NASSAU COUNTY - SAISSA
Task Order Memorandum
Contract CM1852

To:	Olsen Associates, Inc. 2618 Herschel St. Jacksonville, FL 32204	**Date:** **Contract:** **Request Made By:** **Request Received By:** **Task Order No:**	14 March 2018 Coastal Engineering SAISSA Albert E. Browder, Ph.D., P.E. CM 1852-TO 30

Task Order: Nassau Sound: Analyses of Potential Impacts of Borrow Area Excavation - Part 1 of 2
South Amelia Island Shore Stabilization Project
Amelia Island, Nassau County, FL

Consultant shall perform those subtasks described in Exhibit A, with subconsultant assistance as described therein, to conduct Part 1 of 2 of analytical and numerical analyses to evaluate the potential impacts of the proposed borrow area excavation on the ebb shoal at Nassau Sound, FL upon the sediment transport pathways on the ebb shoal and in the vicinity of the borrow area. Costs associated with this work are eligible for State cost-sharing. Subtasks include:

Subtask I:	Field Data Collection	$114,700.00 (Lump Sum)
Subtask II:	Analytical Evaluation of Shoal/Shoreline Changes	$ 52,400.00 (Lump Sum)
Subtask III:	Numerical Model Development and Analysis (up through simulation of existing conditions)	$134,800.00 (Lump Sum)
	Total Fee:	**$ 301,900.00 (Lump Sum – Part 1)**

Requested Completion Date: 9 months from Notice to Proceed (Part 1: Subtasks I-III)

Olsen Associates, Inc.

Albert E. Browder, Ph.D., P.E.

Date: 14 March 2018

SAISSA

Mr. Andrew L. Wallace, SAISSA President

Date: 3/14/2018

Nassau County Board of County Commissioners

Pat Edwards
Its: Chairman

Date: April 9, 2018

Attest to Chair
Signature

John A. Crawford
It's: Ex-Officio Clerk

Date: April 12, 2018

Approved As To Form and Legal Sufficiency:

Michael S. Mullin

Date: April 9,2018

MES
04.10.18

SCOPE-OF-WORK

FOR

South Amelia Island Shore Stabilization Project
Amelia Island, Nassau County, FL

Nassau Sound: Analyses of Potential Impacts of Borrow Area Excavation
(Part 1 of 2)
14 March 2018

Introduction (Parts 1 and 2)

It is proposed to conduct analytical and numerical modeling analyses of the potential impacts of borrow area excavation proposed along the northeast edge of Nassau Sound at Amelia Island, Florida (**Figure 1**). The analytical analyses will seek to describe the volumetric and morphological changes measured at Nassau Sound over the last several decades to 1) evaluate changes occurring within the shoal system, 2) assess the potential changes associated with prior dredging efforts, and 3) provide an analytical description of the apparent sediment transport pathways in the area. Numerical modeling efforts will seek to describe the local wave fields, current patterns, and sediment transport pathways over the Nassau Sound ebb shoal and the adjacent nearshore areas of Amelia Island (north) and Little and Big Talbot Islands (south), with and without the proposed excavation from a sand borrow area(s) (**Figure 2**). The two efforts will be developed in tandem to provide a thorough evaluation of the potential impacts of the proposed excavation. The proposed work is intended to support the permitting of future beach nourishment projects for the South Amelia Island Shore Stabilization Project and to address questions posed by the Florida Department of Environmental Protection (FDEP) regarding the evaluation of potential impacts of borrow area excavation to Nassau Sound and the adjacent islands. This initial Scope of Work was developed with input from the FDEP 'Guidelines for Documenting Numerical Model Studies in Submittals to the FDEP,' (FDEP, 2009).

The analyses shall be conducted in two parts. Part 1 of the effort shall include a) the collection of field data; b) an analytical evaluation of historical shoal and shoreline changes and their implied sediment transport pathways; and c) the first phase of numerical modeling. The first phase of modeling shall include 1) the creation of the numerical model grid (domain) and the population of that domain with topographic/hydrographic data; 2) the calibration and verification of the model to demonstrate its skill in reproducing the hydrodynamics of the inlet; and 3) the simulation of existing bathymetric, wave, and current conditions over a representative tidal cycle for a range of incident wave conditions. The simulation shall then be scaled up to describe average annual transport pathways as well as individual storm conditions.

