**Scope of Work, Schedule, and Cost Proposal for**
**Jupiter Inlet Ebb Shoal and Nearshore Areas Morphology Analysis Services**

In January 2026, the Jupiter Inlet District (JID) retained Taylor Engineering to evaluate shoaling rates and navigation performance for several proposed channel configurations through the Jupiter Inlet ebb shoal. Taylor Engineering built upon an existing, validated MIKE21 Flexible Mesh (FM) modeling system (Taylor Engineering, 2025) that couples hydrodynamics, waves, sediment transport, and morphology to simulate the complex interactions governing inlet and ebb shoal evolution. The modeling framework encompasses Jupiter Inlet, the ebb shoal, adjacent nearshore shorelines, and connected waterways (see Figure 1), providing a robust tool for evaluating estuary, inlet, and coastal sediment transport processes.

Using this modeling framework, Taylor Engineering updated the existing model and evaluated the shoaling performance of four proposed ebb shoal navigation channel alternatives that varied in width and depth (Taylor Engineering, 2026). The analysis examined both short-term and long-term channel evolution under representative wave and tidal conditions and quantified the rates at which sediment accumulates within the proposed navigation channel alternatives. The model results indicate:

- Proposed channel alternatives experience significant shoaling due to the highly active sediment transport environment within the Jupiter Inlet ebb shoal system.
- Depending on channel geometry and the timing of dredging operations, the alternative channels are expected to infill and potentially close within approximately 2 to 5.5 months.
- Among the alternatives evaluated, Alternative 2b, consisting of a 300-foot-wide channel dredged to an elevation of -17 feet MLLW, provided the longest estimated time to closure and therefore exhibited the best overall navigation performance.
- If channel dredging is completed by April 30 in a morphologically representative year, the Alternative 2b channel can generally maintain a minimum navigable depth of approximately -8 feet MLLW for roughly five to six months following dredging. Beyond that period, continued sediment accumulation will likely reduce navigable depths and necessitate maintenance dredging to sustain safe vessel access through the ebb shoal.
- Long-term channel viability depends not only on channel geometry but also on continued sediment management and maintenance dredging operations.

The Taylor Engineering (2026) model simulations also confirmed a dominant net southward sediment transport regime across the ebb shoal. This persistent transport pattern drives sediment accumulation within the channel, influences natural bypassing processes, and promotes gradual southward migration of channel features across the shoal. Historical bathymetric surveys and model results consistently show that sediment moves southward across the inlet system and periodically bypasses the inlet through ebb shoal bar formation and welding processes.

This scope builds upon the validated MIKE21 modeling framework (Taylor Engineering, 2026) applied to evaluate the performance of proposed navigation channels through the Jupiter Inlet ebb shoal. The existing modeling system provides a robust platform for evaluating both local channel behavior and broader sediment management implications.

