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SARASOTA COUNTY GOVERNMENT

Planning and Development Services

TO: Jonathan R. Lewis, County Administrator

FROM: Matthew R. Osterhoudt, Director, Planning and Development Services
Rachel A. Herman, Environmental Protection Division Manager

DATE: November 10, 2025

SUBJECT: **Update: Geosyntec Consultants Work Assignment for Midnight Pass, Data Collection and Model Calibration**

BACKGROUND:

The County has engaged the services of Geosyntec Consultants to continue their work studying Midnight Pass. The firm recently completed the tasks associated with its latest work assignment, Little Sarasota Bay: Gulf to Bay Tidal Connection - Midnight Pass Field Data Collection. This Work Assignment provides additional data on local water levels, currents, and tidal prism presently passing through Midnight Pass, which opened in the fall of 2024. The scope included field data collection for water levels, currents, and flows, along with basic water quality parameters (dissolved oxygen, temperature, and salinity) and updates to the Environmental Fluid Dynamics Code (EFDC) model being developed under the Little Sarasota Bay Watershed Management Plan to calibrate to the data collected under this scope of work.

REPORT:

The technical memos provided by Geosyntec Consultants associated with this Work Assignment are provided in **Attachments 1** and **2**, which, along with the supporting data, complete this work assignment.

Related to Task 1, Midnight Pass Data collection, the memo concludes that:

> *It should also be noted that the maximum flow rates measured under this work assignment were more than two times the maximum flow rates measured under the previous work assignment. This is likely partially because the cross-sectional area of Midnight Pass has almost doubled since the previous round of data collection, according to the survey data provided by the County. Further, it appears, based on visual field observations, that the main flow paths in the north and east branches of Little Sarasota Bay leading to Midnight Pass have also increased in cross-sectional area, which would also contribute to increasing flows through Midnight Pass.*

Related to Task 2, the Little Sarasota Bay EFDC has been updated with the latest data. As described in **Attachment 2**, "… the model calibration results show that the model was able to accurately predict the tidal prism of Midnight Pass under a wide range of tidal conditions, indicating that it is a reliable tool for evaluating the effects of Midnight Pass on hydrodynamics in the Little Sarasota Bay region."

RECOMMENDATIONS / NEXT STEPS:

Staff is working with Geosyntec Consultants on their next work assignment, which will include advancing the Emergency Response Plan, as well as data collection described therein, and data collection to support future inlet management, as presented to the Board at their regular meeting on September 9, 2025. Work is also advancing on the public outreach event discussed by the Board in September, which is tentatively scheduled for the first week of December 2025.

FUNDING:

Funding for this work assignment is through the FDEP Little Sarasota Bay Water Quality Improvement Project grant, L0107.

ATTACHMENTS:

1. Task 1 Memo – Midnight Pass Data Collection
2. Task 2 Memo – Midnight Pass Model Calibration

Geosyntec consultants

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Technical Memorandum

Date:	November 5, 2025
To:	Rachel Herman, MS, CPM and Joseph Kraus, Sarasota County
Copies to:	Spencer L. Anderson, P.E., Sarasota County, and Mike Jenkins, PhD, PE, Geosyntec
From:	Steven J. Peene, Geosyntec
Subject:	Task 2 – Model Set up and Calibration to Period of Field Data Collection for WA Little Sarasota Bay: Gulf to Bay Sustained Tidal Connection Concepts and Alternatives Analysis – Model Setup and Calibration Results

TASK 2 – MODEL SET UP AND CALIBRATION TO PERIOD OF FIELD DATA COLLECTION FOR WA LITTLE SARASOTA BAY

This memorandum provides a summary of the hydrodynamic model setup and calibration results completed under Task 2 of the Little Sarasota Bay: Gulf to Bay Sustained Tidal Connection Concepts and Alternatives Analysis (PO253712; WA NO.250581 TO COUNTY CONTRACT 2613-03). This task is linked to a separate, larger effort (the Little Sarasota Bay Watershed Management Plan; LSB WMP) which is being led by Jones Edmunds & Associates, Inc., and for which Geosyntec has been sub-contracted to develop an updated hydrodynamic model. For the current task, the existing hydrodynamic model developed for the LSB WMP was modified to represent the conditions on the days that field data was collected at Midnight Pass under Task 1 (the Task 1 memo was delivered to the County on 10/27/2025) and adjusted to match the collected flow and water level data.