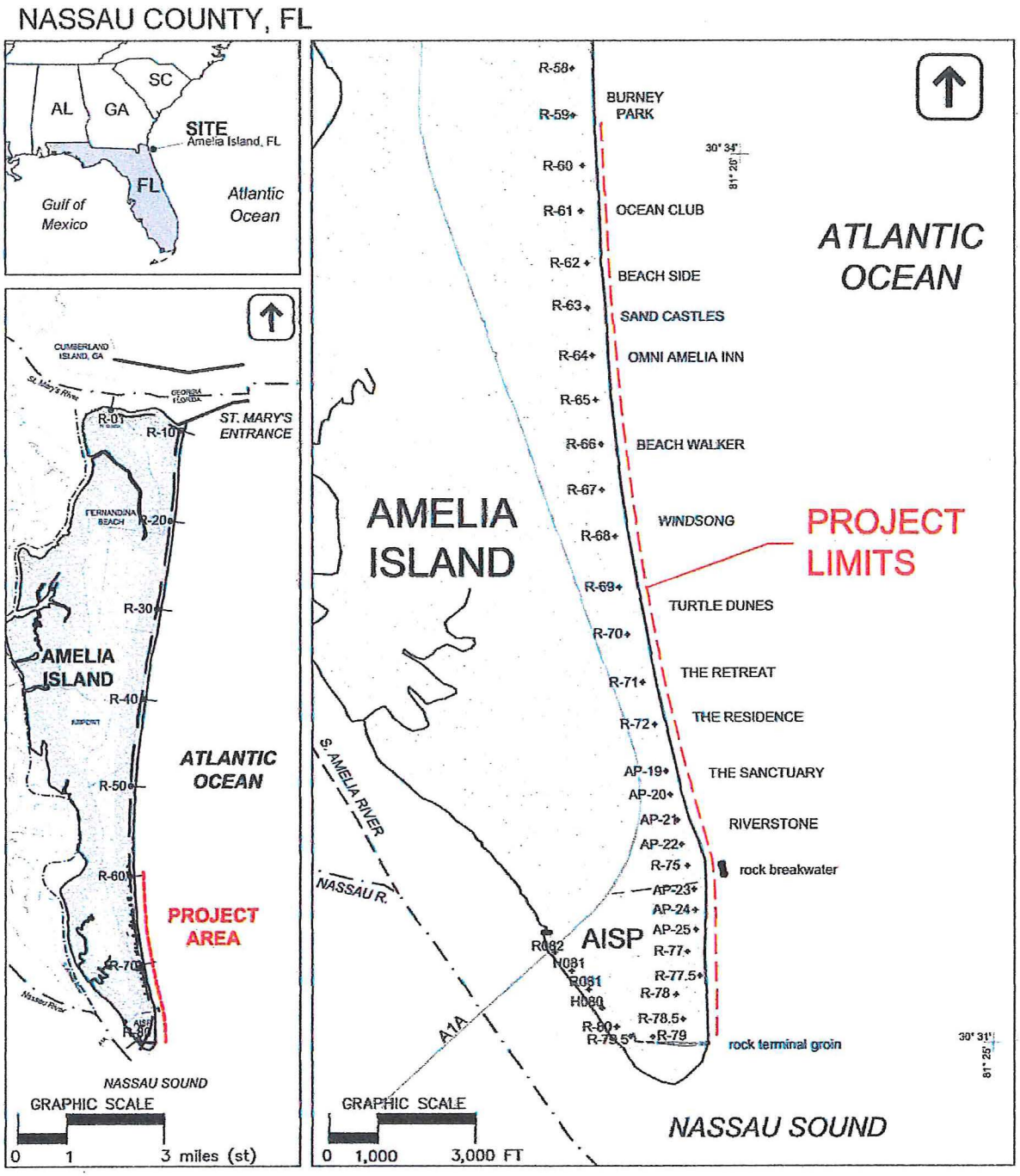

Figure 1 Location Map – South Amelia Shore Stabilization Project, Nassau County, FL.

