTION TO CONCRETE MANHOLE OR INLET BASIN



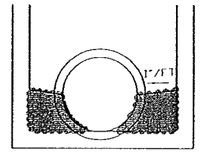
STORM MANHOLE RING AND COVER USF655CWM

GENERAL NOTE:
MORTAR USED TO SEAL THE PIPE INTO THE WALLS OF PRECAST UNITS WILL BE OF SUCH A MIX THAT SHRINKAGE WILL NOT CAUSE LEAKAGE INTO OR OUT OF THE UNITS. MAXIMUM OPENING FOR PIPE SHALL BE THE O.D. OF THE PIPE REQUIRED PLUS 6".



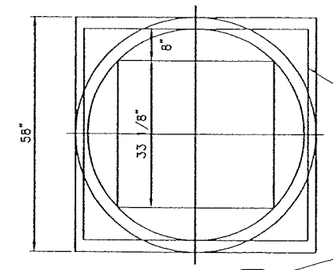
DETAIL OF CHANNELIZATION

NOTE: CHANNELIZATION REQUIRED AT ALL DRAINAGE STRUCTURES



SMOOTH FLOW CHANNELS COMPOSED OF CONCRETE OR BRICK AND MORTAR SHALL BE CONSTRUCTED ON THE BOTTOMS OF ALL STRUCTURES TO A DEPTH EQUAL TO HALF THE DIAMETER OF THE LARGEST PIPE.

INVERT DETAIL

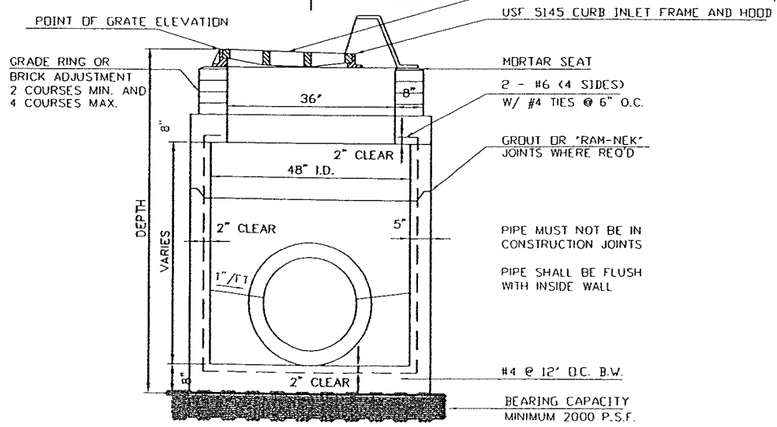


CURB INLET FRAME
GRATE NOT SHOWN

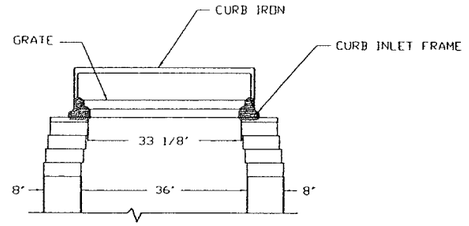
BRICK WORK

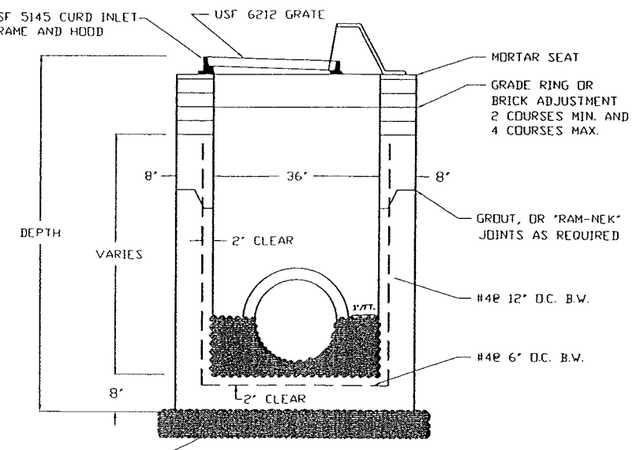
NOTES:
1. CONCRETE DESIGN STRENGTH 4,000 PSI

2. CURB AND GUTTER INLET FRAME SHALL BE USF 5145
GRATE SHALL BE USF 5145-6212



STORM DRAIN CURB INLET (48" I.D.)



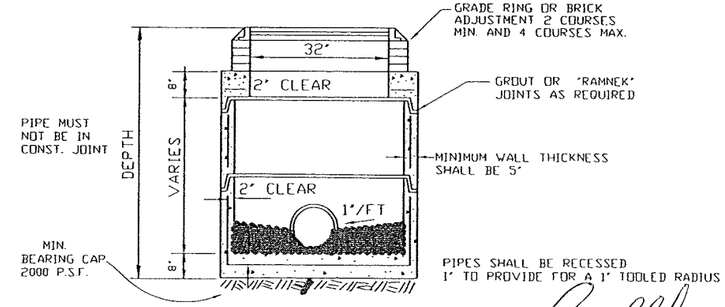


BEARING CAPACITY MINIMUM 2000 PSF

STORM DRAIN CURB INLET (36")

PLAN

PRECAST IN ACCORDANCE WITH LATEST EDITIONS OF ASTM C 478



STORM DRAIN MANHOLE (48" I.D.)

4/9/02

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SD-1

CITY OF ST. AUGUSTINE
PUBLIC WORKS DEPARTMENT
P.O. DRAWER 210, ST. AUGUSTINE, FL. 32085-0210 PHONE: (904)825-1040

DATE: 1/13/98
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STORM DRAINAGE DETAILS

ARTICLE 12C

STORM DRAINAGE MANHOLES

1. SCOPE

1.1 THIS ARTICLE OF THE SPECIFICATIONS DESIGNATES THE REQUIREMENTS FOR THE FURNISHING AND INSTALLATION OF PRECAST CONCRETE STORM DRAINAGE MANHOLES PRINCIPALLY USED FOR ACCESS TO STORM DRAINAGE COLLECTION LINES.

2. GENERAL REQUIREMENTS

2.1 THE CONTRACTOR'S ATTENTION IS DIRECTED TO THE REQUIREMENTS OF THE "GENERAL CONDITIONS" IF APPLICABLE IN REGARDS TO THIS ARTICLE.

3. PRECAST CONCRETE MANHOLES

3.1 PRECAST CONCRETE MANHOLES SHALL MEET THE REQUIREMENTS OF ASTM C478-LATEST EXCEPT AS MODIFIED HEREIN.

3.2 BASE RISER SECTIONS SHALL BE CAST WITH AN INTEGRAL FLOOR.

3.3 FLEXIBLE PLASTIC GASKETS - FOR JOINTING MANHOLE SECTIONS TOGETHER SHALL MEET THE REQUIREMENTS OF AASHTO M-198 75 I, TYPE B.

3.4 RINGS AND COVERS - EACH MANHOLE SHALL BE FITTED WITH CAST IRON RING AND COVER MEETING THE REQUIREMENTS OF ASTM-A48 CLASS 30, GRAY CAST IRON. THE RING AND COVER SHALL BE CAPABLE OF SUPPORTING A 25,000 POUND PROOF LOAD TEST AS DESCRIBED IN FEDERAL SPECIFICATION RR-F-621C. THE RING AND COVER SHALL HAVE DIMENSIONS EQUAL TO U.S. FOUNDRY 655-CWM AND THE COVER SHALL BEAR THE WORDING "CITY OF ST. AUGUSTINE STORM OR CONFLICT STRUCTURE" AS REQUIRED.

4. MANHOLE INSTALLATION

4.1 INSTALLING SECTIONS - PRECAST CONCRETE SECTIONS SHALL BE SET SO THE MANHOLE WILL BE VERTICAL AND WITH SECTIONS IN TRUE ALIGNMENT. JOINT SURFACES OF THE BASE OR PREVIOUSLY SET SECTION SHALL HAVE THE FLEXIBLE PLASTIC GASKET PLACED AROUND THE ENTIRE JOINT IN A MANNER THAT WILL ENSURE A WATER-TIGHT FIT UNDER SATURATED SOIL CONDITIONS.

4.2 NON-SHRINK MORTAR - ALL HOLES IN SECTIONS USED FOR THEIR HANDLING, AND THE ANNULAR SPACE BETWEEN THE WALL AND ENTERING PIPES, SHALL BE THOROUGHLY PLUGGED WITH AN APPROVED NON-SHRINKING MORTAR, APPLIED AND CURED IN STRICT CONFORMANCE WITH THE MANUFACTURER'S RECOMMENDATIONS SO THAT THERE WILL BE ZERO LEAKAGE THROUGH OPENINGS AND AROUND PIPES. THE MORTAR SHALL BE FINISHED SMOOTH AND FLUSH WITH THE ADJOINING INTERIOR AND EXTERIOR MANHOLE WALL SURFACES.

4.3 CURING COMPOUND - AS SOON AS MORTAR IS HYDRATED TO THE POINT WHERE IT WILL NOT BE MARRED BY SUCH APPLICATION, AND WITHIN 2 HOURS AFTER INSTALLING MORTAR, THE CONTRACTOR SHALL APPLY A MEMBRANE CURING COMPOUND, CONFORMING TO ASTM C309-LATEST, TO THE FINISHED MORTAR SURFACES BOTH INSIDE AND OUTSIDE THE MANHOLE.

4.4 GRADE ADJUSTMENT - FOR GRADE ADJUSTMENT IN SETTING THE MANHOLE FRAME, BRICK MASONRY OR PRECAST CONCRETE ADJUSTMENT RINGS SHALL BE USED ON TOP OF MANHOLE SLABS AND PRECAST CONCRETE MANHOLE CONES IN ACCORDANCE WITH THE DRAWINGS. MORTAR SHALL BE 1 PART CEMENT AND 2 PARTS SAND; LIME SHALL NOT BE USED.