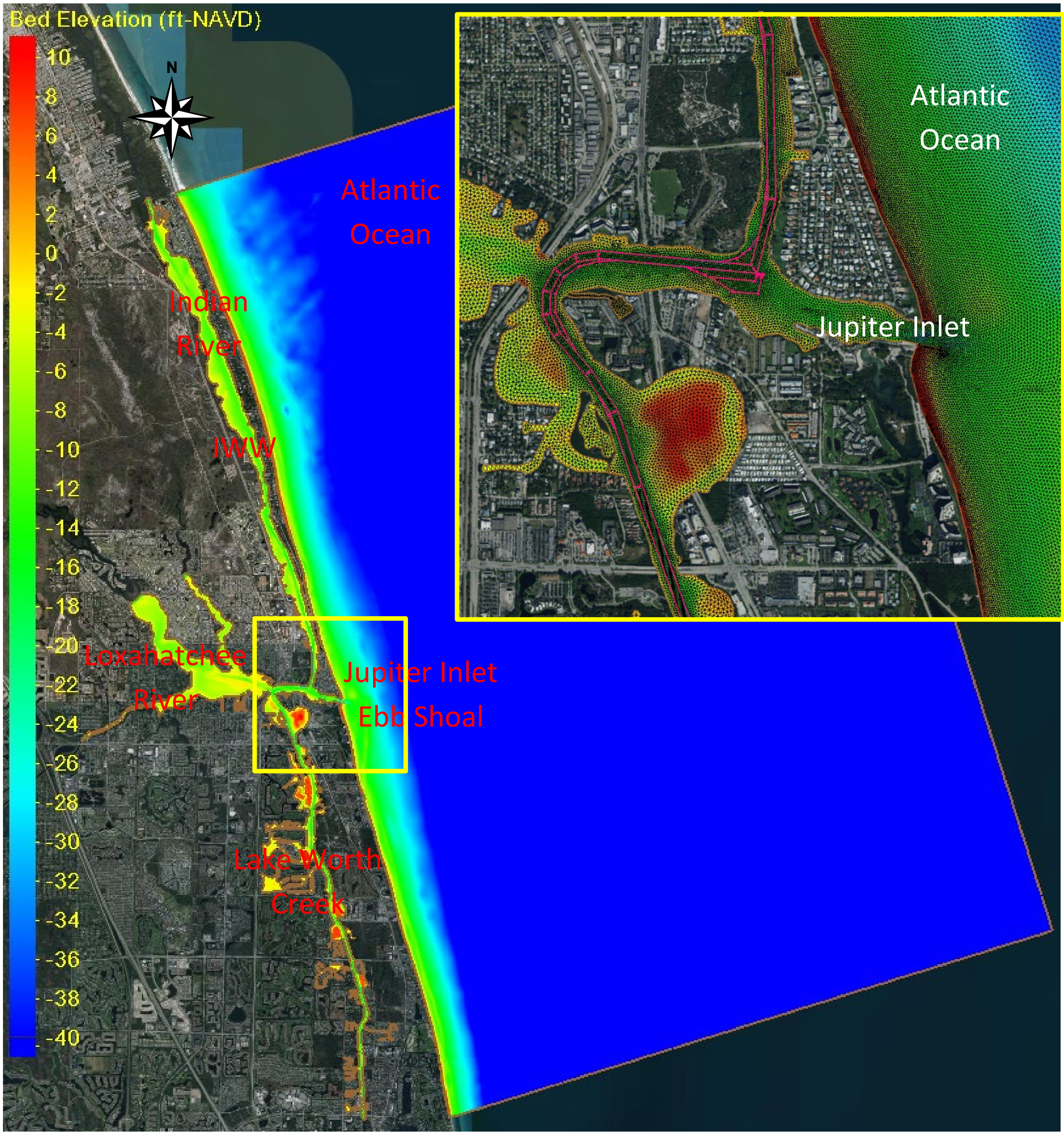


**Figure 1** MIKE21 Model Domain, Bed Elevations, and Model Mesh (Inset) at Jupiter Inlet

Under this scope, Taylor Engineering will expand the previous Taylor Engineering (2026) analysis to evaluate the broader impacts of constructing and maintaining an ebb shoal navigation channel. Specifically, the study will:

- Evaluate potential reductions in natural sediment bypassing across Jupiter Inlet.
- Assess the effects of the ebb shoal navigation channel on Jupiter Inlet sand trap performance and the sand trap's ability to achieve the established bypassing target of approximately 81,000 cubic yards per year.

- Evaluate potential changes in sediment distribution and sediment quality resulting from altered transport pathways.
- Assess long-term ebb shoal channel shoaling, maintenance dredging requirements, and overall channel sustainability.
- Quantify regional sediment transport impacts associated with the dredged ebb shoal navigation channel.
- Determine potential impacts on the downdrift beach nourishment projects, including the North County Coastal Storm Risk Management (CSRM) Project, the Jupiter/Carlin Beach Nourishment Project, and Juno Beach.