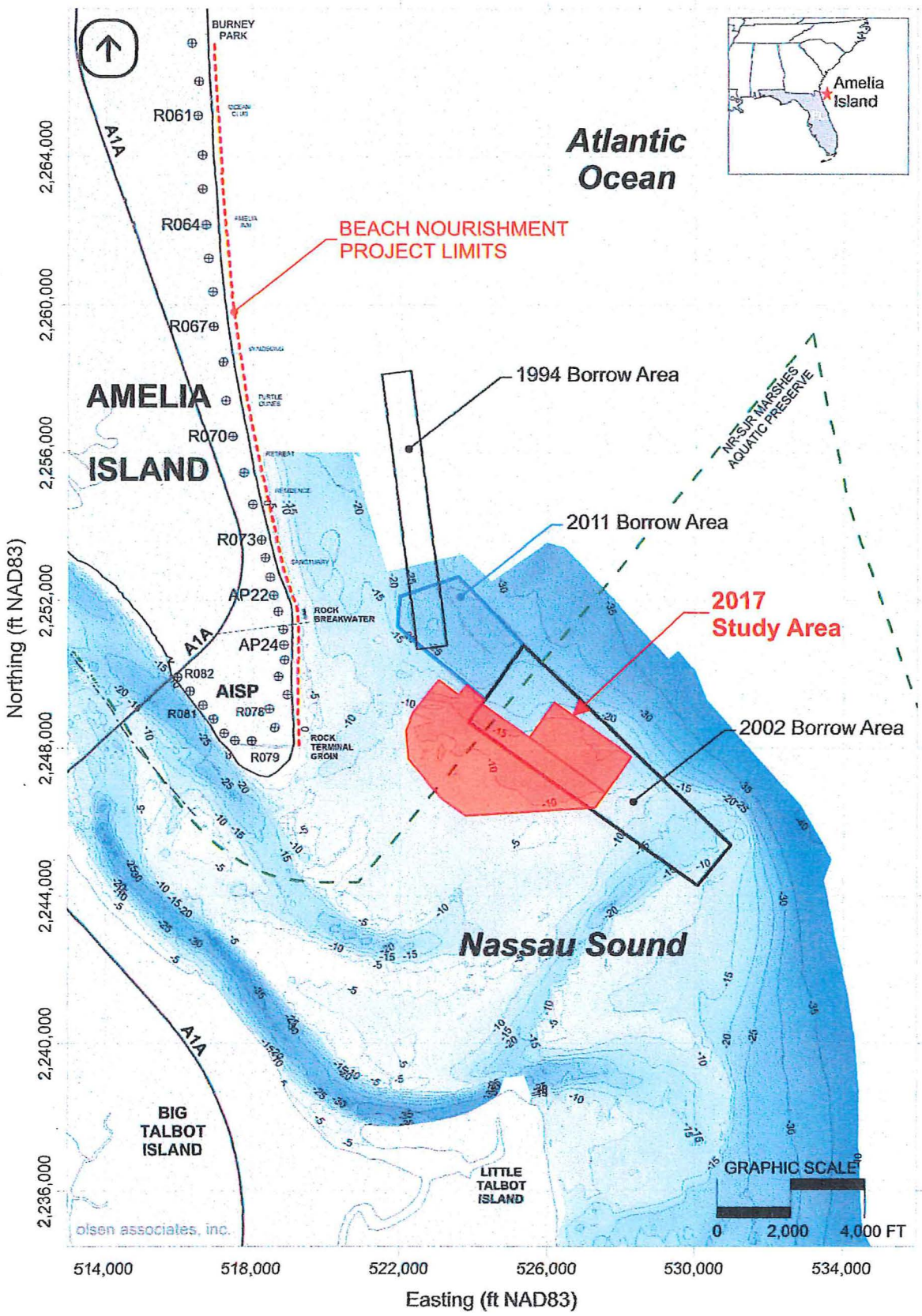

Figure 2 Borrow area development at Nassau Sound (2016/2017 survey conditions).