4.5 SETTING RINGS AND COVERS - RINGS AND COVERS SHALL BE SET TO CONFORM ACCURATELY TO THE FINISHED GROUND OR PAVEMENT SURFACE AS ESTABLISHED BY THE DRAWINGS, UNLESS DIRECTED OTHERWISE BY THE ENGINEER. RINGS ON MANHOLE CONES SHALL BE SET CONCENTRIC WITH THE MASONRY AND IN A FULL BED OF MORTAR SO THAT THE SPACE BETWEEN THE TOP OF THE MANHOLE MASONRY AND THE BOTTOM FLANGES AT THE RING SHALL BE COMPLETELY FILLED AND MADE WATERTIGHT. A RING OF MORTAR AT LEAST 1" THICK AND PITCHED TO SHED WATER AWAY FROM THE FRAME SHALL BE PLACED AROUND THE OUTSIDE OF THE BOTTOM FLANGE. MORTAR SHALL EXTEND TO THE OUTER EDGE OF THE MASONRY AND SHALL BE FINISHED SMOOTH AND FLUSH WITH THE TOP OF THE FLANGE.

4.6 CONNECTIONS TO EXISTING MANHOLES - WHERE SHOWN IN THE PLANS, NEW LINES SHALL BE CONNECTED TO EXISTING MANHOLES. UNLESS STUBS OF CORRECT SIZE ARE FOUND TO EXIST, A PORTION OF THE MANHOLE WALL MASONRY AND FLOOR SLAB SHALL BE REMOVED. THE FLOOR SHALL BE REFORMED AND FINISHED TO MAKE A WATERTIGHT JOINT WITH THE NEW PIPE.

4.7 STUB LINES - WHERE SHOWN IN THE PLANS, STUB LINES SHALL BE PROVIDED FOR THE CONNECTION OF FUTURE STORM DRAIN LINES TO MANHOLES. THE END OF EACH STUB LINE SHALL BE PROVIDED WITH A BELL END WHICH SHALL BE CLOSED BY CONSTRUCTING A BRICK AND MORTAR WALL INSIDE THE PIPE. EACH STUB LINE SHALL BE ACCURATELY REFERENCED TO THE CENTER OF THE MANHOLE AND ACTUAL INVERT ELEVATION OF EACH END OF THE STUB LINE SHALL BE ACCURATELY RECORDED ON THE AS-BUILT DRAWINGS.

END OF ARTICLE 12C

ARTICLE 12D

PRECAST CONCRETE CURB INLETS

1 SCOPE

1.1 THIS ARTICLE OF THE SPECIFICATIONS DESIGNATES THE REQUIREMENTS FOR THE FURNISHING AND INSTALLATION OF PRECAST CONCRETE CURB INLETS.

2 GENERAL REQUIREMENTS

2.1 THE CONTRACTOR'S ATTENTION IS DIRECTED TO THE REQUIREMENTS OF THE "GENERAL CONDITIONS" IF APPLICABLE WITH REGARD TO THIS ARTICLE.

3. PRECAST CONCRETE CURB INLETS

3.1 PRECAST CONCRETE CURB INLETS SHALL MEET THE REQUIREMENTS OF ASTM C913-LATEST AND ASTM C890-LATEST. THE LOADING REQUIREMENTS SHALL BE BASED ON AASHTO H-20 TRUCK LOADS.

3.2 MINIMUM INTERIOR DIMENSIONS OF THE INLET SHALL BE 3'0" X 3'0" OR 4'-0" IN DIAMETER. THE THICKNESS OF THE BOTTOM SLAB SHALL BE 8".

3.3 MINIMUM COMPRESSIVE STRENGTH OF CONCRETE FOR DESIGN SHALL BE 4000 PSI AT 28 DAYS, USING TYPE II CEMENT.

3.4 FRAME, GRATE AND BONNET - EACH CURB INLET SHALL BE FITTED WITH A CAST IRON FRAME, GRATE AND BONNET MEETING THE REQUIREMENTS OF ASTM-A48 CLASS 30, GRAY CAST IRON. THE FRAME, GRATE AND BONNET SHALL BE CAPABLE OF SUPPORTING A 25,000 POUND PROOF LOAD TEST AS DESCRIBED IN FEDERAL SPECIFICATION RR-F-621C. THE FRAME AND BONNET SHALL HAVE DIMENSIONS EQUAL TO U.S. FOUNDRY 5145. THE GRATE SHALL HAVE DIMENSIONS EQUAL TO U.S. FOUNDRY 6212.

4 CURB INLET INSTALLATION

4.1 PRECAST CONCRETE CURB INLETS SHALL BE SET TO GRADE WITH THE SIDE WALLS VERTICAL. THE STRUCTURE SHALL BE ALIGNED PARALLEL TO THE CURB AND ADJUSTED TO ALLOW THE FRAME TO SIT SQUARELY OVER THE WALLS OF THE STRUCTURE.

4.2 NON-SHRINK MORTAR - ALL HOLES IN SECTIONS USED FOR THEIR HANDLING, AND THE ANNULAR SPACE BETWEEN THE WALL AND ENTERING PIPES, SHALL BE THOROUGHLY PLUGGED WITH AN APPROVED NON-SHRINKING MORTAR, APPLIED AND CURED IN STRICT CONFORMANCE WITH THE MANUFACTURER'S RECOMMENDATIONS SO THAT THERE WILL BE ZERO LEAKAGE THROUGH OPENINGS AND AROUND PIPES. THE MORTAR SHALL BE FINISHED SMOOTH AND FLUSH WITH THE ADJOINING INTERIOR AND EXTERIOR MANHOLE WALL SURFACES.

4.3 CURING COMPOUND - AS SOON AS MORTAR IS HYDRATED TO THE POINT WHERE IT WILL NOT BE MARRED BY SUCH APPLICATION, AND WITHIN 2 HOURS AFTER INSTALLING MORTAR, THE CONTRACTOR SHALL APPLY A MEMBRANE CURING COMPOUND, CONFORMING TO ASTM C309-LATEST, TO THE FINISHED MORTAR SURFACES BOTH INSIDE AND OUTSIDE THE MANHOLE.

4.4 GRADE ADJUSTMENT - FOR GRADE ADJUSTMENT IN SETTING THE FRAME AND BONNET, BRICK MASONRY SHALL BE USED ON TOP OF THE PRECAST STRUCTURE. MORTAR SHALL BE ONE PART CEMENT AND TWO PARTS SAND; LIME SHALL NOT BE USED. WHEN NECESSARY TO MATCH CURB HEIGHT, THE SIDES OF THE BONNET MAY BE NOTCHED OUT.

END OF ARTICLE 12D

ARTICLE 12E

CORRUGATED POLYVINYL CHLORIDE STORM DRAINAGE PIPE

1. SCOPE

1.1 THIS ARTICLE OF THE SPECIFICATIONS DESIGNATES THE REQUIREMENTS FOR THE FURNISHING AND INSTALLATION OF CORRUGATED POLYVINYL CHLORIDE STORM DRAINAGE PIPE.

2. GENERAL REQUIREMENTS

2.1 THE CONTRACTOR'S ATTENTION IS DIRECTED TO THE REQUIREMENTS OF THE "GENERAL CONDITIONS" IF APPLICABLE IN REGARDS TO THIS ARTICLE.

2.2 THE PIPE AND FITTINGS SHALL BE MANUFACTURED AND TESTED IN ACCORDANCE WITH AASHTO SPECIFICATION M304M-LATEST, CORRUGATED POLYVINYL CHLORIDE (PVC) RIBBED DRAIN PIPE AND FITTINGS BASED ON CONTROLLED INSIDE DIAMETER. THE PIPE AND FITTINGS SHALL BE COLORED TAN FOR IDENTIFICATION AS STORM DRAINAGE PIPE AND SHALL INCORPORATE AN INTEGRAL BELL AND SPIGOT. THE PIPE SHALL BE EQUAL TO PERM-A-LOC AS PROVIDED BY J-M PIPE, GREEN COVE SPRINGS, FLORIDA.

3. INSTALLATION

3.1 INSTALLATION SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

4. WATER TESTING

4.1 LEAKAGE RATES OF THE PIPE SHALL NOT EXCEED 50 GALLONS PER INCH OF DIAMETER PER MILE PER DAY.

END OF ARTICLE 12E

4/9/02

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DATE: 1/13/98
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STORM DRAINAGE
SPECIFICATIONS