Hydrodynamic Model Setup

Two main adjustments were made to the existing hydrodynamic model to represent the conditions on the days that field data was collected (8/19/2025 – 8/20/2025 and 9/23/2025 – 9/24/2025). The first adjustment was to define the tidal forcing conditions (referred to as water level/pressure series or 'PSER' in the EFDC software) using water level data collected on the same days that flow data was collected and the two days leading up to flow data collection (a model spin-up period of two

days was used for the model runs). The fluctuation of the offshore tides in relation to inlet bottom elevation and in-bay water levels is what drives flow through inlets. It was important for the water level data used as tidal forcing in the model to be referenced to the same vertical datum as the model bathymetry to accurately represent water depths in the model domain. The dataset that was being used to define tidal forcing in the pre-existing model was collected at Venice Inlet by the USGS during the years 2018 – 2022. The Venice Inlet dataset was originally referenced to the North American Vertical Datum of 1988 (NAVD88) and adjusted to match the model bathymetry datum based on depth data collected throughout the bay areas covered by the model domain during 2018 – 2022. Therefore, data from Venice Inlet with the same vertical datum adjustments was also used for the open-inlet model. The original tidal forcing data time series used for each model run is shown in Figure 1. The phase of the Venice Inlet dataset was adjusted for the model to match the water level data collected at Midnight Pass under Task 1. Adjusting the amplitude of the tidal forcing data was also considered but ultimately was not required because the simulated amplitude closely matched that of the water level data collected at Midnight Pass without amplitude adjustment.

The second main model adjustment was to the model grid cell bottom elevations in and around Midnight Pass. The bottom elevations in Midnight Pass were adjusted such that the cross-sectional area was equal to that measured by County surveyors in the weeks that flow data was collected. The bottom elevations of areas around Midnight Pass were also adjusted based on 2025 aerial imagery of areas around the Pass and visual field observations performed during flow data collection. The model grid bottom elevations used for each data collection trip are shown in Figure 2.

