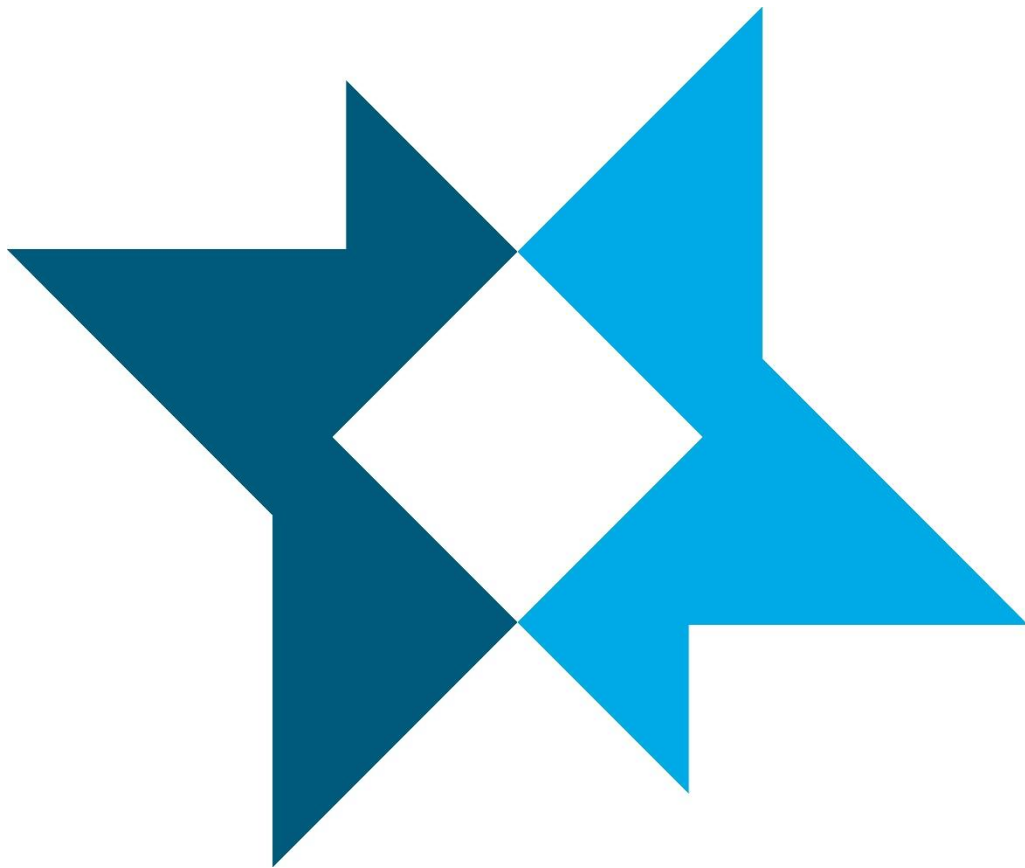




City of Isle of Palms, SC Beach Management Alternatives Analysis



City of Isle of Palms

Isle of Palms, SC

October 2026

Project ID: 0025I025.01

**Solving our clients' toughest
science and engineering challenges.**



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October 19, 2026

Douglas Kerr, City Administrator
City of Isle of Palms
P.O. Drawer 508
Isle of Palms, SC 29451

Re: City of Isle of Palms, SC
Beach Management Alternatives Analysis (RFQ 2025-02)

Dear Douglas:

We are pleased to submit the enclosed final report for the City of Isle of Palms Beach Management Alternatives Analysis, completed in accordance with RFQ 2025-02. The study builds upon a comprehensive review of historical shoreline conditions, beach management activities, monitoring data, engineering studies, and future project plans to evaluate long-term strategies for managing erosion and maintaining desired beach and dune conditions along the Isle of Palms shoreline.

Should you have any questions regarding the findings of this study, please do not hesitate to reach out to us.

Sincerely,

Foth Infrastructure & Environment, LLC

A handwritten signature in blue ink, reading "Christopher G. Creed".

Christopher G. Creed, P.E.
Senior Coastal Engineer and Client Team Leader
Licensed in FL, GA, SC, NC

A handwritten signature in blue ink, reading "N. Zachary Bedell".

N. Zachary Bedell, P.E.
Project Coastal Engineer
Licensed in FL, SC, NC

cc: Sydney Goodman, E.I.

Enclosure

City of Isle of Palms, SC

Beach Management Alternatives Analysis

Project ID: 0025I025.01

Prepared for
City of Isle of Palms

City of Isle of Palms
P.O. Drawer 508
Isle of Palms, SC 29451

Prepared by
Foth Infrastructure & Environment, LLC

October 2026

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City of Isle of Palms, SC

Beach Management Alternatives Analysis

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City of Isle of Palms, SC

Beach Management Alternatives Analysis

Executive Summary

The City of Isle of Palms has experienced persistent shoreline erosion and increasing vulnerability to storm-related impacts along portions of its beachfront. In response to these concerns, the City commissioned this Beach Management Alternatives Analysis to evaluate long-term strategies for managing erosion and maintaining a resilient and sustainable shoreline. The evaluation considered ongoing coastal change, increasing storm risk, and the need for a practical, cost-effective beach management program.

The analysis was based on a review of historical conditions, monitoring data, engineering studies, and future project plans to understand the factors influencing shoreline change at Isle of Palms. A minimum baseline beach condition was then established for the purpose of this study and used to evaluate long-term management strategies over a 50-year planning horizon. Historical low- and high-rate beach volume change scenarios were evaluated to estimate shoreline performance, renourishment volumes, project frequency, sediment availability, environmental constraints, constructability, and cost.

Fourteen beach management alternatives were developed and evaluated. These alternatives ranged from periodic beach nourishment using offshore borrow material at 5-, 7-, and 10-year intervals to more comprehensive approaches incorporating supplemental sand sources from the Atlantic Intracoastal Waterway (AICWW) maintenance dredging program and Dewees Inlet shoal management activities. Additional alternatives included combinations of beach nourishment and structural measures, such as groins, detached breakwaters, geotextile tubes, and a terminal groin at Breach Inlet. Each alternative was evaluated based on its ability to maintain the established baseline condition, improve resilience, reduce erosion-related impacts, and provide long-term economic value.

The analysis demonstrated that periodic beach nourishment will remain the foundation of any successful long-term beach management strategy at Isle of Palms. Alternatives incorporating structural stabilization measures would still require periodic renourishment to maintain beach width, recreational beach resources, and acceptable shoreline conditions. While structural measures may provide localized stabilization benefits, they do not eliminate the need for future sand placement, and they introduce additional permitting, environmental, and implementation challenges.

A key finding of this study is the importance of maintaining access to reliable and diverse sediment sources. Offshore borrow areas represent the primary long-term source of compatible beach-quality sand and are essential to the sustainability of the City's beach management program. This evaluation also demonstrated that supplemental sediment sources, particularly material generated through AICWW maintenance dredging and potential sand recovery from

Dewees Inlet shoal management activities, can significantly improve overall program cost-effectiveness and reduce dependence on offshore borrow resources. Although the quantity, timing, and long-term availability of these supplemental sources remain uncertain, they offer opportunities to reduce future nourishment costs and extend the useful life of offshore sand reserves.

Lifecycle cost analyses were completed for each alternative using planning-level construction costs, anticipated maintenance requirements, and average annual equivalent cost (AAEC) methodologies. The results indicate that alternatives incorporating periodic nourishment together with beneficial use of available supplemental sediment sources generally provide the most favorable balance of shoreline performance, resilience, constructability, and long-term cost-effectiveness. Conversely, alternatives involving extensive structural stabilization measures generally exhibited higher implementation costs, greater permitting complexity, and less favorable economic performance when evaluated over the 50-year planning horizon.

Based on the technical, environmental, and economic evaluations completed as part of this study, a long-term adaptive beach management strategy centered on periodic beach nourishment is recommended. To support implementation of this strategy, the following actions are recommended:

1. Continue periodic beach nourishment as the primary shoreline management tool.
2. Advance offshore sand resource investigations and permitting to ensure long-term sediment availability.
3. Coordinate with the U.S. Army Corps of Engineers and other stakeholders to maximize beneficial use of AICWW maintenance dredging material.
4. Conduct additional investigations of Dewees Inlet shoal management opportunities, including sediment compatibility, recoverable quantities, environmental considerations, and permitting requirements.
5. Investigate in more detail the feasibility, scope, and cost of a terminal groin at the southern end of Reach 1, and similarly a series of structural solutions along Reaches 5 and 6 to complement Dewees Inlet shoal management.
6. Continue shoreline monitoring and beach performance assessments to support adaptive management and optimization of future nourishment timing and volumes.
7. Maintain flexibility within the beach management program to incorporate future sediment sources, changing shoreline conditions, and evolving regulatory requirements.

Collectively, these actions provide a sustainable and adaptable path for maintaining beach and dune conditions, improving resilience, and preserving the environmental, recreational, and economic benefits along the Isle of Palms shoreline.

1. Introduction

At the request of the City of Isle of Palms (City), Foth Infrastructure & Environment, LLC (Foth) has prepared this Beach Management Alternatives Analysis in accordance with RFQ 2025-02. This effort builds upon decades of shoreline monitoring, beach management activities, engineering studies, and public investment in maintaining the Isle of Palms shoreline.

The Isle of Palms (**Figure 1-1**) is a dynamic barrier island that is influenced by tidal inlet processes, longshore sediment transport, storm events, and periodic shoal migration and attachment events. These natural processes create substantial variability in shoreline behavior along different portions of the island, resulting in recurring erosional hotspots and the need for ongoing beach management intervention. As the City continues to evaluate long-term strategies for preserving its beaches, protecting infrastructure, supporting tourism and recreation, and maintaining environmental resources, a comprehensive evaluation of available management options is warranted and assessed through the present study.

This report summarizes the findings of a literature and data review and presents a comparative analysis of potential beach management alternatives. The results are intended to provide City leadership, stakeholders, and residents with technical information to support future policy-making decisions and infrastructure investments associated with preserving and managing the Isle of Palms shoreline.

1.1 Study Purpose

The purpose of this study is to provide an objective, planning-level assessment of potential beach management and erosion control strategies that may be implemented at Isle of Palms to address existing and future shoreline erosion concerns.

The analysis was developed to evaluate the relative advantages, disadvantages, costs, risks, anticipated performance, and implementation considerations associated with various beach management approaches. Rather than identifying a single preferred alternative, the intent of this study is to provide decision-makers with a better understanding of the available management options and the potential tradeoffs associated with each.

The findings and recommendations presented herein are intended to support informed decision-making regarding the long-term sustainability, resiliency, and management of the Isle of Palms shoreline.

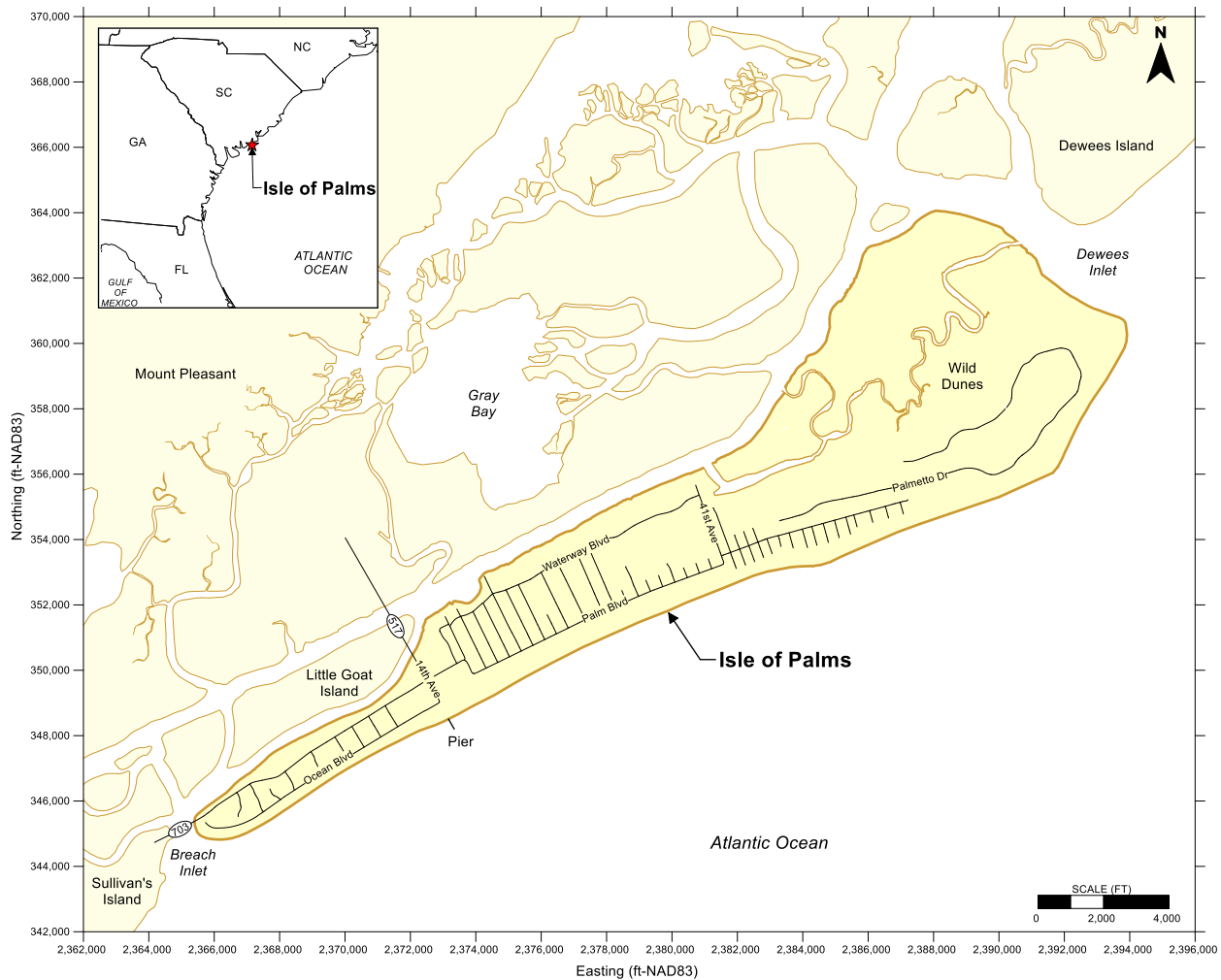


Figure 1-1: Location of Isle of Palms in South Carolina.

1.2 Scope of Study

This study includes a detailed review of historical shoreline conditions, previous beach management activities, monitoring data, aerial imagery, engineering studies, and planned future projects at the Isle of Palms. Information gathered through this review was used to evaluate contemporary shoreline trends and develop a series of alternative beach management strategies for consideration by the City.

The alternatives evaluated as part of this study include:

1. No active beach management along all or portions of the island;
2. Periodic beach renourishment only;
3. Beach renourishment combined with shore-perpendicular groins at strategic locations;

4. Beach renourishment combined with offshore or nearshore breakwaters;
5. Beach renourishment combined with geotextile tube structures;
6. Beach renourishment combined with creative shoal manipulation techniques intended to reduce adverse impacts associated with future shoal attachment events;
7. Projects focused on modifying conditions within Breach Inlet and/or Dewees Inlet to reduce erosional influences, including potential channel realignment, sediment bypassing, or other inlet-management measures; and
8. Combinations of the above approaches.

Each alternative was evaluated from a planning perspective with consideration given to engineering effectiveness, anticipated shoreline response, constructability, permitting feasibility, environmental impacts, aesthetic considerations, operational requirements, long-term maintenance needs, and economic implications. The analysis also considers the potential effects of each alternative on public beach use, tourism, wildlife habitat, adjacent shorelines, and the overall resiliency of the island's beach system.

1.3 Beach Management Goals

The City's beach management objectives serve as the framework against which potential management alternatives are evaluated. Based on discussions with City representatives and recommendations developed through previous planning efforts, the primary goals of beach management at Isle of Palms include:

- ◆ Protecting existing public and private infrastructure from erosion and storm-related impacts;
- ◆ Maintaining a functional recreational beach for residents, visitors, and property owners;
- ◆ Preserving the environmental and habitat value of the beach and dune system;
- ◆ Supporting the economic benefits associated with tourism and recreation;
- ◆ Maintaining a resilient shoreline capable of adapting to future coastal change; and
- ◆ Implementing management strategies that are technically feasible, environmentally responsible, and economically sustainable.

1.4 Study Approach

This analysis was completed in two primary phases. The first phase consisted of a comprehensive review of available literature, monitoring data, historical beach management activities, shoreline surveys, and aerial imagery to establish an understanding of existing shoreline conditions and the processes influencing change along the island.

The second phase builds upon the first and involved development and evaluation of the noted alternative beach management strategies. Each alternative was assessed based on its anticipated ability to maintain a baseline beach condition (that has been developed for this study and is defined in this analysis), reduce erosion-related impacts, and achieve long-term management objectives. Consideration was also given to implementation constraints, permitting requirements, environmental factors, anticipated costs, and expected project longevity.

Together, these analyses provide a technical foundation for evaluating future beach management decisions and establishing a long-term strategy for maintaining the Isle of Palms shoreline.

2. Literature & Data Review

The first component of this study consisted of a comprehensive review of available literature, physical monitoring data (such as beach, nearshore, and offshore bathymetric surveys), engineering studies, aerial imagery, and historical project information describing shoreline conditions and beach management activities at Isle of Palms. Information reviewed during this effort was provided by the City of Isle of Palms, Coastal Science & Engineering (CSE), and other publicly available sources.

The purpose of the literature and data review was to establish an understanding of the physical processes influencing the island, identify long-term shoreline evolution trends, document historical management activities, and provide the technical foundation necessary for evaluating future management alternatives.

Isle of Palms has a long history of proactive beach management in response to recurring erosion concerns. Past beach management efforts have included beach nourishment projects, shoal management activities, beneficial use projects, emergency erosion-control measures, and limited shoreline armoring. While erosion has historically been managed through a combination of these approaches, ongoing shoreline change, inlet dynamics, sea-level rise, and storm impacts continue to present management challenges along several portions of the island.

The following sections summarize the physical setting of the island, historical shoreline behavior, past beach management activities, and the monitoring information used to support this alternatives analysis.

2.1 Island Overview

The City of Isle of Palms is a barrier island located in Charleston County, South Carolina. The island is bounded by the Atlantic Ocean to the southeast, Breach Inlet to the southwest, Dewees Inlet to the northeast, and extensive tidal marsh systems to the northwest. The shape and behavior of the shoreline are influenced by a complex combination of coastal processes, including wave action, longshore sediment transport, storm events, tidal currents, and inlet dynamics. Of these processes, the influences of Breach Inlet and Dewees Inlet are particularly significant because both strongly affect sediment movement, shoreline stability, and erosion patterns along adjacent portions of the island.