To accomplish these objectives, Taylor Engineering will perform a series of tasks that include collection and review of available data, refinement of the existing modeling framework, validation of developed models, execution of short-term and long-term simulations, evaluation of channel-related impacts, development of engineering recommendations, and preparation of a comprehensive technical report. The study will use the dynamically integrated MIKE21 Hydrodynamic (HD), Wave (SW), Sediment Transport (ST); and MIKE21 Littoral Processes (LP) models in a complementary manner to provide both detailed process-based analyses and regional sediment budget assessments.

The following tasks describe: (1) data collection and analysis, (2) refinement of the baseline MIKE21 HD+SW+ST modeling framework, (3) validation of the developed LP model, (4) short-term and long-term simulations to evaluate channel-related impacts, and (5) preparation of the final evaluation report.

**TASK 1 Data Collection, Review, and Analysis**

Understanding the potential impacts of a dredged navigation channel through the Jupiter Inlet ebb shoal requires a thorough understanding of the hydraulic, sediment transport, and morphologic processes that govern the inlet system. These processes influence sediment accumulation within the Jupiter Inlet sand trap, formation and evolution of the ebb shoal, sediment transport through and around the inlet, regional littoral transport along adjacent shorelines, and the spatial distribution of sediment characteristics throughout the nearshore, inlet, and interior waterway system. Historical observations and previous modeling studies demonstrate that these processes are highly interconnected and collectively control channel shoaling, natural bypassing, and beach nourishment performance.

To support the modeling and impact assessment, Taylor Engineering will compile, review, and analyze available data and relevant literature associated with the Intracoastal Waterway (IWW), Jupiter Inlet, the ebb shoal, the adjacent nearshore environment, and nearby beach nourishment project areas. This review will establish the historical context necessary to understand how the inlet system has evolved and how sediment has moved through the system under both natural and managed conditions. Particular emphasis will be placed on documented changes in the inlet sediment trap, ebb shoal morphology, natural channel formation and closure across the ebb shoal between 1996 and 2025, shoreline erosion trends, beach nourishment activities, and sediment management practices implemented within the region. Historical bathymetric surveys indicate recurring cycles of ebb shoal channel formation, migration, shoaling, and closure across the ebb shoal, making these records particularly important for evaluating future channel performance.

The data collection effort will focus on obtaining the information necessary to characterize existing conditions and support refinement of the MIKE21 numerical modeling framework. Relevant datasets may include water-level observations, tidal records, current velocity measurements, wind data, offshore wave conditions, sediment characteristics, topographic surveys, bathymetric surveys, dredging records, beach nourishment records, and sediment bypassing records. Taylor Engineering will also review previous engineering studies, sediment budget analyses, inlet management plans, monitoring reports, and project documentation relevant to the Jupiter Inlet system and adjacent shorelines. This information will support the development of sediment budgets, identification of dominant sediment pathways, and evaluation of historical trends affecting channel maintenance and beach nourishment performance.

The review will focus on hydraulic and morphologic investigations conducted within and adjacent to the Jupiter Inlet system, including the inlet, ebb shoal, IWW, sand trap, nearshore areas, and the following downdrift projects:

- North County Coastal CSRM Project
- Jupiter/Carlin Beach Nourishment Project
- Juno Beach Nourishment Project

Taylor Engineering will obtain data from available federal, state, regional, and local sources, which may include:

- U.S. Army Corps of Engineers (USACE), Jacksonville District
- Florida Department of Environmental Protection (FDEP)
- Florida Inland Navigation District (FIND)
- National Oceanic and Atmospheric Administration (NOAA)
- U.S. Geological Survey (USGS)
- Palm Beach County (PBC)
- South Florida Water Management District (SFWMD)

The collected information will provide the technical foundation for subsequent model refinement, calibration and verification; sediment budget development; and ebb shoal navigation channel impact analyses. The review will also identify data gaps and uncertainties that may influence the interpretation of the modeling results and the development of recommendations. Ultimately, this task will establish the hydraulic, sediment transport, and morphologic conditions that will serve as the baseline against which the effects of the ebb shoal navigation channel will be evaluated.