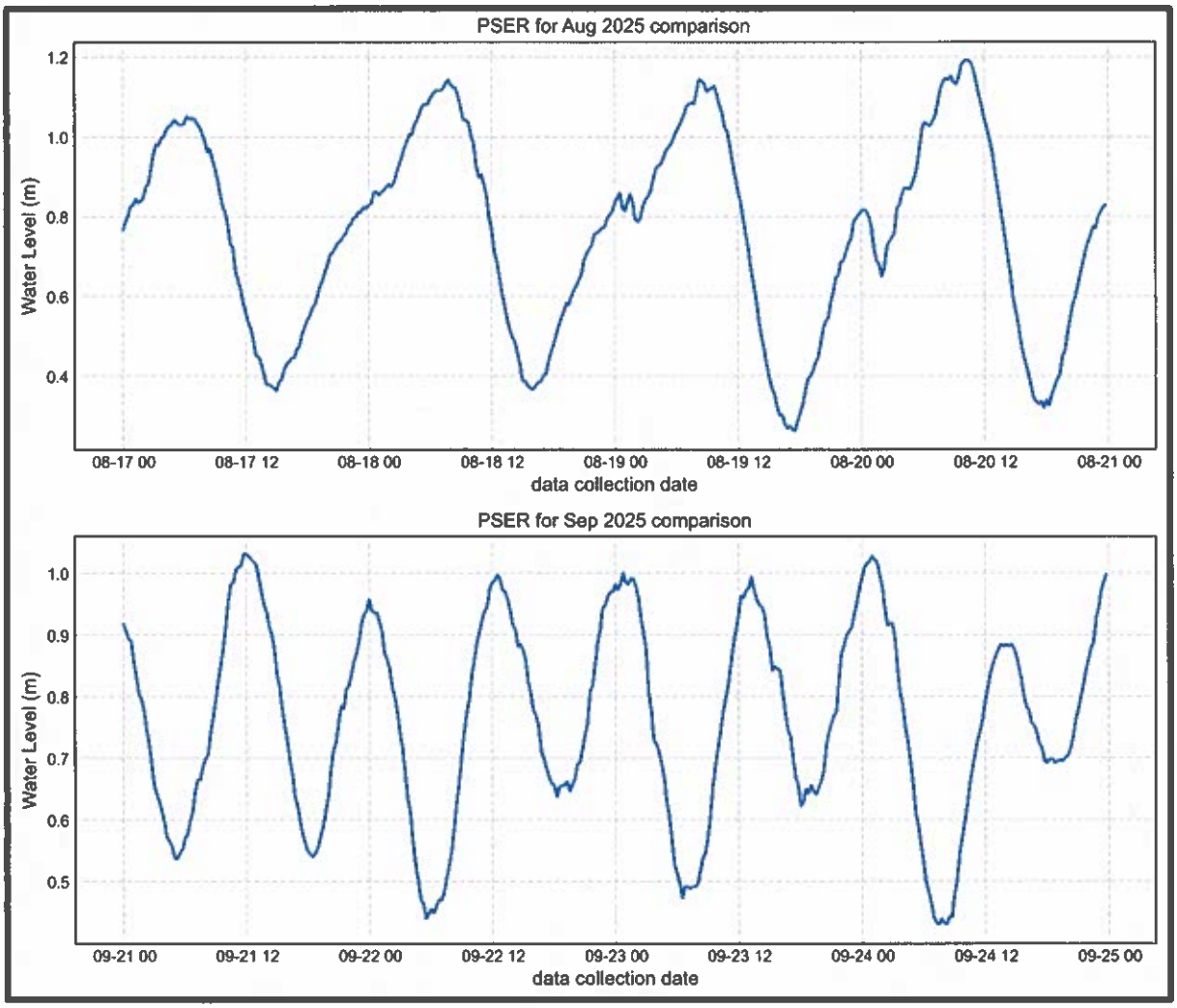

Figure 1. The tidal forcing data (referred to as PSER in the EFDC hydrodynamic modeling software) used to model each of the data collection trips.

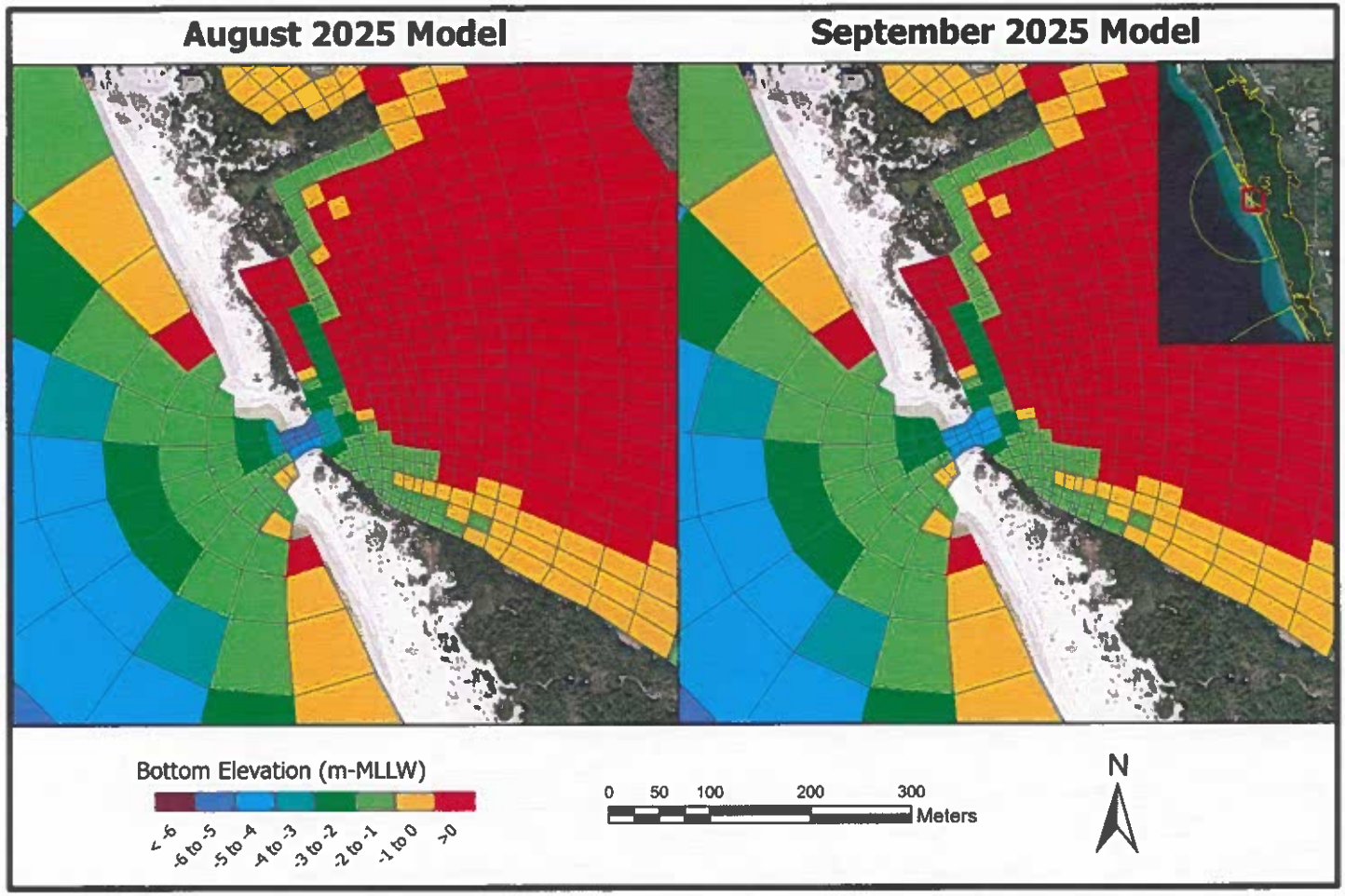

Figure 2. Maps of the model grid cell bottom elevations used for modeling each of the data collection trips. Elevation units are meters below the mean lower low water level of Big Sarasota Pass.