A particularly unique characteristic of the Isle of Palms shoreline is the large offshore shoal field located seaward of the northern portion of the island. Shoals within this system periodically migrate landward and eventually attach to the shoreline. The movement of these features is illustrated by the change in the -5 ft NAVD88 contour between February 2025 and June 2026 shown in **Figure 2-1**. As shoals migrate toward the shoreline, they alter nearshore bathymetry, wave transformation patterns, and sediment transport pathways. These changes can focus wave energy along portions of the shoreline and contribute to periods of accelerated erosion. Following attachment, however, substantial quantities of sediment may be introduced into the beach system, resulting in localized shoreline accretion and temporary improvements in beach width and volume.

The cyclical nature of shoal migration and attachment creates some of the most dynamic shoreline conditions observed along the island. While shoal attachment can provide a valuable source of sediment to the beach system, the process also contributes to significant spatial and temporal variability in shoreline position, beach volume, and erosion rates. Consequently, the shoal system represents both a beneficial sediment resource and one of the principal beach management challenges facing the City. Understanding the influence of these features is critical to evaluating historical shoreline behavior and developing future beach management strategies.

To support the City's long-term shoreline management efforts, Coastal Science & Engineering, Inc. (CSE) has maintained a comprehensive beach monitoring program consisting of more than 100 individual survey-profile transects distributed along the oceanfront shoreline. The monitoring program provides one of the most extensive datasets available for understanding shoreline evolution at Isle of Palms and serves as the foundation for evaluating historical beach

performance, erosion trends, sediment redistribution patterns, and the effectiveness of previous beach management activities.

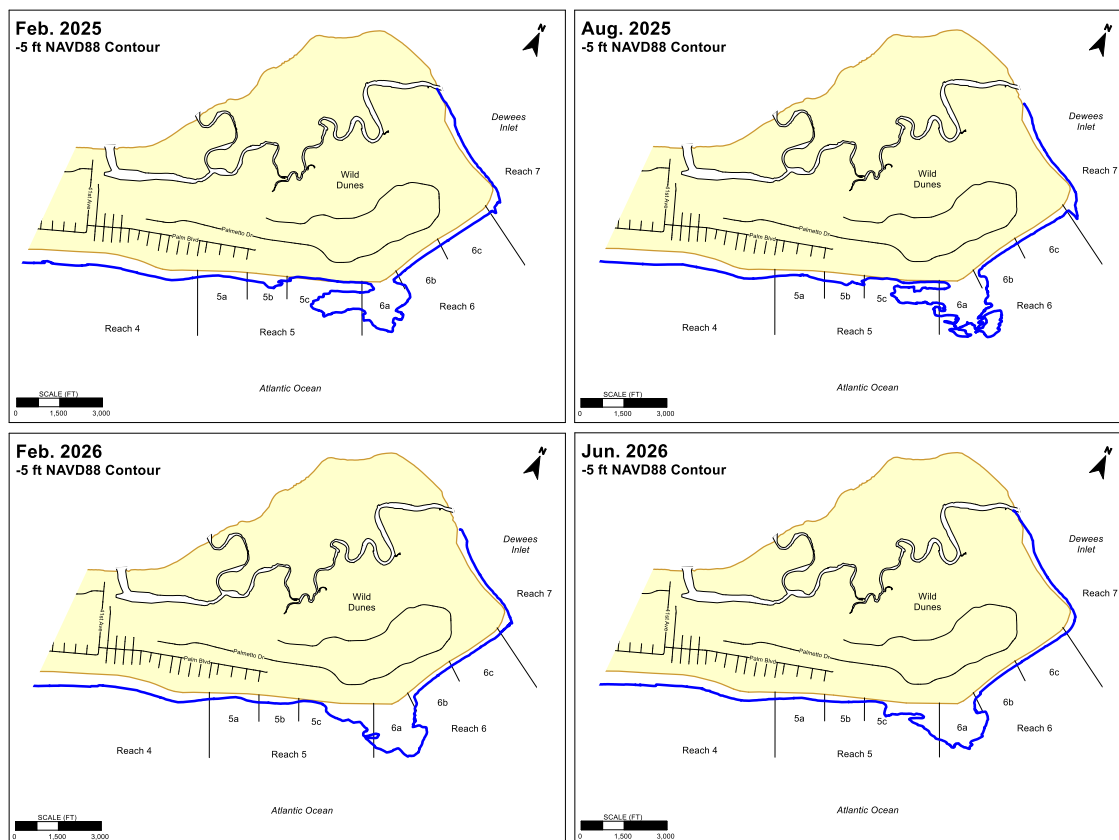


Figure 2-1: Migration of the -5 ft NAVD88 contour at the northern end of the Isle of Palms between February 2025 and June 2026.

For monitoring and management purposes, the shoreline is divided into seven primary reaches extending from Breach Inlet at the southern end of the island to Dewees Inlet at the northern end, as shown in **Figure 2-2**. Each reach exhibits distinct shoreline characteristics and responds differently to the physical processes influencing the island. Consequently, erosion trends, management needs, and beach management objectives vary considerably from one reach to another.

The southern portion of the island, including Reaches 1 and 2, is strongly influenced by Breach Inlet and associated tidal and sediment transport processes. Reaches 3 and 4 occupy the central portion of the island and have historically exhibited greater shoreline stability than the reaches adjacent to the inlets. Reaches 5 and 6 encompass the northern-central portion of the island and are heavily influenced by the recurring shoal migration and attachment cycle. Because of the highly variable shoreline response associated with this process, Reaches 5 and 6 have been further subdivided into multiple sub-reaches (5a through 5c and 6a through 6c) to better characterize localized erosion and accretion patterns. Reach 7 extends along the

shoreline adjacent to Dewees Inlet, where shoreline behavior is controlled primarily by inlet-related processes.

Historical beach management and monitoring efforts have frequently evaluated beach conditions using a volumetric approach, whereby measured beach volumes are compared to predetermined thresholds representing a healthy beach condition. While this methodology remains valuable for understanding sediment gains and losses, this study primarily evaluates beach performance relative to the baseline condition developed specifically for this analysis and presented in Section 3.0. The baseline provides a consistent and readily understandable framework for assessing shoreline vulnerability, evaluating future shoreline change, and comparing the anticipated performance of alternative beach management strategies.

This alternatives analysis relies heavily on shoreline monitoring surveys and volume data collected and provided by CSE. Historical survey information spanning multiple decades was reviewed to evaluate long-term shoreline behavior and identify trends in erosion and accretion. Emphasis was placed on conditions following the 2008 and 2018 beach restoration projects, as well as conditions immediately preceding construction of the planned 2026 Beach Restoration Project. These datasets provide insight into the performance of previous management activities and establish the technical foundation for evaluating future shoreline conditions and beach management alternatives.

Collectively, the monitoring data, historical project information, and understanding of the coastal processes affecting the island provide the basis for evaluating future beach management needs. The dynamic nature of the shoreline, particularly within the reaches influenced by Breach Inlet, Dewees Inlet, and recurring shoal attachment events, underscores the importance of developing adaptive and sustainable management strategies capable of responding to varying erosion conditions over time.

2.2 Beach Management History

The City of Isle of Palms has a long history of actively managing its shoreline in response to persistent erosion concerns, storm impacts, and changing coastal conditions. Beach management efforts have evolved significantly over time and have included shoreline armoring, beach nourishment, sand relocation projects (i.e., sand scraping), shoal management activities, beneficial use projects, and emergency stabilization measures. Many of these efforts have been focused on the island's most vulnerable shoreline reaches, particularly areas influenced by Breach Inlet, Dewees Inlet, and periodic shoal attachment processes.

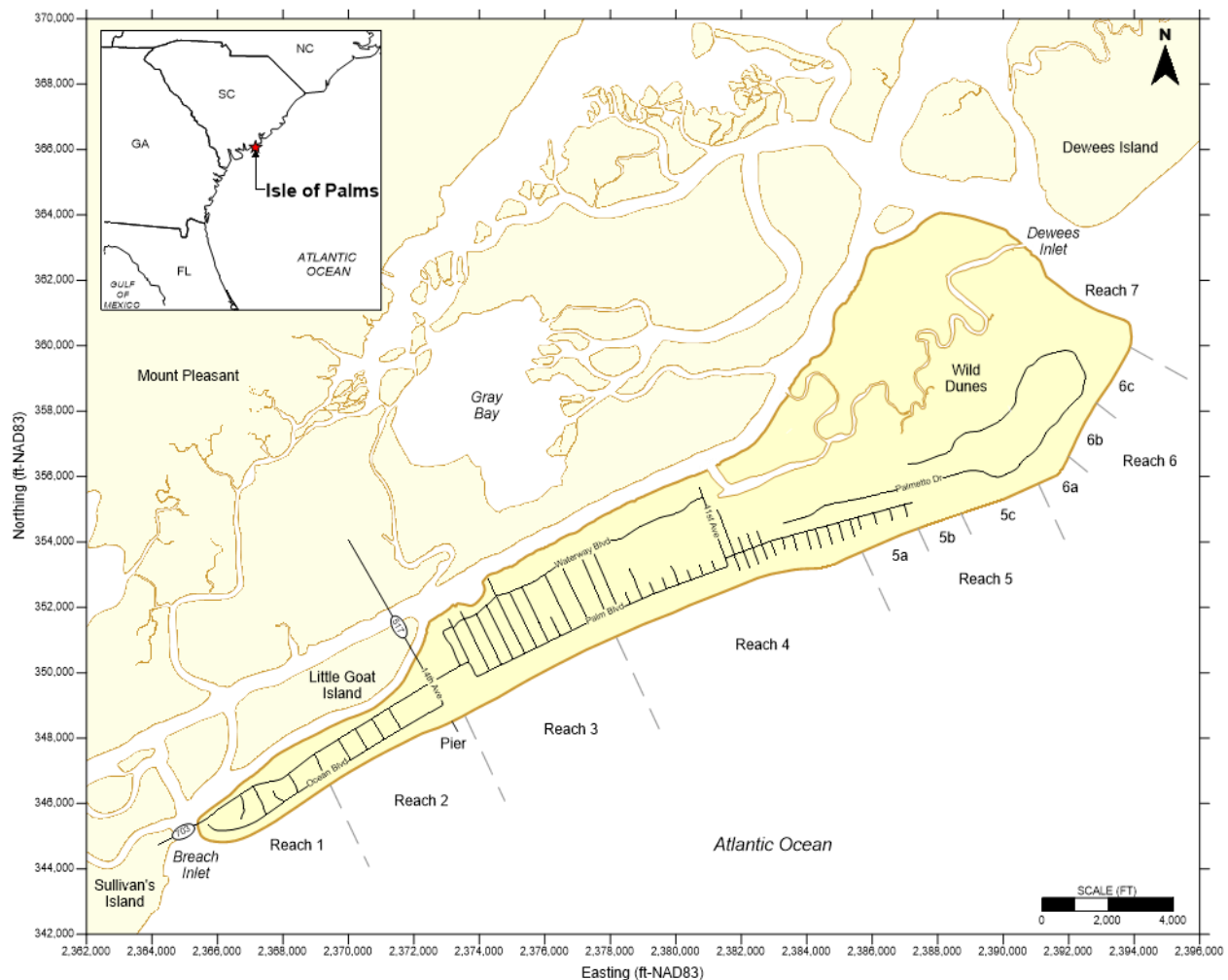


Figure 2-2: Monitoring Reaches 1 through 7 of the Isle of Palms shoreline.

Historically, shoreline stabilization efforts during the 1970s and early 1980s relied heavily on structural solutions, including the construction of seawalls and groins in several erosional areas of the island. While these structures provided localized protection, modern coastal management practices have shifted toward maintaining natural beach systems through nourishment and sediment management practices rather than additional shoreline armoring.

The City's first significant beach nourishment project occurred in 1983-1984, when approximately 350,000 cubic yards (cy) of sand were placed near areas affected by shoal attachment and chronic erosion. This project was accompanied by beach scraping activities and construction of a rubble-mound seawall. Additional sand scraping projects were undertaken in subsequent years as localized erosion concerns developed.

Beginning in the early 2000s, erosion management increasingly focused on temporary erosion-control measures and large-scale beach restoration projects. Sandbags were installed between 2004 and 2007 to stabilize portions of the shoreline experiencing severe erosion. These sandbags were subsequently removed as part of the 2008 Beach Restoration Project, which placed approximately 934,000 cy of sand along multiple shoreline reaches and represented one of the largest nourishment efforts undertaken by the City at that time (CSE, 2008).

Over the following decade, the City implemented a variety of shoal management projects designed to address the effects of periodic shoal migration and attachment along Reaches 5 and 6 (CSE, 2012). These projects included shoal bypassing, sand relocation, and beach scraping efforts intended to redistribute sediment that accreted onshore as a result of the migrating shoals and mitigate erosion in vulnerable areas. Through discussion with City staff, sand scraping provided effective temporary protection by supplying relatively cost-effective and readily available emergency sand compared to alternative measures such as trucking sand or sandbags. It was also noted that, while sand scraping helped address localized erosion onshore, it was unclear whether it influenced or accelerated the natural movement of the offshore shoal system (Kerr, personal communication, August 24, 2026). The recurring need for such projects highlights both the opportunities and challenges associated with the dynamic shoal system.

More recently, the City has responded to severe erosion and storm impacts through a combination of emergency measures and large-scale restoration projects. Emergency berm restoration, sandbag installation, and sand trucking operations were implemented following major storm events including Hurricanes Matthew (2016), Irma (2017), and Idalia (2023). In 2018, the City completed another major nourishment project involving the placement of more than 1.6 million cubic yards (Mcy) of sand along key erosional reaches.

The City has also benefited from several U.S. Army Corps of Engineers (USACE) beneficial-use projects associated with navigational channel maintenance activities at Breach Inlet. These projects have provided additional sediment to portions of the shoreline while supporting regional sediment management objectives.

Shoreline management efforts are expected to continue through a combination of emergency stabilization activities, shoal management initiatives, beneficial-use projects (USACE navigational maintenance), and the 2026 Beach Restoration Project. The 2026 project, which includes placement of about 2.48 Mcy of sand, represents one of the most significant beach nourishment efforts in the City's history and reflects the continued commitment to shoreline resilience and protecting public and private infrastructure along the Isle of Palms shoreline.

The City's extensive history of beach management provides valuable insight into the effectiveness, limitations, and costs associated with different shoreline management

strategies. This historical experience, coupled with the long-term monitoring record, forms the basis for evaluating the alternatives considered in this study.

3. Study Baseline Development

3.1 Baseline Beach Condition

The alternatives analysis presented herein compares future beach management strategies relative to a no-action scenario. To provide a consistent basis for comparison, a baseline beach condition was established along the entire Isle of Palms shoreline specifically for this study. The baseline represents a minimum beach condition that the City may seek to maintain through proactive management and serves as the benchmark for evaluating all alternatives. However, it is not intended as a recommended or officially adopted baseline for future beach management. Additional technical analysis and community input should be completed before the City establishes an official beach management baseline. The baseline developed for this study may serve as one option for consideration during that future process.

The study baseline is defined by a physical shoreline position along the City's managed beach and is intended to represent a healthy minimum condition that supports the City's goals for storm damage reduction, infrastructure protection, recreational use, environmental function, and long-term shoreline resilience. Rather than representing an idealized or maximum beach width, the baseline defines the threshold below which beach conditions would be considered unacceptable and management intervention would likely be warranted.

Development of the baseline considered a combination of regulatory, physical, and design-based reference lines, including:

- The South Carolina Department of Environmental Services (SCDES) Baseline, established in 2017 and revised in 2019;
- The seaward edge of existing infrastructure along the island, delineated using January 2026 Nearmap imagery;
- An offset located 50 feet seaward of the seaward edge of existing infrastructure (January 2026); and
- The design seaward dune crest associated with the 2026 Beach Restoration Project, as depicted in the project bid plans (CSE, 2026).

For the purposes of this study, the baseline corresponds to the desired seaward edge of the primary dune system along the island. The reasoning for establishing the baseline to be the desired primary dune seaward edge is discussed below. The final baseline alignment generally follows the most seaward of the reference lines, identified above, while smoothing localized irregularities where appropriate to maintain a practical and consistent shoreline management target. A cross-shore depiction of the baseline definition is presented in **Figure 3-1**, with

examples of planform locations along Reaches 1, 5, and 6 in **Figures 3-2** and **3-3**. The baseline extends from the southern end of the island adjacent to Breach Inlet, follows the Atlantic Ocean shoreline northward, and continues around the northern end of the island along Dewees Inlet.

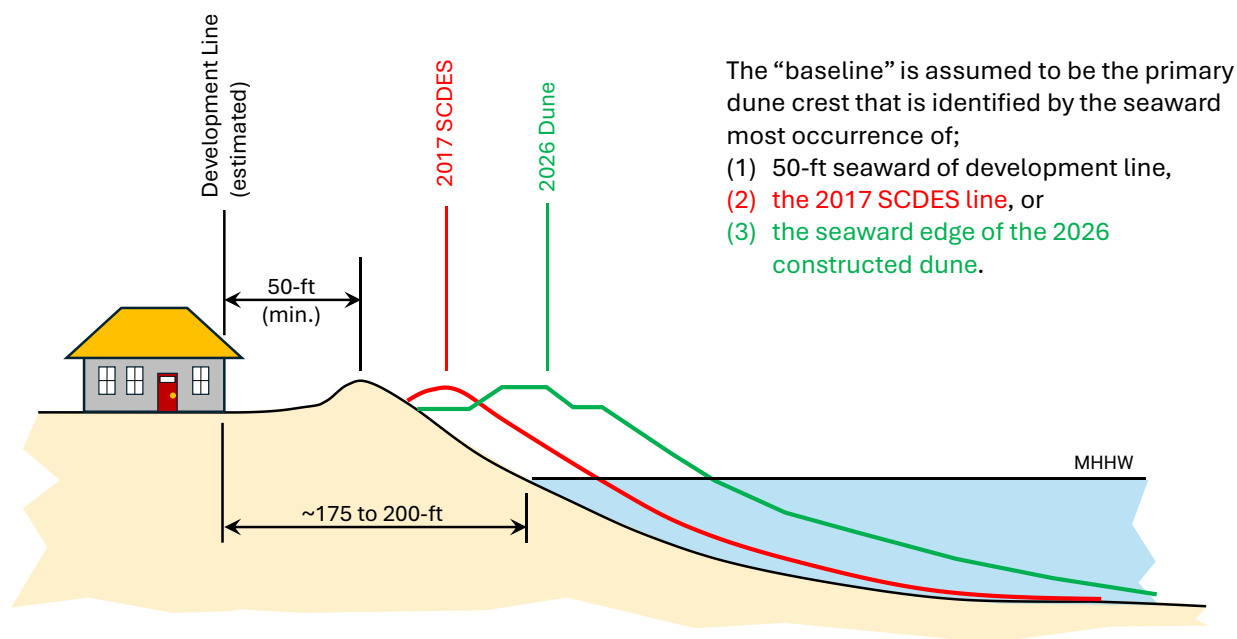


Figure 3-1: Cross-shore depiction of minimum beach baseline “Baseline” definition used for the alternatives analysis. The baseline corresponds to the location of the assumed desired seaward edge of the primary dune along the island.

Along Reaches 1 and 2, the study baseline is established using the SCDES 2017 Baseline and the 2026 project dune location. As described previously, the study baseline represents the most landward position of the primary dune crest prior to implementation of any beach management actions. Throughout most of Isle of Palms, the mean high water (MHW) shoreline is located at least 150 feet seaward of the primary dune system.