APPENDIX VI

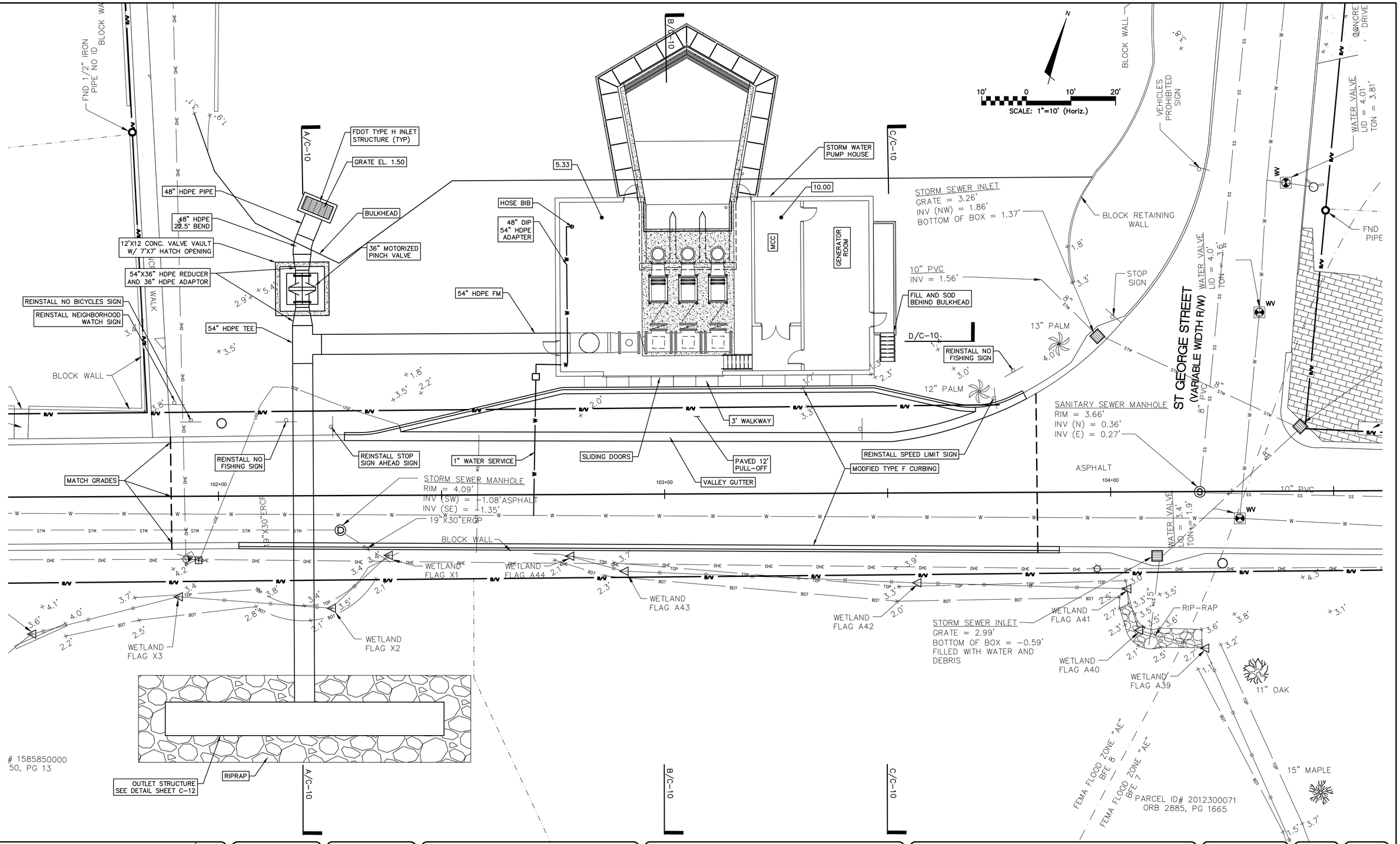
Proposed Pump Station and Forcemain Layout

CITY OF ST. AUGUSTINE

LAKE MARIA SANCHEZ FLOOD MITIGATION

Basis of Design Report

September 2019



REV.NO.	DESCRIPTION	DATE
A	ISSUED FOR BID - NOT FOR CONSTRUCTION	16 SEP 2019

REVISIONS

McKIM&CREED
139 Executive Circle, Suite 201
Daytona Beach, FL 32114-7102
Phone: (386) 274-2828, Fax: (386) 274-1393

CA Lic. No. 29588
www.mckimcreed.com

CITY OF ST AUGUSTINE EST. 1565

THE CITY OF ST. AUGUSTINE

LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT

CIVIL

PUMP STATION SITE PLAN

PROJ. START DATE:	2019/SEPT
MCE PROJ. #	072050002
DRAWN	DMP
DESIGNED	TJP
CHECKED	-
PROJ. MGR.	-

SCALE
HORIZONTAL: AS NOTED
VERTICAL: AS NOTED

C-10
DRAWING NUMBER
A
REVISION

STATUS: ISSUE FOR PERMIT NOT FOR CONSTRUCTION

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APPENDIX VII

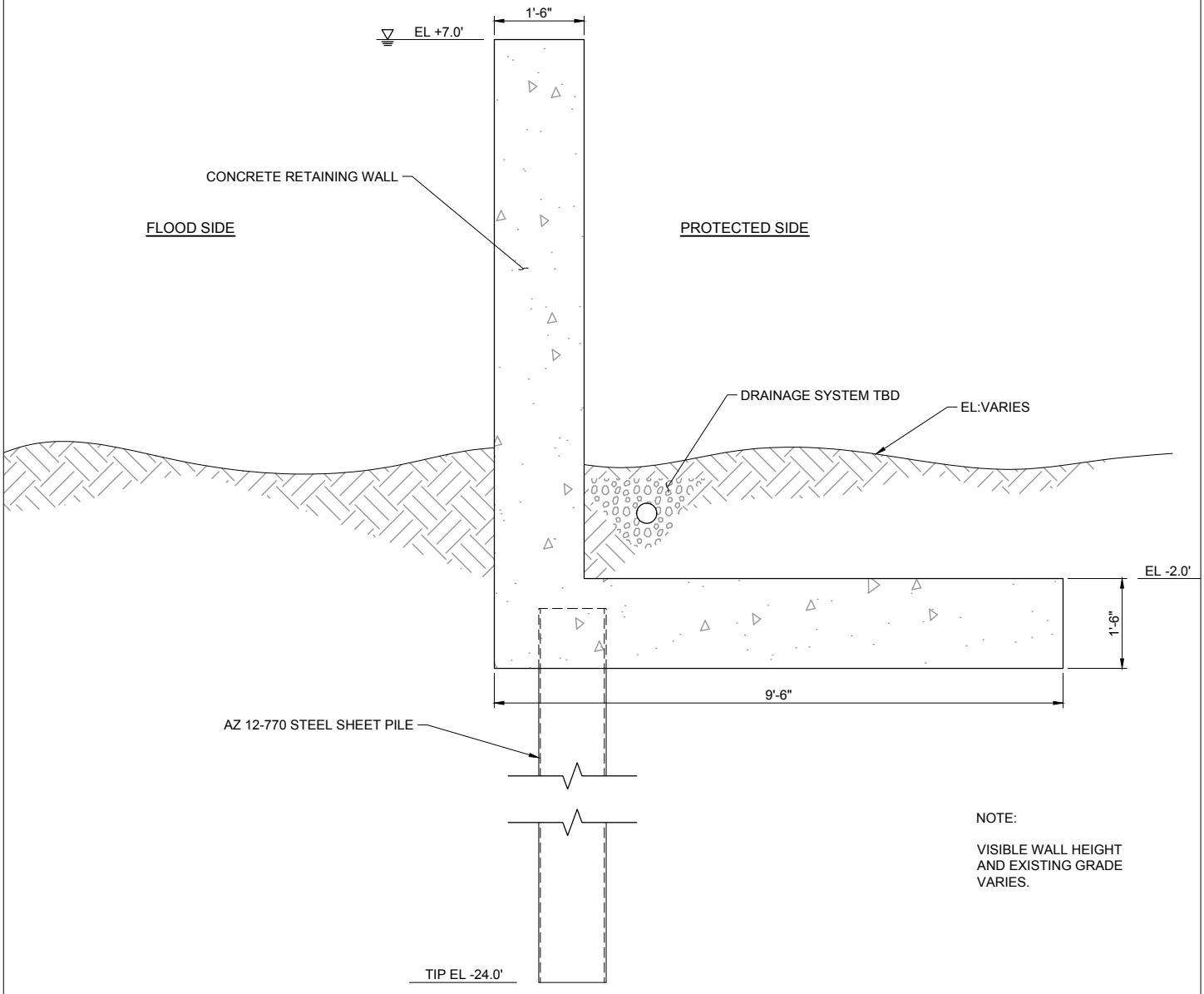
Bulkhead Locations

CITY OF ST. AUGUSTINE

LAKE MARIA SANCHEZ FLOOD MITIGATION

Basis of Design Report

September 2019



FLOOD WALL (L-TYPE CANTILEVER CONCRETE WALL)

SCALE: 3/8"=1'-0"

HORIZONTAL DATUM: NAD83
VERTICAL DATUM:NAVD88

FLOOD WALL

2'-0" 0'-0" 1'-0" 2'-0"