Hydrodynamic Model Calibration Results

As shown in Figure 3, the simulated flows produced by the open-inlet hydrodynamic model closely matched the flow rates measured during both data collection trips with respect to the timing and amplitude of diurnal/semidiurnal fluctuations in flow rate through Midnight Pass and the two flow path branches that convey water between Midnight Pass and the main body of Little Sarasota Bay. The correspondence between the simulated and measured flows indicates that the model was able to accurately represent the tidal prism of Midnight Pass and its spatial distribution under both Trip 1 and Trip 2 conditions.

The tidal conditions of Trip 1 and Trip 2 were very distinct. During Trip 1, the tides were fluctuating with a nearly perfect spring, diurnal pattern, a condition which results in near-maximum tidal prism. Trip 2 was almost the exact opposite of Trip 1 in terms of tidal fluctuations with a semi-diurnal neap, transitioning to spring, cycle. Therefore, the model calibration results show that the model was able to accurately predict the tidal prism of Midnight Pass under a wide range of tidal conditions, indicating that it is a reliable tool for evaluating the effects of Midnight Pass on hydrodynamics in the Little Sarasota Bay region.

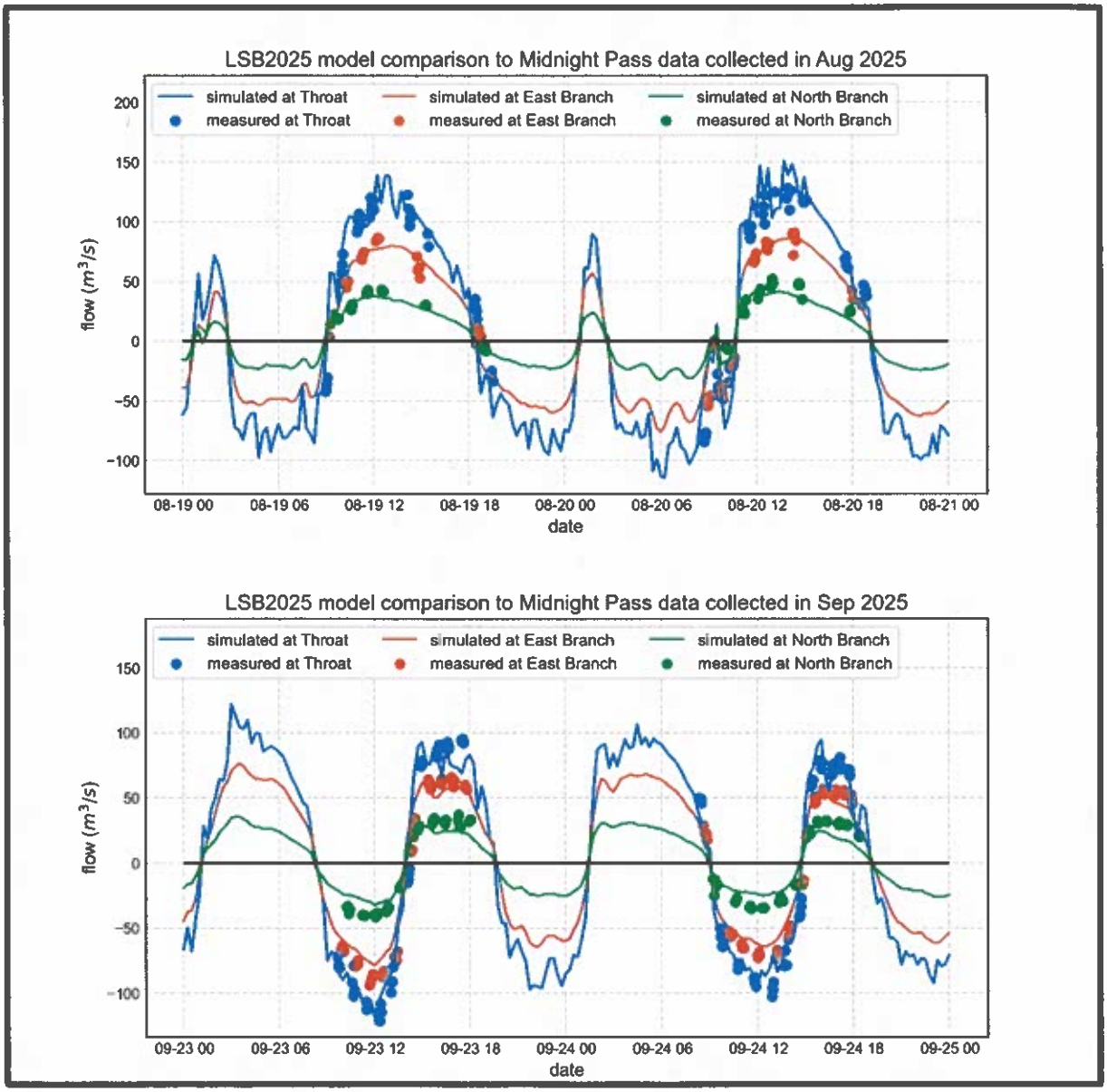

Figure 3. The measured and simulated flow rate timeseries through the Midnight Pass throat and the two branches that convey water between Midnight Pass and the main body of Little Sarasota Bay during Trip 1 (8/19/2025 – 8/20/2025; top) and Trip 2 (9/23/2025 – 9/24/2025; bottom).

Geosyntec consultants

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Technical Memorandum

Date: October 27, 2025

To: Rachel Herman, MS, CPM and Joseph Kraus, Sarasota County

Copies to: Spencer L. Anderson, P.E., Sarasota County, and Mike Jenkins, PhD, PE, Geosyntec

From: Steven J. Peene, Geosyntec

Subject: Task 1 – Field Data Collection for WA Little Sarasota Bay: Gulf to Bay Sustained Tidal Connection Concepts and Alternatives Analysis – Data Collection Results

TASK 1 – FIELD DATA COLLECTION FOR WA LITTLE SARASOTA BAY

This memorandum provides a summary of the data collection completed under Task 1 of the Little Sarasota Bay: Gulf to Bay Sustained Tidal Connection Concepts and Alternatives Analysis (PO253712; WA NO.250581 TO COUNTY CONTRACT 2613-03). This task was a continuation of data collection work, which was previously performed under a different work assignment (Task 7 of WA NO.240470), the memorandum for which was delivered to the county on March 25, 2025. The data collection under the current task included water level data and flow/velocity data within Midnight Pass and its associated channels. Additionally, this includes discussion of the challenges that were experienced during field activities and how they were resolved. Electronic data files are included through a link provided within this memorandum (see below).