In Reaches 1 and 2, the study baseline generally lies well seaward of the 50-foot offset measured from the seaward edge of upland development and, in some locations, is significantly farther seaward. For example, near 3rd Avenue in Reach 1, the study baseline is approximately 90 feet seaward of the seaward edge of development. Similarly, near 8th Avenue in Reach 2, the study baseline is approximately 98 feet seaward of the seaward edge of development. This condition reflects the location of the SCDES 2017 Baseline, which was established based on the position of the primary dune in 2017 when the dune system remained well seaward of existing development.

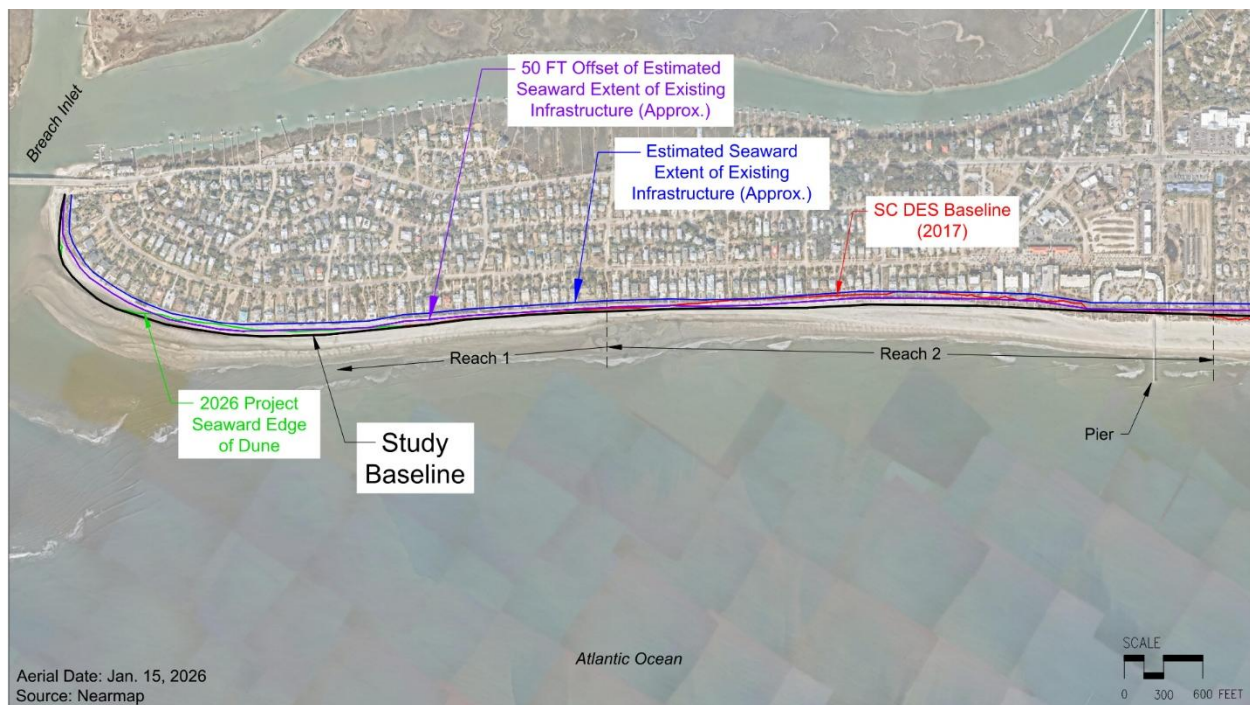


Figure 3-2: Planview of Baseline along Reaches 1 and 2.

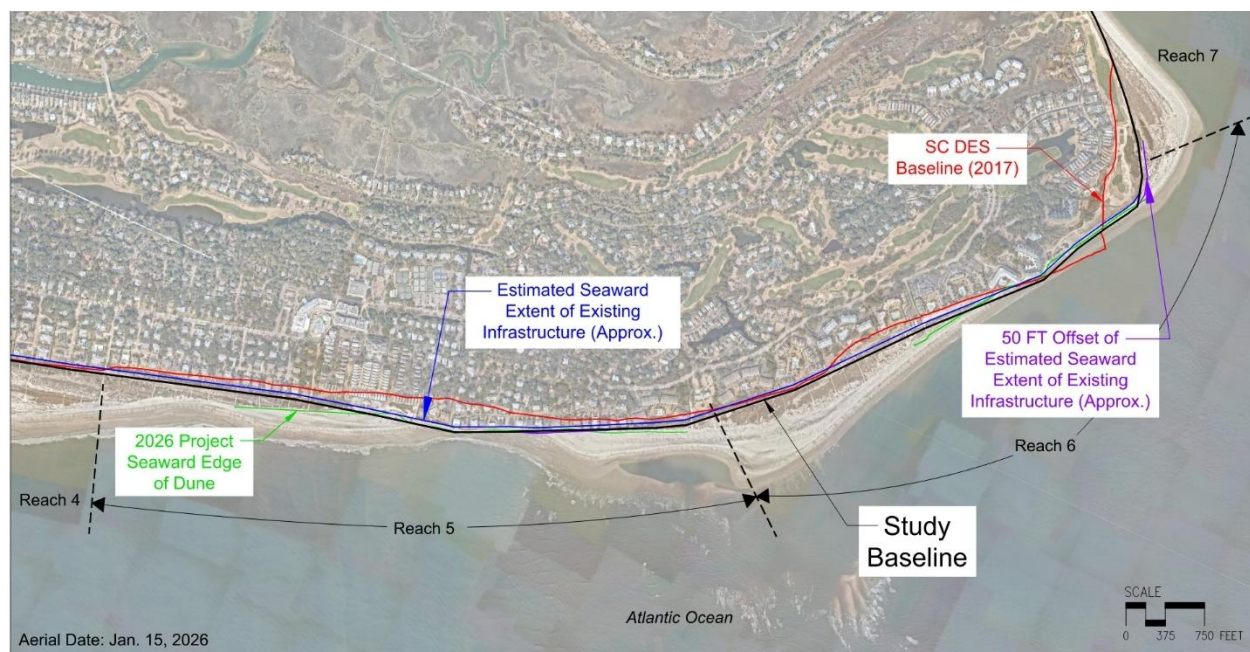


Figure 3-3: Planview of Baseline along Reaches 5 and 6.

In contrast, along Reaches 5 and 6, the study baseline is located much closer to upland development and, in some areas, lies within 50 feet of the seaward edge of development. This condition is primarily the result of the SCDES 2017 Baseline and the 2026 dune crest being situated substantially farther landward than in Reaches 1 and 2. Consequently, the available

buffer between the primary dune system and upland development is more limited in these reaches, reflecting the greater degree of historical shoreline recession and dune migration that has occurred along this portion of the island.

3.2 Rationale for a Dune Position-Based Baseline

Previous beach monitoring and management evaluations conducted by CSE assessed beach conditions using a volumetric approach (Kana, 1993). Under this methodology, the volume of beach material measured above the -13 ft NAVD88 contour at each monitoring profile was compared to a target minimum volume of 380 cubic yards per foot (cy/ft). This approach provided a useful quantitative measure of beach performance and sediment losses over time and continues to serve as an effective monitoring metric.

However, for the purposes of a long-term alternatives analysis, a dune position-based baseline was selected in lieu of a volumetric threshold. While volume-based metrics are valuable for engineering analyses, they can be difficult for stakeholders to visualize and relate to observed conditions on the beach. As such, the location of the seaward dune crest is readily observable and provides a more intuitive representation of beach condition for decision-makers and the public.

Additionally, the morphology of Isle of Palms varies significantly along its shoreline. Offshore bathymetry is considerably shallower in some areas, particularly near Breach Inlet, while other portions of the island have steeper nearshore profiles. As a result, applying a uniform volumetric threshold across the entire island can produce inconsistencies in the interpretation of beach conditions, with equivalent beach volumes corresponding to substantially different visual and functional shoreline characteristics depending on location. That is to say, a minimum beach volume in one area may serve that area appropriately, but the same volume in another area may not address that location's needs. A dune position-based approach provides a more consistent and spatially transferable metric by focusing on the landward extent of the beach and dune system, which more directly relates to storm protection, infrastructure vulnerability, and management objectives.

For these reasons, the established baseline developed for the present study is defined by the desired seaward edge position of the primary dune crest rather than a uniform beach volume threshold. This approach provides a practical, island-wide benchmark that can be easily observed and communicated for evaluating the relative effectiveness and costs of future beach management alternatives.

4. Historical and Contemporary Beach Conditions

Understanding historical beach conditions that have presented along the Isle of Palms shoreline and the processes that influence shoreline change is fundamental to evaluating future beach management alternatives. To develop this Alternatives Analysis, a comprehensive review of available literature, historical monitoring data, aerial imagery, and previous engineering studies was conducted to characterize long-term beach behavior and identify areas of persistent erosion and accretion along the Isle of Palms shoreline.

Historical shoreline position and beach volume data collected by CSE were reviewed and further analyzed by Foth to assess trends in beach performance, shoreline change, and sediment volume distribution and change across the island. These datasets provide insight on the spatial and temporal variability of shoreline positions and help distinguish between short-term fluctuations and long-term shoreline evolution. The analyses also considered the influence of wave-driven sediment transport, storm impacts, inlet dynamics, and the effects of past beach nourishment activities.

The Isle of Palms shoreline is highly dynamic, with beach conditions varying considerably along its length due to differences in coastal processes and sediment supply between the south and north ends of the island. The influences of Breach Inlet to the south and Dewees Inlet to the north, coupled with island-wide longshore sediment transport, result in distinct patterns of erosion, accretion, and shoreline shape in different reaches of the island. As a result, shoreline management needs and expected future performance vary geographically and must be considered when evaluating long-term management strategies.

The following sections summarize the known shoreline conditions, historical trends, and governing coastal processes that influence beach behavior along the island. This information provides the technical foundation for development and evaluation of the beach management alternatives considered in this study.

4.1 Beach Management Areas

Beach monitoring reaches and baseline monitoring stations have been established along the Isle of Palms shoreline through the long-term monitoring program maintained by CSE. These monitoring stations provide a consistent framework for evaluating shoreline position, beach volume, and changes in beach condition over time. The monitoring program consists of more than 100 individual survey transects distributed along the island's oceanfront shoreline, extending from Breach Inlet to Dewees Inlet.

For management and analysis purposes, the shoreline is divided into seven (7) primary reaches based on geomorphic characteristics, historical shoreline behavior, and the coastal processes influencing each portion of the island (**Figure 4-1**). These reaches provide a practical framework for evaluating erosion trends, assessing beach performance, and identifying areas that may

require differing management approaches. The approximate limits and characteristics of each reach are further described below.

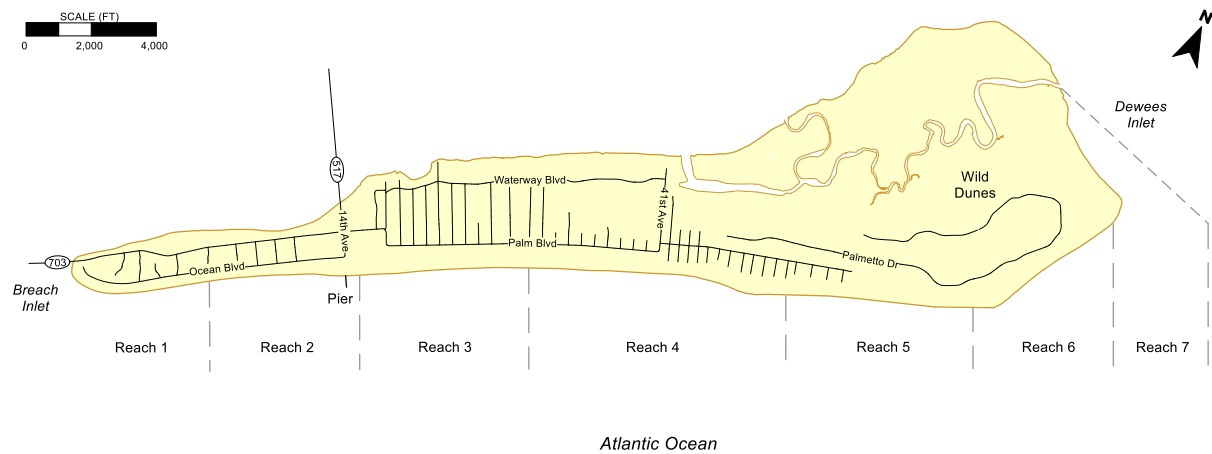


Figure 4-1: Isle of Palms beach monitoring/management reaches.

Reach 1 (Breach Inlet to 6th Avenue) extends from the shoreline adjacent to Breach Inlet around the southern end of the island and encompasses one of the most dynamic portions of the shoreline. This reach is strongly influenced by tidal currents, channel migration, and sediment transport associated with Breach Inlet. As a result, shoreline positions and erosion rates within Reach 1 can fluctuate significantly over relatively short periods. Until recent years, the Reach 1 shoreline has not been routinely included as a major beach fill placement area during large-scale nourishment projects, as these efforts were typically focused along the north end of the island. Beginning in 2024, however, the USACE implemented a beneficial-use navigational maintenance project, utilizing sediment from Atlantic Intracoastal Waterway (AIWW) that placed dredged material along Reach 1, which continued through 2026. In addition, the City completed supplemental dune restoration efforts in 2025. At present, Reach 1 is included in the City's 2026 beach renourishment project.

Reach 2 (6th Avenue to Front Beach/Pier) extends northeastward from Reach 1 along the southern oceanfront shoreline. Although less directly influenced by Breach Inlet, this reach remains subject to sediment transport processes associated with the inlet system and has historically experienced periods of significant erosion. Similar to Reach 1, this reach has not been routinely included as part of past beach restoration efforts.

Reaches 3 and 4 (Front Beach/Pier to 53rd Avenue) occupy the central portion of the island and generally represent the most stable sections of shoreline. These reaches are characterized by a seaward development line that is generally offset landward from the beach by several hundred feet. Historical monitoring data indicate these reaches have experienced comparatively lower erosion rates and, in some periods, have exhibited net

accretion. Consequently, these reaches often serve as sediment sources relative to other portions of the island.

Reaches 5 and 6 (53rd Avenue to Dewees Inlet Entry) encompass the northern-central portion of the island and are characterized by the influence of a large offshore shoal system that periodically migrates landward and attaches to the shoreline. This shoal attachment process creates highly dynamic shoreline conditions, causing significant spatial and temporal variability in erosion and accretion patterns. Because of the unique behavior of this area, Reaches 5 and 6 have been further subdivided into multiple sub-reaches (5a to 5c and 6a to 6c) to better characterize localized shoreline response and sediment movement. Historically, Reaches 5 and 6 have been the focus of the City's past beach management efforts, principally due to the noted shoal attachment events. Both of these reaches are included in the City's 2026 beach renourishment project.

Reach 7 (Dewees Inlet Interior Shoreline) extends along the northern end of the island adjacent to Dewees Inlet. Shoreline behavior within this reach is controlled largely by inlet-related processes, including tidal currents, channel migration, and sediment exchange between the inlet and the adjacent shoreline. As a result, shoreline trends within Reach 7 differ substantially from those observed along the remainder of the oceanfront beach.

Historically, beach conditions have been evaluated using a volumetric monitoring approach in which surveyed beach volumes at each monitoring station are compared to established benchmark values representing a "healthy" beach condition. For the purposes of this alternatives analysis, however, shoreline performance is evaluated relative to the established baseline condition, which represents the minimum beach and dune condition that the City may desire to maintain over time.

In addition to analyses of the historical shoreline and volume monitoring data collected by CSE, particular emphasis in the present study was placed on evaluating conditions following the 2008 and 2018 beach restoration projects, as well as the most recent monitoring surveys completed immediately prior to implementation of the planned 2026 Beach Restoration Project (CSE, 2008 & CSE, 2019). These restoration efforts serve as model examples of the scale of potential future project actions the City may consider in support of long-term beach management. The data associated with these projects provides the foundation for understanding historical shoreline behavior and evaluating future beach management alternatives.

A unique characteristic of the Isle of Palms shoreline is the recurring shoal attachment cycle affecting Reaches 5 and 6. While attachment events can periodically contribute significant quantities of sediment to portions of the beach system, they can also result in accelerated erosion prior to attachment and highly variable shoreline responses after attachment. As a

result, these reaches exhibit some of the most dynamic shoreline changes on the island and require special consideration when evaluating long-term beach management strategies.

4.2 Volume Change

To evaluate the anticipated performance of future beach management alternatives, historical beach volume change data were analyzed. Emphasis was placed on periods that were not significantly influenced by beach or dune nourishment activities, the associated post-construction equilibration processes, or highly erosional conditions during which exposed hardened structures may have altered natural beach behavior and sediment dynamics. As noted previously, the most recent island-wide beach nourishment project along the Isle of Palms shoreline was completed in 2018. Therefore, beach volume changes occurring after completion of that project and prior to the 2025 USACE beneficial-use sand placement project along the southern end of the island were considered representative of recent shoreline performance under relatively undisturbed conditions – otherwise considered “background” beach changes.

Beach monitoring data collected between April 2018 and August 2025 were provided by CSE (CSE, 2026). These data include calculated volume densities at each monitoring station, based upon physical profile surveys, expressed in cubic yards per linear foot (cy/ft) of shoreline. The reported volume density represents the cross-sectional quantity of sand available at each profile, measured above a consistent reference elevation and extending landward to a consistent control point along the profile. While the absolute volume density values provide useful information regarding beach conditions at individual monitoring stations, changes in volume density between successive transects are more meaningful for identifying erosional and accretional trends along the shoreline.

Beach volume changes along the Isle of Palms shoreline were calculated using the average-end-area method. For each monitoring station, the change in cross-sectional volume density between two survey dates of interest was first calculated. Then, the average volume density change between two adjacent stations was multiplied by the corresponding distance between those stations to estimate the total volumetric change within that shoreline segment. Volume changes between each monitoring transect were then summed by reach to quantify net sediment gains and losses along each portion of the island.

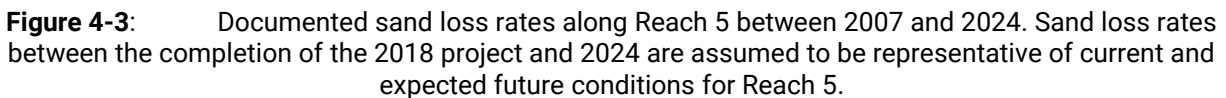
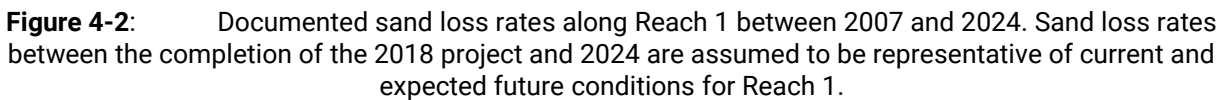
Volume changes were calculated for the following analysis periods:

- **April 2018 to September 2024:** This period represents shoreline behavior following completion of the 2018 nourishment project through the most recent survey period and prior to construction of the 2024 USACE beneficial-use project (**Figure 4-2**). Surveys conducted in 2025 were excluded because sand placement associated with the USACE project on the south end of the island would artificially increase measured beach volumes and mask natural erosional and accretional trends. This period represents what is described herein as the “low” erosion rate case.