**TASK 2 MIKE21 FM Baseline Model Refinement and Modeling for Baseline Conditions**

Task 2 will refine and expand the existing Taylor Engineering (2026) MIKE21 modeling framework to support the evaluation of the proposed ebb shoal navigation channel and its potential impacts on sediment bypassing, ebb shoal change, and long-term channel maintenance. The effort will build upon the validated, dynamically coupled MIKE21 Flexible Mesh (FM) HD, SW, and ST model previously developed for Jupiter Inlet and the surrounding coastal system (Taylor Engineering, 2025). This modeling framework already encompasses the inlet, ebb shoal, adjacent nearshore areas, Intracoastal Waterway (IWW), and connected waterways, providing a robust platform for evaluating sediment transport and morphologic change throughout the inlet, IWW, and ebb shoal area.

Taylor Engineering will first refine the existing MIKE21 FM model to improve resolution within the nearshore environment, ebb shoal, inlet, and adjacent beach systems. The refined model will use temporally and spatially varying tidal water-level boundary conditions derived from MIKE21 global tidal databases along the offshore, northern ocean, and southern ocean boundaries. The model will apply NOAA-predicted water levels at inland boundaries and, where necessary, incorporate velocity components along offshore boundaries to represent Florida Current variability during selected periods. Offshore wave forcing will be based on U.S. Army Corps of Engineers (USACE) Wave Information Study (WIS) hindcast data, including WIS Station 63456, which was also used in the previous studies (Taylor Engineering, 2025 and 2026). Available sediment sampling data and previously established model parameters will define sediment characteristics for the ebb shoal, inlet, IWW, and nearshore areas.

Building on the refined model, Taylor Engineering will develop baseline applications of the MIKE21 FM model. The model will simulate existing conditions without the proposed ebb shoal navigation channel to establish baseline hydrodynamics, sediment transport patterns, shoreline response, and regional sediment budgets (supplemented by the MIKE21 Littoral Processes (LP) model that will be further developed in Task 3). Using the representative wave conditions identified by the LP model, the MIKE21 FM model will simulate inlet and ebb shoal responses during a representative morphologically average year, a high wave-energy year, and a low wave-energy year. This approach will allow the study to evaluate:

- Inlet and ebb shoal evolution for different years with various levels of wave energy that predominantly drive littoral sediment transport.

- Localized sediment budget in the inlet and ebb shoal complex for each of the representative years.

Using a representative one-month period, Taylor Engineering will perform MIKE21 FM model sensitivity analysis to determine the erosion/deposition pattern for different sediment sizes and evaluate baseline sediment distribution patterns and sediment quality, which can later be compared to conditions with the ebb shoal navigation channel.

The above baseline MIKE21 FM model simulations will provide the reference condition against which the effects of the preferred channel alternative will be evaluated. While the MIKE21 FM model will focus on seasonal and year-long inlet and ebb shoal evolution, the LP model that will be developed in Task 3 will provide a multi-year analysis of beaches located updrift and downdrift, including the North County CSRM, Jupiter/Carlin, and Juno Beach project areas.

**TASK 3 Littoral Processes Model Update, Calibration, and Verification; and Modeling for Baseline Conditions**

Taylor Engineering will use the LP model to evaluate multi-year regional longshore sediment transport and shoreline sediment budgets along the coast adjacent to Jupiter Inlet and along the North County CSRM, Jupiter/Carlin, and Juno Beach project areas. The model will simulate wave-driven sediment transport within the surf zone using long-term offshore wave data and representative shoreline geometry. We will update the existing Taylor Engineering (2025) LP model as needed to reflect current shoreline alignments, beach profiles, coastal structures, nearshore bathymetry, and sediment characteristics. The model domain will extend sufficiently updrift and downdrift of Jupiter Inlet to capture regional sediment transport pathways, sediment bypassing processes, and sediment exchange between the inlet system and adjacent beaches. As part of the update, we will select representative transects to characterize beach and nearshore topography and bathymetry for wave-transformation and shoreline-evolution analyses.