Data Collection Timeframes and Tidal Conditions

Data was collected during two separate trips, the dates of which were chosen based on their distinct tidal conditions and the information the collected flow data would provide regarding the tidal prism of Midnight Pass. The first trip (Trip 1) took place from August 18 through August 20, 2025, a period which was expected to exhibit diurnal, spring tide conditions (Figure 1), which would theoretically produce a near-maximum tidal prism. The second trip (Trip 2) took place from September 23 to September 25, during which the tides in Sarasota were predicted to be semi-diurnal and transitioning from neap tide conditions to spring tide conditions. The Trip 2 timeframe was selected such that variable tidal prism volumes could be characterized.

On the first day of the first trip, the team traveled to Sarasota and installed the pressure sensors used to monitor water levels. Two pressure sensors were installed at the Turtle Beach Public Boat Ramp (for redundancy) and two more in Little Sarasota Bay directly inland of Midnight Pass (Figure 2). A fifth pressure sensor was installed in the open air next to the boat ramp to collect atmospheric pressure data that would later be used for atmospheric compensation of the water level data to more accurately convert water pressure readings to water depth.

On the second and third days of the first trip, the team met at the Turtle Beach Public Boat Ramp at sunrise, traveled by boat to Midnight Pass, and collected acoustic Doppler current profiler (ADCP) data throughout the day until sunset. ADCP data was collected from the moving boat in a circuit, alternating between the throat, the east branch, and the north branch (see Figure 2), following standard procedures. This included measuring temperature and salinity at multiple times, which are variables used by the ADCP measurement software to calculate the speed of sound in the water, which is used to calculate water velocity and flow rate based on the acoustic soundings.

The Midnight Pass tide gages were retrieved at the end of the third data collection day of Trip 1 due to concerns of boat collisions and vandalism, but the boat ramp atmospheric and tide gages were left in place since there were more secure locations available to install the sensors at the boat ramp.