- **July 2021 to September 2024:** This period represents approximately the second three-year interval following completion of the 2018 nourishment project (**Figure 4-3**). While this period overlaps with the first period, April 2018 to September 2024, it coincides with a period of accelerated erosion (relative to the first period) along several portions of the shoreline and provides insight into more recent and comparatively severe erosional conditions. This period represents what is described herein as the “high” erosion rate case.

Monitoring data from March 2008 through June 2026 were reviewed to understand the historical shoreline and beach volume change context for this analysis. From this record, two analysis periods were selected to represent two distinct, contemporary trends observed along the Isle of Palms shoreline. The April 2018 to September 2024 period reflects a longer-term post-nourishment response of the beach system, while the July 2021 to September 2024 period captures a shorter-term interval characterized by elevated erosion rates across portions of the island relative to the preceding years in the historical record.

Figure 4-4 and **Figure 4-5** illustrate the alongshore distribution of annualized volume change rates for the two analysis periods. Positive values indicate areas of net accretion, while negative values indicate areas of net erosion. The figures highlight spatial variability in shoreline behavior along the island and demonstrate how erosion and accretion patterns differ among reaches. In particular, the figures illustrate the pronounced erosion occurring within Reaches 1, 2, 5, and 6, as well as the localized areas of accretion associated with the shoal attachment process along portions of Reaches 5 and 6. Together, these figures provide a visual representation of the “low-rate” and “high-rate” erosion scenarios used to evaluate future beach management alternatives.



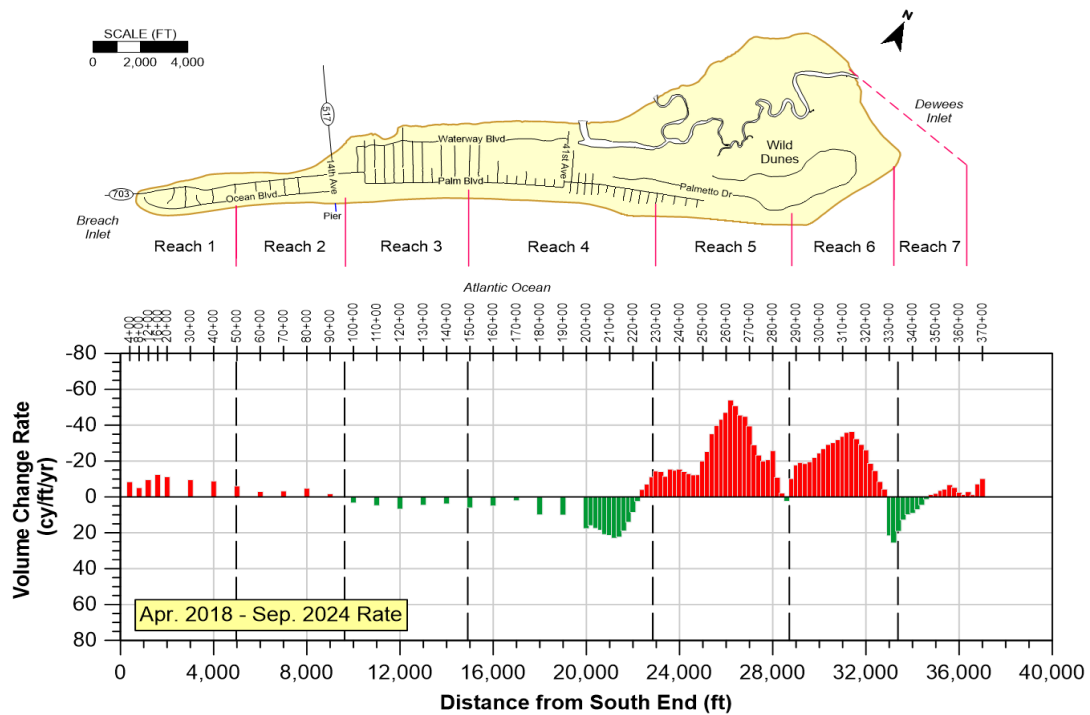


Figure 4-4: Annualized volume change rates for the April 2018 to September 2024 period. This is considered the “low rate” in this analysis.

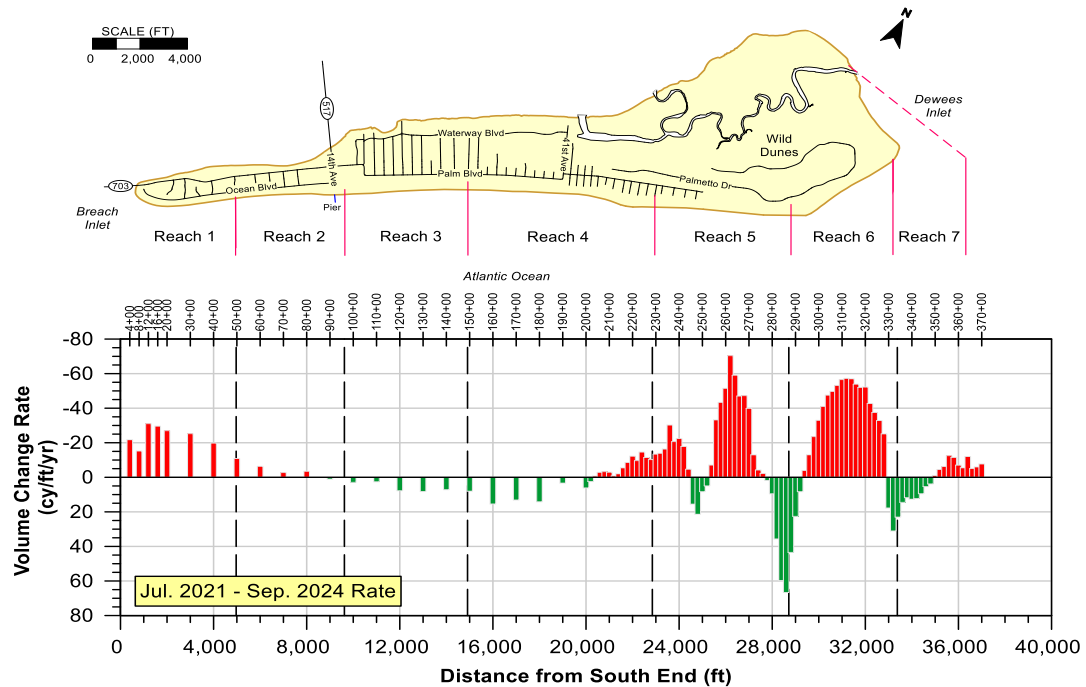


Figure 4-5: Annualized volume change rates for the July 2021 to September 2024 period. This is considered the “high rate” in this analysis.

Table 4-1 presents the annualized net volume change for each reach and analysis period, expressed in cubic yards per year (cy/yr). **Table 4-2** presents the corresponding annualized volume density changes, expressed in cubic yards per foot per year (cy/ft/yr). Volume changes were summarized by reach because different portions of the island are influenced by unique coastal processes and exhibit distinct shoreline responses. Reaches 5 and 6 were further subdivided into sub-reaches to better characterize variations in shoreline behavior associated with the periodic shoal attachment cycle and resulting sediment redistribution patterns.

Between April 2018 and September 2024, the “low” rate period, which represents the post-2018 renourishment period through the most recent survey period evaluated, the only reaches that experienced a net volume gain were Reaches 3, 4, and 7. This pattern is generally consistent with broader shoreline behavior observed along the island. In contrast, Reaches 1, 2, 5, and 6 experienced net erosion during this period, which is similarly consistent with historical observation. The greatest volume loss occurred in Reach 5c, which lost approximately 90,100 cy/yr, equivalent to approximately 37.5 cy/ft/yr.

As has been observed, erosional patterns along Reaches 5 and 6 can change rapidly due to the influence of shoal attachment processes. As a shoal approaches the shoreline and eventually attaches, localized areas may experience periods of rapid accretion. However, although shoal attachment can introduce large quantities of sand into the nearshore and beach system, the added volume has not been sufficient to fully offset the magnitude of erosion occurring along these reaches. Historical trends, discussed in Section 2.1, indicate that erosion commonly increases along Reaches 5 and 6 immediately prior to shoal attachment. The relatively high erosion rates measured during the recent analysis periods support this observation.

Table 4-1: Annualized net volume changes (cy/yr) for the April 2018 – September 2024 and the July 2021 – September 2024 periods along the Isle of Palms shoreline.

Reach	Reach Length (ft)	Annualized Volume Change Rate (cy/yr)	
		April 2018 - September 2024 ("low")	July 2021 - September 2024 ("high")
Reach 1	4,000	-36,800	-96,200
Reach 2	5,000	-22,300	-32,900
Reach 3	5,000	20,500	25,600
Reach 4	8,200	82,000	53,200
Reach 5	5,800	-141,900	-108,400
Reach 6	4,800	-102,200	-95,700
Total All Reaches	32,800	-200,700	-254,400
Total Reaches 1, 2, 5, & 6	19,600	-303,200	-333,200
Total Gross Losses 1, 2, 5, & 6	19,600	-303,200	-391,300

Table 4-2: Annualized net volume density changes (cy/ft/yr) for the April 2018 – September 2024 and the July 2021 – September 2024 periods along the Isle of Palms shoreline.

Reach	Reach Length (ft)	Annualized Volume Change Rate (cy/ft/yr)	
		April 2018 - September 2024 ("low")	July 2021 - September 2024 ("high")
Reach 1	4,000	-9.2	-24.1
Reach 2	5,000	-4.5	-6.6
Reach 3	5,000	4.1	5.1
Reach 4	8,200	10.0	6.5
Reach 5	5,800	-24.5	-18.7
Reach 6	4,800	-21.3	-19.9
Avg. All Reaches	32,800	-6.1	-7.8
Avg. Reaches 1, 2, 5, & 6	19,600	-15.5	-17.0
Total Gross Losses 1, 2, 5, & 6	19,600	-15.5	-20.0

The dynamic nature of shoreline change along Reaches 5 and 6 is reflected in the spatial variability of erosion and accretion rates observed throughout the monitoring period. Localized areas of accretion associated with recent shoal attachment are evident within portions of Reach 6, while adjacent areas continue to experience substantial erosion. These contrasting patterns demonstrate the strong influence of shoal attachment processes on sediment distribution and highlight the highly dynamic behavior of this portion of the island.

From April 2018 to September 2024, Reaches 5 and 6 experienced a combined net average loss of approximately 244,100 cy/yr, or 23.0 cy/ft/yr. Whether these recent erosion rates will continue at their current levels, increase, or decrease in the future is uncertain. However, given the magnitude of observed erosion and the potential for continued sea level rise and storm impacts, it is prudent to proactively plan for high erosion-rate scenarios rather than rely on a reactive management approach. Overall, the net beach volume change during the *low* period was a loss of approximately 303,200 cy/yr (15.5 cy/ft/yr) within Reaches 1, 2, 5, and 6, combined. Net volume changes computed were negative at all monitoring transects within each of these reaches over the low period and thus similarly represent the *gross losses*.

During the July 2021 to September 2024 period, "high" rate period, the average erosion rates approximately 96,200 cy/yr in Reach 1 and 32,900 cy/yr in Reach 2, equivalent to 24.1 cy/ft/yr and 6.6 cy/ft/yr, respectively. While Reach 2 presented erosion rates marginally above the low rate over this period, Reach 1 exhibited an accelerated rate about 2.6 times greater than the low rate. Like Reaches 5 and 6, it is uncertain whether these erosion rates will persist along the south end of the island in the future; although, the data demonstrate the periodic erosion

potential that the southerly reaches adjacent to Breach Inlet may be subject to. Future management planning should therefore account for the likelihood of such intermittent high-erosion periods along the southern end of the island.

Overall, the net beach volume change during the *high* period was a loss of approximately 333,200 cy/yr (17.0 cy/ft/yr) within Reaches 1, 2, 5, and 6, combined. However, during this period the net volume changes at each transect among these reaches were a combination of areas of net gains and losses. From a planning perspective, it is important to identify total net losses, since it is not certain that future gains will offset such reductions in volume. As such, the sum of only net losses, along the corresponding shoreline lengths, during the high period for these Reaches was 391,300 cy/yr (22.8 cy/ft/yr).

As noted previously, whether the recent erosion and accretion rates represent a temporary condition or a longer-term shift in shoreline behavior is uncertain. The observed changes may reflect natural variability associated with shoal attachment cycles, storm activity, and sediment transport, or they may indicate a more persistent increase in erosional pressures related to sea level rise and broader geomorphic changes.

Overall, the volume-change analysis indicates that Reaches 1, 2, 5, and 6 are experienced substantial net erosion during the post-2018 monitoring period. Erosion rates were particularly high during the July 2021 to September 2024 analysis period compared to rates documents by longer-term data, highlighting the potential for these reaches to experience prolonged periods of significant sediment loss. These findings support the identification of Reaches 1, 2, 5, and 6 as vulnerable shoreline areas and provide a technical basis for evaluating future beach management alternatives intended to maintain the island's shoreline at or seaward of the baseline condition.

The annualized erosion and accretion rates developed through this analysis provide the basis for evaluating the anticipated performance and lifecycle costs associated with each of the beach management alternatives considered in this study. These rates were used to estimate future sand losses, renourishment intervals, and maintenance requirements for each alternative and were subsequently incorporated into the 50-year lifecycle cost analysis and Average Annual Equivalent Cost (AAEC) calculations.

4.3 2026 Beach Renourishment Project

The 2026 Beach Renourishment Project represents a significant investment in the long-term resiliency of the Isle of Palms shoreline and serves as the foundation for evaluating future beach management alternatives. The project focuses on the portions of the island that have historically experienced the highest rates of erosion and sediment loss, including Reaches 1 and 2 along the southern end of the island adjacent to Breach Inlet and Reaches 5 and Reach 6 along the northern end of the island adjacent to Dewees Inlet. These areas have consistently

required management attention and intervention and have been the focus of previous nourishment efforts due to their vulnerability to erosion and storm impacts.

The anticipated nourishment quantities for the 2026 project are approximately 800,000 cy within Reaches 1 and 2, 800,000 cy within Reach 5, and 880,000 cy within Reach 6, resulting in a total placement volume of approximately 2,480,000 cy of sand (CSE, 2026). **Figure 4-4** presents the general distribution of beach fill placement densities (cy/ft) along the respective project reaches.

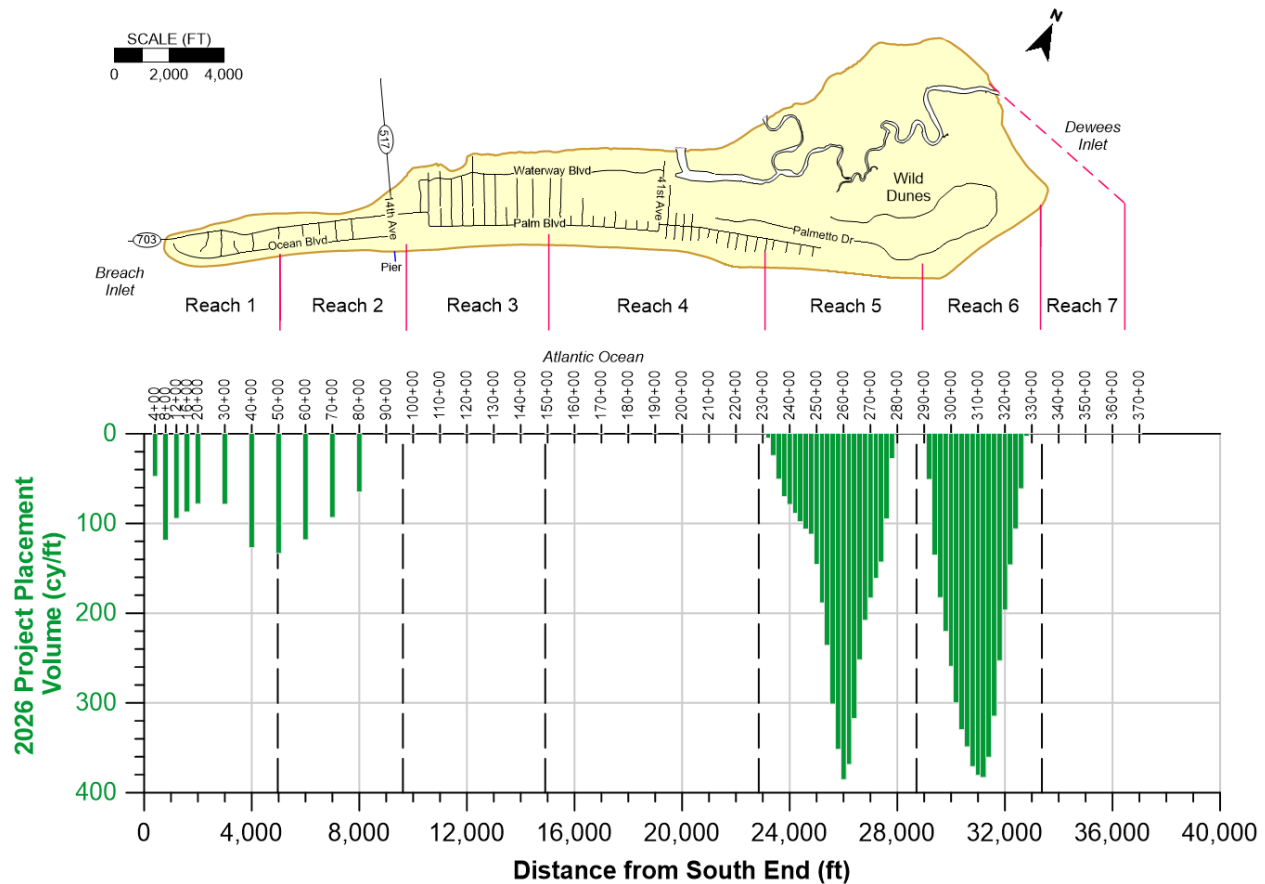


Figure 4-4: 2026 beach renourishment project volume density by monitoring station.

4.4 Anticipated Immediate Post-Project (2026 Beach Condition)

For purposes of this analysis, the June 2026 pre-construction survey was selected to represent the existing condition of the Isle of Palms shoreline immediately prior to construction. The survey was compared to the study baseline condition (described in Section 3) to identify the amount of sand volume available seaward of the baseline (volume surplus) and the sand volume deficit landward of the baseline (volume deficit). This comparison provides an indication of the condition of the beach prior to implementation of the 2026 project relative to

the assumed baseline and assists in quantifying the *expected* conditions of the beach following completion of the 2026 project.