Part 2 of 2 of the study shall include a) the simulation of numerous alternative configurations of the proposed borrow areas, including the simulation of a future potential second borrow area in the same general location; b) the preparation of a final engineering report; and c) the processing of post-submittal Requests for Additional Information (RAIs) from regulatory agencies specifically regarding the numerical modeling effort. The RAI subtask does include a contingency for executing an additional alternative model run.

Engineered Beach Project Description

The South Amelia Island Shore Stabilization Association (SAISSA), Nassau County, FL, and the Florida Park Service presently maintain 3.6 miles of engineered beaches along the Atlantic Ocean shoreline at the southern end of Amelia Island in Nassau County, FL (**Figure 1**). The project Owners seek to acquire a set of 15-yr, multiple-nourishment permits to maintain the project via periodic dredging and beach nourishment. The proposed first renourishment of the engineered beach under the new permits would occur in the summer of 2021 (approx.) and would replace not only the expected average annual erosion losses from the project fill but also sand losses directly associated with Hurricane Matthew, which impacted the project in October 2016, and Hurricane Irma (September 2017).

General Approach and Objective of Modeling Effort

OAI (2017) describes the recent geotechnical sand search data collection performed along the northeast edge of the Nassau Sound ebb shoal at the south end of Amelia Island (**Figure 2**). This geotechnical investigation identified over 5.2 million cubic yards of beach-compatible sediment that could be excavated for beach nourishment along the South Amelia Island beaches. For each nourishment effort -- typically performed every 8-10 years -- approximately two million cubic yards of sand are placed along the project shoreline. This approach has been utilized in the three previous nourishment projects at this location (1994, 2002, 2011, see **Figure 2**).

To address questions posed by the Florida Department of Environmental Protection (FDEP) regarding the potential impacts of future excavation of sand from the Nassau Sound ebb shoal, it is proposed to conduct Sound-specific analyses to investigate historical shoreline and volume changes in the area, including time periods associated with previous dredging/nourishment projects and with the construction of the current A1A bridge over the Sound (1999-2000). It is further proposed to apply the Delft3D suite of numerical modeling tools created and supported by Deltares, NL, and Delft University of Technology. Delft3D is an internationally recognized 2-D/3-D numerical modeling system designed to investigate riverine, tidal- and wave-driven hydrodynamics, sediment transport, and morphological change in coastal

and estuarine environments. The Delft3D suite shall be applied to develop a series of coupled numerical grids to describe the hydrodynamics (Delft3D-FLOW), wave fields (Delft3D-WAVE) and sediment transport potential (Delft3d-MOR; run in fixed bed mode) across the nearshore and into the inlet. By developing and calibrating the model grid for local conditions, the potential effects of excavating a sand borrow area can be evaluated by comparison of the with- and without-borrow area conditions.

Subtask 1 Field Data Collection

The following field data shall be acquired to support the analyses:

- Bathymetric survey of Nassau Sound – Consultant, with the assistance of a professional certified hydrographic surveyor licensed pursuant to Chapter 472, F.S., shall acquire an updated bathymetric survey of the Nassau Sound ebb shoal complex. Consistent with prior surveys of the Sound, bank-to-bank (approx.) seabed elevation data shall be collected from west of the Atlantic Intracoastal Waterway (AIWW) and the confluence of the South Amelia and Nassau Rivers, through the A1A bridge and the throat of the Sound, and offshore to the -35ft to -40ft contour (e.g. **Figure 2**). As part of the survey effort, the pilings and pile cap features associated with the old and new bridges across the Sound will be located with sufficient detail to place these features in the numerical model grid. Hydrographic surveys will extend along the adjacent shorelines north and south approximately 5,000 ft from the ebb shoal. These data shall be collected in accordance with the FDEP monitoring guidelines for collection of survey data, as published in "Monitoring Standards for Beach Erosion Control Projects," (FDEP, October 2014)." The last bathymetric survey of Nassau Sound was performed in June 2016, prior to Hurricanes Matthew (Oct 2016) and Irma (Sept 2017).
- Water level data – To support the calibration of the model, water level data shall be collected in the vicinity of Nassau Sound for a period of 30 days, sufficient to capture a full lunar tidal cycle. These data shall be collected via the installation of tide gages installed at strategic points throughout the anticipated model domain (generally depicted in **Figure 3**).
- Tidal current data – During the 30-day water-level collection period, measurements of the tidal currents and tidal discharge across the throat of the Sound, east of the A1A bridge, shall be collected over a tidal cycle to assess the tidal prism and provide calibration data for the model. Additional current profile data shall be collected over a tide cycle at strategic transects in the inlet interior, intended to identify the relative distribution of flows to and from the South Amelia River, the Nassau River, and the south channel of the AIWW (approaching Gunnison Cut). These data shall be collected via vessel-mounted Acoustic Doppler Current Profiler (ADCP).