As previously mentioned, the second sampling event (Trip 2) took place from September 23 to September 25, 2025, under transitioning neap-to-spring tidal conditions (Figure 1). ADCP data was collected on the first and second days of Trip 2 in the same manner as was done for Trip 1. Tide gages were also installed at Midnight Pass at the beginning of the first day and retrieved at the end of the second day of Trip 2, since this was the last time the data collection team would be at Midnight Pass during Trip 2. The boat ramp pressure sensors were retrieved at the beginning of the third day of Trip 2, prior to leaving Sarasota.

Collected Data

The measured water level and flow data for Trips 1 and 2 are shown in Figure 3, and **the electronic data files produced can be found HERE**. Note that special software is needed to open the raw ADCP and pressure data files. Additional information is provided in the README files in each raw data file folder. The water levels collected during Trip 1 showed an approximately 3-foot tidal range (Figure 3a), which was about 0.5 ft higher than what was predicted by the National Oceanic and Atmospheric Administration (NOAA) (Figure 1) and about 1 ft larger than the largest tidal range that took place during the previous flow sampling events which took place at Midnight Pass on 12/9/2024 – 12/10/2024 and 2/4/2025 – 2/6/2025 under a different work assignment. Almost

fully diurnal tidal conditions were observed during Trip 1. The tide was ebbing throughout most of the daylight hours during Trip 1, with high tide taking place around 9:30 a.m. on the first day and 10:30 a.m. on the second day. Low tide took place at around 6:00 p.m. on the first day and 7:00 p.m. on the second day.

Flow measurements were performed throughout the full ebb on both days of Trip 1. Since a large spring tide was occurring during Trip 1, this means the measured flow data collected during Trip 1 could effectively characterize the maximum tidal prism expected to occur at Midnight Pass, which was the goal of the Trip 1 sampling event. The peak flows measured in the throat during Trip 1 were approximately 120 cubic meters per second (m^3/s), with maximum average velocities of approximately 1 meter per second (m/s) and maximum point velocities of approximately 2 m/s. Flows measured in the east branch were approximately two-thirds those measured in the throat, with the remaining one-third going through the north branch. Maximum average velocities in both branches were approximately 0.75 m/s, and maximum point velocities were 1.5 m/s.

Flow rates under a variety of tidal conditions were captured during Trip 2 (Figure 3b). Tidal fluctuations were fully semi-diurnal during Trip 2, with low tides occurring at around 9:30 a.m. and again at 7:15 p.m. on the first day and 8:30 a.m. and again at 6:00 p.m. on the second day. High tides occurred at 2:15 p.m. on the first day and 2:30 p.m. on the second day. The measured tidal ranges varied between 0.6 ft and 2 ft. Therefore, variable peak flood and ebb flows were captured on both days of Trip 2.

The maximum flood flow measured in the throat on the first day of Trip 2 was approximately 120 m^3/s, while the maximum ebb flow was approximately 92 m^3/s. On the second day, the maximum flood flow was approximately 100 m^3/s, and the maximum ebb flow was approximately 80 m^3/s. As with previous data collection trips, the flow rate in the east branch was approximately two-thirds that of the throat, and the flow rate in the north branch was approximately one-third that of the throat.

The data collected during Trip 2 can effectively characterize how the tidal prism of Midnight Pass and its distribution into Little Sarasota Bay vary with tidal conditions. While the maximum flow measured during Trip 2 was approximately equal to that measured during Trip 1, the tidal prism under Trip 2 conditions was likely much less than that for Trip 1 due to Trip 2 being under semi-diurnal conditions, meaning flow in a given direction would be sustained for approximately half the time during Trip 2 compared to Trip 1. Further, Trip 2 data showed that maximum and minimum flow rates can vary with changing tidal conditions.

It should be noted that the water clarity observed during Trip 2 was noticeably higher (i.e., the water in the bay around Midnight Pass was clearer) compared to Trip 1. Also, the temperature measured at the site varied between 31.6 degrees Celsius (°C) and 33.2°C during Trip 1 but varied between 28°C and 30°C during Trip 2.

It should also be noted that the maximum flow rates measured under this work assignment were more than two times the maximum flow rates measured under the previous work assignment. This is likely partially because the cross-sectional area of Midnight Pass has almost doubled since the previous round of data collection according to the survey data provided by the County. Further, it appears, based on visual field observations, that the main flow paths in the north and east branches in Little Sarasota Bay leading to Midnight Pass have also increased in cross-sectional area, which would also contribute to increasing flows through Midnight Pass.