*LP Model Calibration and Verification*

Taylor Engineering will calibrate the LP model using available shoreline change data, sediment budgets, beach nourishment records, dredging histories, inlet-bypassing estimates, and/or other relevant beach monitoring datasets. The calibration process will focus on reproducing observed shoreline trends and regional sediment transport patterns by adjusting transport coefficients and other key LP model parameters as necessary. By comparing modeled and observed shoreline response, volumetric change, or net littoral transport rates, we will confirm that the model accurately represents long-term littoral transport processes within the study area.

Following calibration, Taylor Engineering will verify the LP model using independent datasets and historical periods not included in the calibration effort. Verification will assess the model's ability to reproduce observed shoreline evolution and regional sediment transport trends under varying wave conditions. Once calibrated and verified, the MIKE21 LP model will provide a reliable framework for quantifying regional sediment budgets, evaluating sediment transport continuity, and assessing the influence of Jupiter Inlet and the ebb shoal navigation channel on adjacent beaches. The LP model results will complement the detailed inlet-scale analyses performed with the higher-resolution 2D process-based MIKE21 FM morphology model and support the evaluation of the effects of the proposed ebb shoal navigation channel and long-term sediment management strategies.

*Development of Representative Periods*

Taylor Engineering will configure the calibrated and verified LP model to represent baseline coastal conditions and calculate gross and net longshore sediment transport rates at selected shoreline locations. Specifically, the LP model will use long-term offshore wave records, including available WIS data from approximately 1980 through 2024, to:

- Identify representative years that reflect average-, high-, and low-wave-energy morphologic conditions.
- Identify an updated representative month for short-term evaluations.
- If needed, evaluate wave transformation and sediment transport during the representative years and identify the morphologically significant wave conditions that drive sediment transport and

shoreline change within the study area.

- Use the identified representative wave conditions as the basis for efficiently simulating long-term morphologic response while preserving the primary drivers of erosion and accretion.

*LP Modeling of Baseline Conditions*

Using the full offshore wave record or equivalent representative periods, the LP model will quantify seasonal and annual transport variability, identify alongshore transport gradients, and evaluate regional sediment delivery to neighboring shorelines. This approach will provide an efficient and reliable assessment of baseline long-term littoral transport processes and regional sediment-budget relationships that cannot be evaluated efficiently and effectively with the higher-resolution, two-dimensional, and computationally intensive MIKE21 FM model.

**TASK 4 Analysis of the Effects of the Ebb Shoal Navigation Channel**

In Task 4, Taylor Engineering will modify the baseline MIKE21 FM model to incorporate the preferred ebb shoal navigation channel geometry, including its location, alignment, depth, width, and length. We will evaluate the system response to the ebb shoal navigation channel under tide and wave conditions of the representative morphologically average year, a high wave-energy year, and a low wave-energy year. As needed, we will develop nested model domains to increase resolution within areas of interest while using results from the larger-scale model to define boundary conditions. By leveraging the complementary strengths of the MIKE 21 FM and LP models, we will evaluate the impacts of the ebb shoal navigation channel at both the local inlet scale and the regional shoreline scale. This integrated approach will provide a comprehensive assessment of sediment transport processes, including the effects of the ebb shoal navigation channel, channel maintenance requirements, and the effectiveness of long-term sediment-management strategies for ebb shoal navigation channel maintenance.

*Evaluations of Impacts to the Jupiter Inlet Sediment Trap's Ability to Meet Bypassing Goals and Changes in Natural Bypassing Across the Inlet*

We will evaluate the extent to which the ebb shoal navigation channel captures sediment that would otherwise naturally bypass Jupiter Inlet or contribute to the inlet sand trap system. To accomplish this, we will apply both the MIKE 21 FM and LP models to quantify changes in sediment transport pathways and natural bypassing across the inlet.