The analysis indicates that Reaches 1, 2, 5, and 6 contain extensive areas that fall below the baseline condition, as of the June 2026 survey, which are consistent with historical erosion patterns observed throughout the long-term monitoring record. In contrast, portions of Reaches 3 and 4 exhibited beach volumes that exceed the baseline condition and therefore had a sediment surplus relative to the baseline. Reach 7 also exhibits a volume deficit; however, shoreline behavior within this area is strongly influenced by the dynamic processes associated with Dewees Inlet. Additionally, the baseline condition in Reach 7 is partially governed by the proximity of existing infrastructure and the shoreline position adjacent to the Links Golf Course, making direct comparisons to other portions of the island less apparent due to differing sediment transport processes.

Figure 4-5 illustrates the estimated sediment volume required at each monitoring station to (1) restore beach conditions to the baseline condition, (2) the existing sand volume (if present) seaward of the baseline, and (3) the sand volume to be placed as part of the 2026 project. The volumes for each reach are summarized in **Table 4-3**. The results demonstrate that the southern end of the island requires the greatest amount of sediment to achieve the baseline condition, reflecting the persistent erosional influences associated with Breach Inlet on the adjacent shoreline reaches. The volume deficit gradually decreases moving northward through Reach 2, while localized areas within the central portions of Reaches 5 and 6 similarly exhibited deficits prior to the 2026 sand placement event.

Results of the June 2026 pre-construction survey compared to the baseline condition indicate that approximately 542,800 cy of fill would be needed within Reaches 1, 2, 5, and 6 to restore the beach to the baseline condition prior to nourishment. Based on the anticipated total placement volume of approximately 2.48 Mcy, roughly 1.98 Mcy of fill is expected to be placed seaward of the baseline condition. The survey also indicated that portions of several reaches already contained sand seaward of the baseline, with most of this volume occurring in Reaches 3 and 4, consistent with the historically stable nature of these areas.

Beyond simply restoring existing deficits, the 2026 beach renourishment project will provide substantial additional benefits by placing sediment volumes that exceed the minimum baseline condition in many locations. Volume exceeding the baseline condition is known as *advance nourishment* and serves as a reserve sediment buffer that can be gradually redistributed by natural processes over time, extending the functional life of the project and delaying the onset of future shoreline deficiencies. As a result, the 2026 project not only restores beach conditions to the island's most vulnerable areas but also establishes a meaningful initial condition from which future management alternatives can be evaluated against. The 2026 post-construction

beach condition, considering both existing and placed sand volumes, will serve as the basis for forecasting future shoreline performance under the various beach management alternatives.

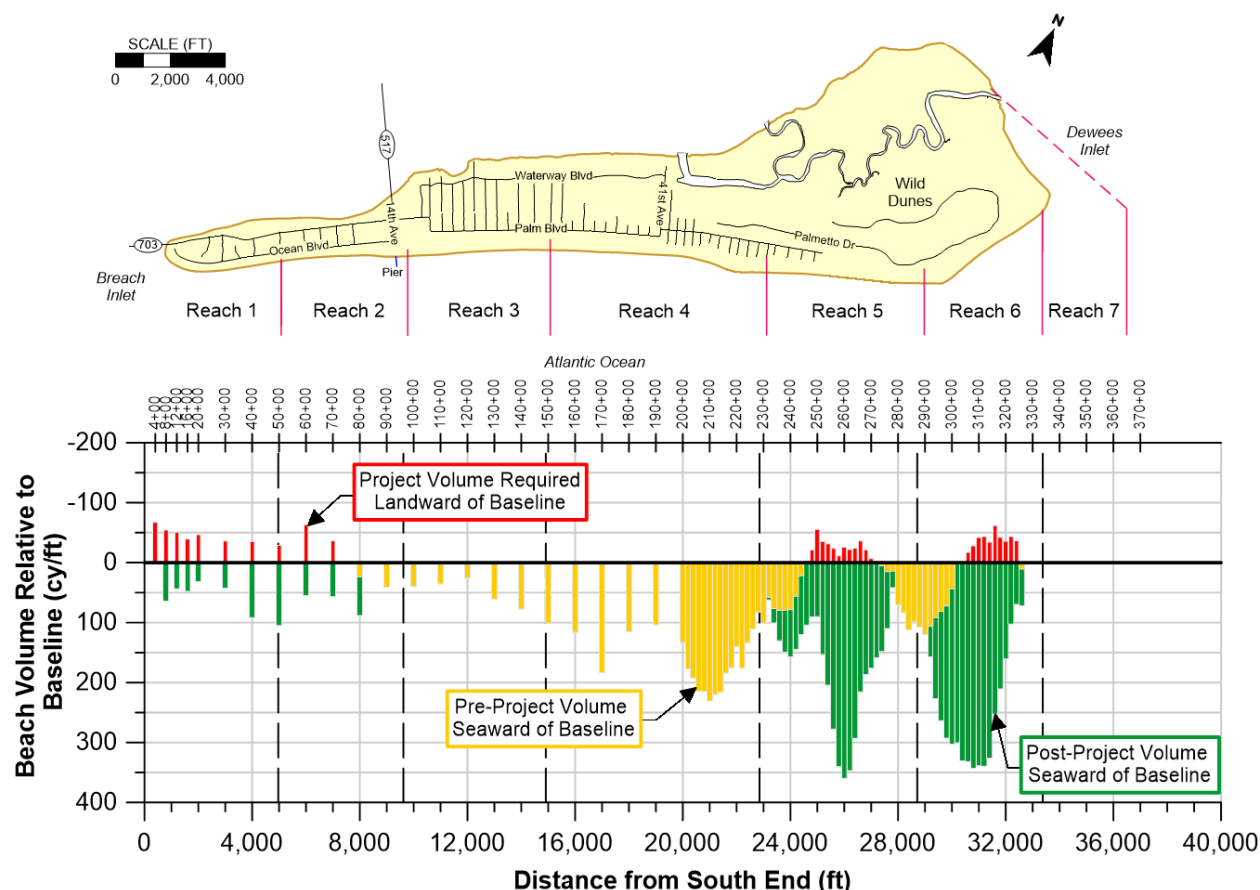


Figure 4-5: Comparison of volume needed to reach baseline condition at the time of the June 2026 survey versus the 2026 project placement volume.

Table 4-3: Summary of approximate 2026 beach renourishment and total post-project volumes relative to the beach management baseline (both landward and seaward) relative to the June 2026 pre-construction survey.

Reach	Project Volume Total (cy)	Project Volume Required Landward of Baseline (cy)	Project Volume Seaward of Baseline (cy)	Pre-Project Sand Volume Seaward of the Baseline (cy)	Total Post-Project Volume Seaward of Baseline (cy)
1	340,100	222,700	158,300	0	158,300
2	460,600	168,300	292,400	51,200	343,600
3	0	0	0	251,200	251,200
4	0	0	0	1,276,700	1,276,700
5	799,100	73,400	725,800	205,100	930,900
6	880,100	78,400	801,800	191,800	993,600
Total	2,479,900	542,800	1,978,300	1,976,000	3,954,300

5. Beach Management Alternatives

The main purpose of this study is to identify and evaluate potential long-term beach management strategies that will maintain desired beach conditions along all areas of the island. This analysis concentrated on Reaches 1, 2, 5, and 6, which have tended to experience the greatest historical shoreline and volume change at Isle of Palms and are expected to continue requiring some level of intervention to maintain desired beach and dune conditions. These reaches also represent the areas where future erosion is projected to cause beach conditions to fall below the baseline thresholds established in this report if no proactive, corrective action is implemented.

In contrast, the beach and dune systems within Reaches 3 and 4 have been generally stable to accretional under normal coastal processes. These reaches benefit from the natural alongshore sediment transport and deposition of material originating from adjacent erosional reaches, resulting in a sustained sand-feeding effect that helps maintain shoreline stability. As such, they are not presently expected to require significant active management under most future conditions.

The purpose of this alternatives analysis is to evaluate a range of potential beach management strategies that could be implemented to maintain a healthy and resilient shoreline at Isle of Palms over the long term. Building upon the understanding of existing shoreline conditions, historical trends, and coastal processes discussed in the previous sections, this analysis examines how various management approaches may influence future beach performance relative to a defined baseline condition.

As part of this study, vulnerable shoreline reaches were identified by comparing historical shoreline and beach volume trends to the established baseline beach condition, which represents the minimum beach condition the City seeks to maintain. Areas projected to fall below this threshold condition under existing erosion trends were considered candidates for future management action. The alternatives evaluated herein are intended to address these vulnerable reaches through varying levels of intervention, ranging from no action to more proactive sediment management and structural approaches.

The assessment focuses on both the physical effectiveness and potential implementation implications of each alternative. Factors considered include the ability of an alternative to improve shoreline stability and maintain the baseline beach condition. Accomplishing these goals will enhance storm damage reduction benefits, reduce future erosion risk, and support the recreational and environmental functions of the beach. Consideration is also given to constructability, permitting feasibility, environmental impacts, and long-term maintenance requirements where appropriate.

The alternatives evaluated as part of this study include:

- No Active Beach Management ("Do Nothing")
- Beach Renourishment Only
- Supplemental Sand Placement from:
 - USACE Atlantic Intracoastal Waterway (AICWW) Maintenance Dredging
 - Dewees Inlet Ebb Shoal Management
- Beach Renourishment with Structural Measures

Each alternative is evaluated relative to the no-action condition to better understand its potential benefits, limitations, and anticipated influence on future shoreline evolution. The objective of this analysis is not to identify a single preferred solution at this stage, but rather to provide the City with a technically supported understanding of the available management options and the relative tradeoffs associated with each approach. This information can then be used to support future planning efforts and guide development of a sustainable, long-term beach management strategy for the Isle of Palms shoreline.

5.1 No Active Beach Management - "Do Nothing"

The first management alternative considered for the Isle of Palms shoreline is the No Active Beach Management, or "Do Nothing," alternative. Under this scenario, no future beach nourishment projects, structural improvements, sediment management activities, or other shoreline stabilization measures would be implemented following completion of the 2026 Beach Restoration Project. Subsequent shoreline evolution would occur solely under the influence of natural coastal processes, including waves, tides, storms, inlet dynamics, and longshore sediment transport. The No Active Beach Management alternative serves as the reference condition against which all proactive management strategies are evaluated.

For this evaluation, the projected post-construction beach condition associated with the 2026 Beach Restoration Project was used as the starting point. This approach recognizes that the project is expected to temporarily increase beach width, sediment volume, and dune elevation along much of the island. The analysis therefore examines how shoreline conditions are expected to change over time in the absence of additional management actions following project completion.

Future beach performance under the no-action scenario was assessed by applying historical beach volume change rates to the projected post-construction condition. The change rates were derived from both the long-term and short-term monitoring records presented in **Figures 4-2** and **4-3**, respectively. These periods represent relatively low and high rates of sediment loss observed along the island. Applying these historical trends provides a range of potential future

shoreline responses and allows evaluation of the rate at which beach and dune conditions may deteriorate over time. The analysis also identifies the shoreline reaches most susceptible to future erosion and estimates the timeframe over which the established baseline beach conditions may be compromised if no additional corrective actions are undertaken.

Results were compared to the baseline beach condition, which represents the assumed minimum acceptable beach condition the City may seek to maintain. By evaluating predicted shoreline and beach volume changes relative to this baseline, it is possible to estimate when and where portions of the island are expected to erode landward of the desired baseline condition. This analysis provides insight into the expected longevity of the 2026 Beach Restoration Project in the absence of future intervention and highlights the shoreline reaches that would be most vulnerable to erosion-related impacts.

Figure 5-1 illustrates the projected beach volume change under the low erosion rate scenario. In this case, the 2026 project advance nourishment is projected to gradually diminish over time, with the first areas eroding to the baseline condition by approximately year 5 within Reaches 1 and 5, where historical erosion rates have been highest. By year 7, these deficits expand spatially within Reaches 1 and 5 and begin to affect portions of Reach 6. By year 10, substantial portions of Reaches 1, 5, and 6 are projected to have lost sand volume landward of the baseline condition. In contrast, Reaches 3 and 4 are expected to remain generally stable and continue to exist at or seaward of the baseline due to their historically lower erosion rates and greater stability.

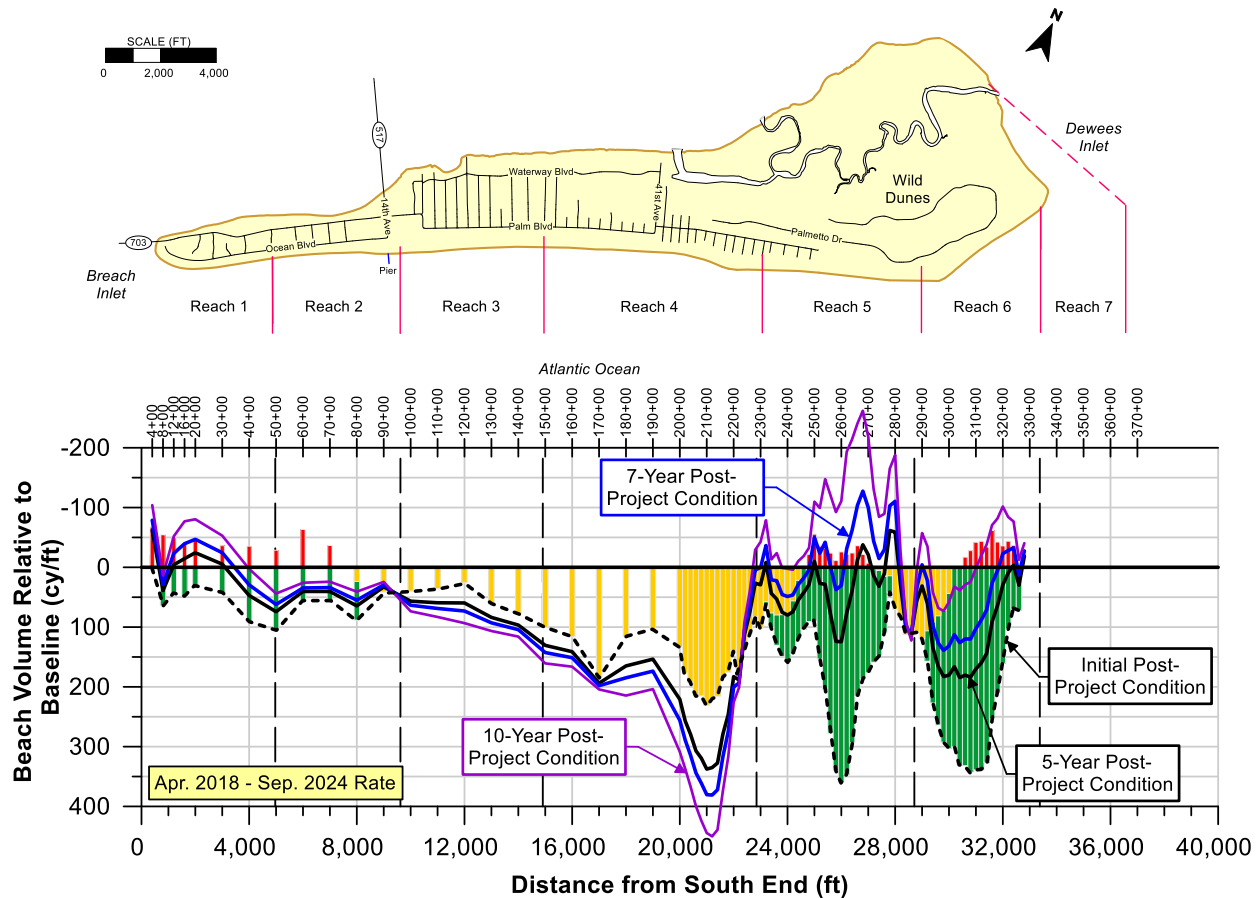


Figure 5-1: Estimated localized remaining fill density, relative to baseline conditions, after 5, 7, and 10 years of in-place service of the 2026 project. These results are based on the “low” sand loss rate developed from the April 2018 to September 2024 timeframe. **RED** bars represent the pre-2026 project volume required to establish the baseline. **YELLOW** represents the pre-project volume seaward of the baseline. **GREEN** represents the projected post-2026 project volume seaward of the baseline.

Figure 5-2 illustrates the projected beach volume change under the high erosion rate scenario. Under the high rate, deterioration of beach conditions occurs more rapidly. Portions of Reaches 1, 5, and 6 are expected to be the first to erode to the baseline condition by year 5. By year 7, erosion impacts become more widespread within the same reaches. By year 10, much of the advance nourishment placed within the highly erosive reaches, including Reaches 1, 5, 6, and the southern portion of Reach 2, is projected to be exhausted, resulting in extensive areas of sand loss landward of the baseline condition. These results demonstrate that, without future management actions, Reaches 1, 5, and 6 remain the most vulnerable portions of the island and would be expected to require future intervention well before the more stable reaches along the central portion of the island.

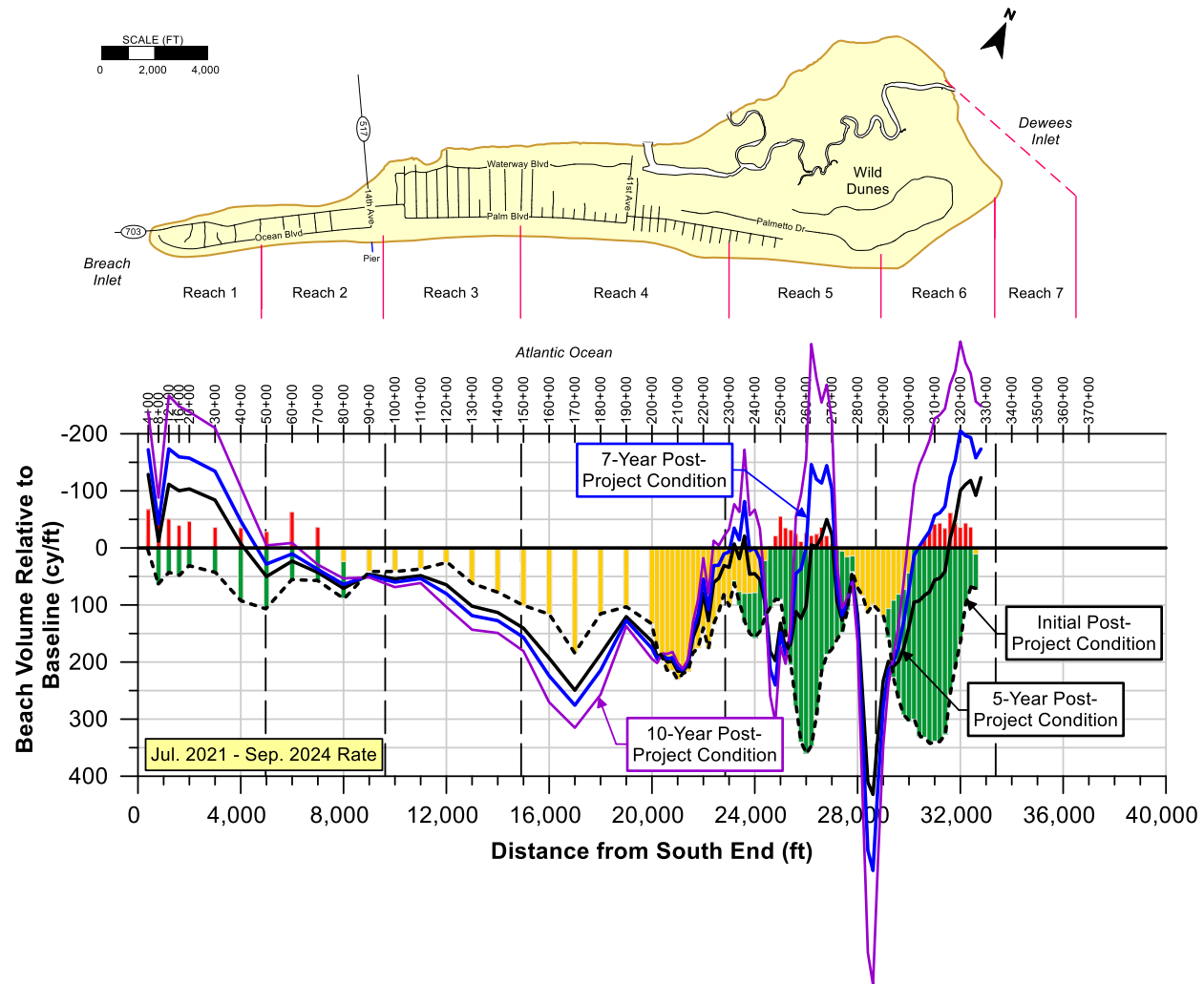


Figure 5-2: Estimated localized remaining fill density, relative to baseline conditions, after 5, 7, and 10 years of in-place service of the 2026 project. These results are based on the “high” sand loss rate developed from the July 2021 to September 2024 timeframe. **RED** bars represent the pre-2026 project volume required to establish the baseline. **YELLOW** represents the pre-project volume seaward of the baseline. **GREEN** represents the projected post-2026 project volume seaward of the baseline.