Data Collection Challenges

Several challenges were encountered during the two data collection trips. On both days of Trip 1, the data collection team was subjected to high heat indices, forcing them to take multiple breaks to cool off to prevent heat stress. Also, on the first day of Trip 1, lightning was observed in the vicinity of the study area, and data collection had to be paused while a thunderstorm passed. Later in the first day of Trip 1, the global positioning system (GPS) unit on the ADCP stopped functioning, which caused the instrument to lose some of its quality control functionality, but it continued to perform its core flow measurement functions. The GPS unit began working again at the beginning of the second day of Trip 1. During the peak flow conditions of Trip 1, signs of a moving bed were detected while collecting flow data, indicated by a divergence in the bottom-tracking and GPS tracks. A moving bed can interfere with ADCP flow measurements which rely on bottom tracking to determine the velocity of the boat during the transect, which is taken into account in determining the water velocity. While methods are available to correct the ADCP flow for a moving bed, these methods were not ideal for the study area because of their relying on a nearly constant flow and require the collection of additional data at each measurement location. Instead, actions were taken to avoid areas with a moving bed to assure higher quality flow data.

In the time between Trip 1 and Trip 2, Geosyntec personnel tested the ADCP instrument and found that the GPS unit had stopped working entirely. Therefore, it was decided to rent an ADCP for Trip 2 to ensure that a fully functioning instrument would be used for the data collection. At the beginning of the first day of Trip 2, it was found that the power converter used to power the laptop needed for data collection had blown a fuse, causing it to not function. Therefore, data collection was delayed by approximately an hour on the first day of Trip 2 so that a replacement fuse could be purchased from a nearby hardware store.

Although challenges were encountered during the field data collection, the team acted quickly and effectively to resolve those challenges and collect adequate data to achieve the goals of the study.

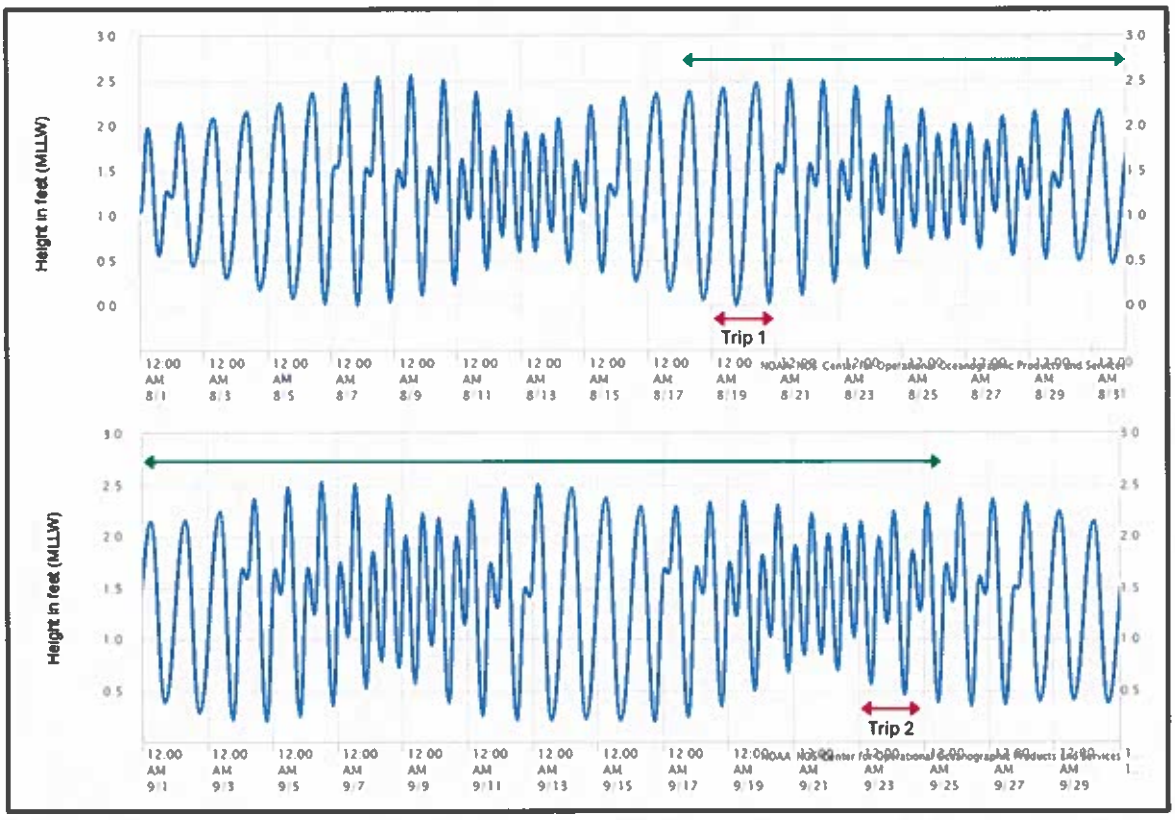

Figure 1. NOAA Tide Predictions for Big Sarasota Pass for the Months of August and September 2025. Water level data was collected from 8/18/2025 to 9/25/2025 (the time frame indicated by the green arrows). Flow data was collected during daylight hours of 8/19/2025, 8/20/2025, 9/23/2025, and 9/24/2025 (the time frames indicated by the red arrows).