- Wave data – Concurrent with the 30-day water level data collection, directional wave data shall be collected offshore of the Nassau Sound ebb shoal in order to provide wave forcing data for the model calibration/verification period. Data shall be collected from a seabed-mounted upward facing ADCP located in roughly 35 to 40 ft water depths. Data products from the ADCP shall include time series of significant wave height, period, and direction as well as local current velocity data. These data shall be supplemented by wave data collected offshore of the St. Marys River entrance at NOAA buoy 41112.

Consultant shall develop the field test plan and shall subcontract and coordinate with the professional surveyor and a qualified marine subconsultant to acquire the necessary data. Consultant shall provide notifications to the appropriate regulatory agencies for installation of instrumentation and shall apply for a USACE Nationwide Permit (#5) for the wave gage installation. Consultant shall assemble and format the acquired data for model use.

Deliverables – Subtask I Surveyor shall provide electronic copies of the survey data in the prescribed datums and formats to the Consultant for formatting and distribution to the Clients (SAISSA, FPS, FDEP). Surveyor shall likewise provide to Engineer two (2) signed and sealed hardcopies of the survey. Surveyor and Consultant shall develop and submit those portions of the FDEP data submittal requirements that are the primary responsibility of the Surveyor, including copies of field book pages, monument control, QA/QC, surveyor reports, etc. Consultant shall review and approve these documents for submittal to FDEP. Consultant shall prepare a brief report of data collection efforts.

Subtask II Analytical Analyses of Shoal and Shoreline Changes

Consultant shall assemble historical aerial photography and shoreline, beach profile, and bathymetric survey data to evaluate morphological changes in the inlet shoal system and along the adjacent beaches. Data for this analysis shall include recent LIDAR (if available) and conventional beach profile survey data collected from other sources, as well as the bathymetric survey collected in Subtask I. Consultant shall summarize prior investigations of sediment transport in the area. Consultant shall prepare an analysis of the volumetric changes within the inlet shoal system and along the beaches and seek to relate these changes to historical activities at Nassau Sound, including the prior beach nourishment projects and the construction of the new A1A bridge in 1999/2000. From the existing data, Consultant shall seek to develop a description of the typical sediment transport pathways and potential morphological changes in the Sound.

Deliverables – Subtask II Consultant shall prepare a brief engineering report of the analytical analyses and shall incorporate the findings into the final engineering report (Subtask IV). Consultant shall provide two (2) hardcopies of the engineering report and an electronic version of the memorandum in *.PDF format.

Subtask III Numerical Model Development and Analysis

The numerical modeling approach will follow the method described in Elias and Hansen (2013) to describe patterns of sediment transport potential near the proposed borrow area and across the Nassau Sound ebb shoal platform. Input wave conditions, weighted by annual probability of occurrence, shall be used as model input over a representative tidal cycle to allow for time-efficient depictions of a) the current patterns at specific times in the tidal cycle, and b) the sediment transport potential generated over a typical year in the study area. In these simulations the seabed elevations will be held fixed. As discussed by Elias and Hansen (2013), to reasonably model morphological changes across the study area would require an accurate schematization of the seabed sediment gradation and stratigraphy across the model grid and significant, rigorous, and time-intensive validation of sediment fluxes. With only snapshot surveys spaced several years apart, and no sediment information available beyond the immediate borrow area, such efforts were judged to be unfeasible and well beyond the scope needed to satisfy the current project interests.