While the No Active Beach Management alternative eliminates future beach management costs, it is anticipated to result in progressive beach narrowing, landward migration of the shoreline and dune system, increased exposure of infrastructure to coastal hazards, and gradual reduction in the recreational, environmental, and storm damage reduction benefits provided by the beach. The timing and magnitude of these impacts are expected to vary along the island based on local erosion patterns, inlet influences, and historical shoreline behavior described previously.

5.2 Beach Renourishment

The beach renourishment alternative would maintain desired beach and dune conditions through periodic replacement of sediment losses without structural stabilization measures. Project timing and placement volumes would be determined by observed or projected losses. This approach continues the traditional strategy used at Isle of Palms and other developed and managed shorelines.

Baseline renourishment scenarios assume all sand is obtained from permitted offshore borrow areas containing beach-compatible material. Comparative scenarios supplement offshore sand with material from AICWW maintenance dredging and Dewees Inlet shoal management. Sand availability, compatibility, permitting, and cost therefore affect the long-term feasibility of each strategy.

Two renourishment approaches were evaluated. The planned-interval approach restores the shoreline at fixed 5-, 7-, or 10-year intervals and may allow localized erosion landward of the baseline following the 2026 project but not during future intervals. The first renourishment event restores baseline deficits and replenishes advance nourishment seaward of the baseline sufficient to maintain baseline conditions thereafter. The baseline-trigger approach initiates renourishment before a defined extent of erosion affects the baseline, requiring closer monitoring and more timely intervention.

Planned Renourishment Intervals. Fixed 5-, 7-, and 10-year cycles were evaluated to compare project frequency, nourishment volume, shoreline performance, and lifecycle cost. These intervals also encompass the range between past Isle of Palms renourishment projects. Each scenario assumes a single island-wide construction event to limit construction impacts, avoid multiple dredge mobilizations, and capture economies of scale.

Projected post-2026 conditions from the No Active Beach Management analysis were used to estimate losses at years 5, 7, and 10 under the low and high sand-loss rates. The analysis identifies where advance nourishment would be depleted, where deficits would develop landward of the baseline, and the volume required at each scheduled event.

The first event differs from subsequent maintenance events because the 2026 placement is the analysis starting point but does not provide enough advance nourishment to keep every shoreline segment at or seaward of the assumed study baseline through any evaluated interval. The first renourishment must therefore replace losses seaward of the baseline, rebuild deficits landward of the baseline, and add sufficient advance nourishment for the next cycle to project the area landward of the baseline from future losses. Subsequent events are assumed to replace recurring interval losses and renew the advance-fill buffer. Required volumes generally increase with the interval length and assumed sand-loss rate.

The primary advantage of the renourishment-only approach is the ability to maintain beach width, storm damage reduction benefits, and recreational opportunities without constructing permanent coastal structures. However, this alternative requires continued access to reliable, compatible offshore borrow areas, long-term funding commitments, and recurring construction activities over the life of the management program. The estimated nourishment volumes, project frequencies, lifecycle costs, and anticipated performance associated with the 5-, 7-, and 10-year intervals are presented in the following sections.

Predicted Sand Losses. **Figures 5-3, 5-4, and 5-5** depict the predicted alongshore distribution of volume change following completion of the 2026 renourishment project for the 5-, 7-, and 10-year evaluation periods, respectively. Each figure presents results using both the “low” and “high” localized sand-loss rates developed for the Isle of Palms shoreline (see Section 4.2). The figures distinguish between losses from the advance-fill component and losses that erode landward into the baseline condition.

Under all scenarios evaluated, both the low and high sand-loss rates result in some degree of sediment loss from the baseline condition. The least effect on the baseline condition occurs under the 5-year interval using the low sand-loss rates. For this scenario, predicted sand losses are concentrated within Reaches 1, 5, and 6, with the greatest losses occurring within Reaches 1 and 5.

Table 5-1 through **5-3** summarize first-event and subsequent renourishment requirements for the fixed intervals. Estimated first-event volumes are approximately 1.52 Mcy and 1.96 Mcy for the 5-year interval, 2.12 Mcy and 2.74 Mcy for the 7-year interval, and 3.03 Mcy and 3.91 Mcy for the 10-year interval under the low- and high-loss-rate scenarios, respectively. The first-event quantities include advance nourishment losses, restoration of baseline deficits, and advance fill for the following cycle; subsequent events replace recurring interval losses.

The 5-year interval produces smaller, more frequent projects and retains more of the 2026 advance nourishment. The 7-year interval requires larger projects and allows broader localized baseline deficits to occur, particularly in Reaches 1, 5, and 6. The 10-year interval minimizes construction frequency but requires the largest projects and permits the greatest interim degradation. Increasing the interval from 5 to 10 years approximately doubles the event volume, and the high-loss scenarios require about 29 percent more sand than the corresponding low-loss scenarios.

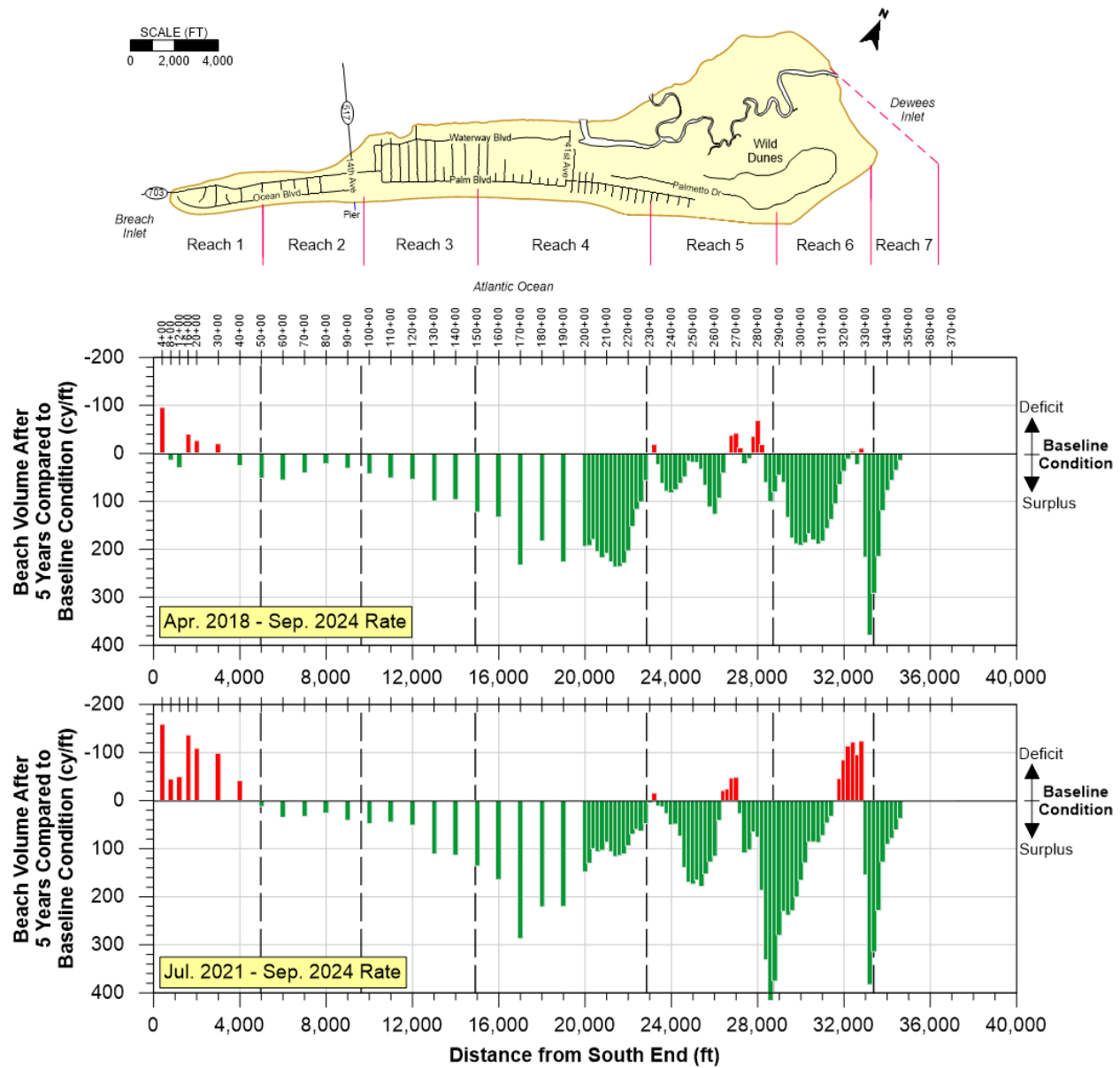


Figure 5-3: Estimated alongshore beach volume density after 5 years compared to the baseline condition using the April 2018 – September 2024 (low rate, top) and July 2021 – September 2024 (high rate, bottom) volume change rates.

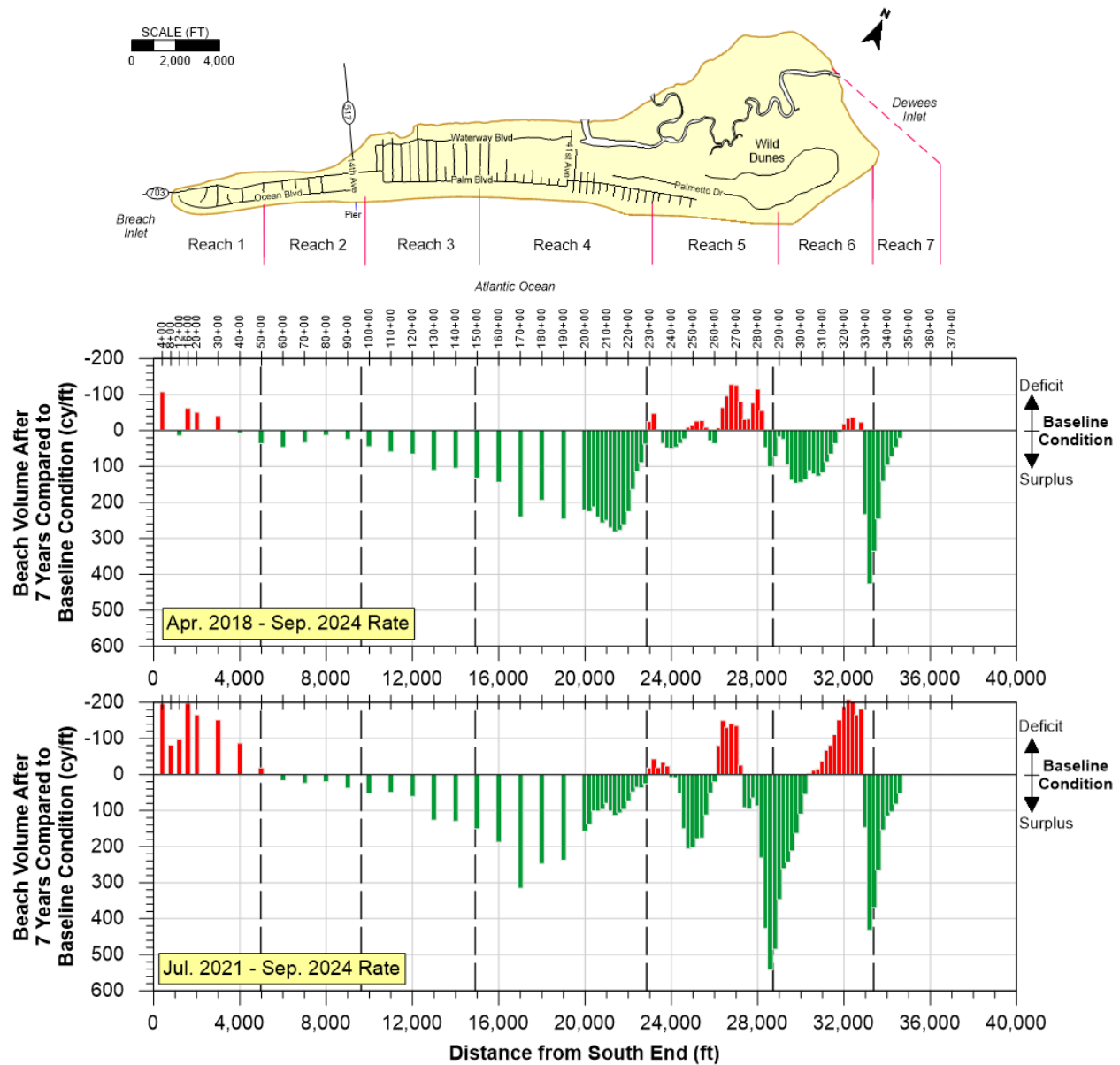


Figure 5-4: Estimated alongshore beach volume density after 7 years compared to the baseline condition using the April 2018 – September 2024 (low rate, top) and July 2021 – September 2024 (high rate, bottom) volume change rates.

Table 5-1: Summary of predicted beach volume change 5 years following completion of the 2026 project; required replacement sand volume for the first renourishment event to restore sand losses landward of the baseline; and future renourishment event volume needed to replace sand lost during each subsequent 5-year interval along the Isle of Palms shoreline. The first-event renourishment volume includes advance nourishment losses seaward of the baseline, the baseline deficit to be restored, and additional advance nourishment needed to maintain beach conditions seaward of the baseline during subsequent intervals.

5-Year Project Interval after Completion of 2026 Project				
Reach	April 2018 - September 2024 ("Low" Erosion Rate)			
	Predicted Performance of 2026 Project after 5 Years			[D = C + B] Future Volume Required to Restore and Maintain Beach Seaward of Baseline (cy)
	[A] Volume Lost Seaward of Baseline (cy)	[B] Volume Lost Landward of Baseline (cy)	[C = A + B] Total Volume Lost (Req. Renourishment Volume Following First Renourishment) (cy)	
1	122,300	61,500	183,800	245,300
2	111,400	0	111,400	111,400
3	0	0	0	0
4	0	0	0	0
5	664,200	45,000	709,200	754,200
6	503,700	7,500	511,200	518,700
Total	1,401,600	114,000	1,515,600	1,629,600

5-Year Project Interval after Completion of 2026 Project				
Reach	July 2021 - September 2024 ("High" Erosion Rate)			
	Predicted Performance of 2026 Project after 5 Years			[D = C + B] Future Volume Required to Restore and Maintain Beach Seaward of Baseline (cy)
	[A] Volume Lost Seaward of Baseline (cy)	[B] Volume Lost Landward of Baseline (cy)	[C = A + B] Total Volume Lost (Req. Renourishment Volume Following First Renourishment) (cy)	
1	158,300	322,800	481,100	803,900
2	164,300	0	164,300	164,300
3	0	0	0	0
4	43,400	0	43,400	43,400
5	564,800	28,500	593,300	621,800
6	591,100	126,500	717,600	844,100
Total	1,521,900	477,800	1,999,700	2,477,500

Table 5-2: Summary of predicted beach volume change 7 years following completion of the 2026 project; required replacement sand volume for the first renourishment event to restore sand losses landward of the baseline; and future renourishment event volume needed to replace sand lost during each subsequent 7-year interval along the Isle of Palms shoreline. The first-event renourishment volume includes advance nourishment losses seaward of the baseline, the baseline deficit to be restored, and additional advance nourishment needed to maintain beach conditions seaward of the baseline during subsequent intervals.

7-Year Project Interval after Completion of 2026 Project				
Reach	April 2018 - September 2024 ("Low" Erosion Rate)			
	Predicted Performance of 2026 Project after 7 Years			[D = C + B] Future Volume Required to Restore and Maintain Beach Seaward of Baseline (cy)
	[A] Volume Lost Seaward of Baseline (cy)	[B] Volume Lost Landward of Baseline (cy)	[C = A + B] Total Volume Lost (Req. Renourishment Volume Following First Renourishment) (cy)	
1	146,300	110,900	257,200	368,100
2	155,900	0	155,900	155,900
3	0	0	0	0
4	0	0	0	0
5	816,100	176,900	993,000	1,169,900
6	674,300	41,400	715,700	757,100
Total	1,792,600	329,200	2,121,800	2,451,000
7-Year Project Interval after Completion of 2026 Project				
Reach	July 2021 - September 2024 ("High" Erosion Rate)			
	Predicted Performance of 2026 Project after 7 Years			[D = C + B] Future Volume Required to Restore and Maintain Beach Seaward of Baseline (cy)
	[A] Volume Lost Seaward of Baseline (cy)	[B] Volume Lost Landward of Baseline (cy)	[C = A + B] Total Volume Lost (Req. Renourishment Volume Following First Renourishment) (cy)	
1	158,300	515,300	673,600	1,188,900
2	218,900	11,000	229,900	240,900
3	0	0	0	0
4	60,800	0	60,800	60,800
5	675,900	154,700	830,600	985,300
6	715,100	289,600	1,004,700	1,294,300
Total	1,829,000	970,600	2,799,600	3,770,200

Table 5-3: Summary of predicted beach volume change **10 years** following completion of the 2026 project; required replacement sand volume for the first renourishment event to restore sand losses landward of the baseline; and future renourishment event volume needed to replace sand lost during each subsequent 10-year interval along the Isle of Palms shoreline. The first-event renourishment volume includes advance nourishment losses seaward of the baseline, the baseline deficit to be restored, and additional advance nourishment needed to maintain beach conditions seaward of the baseline during subsequent intervals.