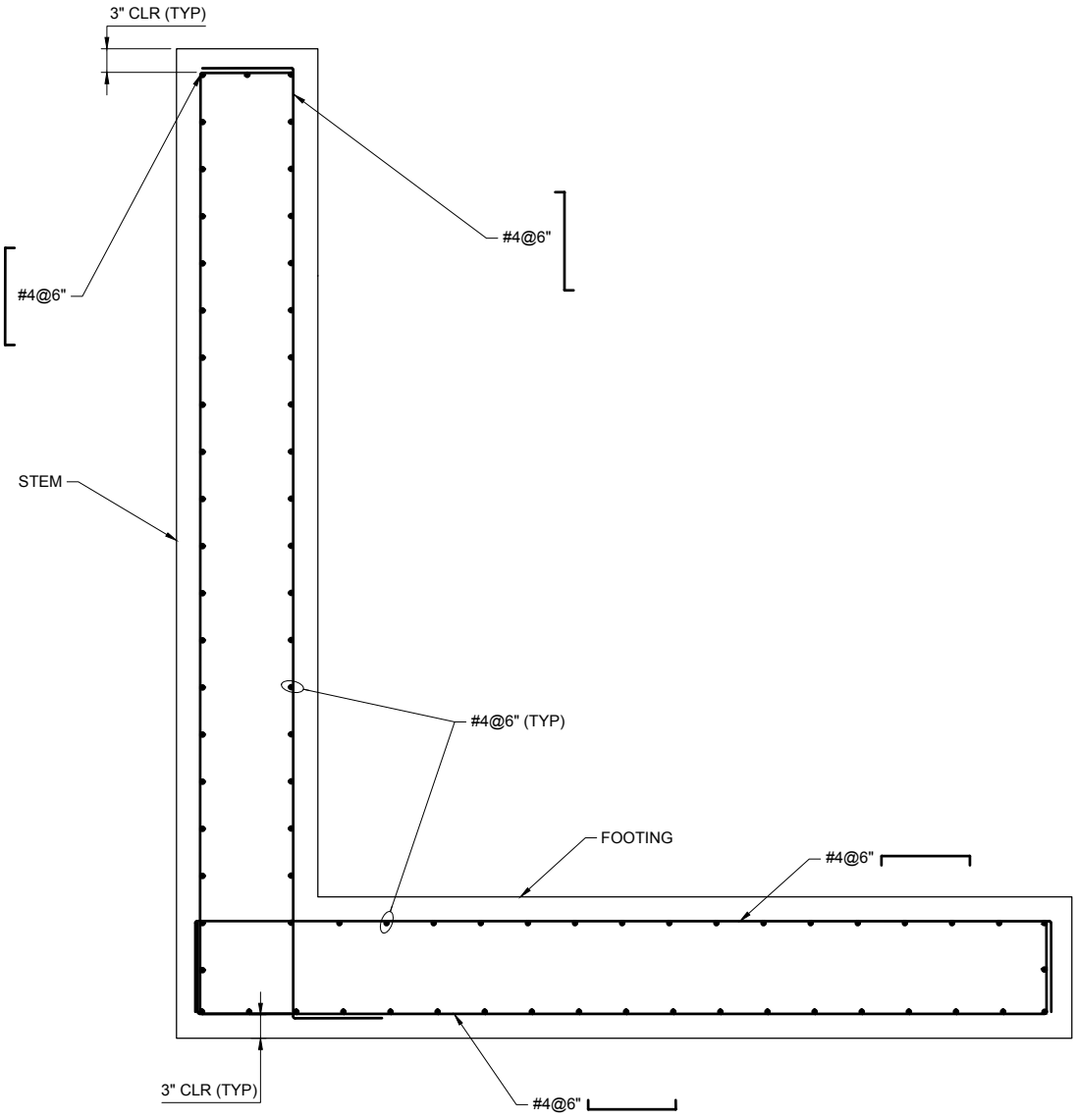
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MCKIM & CREED

LAKE MARIA SANCHEZ FLOOD MITIGATION

2019-08-12

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L-TYPE CANTILEVER CONCRETE WALL REINFORCEMENT

SCALE: 1/2"=1'-0"

HORIZONTAL DATUM: NAD83
VERTICAL DATUM:NAVD88

FLOOD WALL REINFORCEMENT

1'-0" 0'-0" 1'-0" 2'-0"

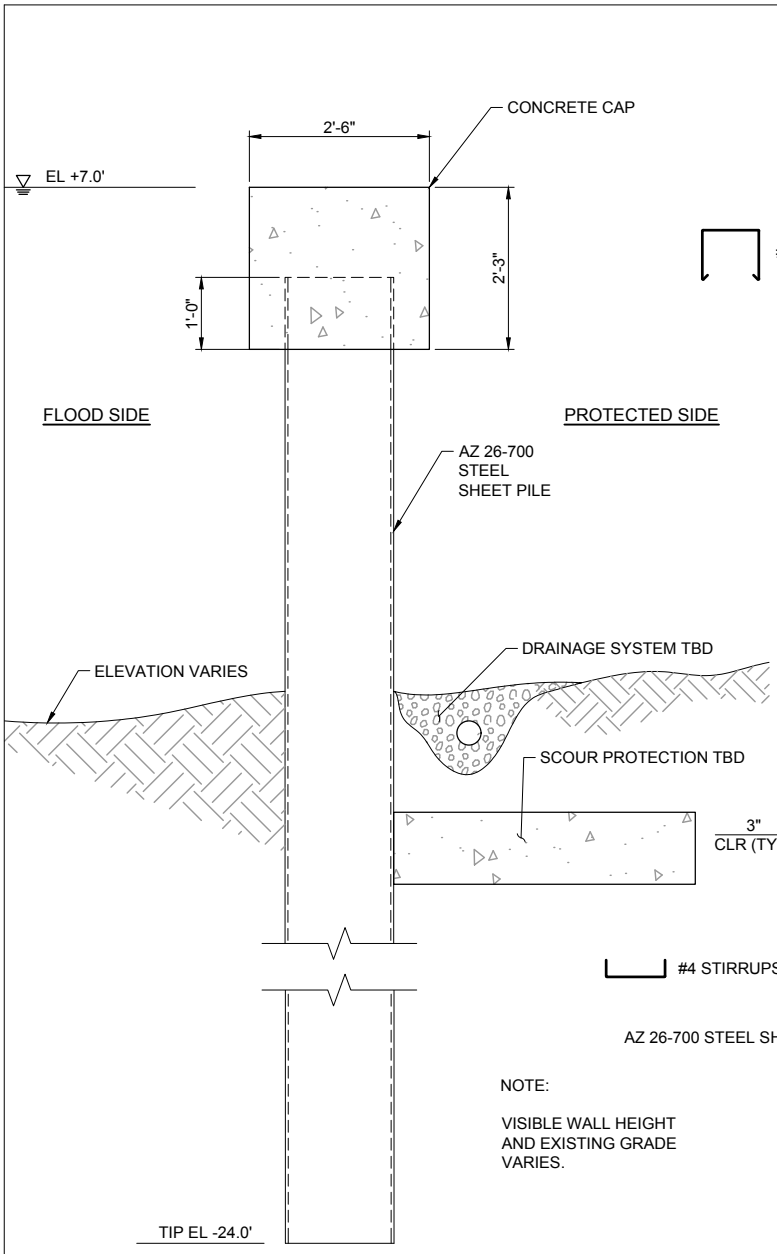
SCALE: 1/2"=1'-0"

MCKIM & CREED

LAKE MARIA SANCHEZ FLOOD MITIGATION

2019-08-12

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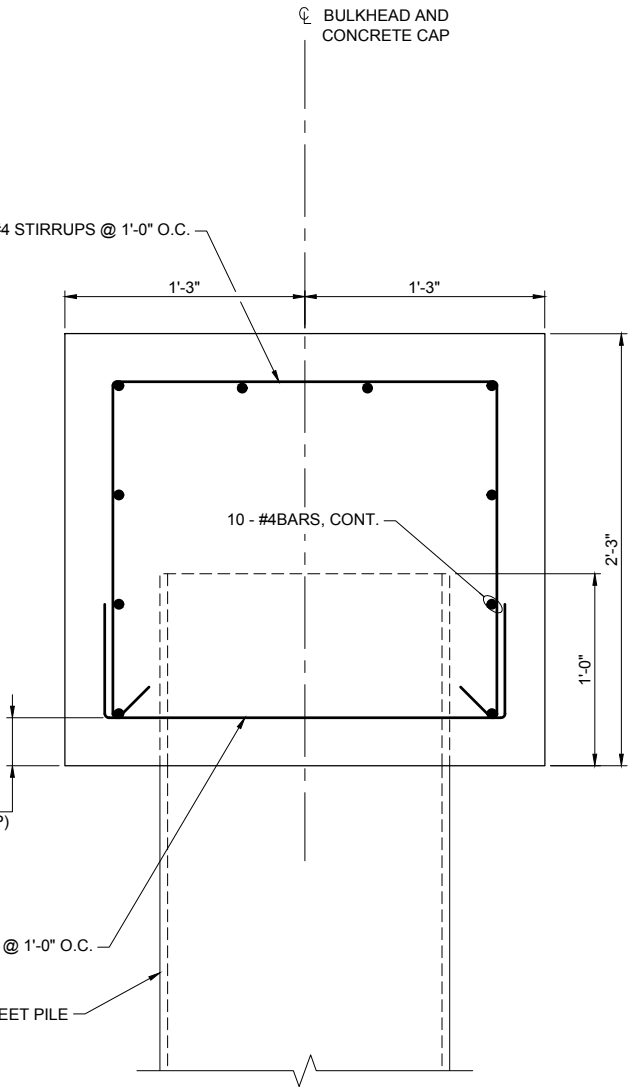


FLOOD WALL (STEEL SHEET PILE)

SCALE: 3/8"=1'-0"

2'-0" 0'-0" 1'-0" 2'-0"

SCALE: 3/8"=1'-0"



NOTE:

VISIBLE WALL HEIGHT AND EXISTING GRADE VARIES.