To investigate the potential changes in the Sound from the excavation of a sand borrow area on the ebb shoal, the Consultant shall utilize the Delft3D modeling suite to:

- Create a model grid of representative quadrilateral horizontal areas -- elements -- that map the model domain (more accurately a set of coupled model grids) to provide the framework for analysis of the hydrodynamics and wave fields in the vicinity of Nassau Sound. To provide a sufficiently accurate representation of these flows and waves, the modeled domain is expected to extend many miles offshore, alongshore, and inshore (upriver) from Nassau Sound to isolate boundary effects and provide an accurate representation of the flows in the immediate vicinity of the proposed borrow area and the Sound (**Figure 3**). The resolution of the model grid(s) will vary across the domain, with finer resolution provided in the immediate area of interest at Nassau Sound;
- Populate the grids with bathymetric data obtained from the Subtask I survey and from existing historical sources, most notably the NOAA database;
- Synthesize the available wave and tide data in the area and merge those data with the data collected in Subtask I. Format these data to provide input to the Delft3D model;
- Calibrate the model using portions of the field data collected in Subtask I, especially the tidal discharge and current monitoring effort.
- Verify the model performance using the remainder of the data collected in Subtask I.

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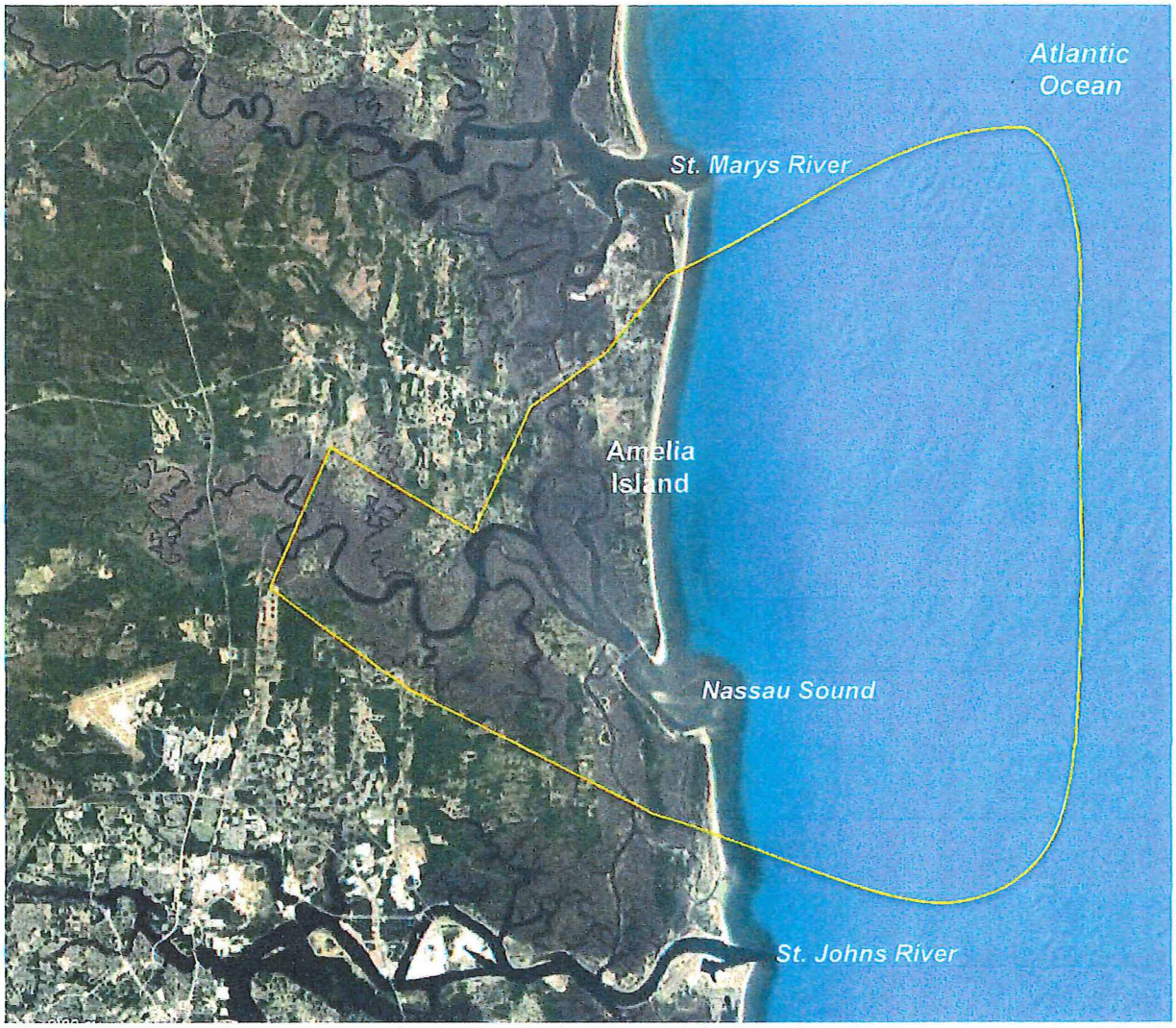