Using the MIKE 21 FM model, Taylor Engineering will quantify sediment transport pathways and deposition patterns within the ebb shoal and Jupiter Inlet sand trap system under tide and wave conditions of the representative morphologically average year, a high wave-energy year, and a low wave-energy year. For each representative year, we will calculate pro-rated sediment fluxes across strategically positioned transects extending from the updrift shoreline, across the ebb shoal, and into the downdrift shoreline system, including areas east and west of the sand trap. By comparing baseline conditions with with-project conditions (i.e., with the ebb shoal navigation channel), we will quantify changes in inlet bypassing efficiency and sediment trapping efficiency. We will also use the model results to estimate the shoaling rate within the inlet sand trap system under with-project conditions and compare that rate to the established bypassing target of approximately 81,000 cubic yards per year.

Building on the MIKE 21 FM results, we will use the LP model to evaluate long-term wave-driven littoral transport and quantify changes in regional sediment bypassing efficiency. We will incorporate the

MIKE 21 FM-derived inlet bypassing and trapping efficiencies into the LP model to assess long-term sediment-supply changes along the adjacent shoreline. By integrating the MIKE 21 FM and LP model results, we will quantify both short-term process-based effects and long-term impacts on sediment delivery to downdrift beaches.

*Evaluation of Changes to Sediment Quality*

Taylor Engineering will evaluate potential changes in sediment quality and distribution using both the MIKE21 FM and LP modeling tools. The LP model will provide a screening-level assessment of sediment quality changes by examining variations in wave-driven transport energy and directionality. We will use these results to identify areas where altered transport pathways could influence sediment sorting and compatibility.

Using the MIKE21 FM model, we will perform five simulations applying a range of median grain sizes (e.g., D50 ≈ 0.10, 0.22, 0.30, 0.40, and 0.50 mm) to evaluate sediment redistribution throughout the ebb shoal, inlet sand trap, and adjacent beaches during the one-month representative period (determined in Task 3). These simulations will identify areas of preferential sediment trapping and transport and assess whether the ebb shoal navigation channel selectively captures certain sediment fractions and alters the sediment characteristics reaching interior waterways and downdrift beaches.

Together, the LP and MIKE21 FM model analyses will provide a comprehensive assessment of potential changes in sediment quality relevant to beach nourishment and sediment management.

*Evaluation of Long-Term Ebb Shoal Navigation Channel Maintenance Requirements*

Taylor Engineering will use the MIKE21 FM model results for a representative morphologically average year, a high wave-energy year, and a low wave-energy year to quantify changes in ebb shoal navigation channel bed elevations. We will estimate rates of sediment accumulation, identify dominant sediment sources contributing to shoaling, and determine the time required for partial or complete channel infilling. Building on previous modeling results that indicated potential closure within several months (Taylor Engineering, 2026), we will estimate pro-rated annualized sedimentation rates, maintenance dredging requirements, and anticipated dredging intervals across a broader range of hydraulic conditions.

*Evaluation of Impacts on Downdrift Beach Projects*

Taylor Engineering will use the LP model to evaluate how the ebb shoal navigation channel affects sediment delivery to the North County CSRM, Jupiter/Carlin, and Juno Beach project areas. We will compare sediment-transport rates under baseline and with-project conditions and translate those differences into regional-scale sediment deficits or surpluses. This analysis will provide both local and regional assessments of potential impacts on downdrift beach nourishment projects and shoreline management efforts.

**Task 5 Report Preparation and Presentation**

We will prepare a feasibility report summarizing the results of Tasks 1–4. The report will include model documentation, featuring a written summary of the modeling approach and key findings, along with supporting graphics. Additionally, the report will present hydraulic model results in tabular format for both the baseline condition (without the ebb shoal navigation channel) and the with-project (with ebb shoal navigation channel) condition.

**SUMMARY**

We will perform these services for a lump-sum fixed price of $198,206. Table 1 provides a detailed cost breakdown, and Table 2 outlines the proposed task schedule. The model refinements and validation for the baseline condition analysis (Tasks 2 and 3) will require multiple iterations and simulations, which we estimate will take approximately 6 – 9 months to complete. Additionally, we estimate that the analysis of the effects of the ebb shoal navigation channel will take approximately 9 months. Based on these requirements, we anticipate that completion of Tasks 1–5 will take approximately 21 months.