BULKHEAD CAP SECTION

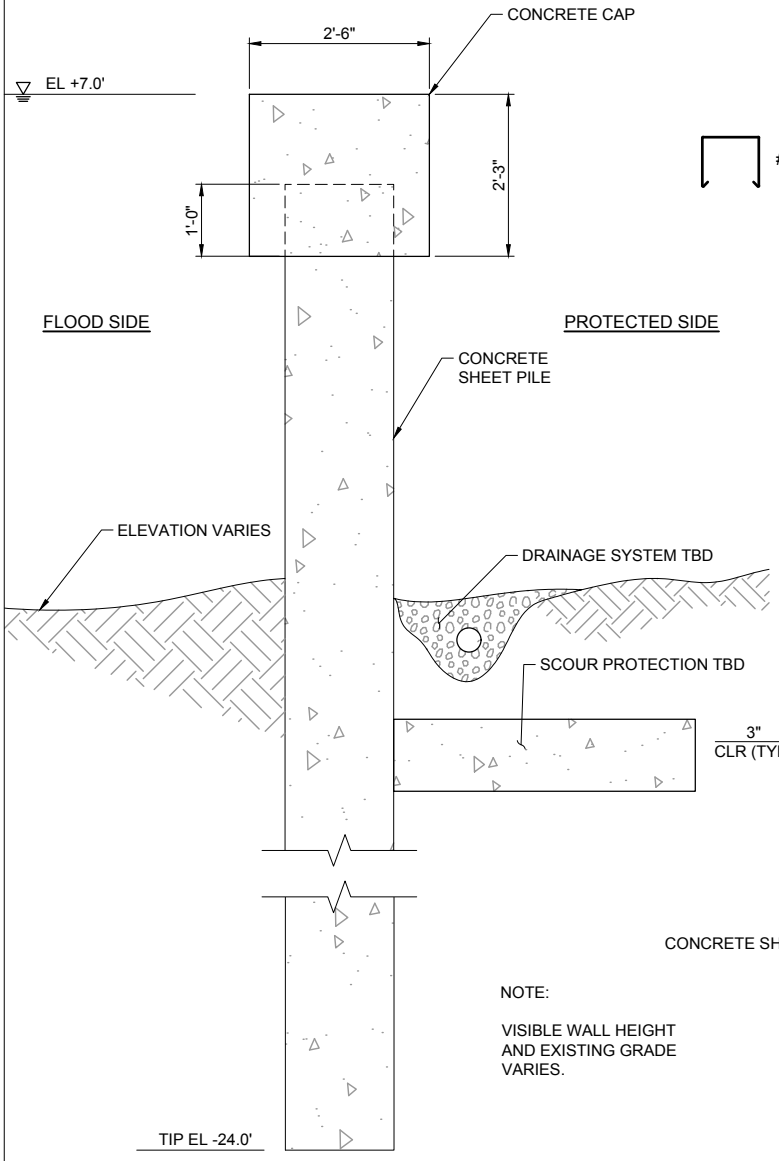
SCALE: 1"=1'-0"

0'-6" 0'-0" 0'-6" 1'-0"

SCALE: 1"=1'-0"

HORIZONTAL DATUM: NAD83 VERTICAL DATUM:NAVD88	STEEL SHEET PILE	LAKE MARIA SANCHEZ FLOOD MITIGATION
	MCKIM & CREED	2019-08-12

File: Q:\TA\103451\0500_CAD_Active_Permits\10345_SHT-007.; Plotted: 8/12/2019 10:42 AM by DURAN, JESUS.; Saved: 8/12/2019 10:41 AM by JDURAN



NOTE:

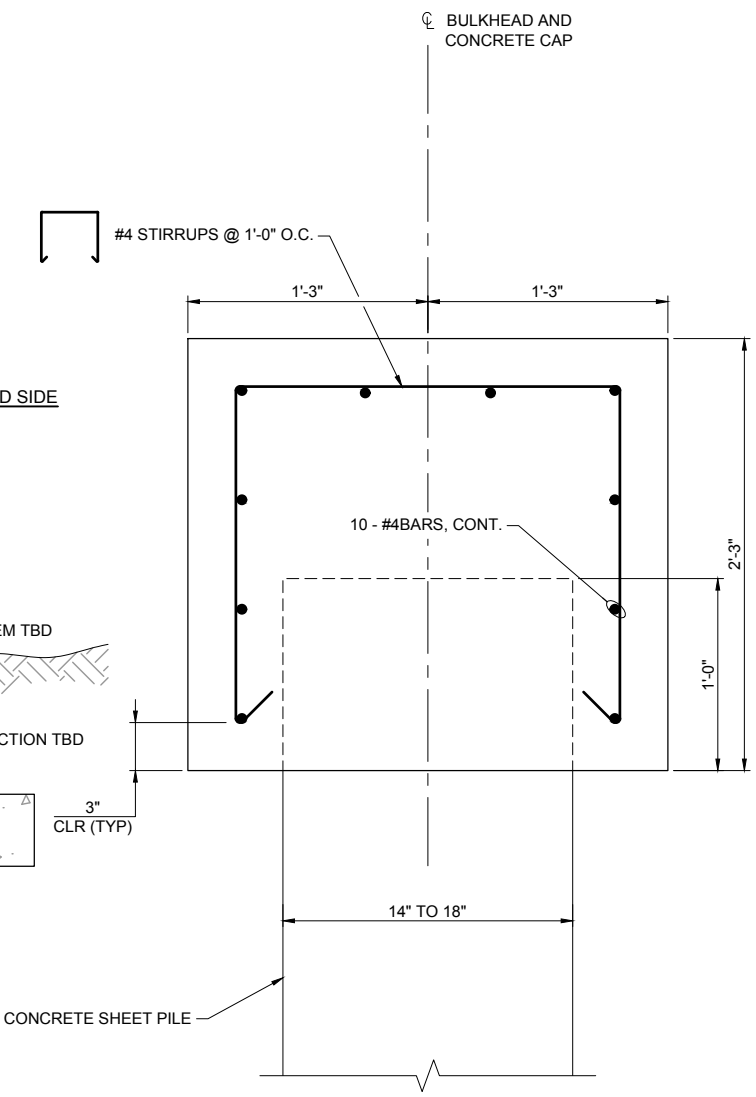
VISIBLE WALL HEIGHT AND EXISTING GRADE VARIES.

FLOOD WALL (CONCRETE SHEET PILE)

SCALE: 3/8"=1'-0"

2'-0" 0'-0" 1'-0" 2'-0"

SCALE: 3/8"=1'-0"



BULKHEAD CAP SECTION

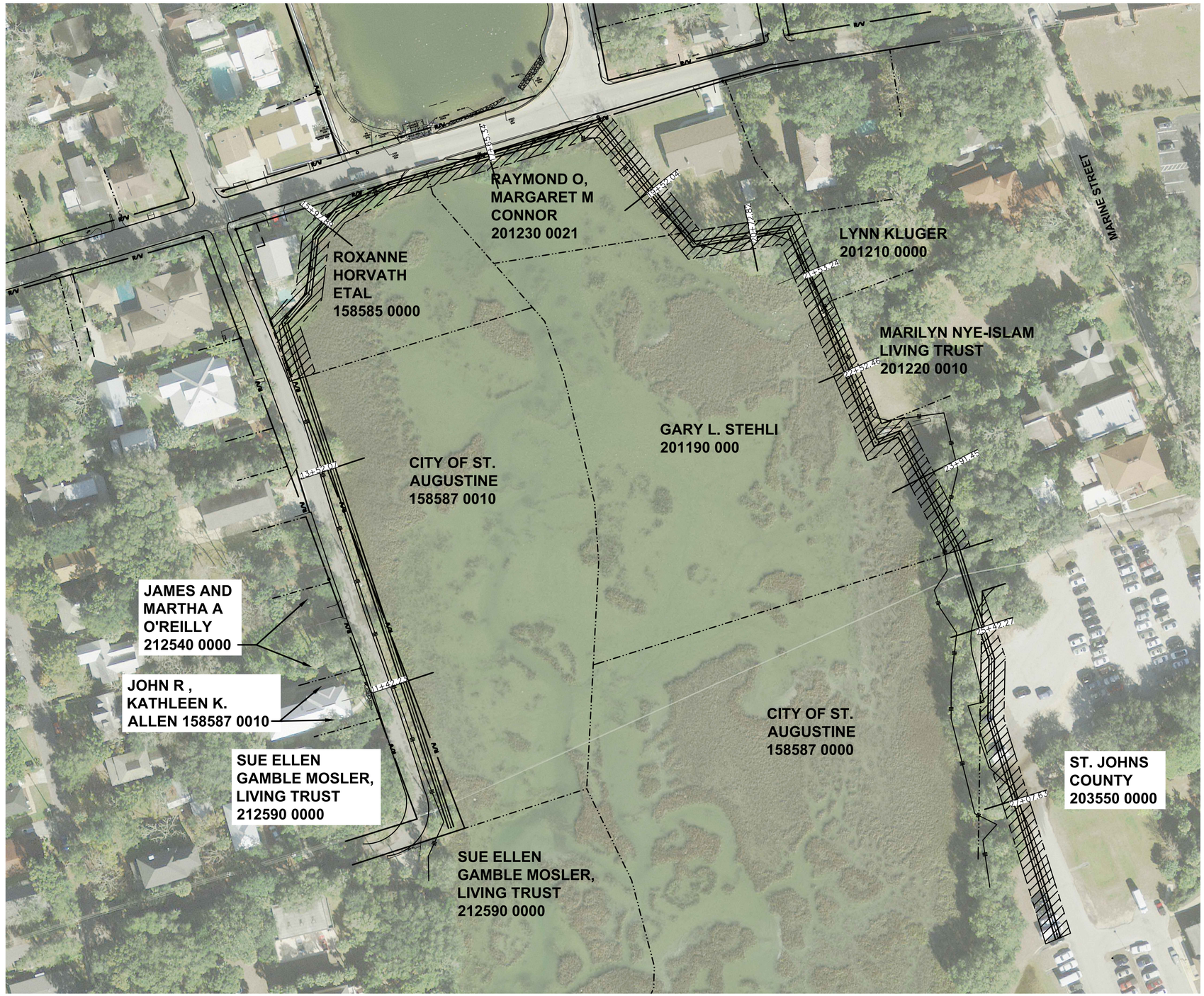
SCALE: 1"=1'-0"

0'-6" 0'-0" 0'-6" 1'-0"

SCALE: 1"=1'-0"

HORIZONTAL DATUM: NAD83 VERTICAL DATUM:NAVD88	CONCRETE SHEET PILE	LAKE MARIA SANCHEZ FLOOD MITIGATION
	MCKIM & CREED	2019-08-12

File: Q:\TA\10345\0500_CAD_Active_Permits\10345_SHT-008 ; Plotted: 8/12/2019 10:42 AM by DURAN, JESUS ; Saved: 8/12/2019 10:14 AM by JDURAN



N

50' 0 50' 100'

SCALE: 1"=50' (Horiz.)