Figure 3 General area of analysis for Delft3D model domain of Nassau Sound. Final dimensions and geometry of model domain to be determined (Google Earth).

- Schematize the input tidal and wave conditions to create representative tide-cycle averaged wave conditions that will represent the average annual wave and sediment transport potential conditions within the study area. In this process, an additional storm wave case (e.g. nor'easter condition) shall be included in the model simulations. It is anticipated that long-term wave conditions would be obtained from available USACE Wave Information Studies (WIS) hindcasts and/or wave buoy data, from which the representative wave conditions can be schematized. Tidal currents will be schematized utilizing tidal constituent values from the TPXO Global Inverse Tide Model, or equivalent.

- Simulate existing conditions (2018, pre-excavation) to establish typical flood and ebb flow conditions, the distribution of wave energy across the ebb shoal platform for various wave conditions and tide stages, and Sound-wide sediment transport potential patterns [production run #1].

Deliverables – Subtask III Consultant shall prepare a brief descriptive summary of the numerical modeling effort that provides the details of the model creation and calibration/verification and the results of the existing condition simulation. The summary shall include graphics depicting the overall modeling domain, the incorporation of the field data and input schematization, and the individual flow and potential transport patterns of existing conditions. [In Part 2 of 2, the results of the alternatives simulations shall be compared to the existing condition simulation] Consultant shall provide two (2) hardcopies of the numerical modeling report summary memorandum document and an electronic version of the memorandum in *.PDF format. Following the Guidelines for Documenting Numerical Model Studies in Submittals to the FDEP Beaches Inlets and Ports Program (BIPP, formerly (BBCS)), input and output files from the modeling effort shall be provided in their native electronic formats.

References

Elias, E., and Hansen, J. (2013), "*Understanding processes controlling sediment transports at the mouth of a highly energetic inlet system (San Francisco Bay, CA),*" Marine Geology V. 345, pp. 207,220. Elsevier B.V., Amsterdam, the Netherlands.

Olsen Associates, Inc. (OAI, 2017), "*Nassau Sound, FL, Geotechnical Investigation for Borrow Area Development,*" Report submitting to South Amelia Island Shore Stabilization Association, Inc., Nassau County, FL, and Beaches, Inlets, and Ports Program, Florida Department of Environmental Protection, Olsen Associates, Inc., Jacksonville, FL.

EXHIBIT B
Task Order 30, CM1852

SCOPE-OF-WORK: COASTAL ENGINEERING SERVICES

FOR

South Amelia Island Shore Stabilization Project
Amelia Island, Nassau County, FL

Nassau Sound: Analyses of Potential Impacts of Borrow Area Excavation
Part 1 of 2

14 March 2018

COST SUMMARY

Permit-Level Design and Permit Application		
Subtask I	Field Data Collection	**$114,700.00 (Lump Sum)**
Subtask II	Analytical Evaluation of Shoal/Shoreline Changes	**$52,400.00 (L.S.)**
Subtask III	Numerical Model Development and Analyses	**$134,800.00 (L.S.)**
	TOTAL FEE:	**$301,800.00 (Lump Sum) (part 1 of 2)**