Figure 2. Locations of Pressure Sensors (i.e., Tide Gages) and ADCP Transects where Water Level Data and Flow Data Were Collected, Respectively.

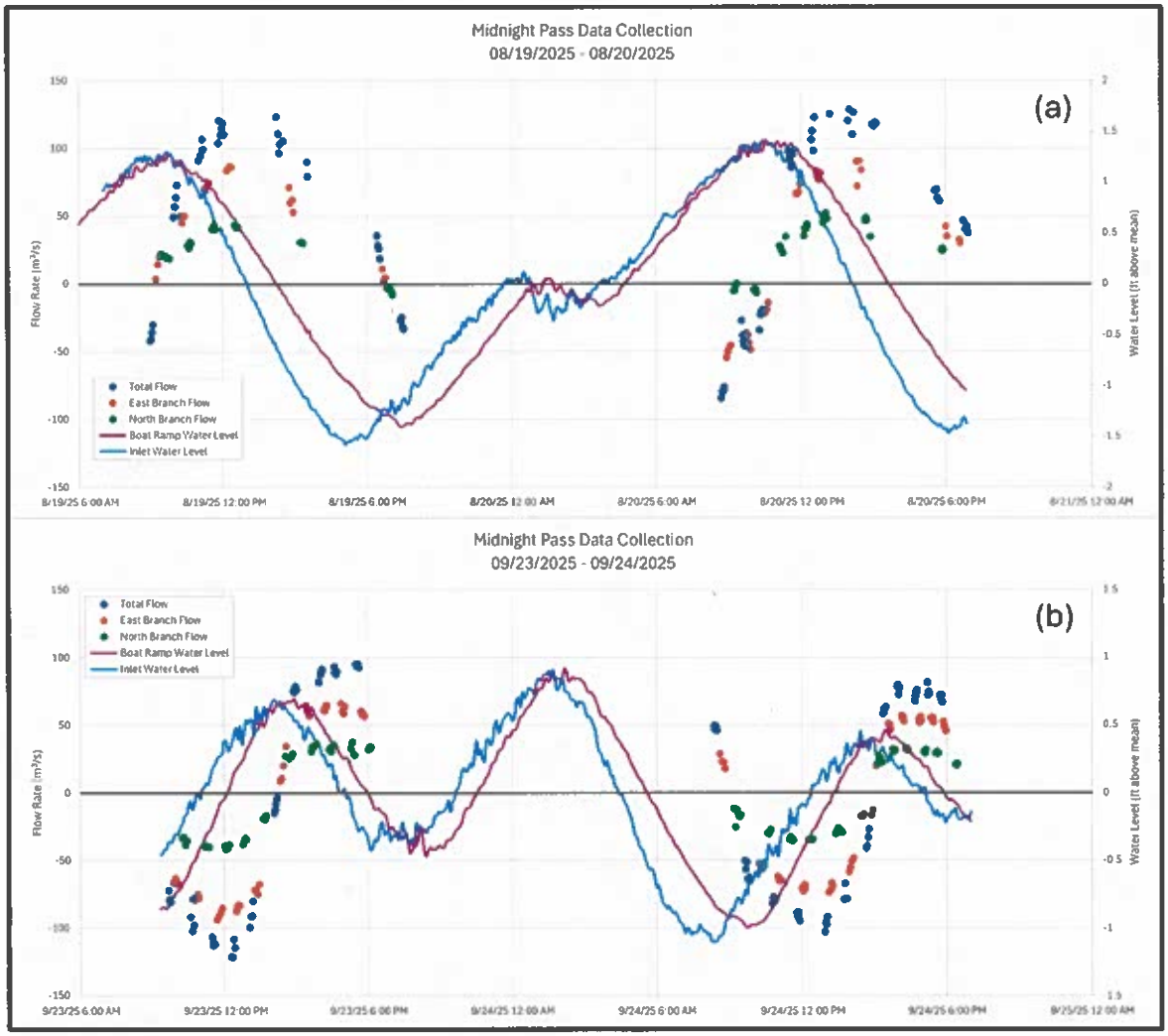

Figure 3. Time Series of Water Level and Flow Data Collected during Trip 1 (a) and Trip 2 (b). Positive flow indicates flow from the Bay into the Gulf.