**ASSUMPTIONS**

We have made several key assumptions in developing this scope of work and the associated fees for the project. These assumptions, outlined below, influence the proposed level of effort and corresponding costs. <u>If any of these assumptions prove to be incorrect, we will provide a revised proposal to adjust the scope and fees accordingly.</u> The scope of work has been developed based on the following assumptions and background information:

i. No field measurements are included in this scope of work.
ii. Recent topography, bathymetry, and sediment data along nearshore areas to the north and south of Jupiter Inlet and at the North CSRM, Jupiter/Carlin, and Juno Beach project areas are available in digital format.
iii. There will be one preferred ebb shoal navigation channel design for the analysis in Task 4.
iv. Littoral transport is the main and regular source of sediment that can shoal in the proposed ebb shoal navigation channel. The Loxahatchee River system does not primarily supply the sediments in the ebb shoal.
v. Littoral transport estimates based on beach monitoring survey data are available at beaches north and south of Jupiter Inlet and at the North CSRM, Jupiter/Carlin, and Juno Beach projects to facilitate LP model calibration/verification.
vi. Engineering design and permit application services are excluded from this scope of work.

As channels shoal and sediments accumulate, shoaling rates typically decrease over time. Therefore, long-term shoaling rates may differ from those presented in Tasks 2 – 4. Additionally, future hydraulic conditions—such as tides and waves—may vary from those characterized in the proposed analysis. The proposed analysis relies on MIKE21 FM model results for long-term representative years and a short-term representative month and LP model results for multi-year regional littoral transport. Extreme episodic events, such as storm surges and high-wave conditions, can also cause significant deposition and erosion. For example, major storms can erode large volumes of sediment from the nearshore and central embayment of the Loxahatchee River and transport these sediments into the ebb shoal navigation channel. Multi-year model simulations account for greater variability in channel sediment trapping efficiency and incorporate a wider range of hydraulic conditions over time. As a result, they provide a more reliable estimate of the ebb shoal navigation channel's influence on the inlet sediment trap and upwind/downdrift beaches.

**REFERENCES**

Taylor Engineering. 2025. Jupiter Inlet Area IWW Sediment Impoundment Basin Feasibility Study — Data Collection, Model Development, and Evaluation of Performance of Basin Alternatives, Palm Beach County, FL, Final Report, 94 p.

Taylor Engineering. 2026. Jupiter Inlet Jupiter Inlet Ebb Shoal Navigation Channel Modeling and Analysis, Draft Letter Report, 28 p.

**Table 1** Estimated Task Cost for the Jupiter Inlet Ebb Shoal and Nearshore Areas Morphology Analysis Services

| Task | Task Name | Fee |
|---|---|---|
| 1 | Data Collection, Review, and Analysis | $16,798 |
| 2 | MIKE21 FM Baseline Model Refinement and Modeling for Baseline Conditions | $47,488 |
| 3 | Littoral Processes Model Update, Calibration, and Verification; and Modeling for Baseline Conditions | $48,278 |
| 4 | Analysis of the Effects of the Ebb Shoal Navigation Channel | $61,488 |
| 5 | Report Preparation and Presentation | $24,154 |
| | **Total** | **$198,206** |

**Table 2** Estimated Task Schedule for the Jupiter Inlet Ebb Shoal and Nearshore Areas Morphology Analysis Services

| Task No. | Task Description | Quarters from Notice-to-Proceed | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | Data Collection, Review, and Analysis | | | | | | | | |
| 2 | MIKE21 FM Baseline Model Refinement and Modeling for Baseline Conditions | | | | | | | | |
| 3 | Littoral Processes Model Update, Calibration, and Verification; and Modeling for Baseline Conditions | | | | | | | | |
| 4 | Analysis of the Effects of the Ebb Shoal Navigation Channel | | | | | | | | |
| 5 | Report Preparation and Presentation | | | | | | | | |