LEGEND

- SUGGESTED BULKHEAD LOCATION
- WETLANDS AND MARKERS
- R/W — RIGHT OF WAY
- PROPERTY LINES
- REQUIRED PERMANENT AND TEMPORARY CONSTRUCTION EASEMENT AREA

REV.NO.	DESCRIPTION	DATE
B	ISSUED FOR PERMIT	1 OCT 2019
A	ISSUED FOR PERMIT - NOT FOR CONSTRUCTION	16 SEP 2019

REVISIONS

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Daytona Beach, FL 32114-7102
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www.mckimcreed.com

CITY OF ST AUGUSTINE EST. 1565

THE CITY OF ST. AUGUSTINE

LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT

GENERAL

BULKHEAD ALIGNMENT PROPERTY OWNERS MAP

PROJ. START DATE:	2019/OCT
MCE PROJ. #	072050002
DRAWN	DMP
DESIGNED	CHH
CHECKED	-
PROJ. MGR.	-

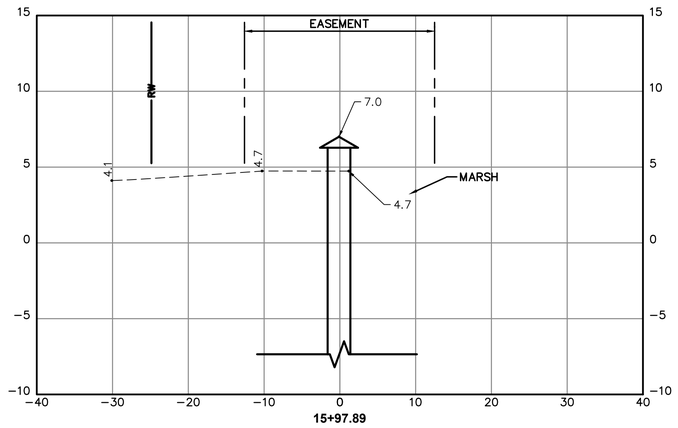
SCALE: HORIZONTAL: AS NOTED VERTICAL: N/A

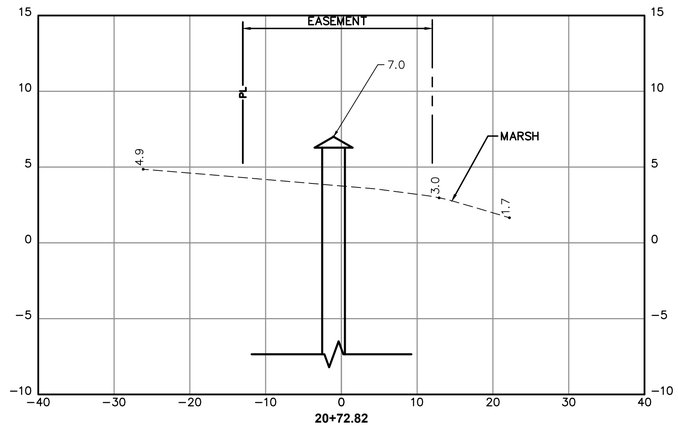
B-1 DRAWING NUMBER

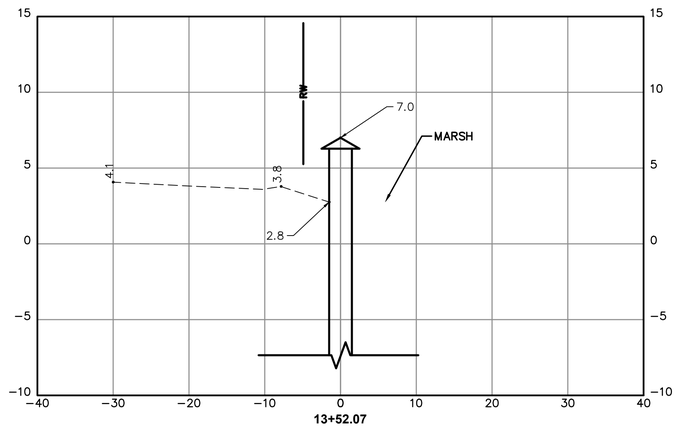
B REVISION

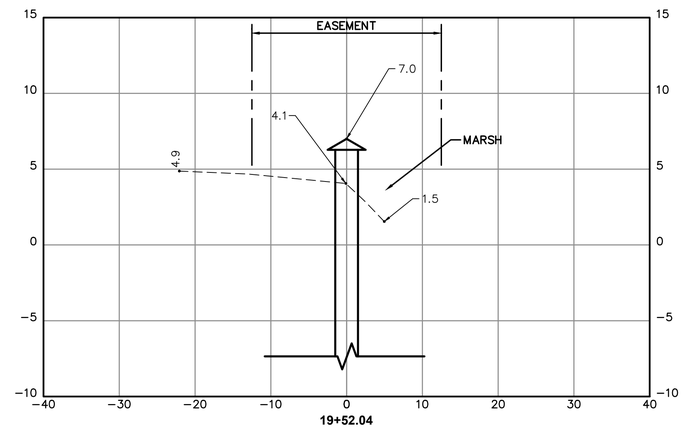
STATUS: NOT FOR CONSTRUCTION ISSUED FOR PERMIT

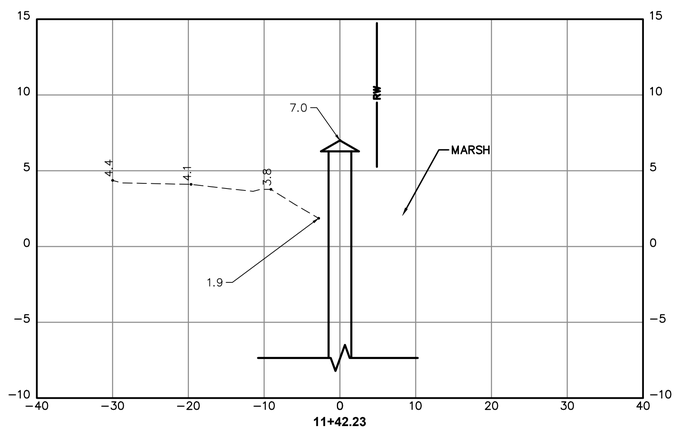
S:\07205\0002\80-DRAWINGS\86-DESIGN\BULKHEAD\BH001-072050002.DWG 09/27/2019 14:56:05 DOREEN PADGETT

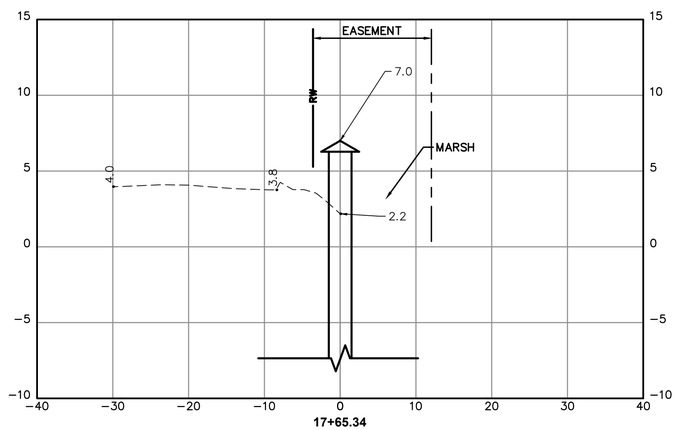












REV.NO.	DESCRIPTION	DATE
-	----	

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THE CITY OF
ST. AUGUSTINE

LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT

GENERAL

BULKHEAD IMPACTED PROPERTIES EASEMENTS REQUIRED

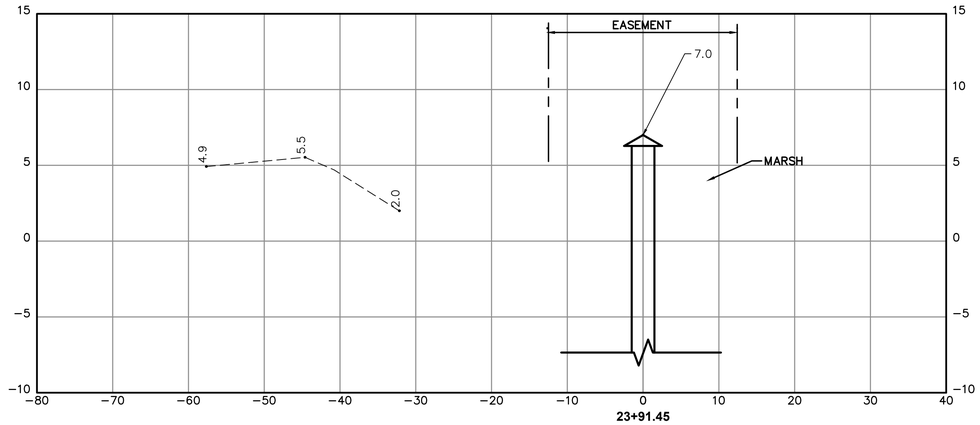
PROJ. START DATE:	2019/JAN
MCE PROJ. #	072050002
DRAWN	DMP
DESIGNED	CHH
CHECKED	-
PROJ. MGR.	-