10-Year Project Interval after Completion of 2026 Project				
Reach	April 2018 - September 2024 ("Low" Erosion Rate)			
	Predicted Performance of 2026 Project after 10 Years			[D = C + B] Future Volume Required to Restore and Maintain Beach Seaward of Baseline (cy)
	[A] Volume Lost Seaward of Baseline (cy)	[B] Volume Lost Landward of Baseline (cy)	[C = A + B] Total Volume Lost (Req. Renourishment Volume Following First Renourishment) (cy)	
1	158,300	209,200	367,500	576,700
2	222,800	0	222,800	222,800
3	0	0	0	0
4	0	0	0	0
5	885,300	533,300	1,418,600	1,951,900
6	865,800	156,600	1,022,400	1,179,000
Total	2,132,200	899,100	3,031,300	3,930,400

10-Year Project Interval after Completion of 2026 Project				
Reach	July 2021 - September 2024 ("High" Erosion Rate)			
	Predicted Performance of 2026 Project after 10 Years			[D = C + B] Future Volume Required to Restore and Maintain Beach Seaward of Baseline (cy)
	[A] Volume Lost Seaward of Baseline (cy)	[B] Volume Lost Landward of Baseline (cy)	[C = A + B] Total Volume Lost (Req. Renourishment Volume Following First Renourishment) (cy)	
1	158,300	804,000	962,300	1,766,300
2	262,600	66,000	328,600	394,600
3	0	0	0	0
4	86,800	0	86,800	86,800
5	741,500	445,000	1,186,500	1,631,500
6	761,700	673,600	1,435,300	2,108,900
Total	2,010,900	1,988,600	3,999,500	5,988,100

The fixed-interval results show the central tradeoff: longer intervals reduce project and mobilization frequency but require larger replacement volumes and allow greater temporary degradation, particularly in Reaches 1, 5, and 6.

Application to the Cost Analysis. Each cost scenario assumes one island-wide event at the end of the applicable interval. The first event replaces all modeled losses, including advance-fill depletion and baseline deficits, and reestablishes the intended advance nourishment buffer. Subsequent events replace recurring interval losses. Consolidating placement into one event provides a consistent comparison and captures the benefit of a single dredge mobilization.

The modeling indicates that localized areas would fall below the baseline before the first scheduled event under all six fixed-interval scenarios. The duration and magnitude of these deficits increase with longer intervals and higher loss rates and may be substantial under the 7- and 10-year high-loss cases. If erosion threatens infrastructure before the next island-wide project, interim sand placement, Dewees Inlet shoal management, or localized structural measures may be required; associated costs are evaluated under separate alternatives.

Baseline Trigger Approach. To evaluate a renourishment strategy based on erosion of the beach to the baseline condition, the post-construction profile associated with the 2026 beach restoration project was used as the initial condition. For this analysis, localized low and high sand-loss rates were applied across Reaches 1 through 6. The progressive loss of sediment from the project profile was then tracked over time to identify when all advance nourishment material at a given location would be exhausted and erosion would begin affecting the baseline condition.

For the purposes of establishing a renourishment trigger, the criterion was defined as erosion extending through the advance nourishment and impacting a contiguous shoreline segment at least 1,000 feet in length. Once this threshold was reached, the time required to reach the trigger condition and the associated sediment losses were documented.

Because this approach is intended to maintain the beach at or above the baseline condition at all times, the frequency of sand placement is relatively high and the required nourishment volume at each event is relatively low compared to the fixed 5-, 7-, and 10-year renourishment interval scenarios evaluated in the previous section. **Table 5-4** and **Table 5-5** summarize the initial post-construction sand volumes relative to pre-2026 beach conditions, the localized low and high sand-loss rates, respectively, and the predicted time required for erosion to impact at least 1,000 contiguous feet of shoreline within Reaches 1 through 6. The analysis provides an estimate of the renourishment frequency that would be required to maintain the beach at or above the baseline condition throughout the management period.

Table 5-4: Predicted renourishment trigger timing and sediment losses based on the baseline-condition threshold using the “low” sand-loss rate. The trigger occurs 3 years after the 2026 project.

Reach	Trigger - 3 Years Until Erosion into Baseline [Between Stations 12+00 and 30+00]			
	April 2018 - September 2024 ("Low" Erosion Rate)			[D = C + B] Future Volume Required to Restore and Maintain Beach Seaward of Baseline (cy)
	Predicted Preformance of 2026 Project after 3 Years			
	[A] Volume Lost Seaward of Baseline (cy)	[B] Volume Lost Landward of Baseline (cy)	[C = A + B] Total Volume Lost (Req. Renourishment Volume Following First Renourishment) (cy)	
1	97,300	13,000	110,300	123,300
2	66,800	0	66,800	66,800
3	0	0	0	0
4	0	0	0	0
5	418,500	7,100	425,600	432,700
6	306,700	0	306,700	306,700
Total	889,300	20,100	909,400	929,500

Table 5-5: Predicted renourishment trigger timing and sediment losses based on the baseline-condition threshold using the “high” sand-loss rate. The trigger occurs 1 year after the 2026 project.

Reach	Trigger - 1 Year Until Erosion into Baseline [Between Stations 12+00 and 30+00]			[D = C + B] Future Volume Required to Restore and Maintain Beach Seaward of Baseline (cy)
	July 2021 - September 2024 ("High" Erosion Rate)			
	Predicted Performance of 2026 Project after 1 Year			
	[A] Volume Lost Seaward of Baseline (cy)	[B] Volume Lost Landward of Baseline (cy)	[C = A + B] Total Volume Lost (Req. Renourishment Volume Following First Renourishment) (cy)	
1	88,100	8,100	96,200	104,300
2	32,900	0	32,900	32,900
3	0	0	0	0
4	8,700	0	8,700	8,700
5	118,700	0	118,700	118,700
6	141,700	1,900	143,600	145,500
Total	390,100	10,000	400,100	410,100

Under the “low” sand-loss-rate scenario, the trigger condition is predicted to occur approximately three years following completion of the 2026 beach restoration project. The trigger is expected to occur within Reach 1, where erosion first extends through the advance nourishment and affects the baseline condition along a contiguous 1,000-foot shoreline segment. At the time the trigger condition is reached, approximately 909,400 cubic yards of sand are projected to have been lost from Reaches 1, 2, 5, and 6. Of this volume, approximately 889,300 cubic yards represent depletion of advance nourishment material, while approximately 20,100 cubic yards represent sediment losses landward of the baseline condition.

Under the “high” sand-loss-rate scenario, the trigger condition is predicted to occur approximately one year following completion of the 2026 project. The most significant erosion is projected to occur within Reaches 1 and 5, where elevated sand-loss rates result in more rapid depletion of the advance nourishment. At the time the trigger condition is reached, approximately 400,100 cubic yards of sediment are projected to have been lost from the evaluated reaches. Of this total, approximately 390,100 cubic yards are associated with depletion of advance nourishment material, while approximately 10,000 cubic yards represent losses from the beach landward of the baseline condition.

The predicted timing of the trigger events and corresponding replacement volumes serve as the basis for the economic evaluation of this management approach. These values were incorporated into the lifecycle cost analysis to estimate the annualized cost of maintaining the beach at or above the baseline condition through trigger-based renourishment. Unlike the fixed-interval nourishment scenarios, this approach initiates sand replacement when measurable erosion thresholds are reached, thereby minimizing the duration and extent of shoreline conditions that fall below the desired minimum beach profile. However, the approach may also increase project frequency, mobilization costs, and long-term management expenditures relative to less frequent renourishment strategies.

Key Differences Between the Planned-Interval and Baseline-Trigger Renourishment Approaches

Although both approaches rely on periodic beach nourishment to offset ongoing sediment losses and maintain project benefits, they differ in how renourishment timing is established and how beach performance is managed between nourishment events.

Planned-Interval Approach

- Renourishment occurs on a planned, fixed schedule (e.g., every 5, 7, or 10 years), regardless of actual shoreline performance.
- Project planning, funding, permitting, and mobilization schedules can be established well in advance.

- Nourishment volumes generally increase with longer intervals because more sediment loss accumulates between projects.
- Portions of the shoreline may erode below the baseline condition before the next scheduled renourishment event, particularly in areas experiencing elevated erosion rates.
- The approach is operationally simple and reflects the traditional beach management strategy historically employed at Isle of Palms.

Baseline-Trigger Approach

- Renourishment is initiated when a predefined erosion threshold is reached, rather than on a fixed schedule.
- The trigger evaluated in this study is the erosion of the advance-fill component along a contiguous 1,000-foot segment of shoreline, resulting in impacts to the baseline condition.
- Project timing is directly tied to actual beach performance and localized erosion rates.
- The approach is intended to minimize the amount of time that shoreline conditions fall below the baseline condition and may better maintain desired levels of storm damage reduction, recreational beach width, and environmental function.
- Because nourishment timing is uncertain and depends on future erosion patterns, budgeting, planning, permitting, and mobilization activities may be more difficult to predict.

Cost and Performance Considerations.

- The predetermined-interval approach may be more cost-efficient from a construction and mobilization perspective because projects can be scheduled less frequently and coordinated island-wide. This will be explored in detail in **Section 7**.
- The trigger-based approach will require more frequent renourishment events in highly erosional areas but could reduce the magnitude and duration of shoreline deficits.
- Predetermined intervals accept some widespread degradation of beach conditions following the 2026 project, whereas the trigger-based approach prioritizes maintaining the beach at or near the baseline condition.
- The interval approach emphasizes operational predictability, while the trigger approach emphasizes beach performance and condition-based management.

Summary. In essence, the predetermined-interval approach answers the question, “When should the City renourish?” with a fixed schedule, while the baseline-trigger approach answers the same question based on actual shoreline response and observed erosion impacts. The interval

approach provides greater planning certainty, whereas the trigger approach provides greater assurance that beach conditions will remain closer to the desired baseline condition throughout the management period, especially during the first interval following completion of the 2026 project.

The predetermined-interval and baseline-trigger approaches represent two different asset management philosophies. The predetermined-interval approach prioritizes construction efficiency, budget predictability, and reduced mobilization frequency, while accepting that portions of the shoreline may temporarily erode below the baseline condition between nourishment events. In contrast, the baseline-trigger approach prioritizes maintenance of the desired beach condition through condition-based intervention, potentially reducing erosion impacts but increasing the frequency of nourishment activities and associated mobilization costs. The lifecycle cost analysis presented in Section 7.0 evaluates these tradeoffs by comparing the total project costs and Average Annual Equivalent Costs (AAEC) associated with each management strategy over the 50-year analysis period.

5.3 Supplemental Sand Source Alternatives

5.3.1 Dewees Inlet Shoal Management

The Dewees Inlet Shoal Management alternative is a proposed sediment management strategy that seeks to beneficially use sand contained within the Dewees Inlet ebb shoal complex to support the long-term maintenance of the Isle of Palms shoreline. The alternative is designed to proactively recover sediment from migrating ebb shoal features before the shoal approaches and attaches to the shoreline, thereby capturing a valuable sediment resource and reducing the adverse shoreline impacts commonly associated with shoal migration and attachment events.

Under this alternative, it is assumed that approximately 700,000 cubic yards of beach-compatible sand would be dredged from selected portions of the Dewees Inlet ebb shoal complex (**Figure 5-6**) at a 7-year interval, on average, representing an average annual sediment contribution equivalent to about 100,000 cubic yards per year. All recovered material would be placed along Reaches 5 and 6, the areas most directly influenced by sediment exchanges between Dewees Inlet and the northern portion of Isle of Palms. Because this sediment would supplement future beach renourishment needs using a nearby inlet-derived sand source, the alternative is expected to reduce the volume of sand required from offshore borrow areas during future renourishment events.

The primary objective of this alternative is to intercept ebb shoal sediment prior to onshore migration and attachment, reducing the magnitude and frequency of future shoal attachment impacts while placing sediment directly where it provides the greatest shoreline protection benefit. Placement of inlet-derived sediment along Reaches 5 and 6 would increase beach

volume and width, enhance storm damage reduction benefits, and improve shoreline resilience along the northern portion of the island. By supplementing the beach with sediment that would otherwise migrate toward the shoreline through natural shoal attachment processes, the alternative is expected to extend the effective life of nourishment projects and increase the interval between major renourishment events.

Project access would be provided through the interior waters of Dewees Inlet, allowing dredging and placement operations to be conducted within a relatively protected environment compared to offshore borrow area operations. However, implementation would require careful consideration of shallow-water conditions within the inlet and around the targeted shoal features. Dredging equipment selection, navigation routes, and construction sequencing would need to account for water depth limitations and tidal fluctuations to maintain operational efficiency and minimize impacts to inlet processes (personal communication with Tom Payne, Marinex Construction, Inc.).

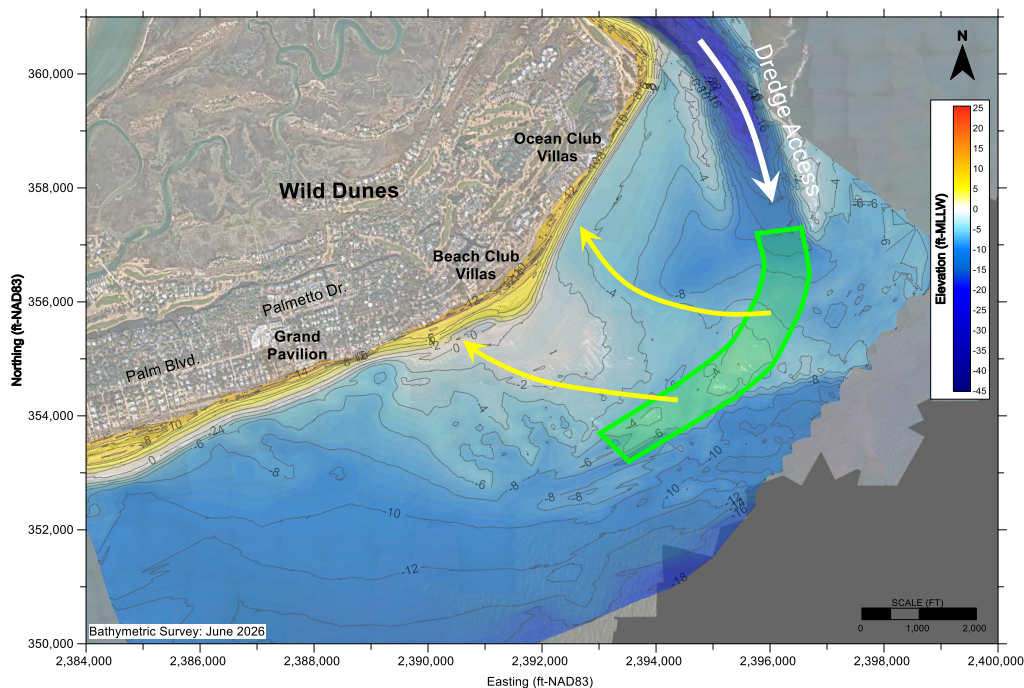


Figure 5-6: Conceptual Dewees Inlet shoal management approach showing the proposed shoal dredging area, interior inlet access route, and anticipated sediment transfer pathway for placement along Reaches 5 and 6.

An important advantage of this alternative is the close proximity of the borrow area to the placement site; roughly 4,000 feet. The short transport distance between the Dewees Inlet shoals and the Isle of Palms shoreline would likely result in slightly lower dredging and pumping costs compared to projects utilizing offshore borrow areas which are further offshore of the island. In addition, conducting operations near the protected waters of Dewees Inlet may reduce weather-related downtime and improve overall construction efficiency relative to offshore

dredging operations. As a result, this alternative is expected to offer a supplemental and possibly more cost-effective source of beach-compatible sediment while simultaneously reducing reliance on offshore borrow resources.

Overall, the Dewees Inlet Shoal Management alternative represents a proactive sediment management strategy that beneficially uses naturally available inlet sand resources to improve shoreline resilience, reduce the impacts of future shoal migration and attachments, extend nourishment longevity, and decrease dependence on offshore borrow areas. The alternative also offers the potential for lower implementation costs due to the proximity of the sediment source and placement area, making it an attractive option to be considered for the long-term shoreline management program for Isle of Palms.

As illustrated in **Figure 5-6**, the proposed concept would focus on a portion of the Dewees Inlet ebb shoal located seaward of the northern Isle of Palms shoreline. The dredging area would be positioned along the outer and central portions of the shoal complex, where shallow sand deposits are expected to migrate landward toward Reaches 5 and 6 as part of the recurring shoal migration and attachment cycle. Dredging would intercept a portion of this material before attachment, and place recovered sediment along the adjacent erosional shoreline.

The arrows shown on the figure represent the intended sediment management pathway: material would be removed from the shoal feature accessed from the interior side of Dewees Inlet and transferred landward and southwestward for placement along the northern Isle of Palms shoreline. This approach is intended to reduce the severity of erosional conditions that can develop as shoals approach the shoreline, while also beneficially using inlet sand near the placement area. The concept would require detailed surveys, sediment compatibility testing, and construction planning to confirm excavation limits, access routes, dredging equipment requirements, and potential effects on inlet hydraulics and shoal evolution.

Preliminary consultation with State and Federal regulatory agencies regarding this concept was favorable. Agency representatives indicated that the proposed action would likely be viewed similarly to dredging an offshore borrow area, provided that the project is supported by appropriate documentation, including sediment compatibility information, defined excavation limits, environmental resource evaluations, and an assessment of potential effects on inlet hydraulics and shoal evolution.

5.3.2 Breach Inlet AICWW Maintenance Dredging Sand

The Breach Inlet AICWW Maintenance Dredging Sand Alternative evaluates the beneficial use of sand generated through maintenance dredging of the Atlantic Intracoastal Waterway (AICWW) within Breach Inlet. Under this alternative, suitable dredged material would be placed along Reaches 1 and 2 as a supplemental sand source to support the southern end of the island,

where persistent erosion and inlet-related sediment losses have historically contributed to recurring beach management needs.

The U.S. Army Corps of Engineers (USACE) has indicated that it may be able to provide approximately 150,000 cubic yards (cy) of sand on an approximate three-year interval for placement along the southern end of Isle of Palms. For purposes of this analysis, the full volume is assumed to be placed within Reaches 1 and 2, resulting in an average annual sediment contribution of approximately 50,000 cy per year. This volume is assumed to directly offset an equivalent amount of sand that would otherwise be required from future beach nourishment activities.

Use of this material would support several beach management goals. First, it would beneficially use dredged material that is already being excavated for navigation maintenance, thereby keeping sediment within the regional littoral system. Second, it would provide a recurring supplemental sand source for Reaches 1 and 2, reducing the long-term sediment deficit along the southern end of the island. Third, by periodically adding sand between major renourishment events, this alternative may extend the time between required offshore borrow-area nourishment projects. Finally, the supplemental material would reduce the total quantity of sand that must be obtained from offshore borrow sources over the 50-year planning period.

For this planning-level evaluation, it is assumed that the dredged material will be suitable for beach placement and will perform similarly to native beach-quality sand once placed on the shoreline. This assumption should be confirmed through sediment compatibility testing before implementation. If the material is substantially finer than the existing beach sand, it may be more susceptible to erosion and transport by waves and currents, which could reduce its effective longevity and the degree to which it offsets future nourishment requirements.