SCALE
HORIZONTAL: 1:10
VERTICAL: 1:5

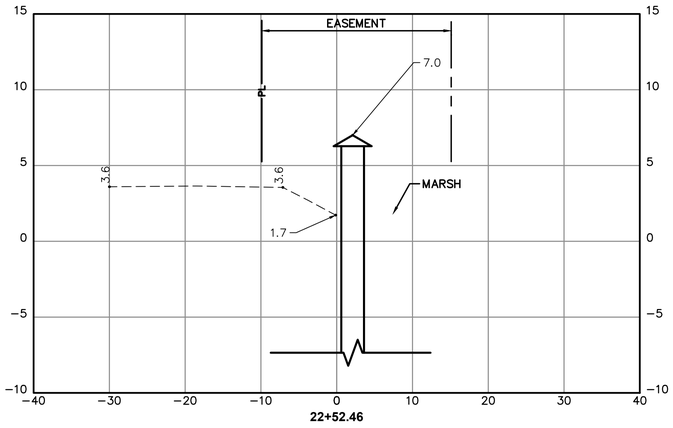
B-2
DRAWING NUMBER
-
REVISION

STATUS: 30% DESIGN SUBMITTAL NOT FOR CONSTRUCTION

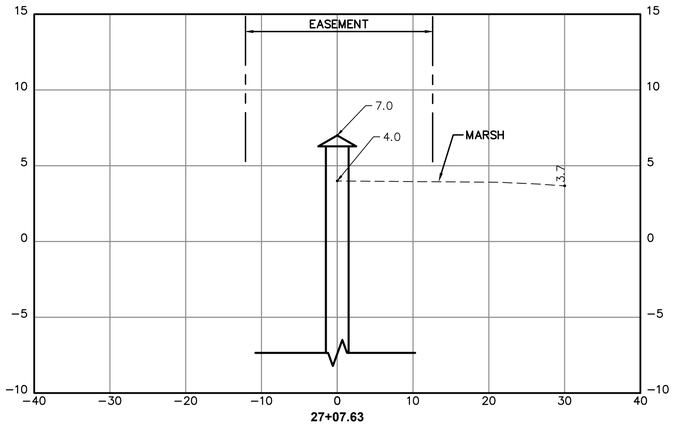
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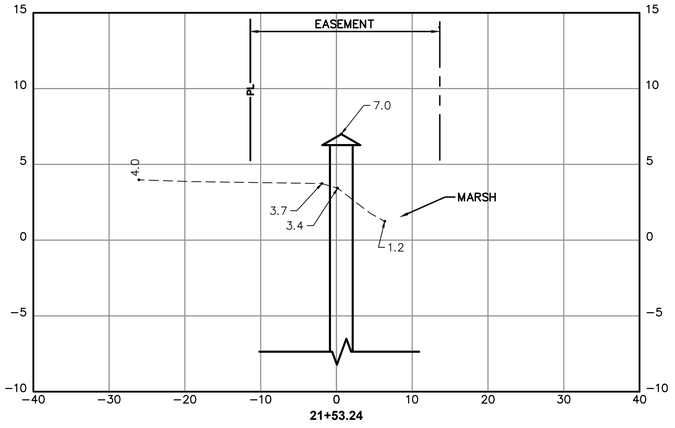
23+91.45



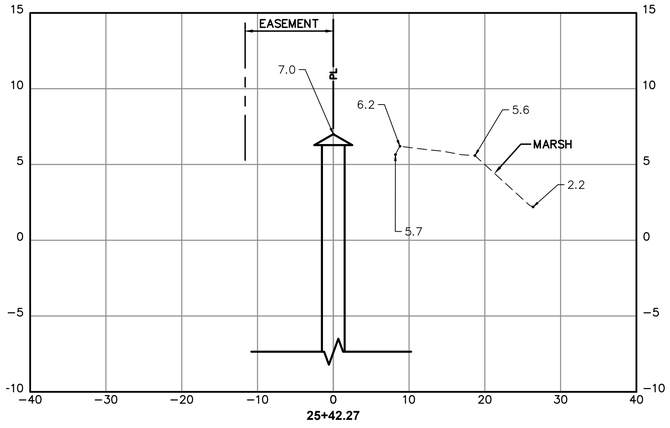
22+52.46



27+07.63



21+53.24



25+42.27

REV.NO	DESCRIPTION	DATE
-	----	

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THE CITY OF
ST. AUGUSTINE

LAKE MARIA SANCHEZ FLOOD MITIGATION AND DRAINAGE PROJECT

GENERAL

BULKHEAD IMPACTED PROPERTIES EASEMENTS REQUIRED

PROJ. START DATE:	2019/JAN
MCE PROJ. #	072050002
DRAWN	DMP
DESIGNED	CHH
CHECKED	-
PROJ. MGR.	-

SCALE
HORIZONTAL: 1:10
VERTICAL: 1:5

B-3
DRAWING NUMBER
-
REVISION

STATUS: 30% DESIGN SUBMITTAL NOT FOR CONSTRUCTION

S:\07205\0002\80-DRAWINGS\86-DESIGN\BULKHEAD\BH001-072050002.DWG 08/21/2019 14:16:01 DOREEN PADGETT

APPENDIX VIII

Figures

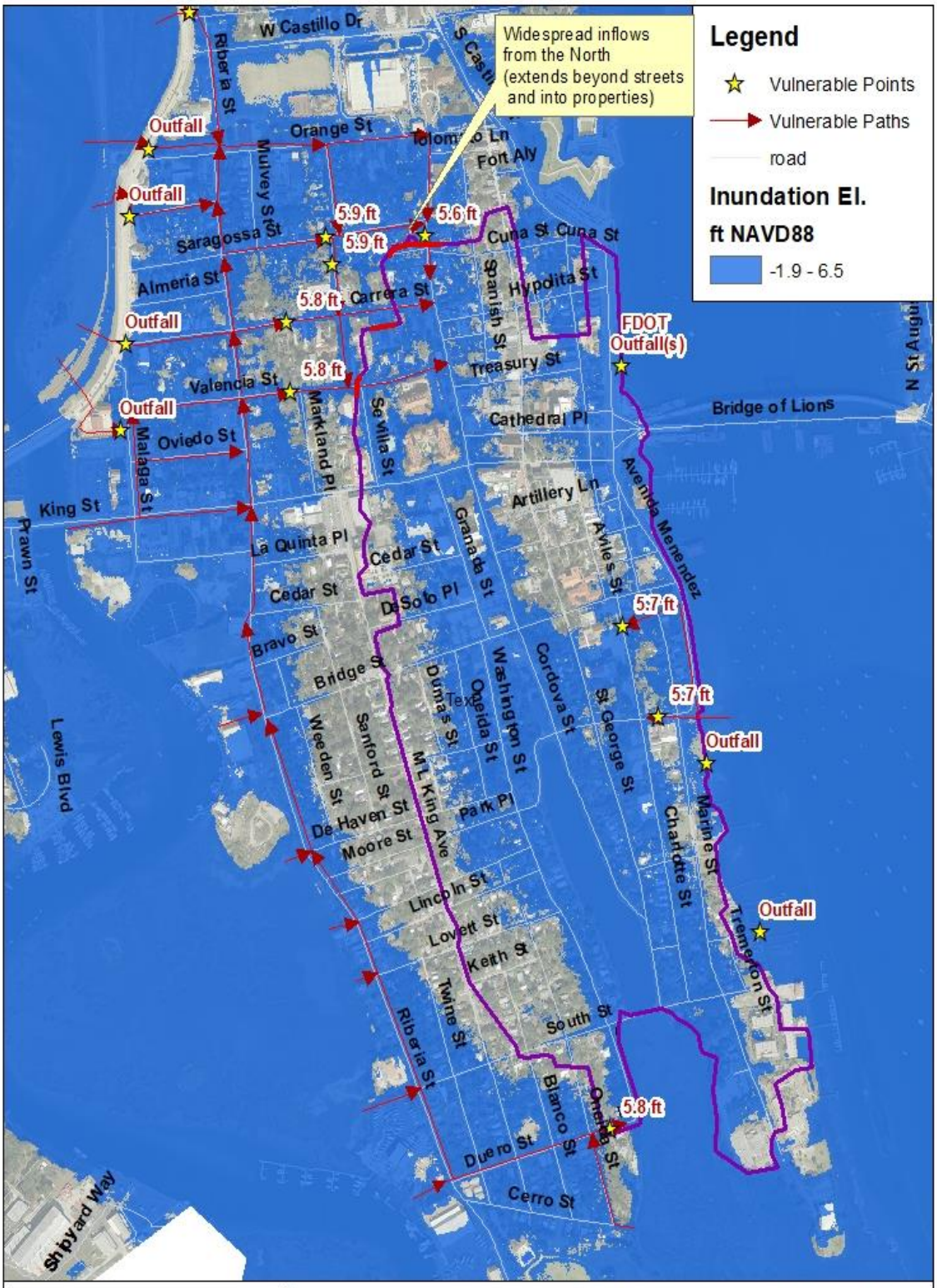
CITY OF ST. AUGUSTINE

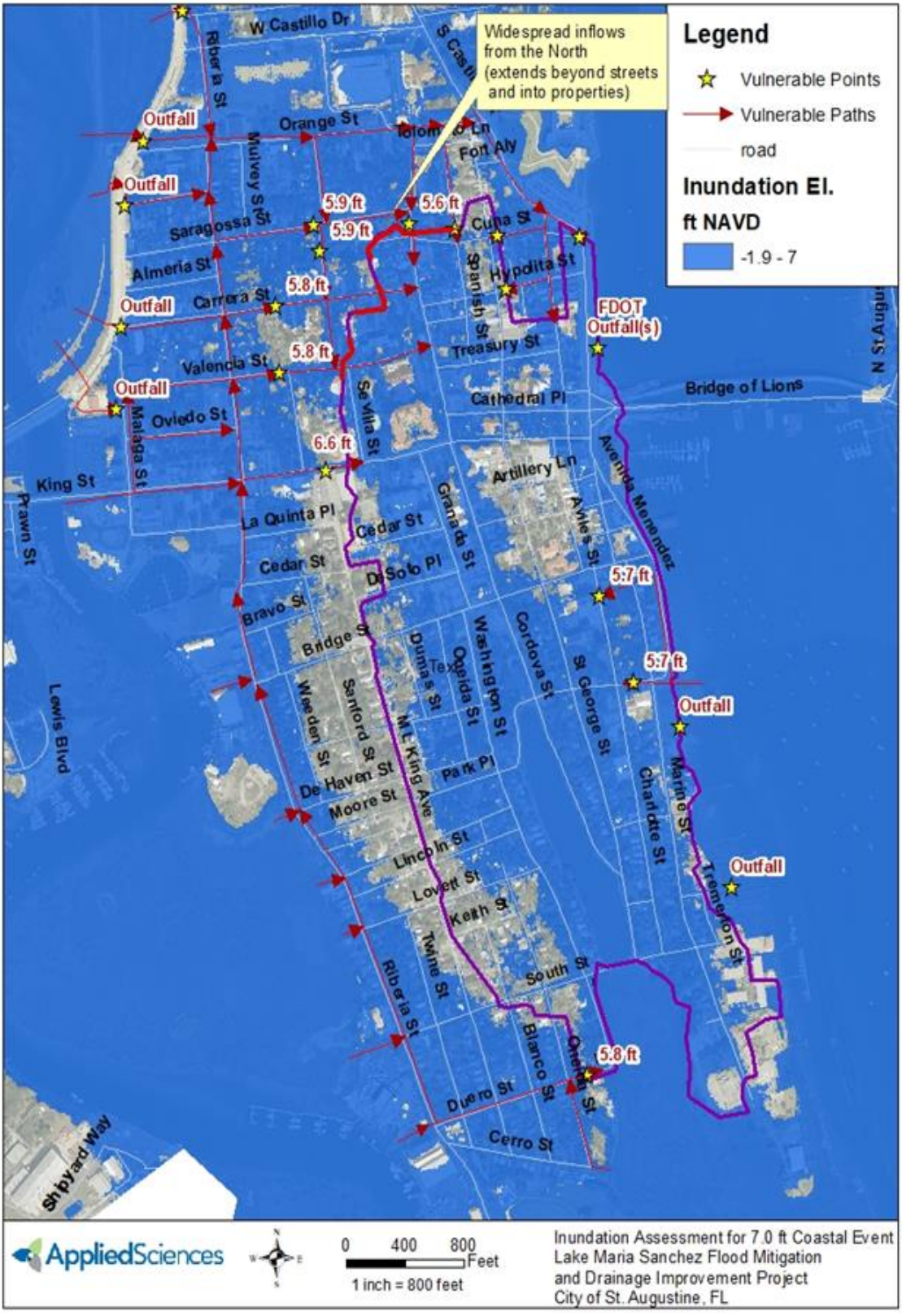
LAKE MARIA SANCHEZ FLOOD MITIGATION

Basis of Design Report

September 2019

FIGURES


Widespread inflows from the North (extends beyond streets and into properties)
Legend
Vulnerable Points
Vulnerable Paths
road
Inundation El. ft NAVD88
-1.9 - 6.5
W Castillo Dr
Ribera St
Outfall
Orange St
Fort Aly
Muvey St
5.9 ft
5.6 ft
Saragossa St
Cuna St
Almeria St
Carrera St
5.8 ft
Spanish St
Hypolita St
FDOT Outfall(s)
Valencia St
Treasury St
Malaga St
Oviedo St
Markland Pl
Sevilla St
Cathedral Pl
Bridge of Lions
N St Augu
King St
Artillery Ln
Avenida Menendez
Prawn St
La Quinta Pl
Cedar St
Granada St
Aviles St
DeSoto Pl
5.7 ft
Bravo St
Bridge St
Cordova St
Washington St
Dumas St
Ocpeida St
St George St
Lewis Blvd
Weeden St
Sanford St
M L King Ave
Charlotte St
Maine St
De Haven St
Park Pl
Moore St
Lincoln St
Tremenon St
Lovett St
Keith St
Twine St
South St
Ribera St
Blanco St
Duero St
Cerro St
Shipyard Way
AppliedSciences
0 400 800 Feet
1 inch = 800 feet
Inundation Assessment for 6.5 ft Coastal Event
Lake Maria Sanchez Flood Mitigation
and Drainage Improvement Project
City of St. Augustine, FL


Legend
Vulnerable Points
Vulnerable Paths
road
Inundation El.
ft NAVD
-1.9 - 7
Widespread inflows from the North (extends beyond streets and into properties)
W Castillo Dr
Riberia St
Outfall
Orange St
Fort Aly
Mulvey St
Saragossa St
5.9 ft
5.6 ft
Cuna St
Almeria St
Carrera St
5.8 ft
Hypolita St
Spanish St
FDOT Outfall(s)
Valencia St
Treasury St
Bridge of Lions
Cathedral Pl
Oviedo St
Malaga St
Sevilla St
6.6 ft
King St
Artillery Ln
Avenida Menendez
Prawn St
La Quinta Pl
Cedar St
Granada St
Aviles St
DeSoto Pl
5.7 ft
Bravo St
Bridge St
Dumas St
Ponce De Leon
Ogeida St
Washington St
Cordova St
St George St
Lewis Blvd
Weeden St
Sanford St
M L King Ave
Charlotte St
Marine St
De Haven St
Park Pl
Moore St
Lincoln St
Lovett St
Keith St
Tremenon St
Twine St
South St
Riberia St
Blanco St
Duero St
Cerro St
Shipyard Way
AppliedSciences
0 400 800 Feet
1 inch = 800 feet
Inundation Assessment for 7.0 ft Coastal Event
Lake Maria Sanchez Flood Mitigation
and Drainage Improvement Project
City of St. Augustine, FL

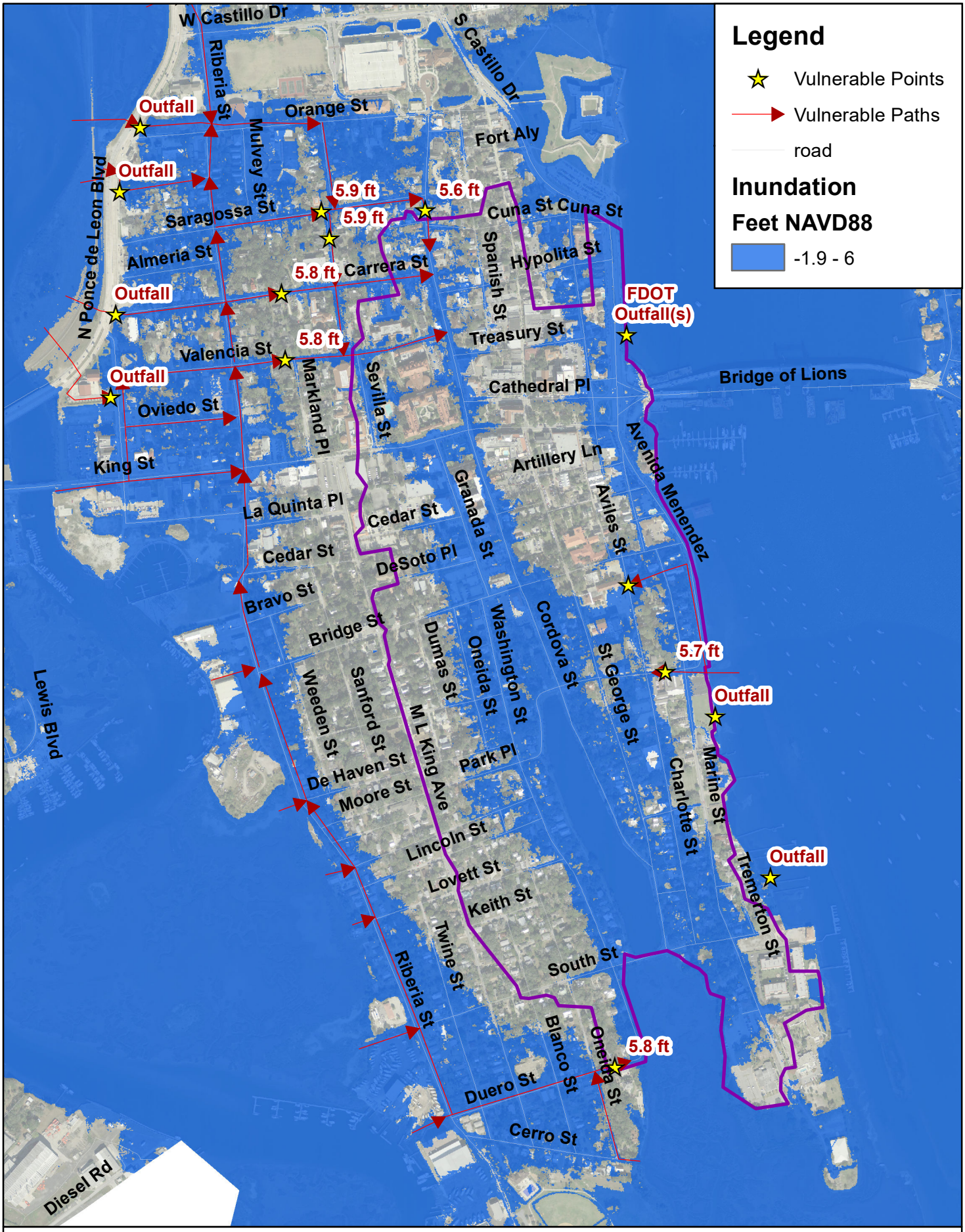


Figure 8. Inundation for 6.0 ft Coastal Event
Lake Maria Sanchez Flood Mitigation
and Drainage Improvement Project
City of St. Augustine, FL