The analysis further assumes that the material would be provided to the City at no cost. As a result, this alternative could substantially reduce future nourishment costs by decreasing the volume of paid beach fill required from offshore borrow areas. Although the timing and volume of future USACE maintenance dredging events may vary, the assumed recurring contribution of approximately 150,000 cy per event provides a reasonable planning-level basis for evaluating the potential cost and performance benefits of this supplemental sand source.

As shown in **Figure 5-7**, the Breach Inlet AICWW maintenance dredging concept would beneficially use sand excavated from the AICWW maintenance dredging area within Breach Inlet and place the material along Reaches 1 and 2. The graphic illustrates the relationship between the maintenance dredging source area, the southern end of Isle of Palms, and the intended placement area. This approach would keep compatible sediment within the local coastal system while providing a recurring supplemental sand source to help maintain beach

conditions, extend the time between larger renourishment projects, and reduce reliance on offshore borrow areas.



Figure 5-7: Breach Inlet AICWW Maintenance Dredging Sand Alternative showing the assumed maintenance dredging sand source within Breach Inlet and conceptual placement along Reaches 1 and 2.

Collectively, the Dewees Inlet shoal management and Breach Inlet AICWW maintenance dredging alternatives could provide an average of approximately 150,000 cubic yards of supplemental sand per year—about 100,000 cy/yr to Reaches 5 and 6 and 50,000 cy/yr to Reaches 1 and 2. If these sources remain available at the assumed frequencies, they could supply approximately 7.5 million cubic yards over the 50-year planning period, directly offsetting an equivalent volume that would otherwise need to be obtained from offshore borrow areas. This quantity represents approximately 30 percent of the estimated 25 million cubic yards of remaining material within prospective Offshore Borrow Areas 1 through 5.

Dewees Inlet shoal management could also provide an important incidental shoreline-performance benefit by modifying approaching shoal features before migration and attachment substantially alter nearshore wave conditions. Selective removal and redistribution of shoal sediment may reduce localized wave focusing and the associated concentration of wave energy

along Reaches 5 and 6, thereby moderating the periods of excessive erosion and elevated sand-loss rates that have historically occurred as shoals approach and attach to the shoreline. Although the magnitude of this benefit would require confirmation through detailed coastal-process analyses and post-construction monitoring, a reduction in shoal-induced erosion could improve retention of both supplemental and offshore-derived nourishment sand, extend nourishment longevity, and further reduce long-term demand on offshore borrow resources.

Accordingly, use of both supplemental sources could materially extend the useful life of the City's finite offshore sand resources, reduce the volume and potentially the frequency of offshore dredging, and improve the long-term sustainability of the nourishment program. These benefits remain dependent on future sediment availability, compatibility, permitting, successful implementation of the assumed dredging cycles, and verification that shoal management produces the anticipated changes in wave transformation and shoreline response.

5.4 Shore-Stabilizing Structure Alternatives

The Renourishment Only alternative highlights shoreline reaches that may not maintain the desired baseline condition through beach nourishment alone or would require increasingly frequent nourishment cycles to do so. Under either scenario, the long-term sustainability of the beach management program may be constrained by recurring erosion and sediment losses that reduce the longevity of placed sand. Existing erosional conditions along portions of the island, particularly within Reaches 1, 5, and 6, have historically resulted in accelerated shoreline recession and reduced beach widths between nourishment events. In some locations, these erosional trends have diminished the protective beach buffer to the extent that upland infrastructure, public access features, and other developed assets become increasingly vulnerable before subsequent renourishment can be implemented.

To address these challenges, a shoreline stabilization strategy incorporating structural measures has been identified for further evaluation. The planning-level concepts under consideration include a terminal groin in Reach 1 and combinations of detached breakwaters and shore-perpendicular groins in Reaches 5 and 6. These structures would be evaluated in conjunction with periodic beach nourishment as supplemental measures intended to reduce sediment losses, improve shoreline stability, maintain minimum desired beach conditions, and provide an additional line of defense in historically erosional areas. The conceptual structural alternatives are intended to support evaluation of feasibility, anticipated benefits, constructability, environmental considerations, permitting requirements, and rough-order-of-magnitude costs for comparison with other shoreline management strategies. Detailed engineering analyses performed during subsequent project phases would be used to refine structural configurations and assess their effectiveness in meeting the City's long-term beach management objectives.

5.4.1 Terminal Groin (Reach 1)

This alternative consists of constructing a terminal groin at the southern end of Isle of Palms adjacent to Breach Inlet. The terminal groin would be implemented in conjunction with future beach nourishment projects to:

- Reduce sand loss from the southern end of the island;
- Anchor the shoreline at a position seaward of the study, or other defined baseline;
- Extend the time between required renourishment events; and
- Reduce long-term demand for sand from offshore borrow areas.

The terminal groin is not intended to replace beach nourishment as the primary beach management strategy. Rather, the structure would supplement future nourishment by reducing sediment losses into Breach Inlet, improving retention of placed sand, and maintaining beach and dune conditions seaward of the baseline for a longer period. Improved sand retention could increase nourishment longevity, reduce the frequency and volume of future renourishment projects, and preserve the City's finite offshore sand resources.

The scope of this alternative includes a planning-level engineering evaluation. Subsequent engineering studies would be required to refine the structure configuration, evaluate sediment bypassing requirements, assess potential impacts to adjacent shorelines and coastal processes, and determine final design parameters.

Figure 5-8 presents a conceptual terminal groin located adjacent to Breach Inlet. The location and configuration shown are illustrative only and are intended solely to support planning-level evaluations of feasibility, performance, and cost.

For purposes of this analysis, the terminal groin is assumed to extend approximately 1,200 feet from the upland shoreline into Breach Inlet and tie into the upland to minimize the potential for flanking during extreme erosion or storm events. The conceptual structure is estimated to require approximately 15,000 tons of armor stone and internal chinking stone.

For planning-level performance and lifecycle cost analyses, the terminal groin is assumed to reduce the Reach 1 sand-loss rate by 50 percent and the Reach 2 sand-loss rate by 25 percent. Applying these reductions to the high erosion-rate scenario decreases annual sand losses from approximately 96,200 cy/yr to 48,100 cy/yr in Reach 1 and from approximately 32,900 cy/yr to 24,700 cy/yr in Reach 2. The corresponding volume-density loss rates decrease from 24.1 to 12.1 cy/ft/yr in Reach 1 and from 6.6 to 5.0 cy/ft/yr in Reach 2. These assumed reductions are

intended solely to support planning-level comparisons and should be verified through detailed engineering analyses and numerical modeling prior to implementation.



Figure 5-8: Conceptual terminal groin alternative at the southern end of Reach 1 adjacent to Breach Inlet.

The location, configuration, performance assumptions, and quantities described herein are intended solely to support planning-level evaluations of feasibility, anticipated performance, constructability, permitting requirements, and rough-order-of-magnitude costs. Subsequent details engineering and design investigations would be required to refine the structure location, length, cross-section, crest elevation, foundation requirements, and performance expectations.

5.4.2 Detached Breakwaters and/or T-Head Groins (Reaches 5 and 6)

This alternative consists of constructing a system of detached breakwaters and T-head groins within Reaches 5 and 6. The structures would be implemented in conjunction with future beach nourishment projects to:

- Provide a last line of defense for upland infrastructure;
- Anchor the shoreline at or seaward of the study baseline under the most severely eroded conditions; and
- Maintain a recreational beach seaward of the baseline to the extent practicable.

The structural system is not intended to replace beach nourishment as the primary beach management strategy. Rather, the structures would supplement future nourishment by stabilizing the shoreline near the baseline and helping preserve a recreational beach seaward of

the structures. During periods of severe erosion, the structures would provide an additional level of protection for upland development and infrastructure until subsequent renourishment can be completed.

Figure 5-9 presents a conceptual planning-level representation of this alternative within Reaches 5 and 6. The figure illustrates the general extent and potential application of structural stabilization measures in historically erosive areas where beach losses between nourishment cycles can increase the vulnerability of upland infrastructure. The locations and configurations shown are illustrative only and do not represent a recommended design or preferred structural approach.

For purposes of this planning-level analysis, the conceptual structural system is assumed to include:

- Reach 5: Five T-head groins and two detached breakwaters; and
- Reach 6: Two T-head groins and two detached breakwaters.

Each T-head groin is assumed to require approximately 2,800 tons of armor and internal stone, including the associated foundation. Each detached breakwater is assumed to require approximately 1,600 tons of armor and internal stone, including the associated foundation. Based on these assumptions, the conceptual system would include approximately 17,200 tons of stone in Reach 5 and 8,800 tons in Reach 6, for a combined total of approximately 26,000 tons.

For the planning-level performance and lifecycle cost analyses, the structures are not assumed to reduce the underlying sand-loss rates applied to future renourishment volumes. However, by anchoring the shoreline near the baseline and providing direct protection during severely eroded conditions, the structures may allow future renourishment projects to utilize smaller fill volumes and extend the period between renourishment events. These potential benefits are conceptual and should be verified through detailed coastal-process analyses, numerical modeling, design development, and regulatory coordination.

The locations, configurations, performance assumptions, and quantities described herein are intended solely to support planning-level evaluations of feasibility, anticipated performance, constructability, permitting requirements, and rough-order-of-magnitude costs. Subsequent investigations would be required to refine the structure type, number and location of structures, dimensions, spacing, orientation, crest elevations, foundation requirements, and associated nourishment needs.

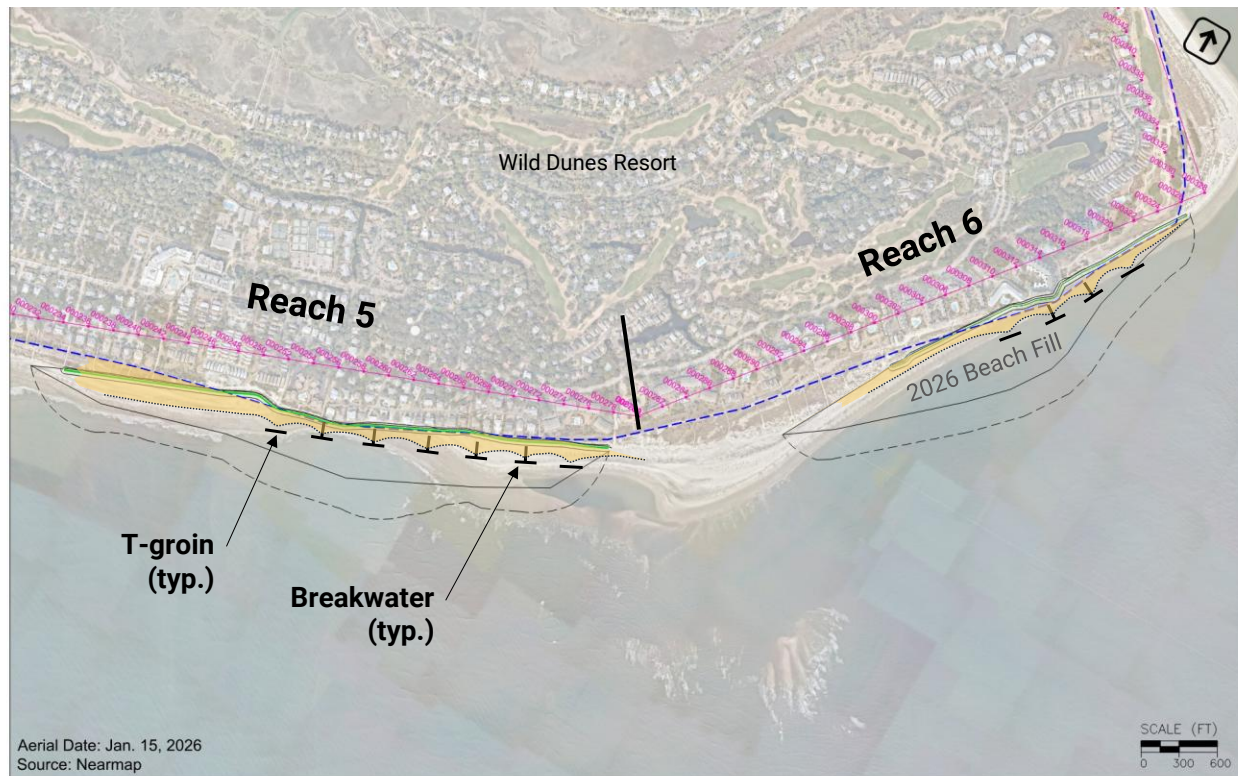


Figure 5-9: Conceptual structural stabilization alternative for Reaches 5 and 6 consisting of detached breakwaters, T-head groins, or a combination thereof. Structure locations and configurations are illustrative and intended solely to support planning-level evaluation of feasibility, benefits, and rough-order-of-magnitude costs.

5.4.3 Shore-Parallel Geotextile Tubes (Reaches 5 and 6).

This alternative consists of installing shore-parallel geotextile tubes within Reaches 5 and 6 to provide a last line of defense for upland infrastructure and anchor the shoreline near the study baseline under the most severely eroded conditions. The geotextile tubes would be implemented in conjunction with future beach nourishment projects and are intended to function as a shoreline stabilization measure when erosion has reduced beach widths to critically narrow conditions.

Unlike groins, breakwaters, or other sediment-retention structures, geotextile tubes are not intended to substantially alter sediment transport patterns, retain nourishment sand, or maintain a recreational beach seaward of the baseline condition. Rather, the tubes are intended to provide direct protection to upland infrastructure and limit further landward shoreline recession when beach nourishment alone is no longer sufficient to maintain the desired shoreline position.

The planning-level concept assumes that shore-parallel geotextile tubes would be installed along or immediately landward of the beach management baseline within shoreline segments

that have historically experienced persistent erosion and recurring losses of beach width between nourishment cycles. Future nourishment would still be required to maintain beach width and the recreational and environmental functions of the shoreline.

Because geotextile tubes are not intended to maintain a recreational beach under severely eroded conditions, beach access and usable beach width may be significantly reduced where the tubes become exposed. This alternative therefore prioritizes protection of upland infrastructure and maintenance of the baseline shoreline position rather than preservation of a recreational beach seaward of the baseline.

For purposes of this planning-level analysis, the conceptual geotextile tube system is assumed to include approximately 3,300 linear feet of shoreline protection within Reach 5 and approximately 1,700 linear feet within Reach 6, for a combined total protected shoreline length of approximately 5,000 feet. The actual requirements, should this be an alternative desired by the City, will be determined during detailed engineering and design analyses.

Figure 5-10 presents a conceptual planning-level representation of shore-parallel geotextile tubes within Reaches 5 and 6. The figure illustrates the general extent and potential application of the tubes in shoreline segments where recurring erosion may threaten upland infrastructure before future nourishment projects can be completed. The locations and configurations shown are illustrative only and do not represent a recommended design or final alignment.

The scope of this alternative includes planning-level engineering evaluations. Potential project components may include shore-parallel geotextile tubes, associated beach nourishment, anchoring and scour-protection measures, and long-term monitoring and maintenance activities. Subsequent engineering studies would be required to determine appropriate tube dimensions, crest elevations, alignments, burial depths, and construction methods.

For planning-level performance and lifecycle cost analyses, the geotextile tubes are assumed to provide shoreline stabilization and direct infrastructure protection but are not assumed to reduce the underlying sand-loss rates applied to future renourishment volumes. However, by limiting shoreline recession beyond the baseline condition, the tubes may reduce the risk of erosion-related impacts to upland infrastructure and provide additional flexibility in the timing of future renourishment projects. These potential benefits are conceptual and should be verified through detailed coastal-process analyses, numerical modeling, design development, and regulatory coordination.

The locations, configurations, performance assumptions, and quantities described herein are intended solely to support planning-level evaluations of feasibility, anticipated performance, constructability, permitting requirements, and rough-order-of-magnitude costs.

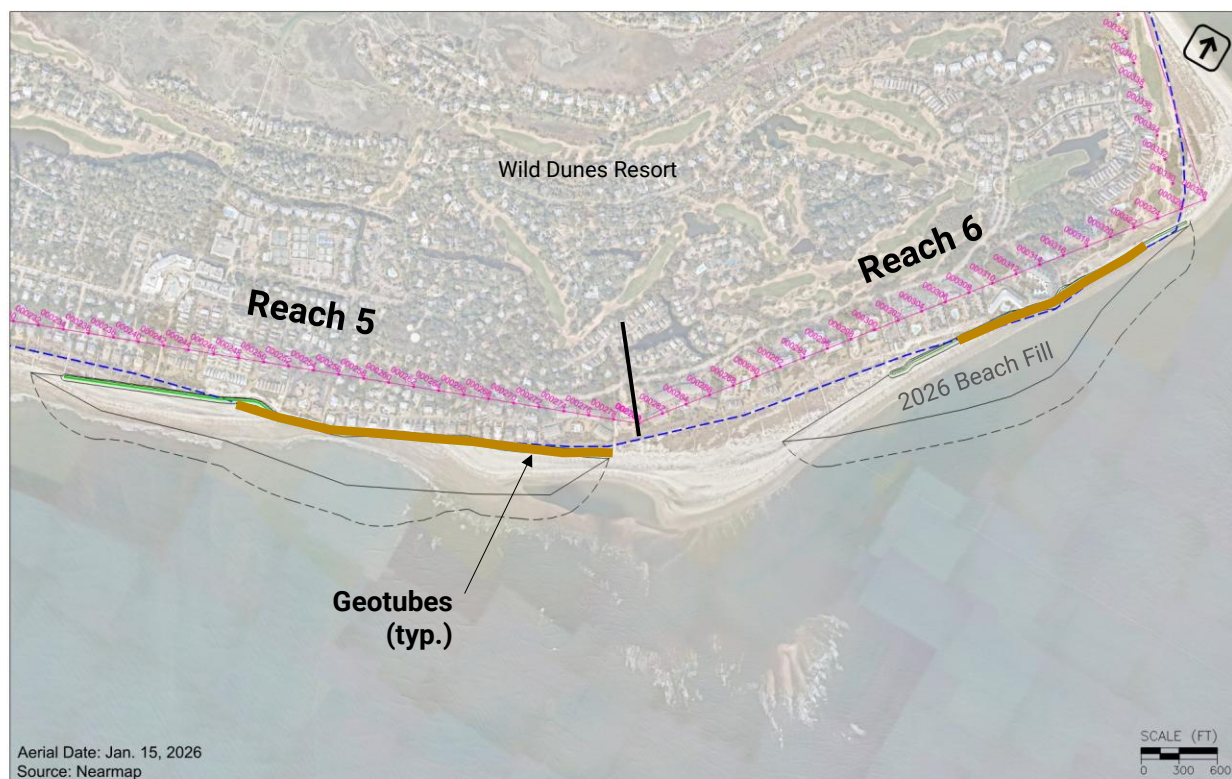


Figure 5-10: Conceptual shore-parallel geotextile tube alternative within Reaches 5 and 6. Tube locations and configurations are illustrative and intended solely to support planning-level evaluation of feasibility, benefits, and rough-order-of-magnitude costs.

6. Sand Sources

The long-term success and sustainability of the City's beach management program depend on the availability of compatible sand resources to support future nourishment needs. Beach nourishment remains an effective and adaptable strategy for maintaining beach width, storm damage reduction benefits, recreational value, and shoreline resilience. However, its continued implementation requires access to sufficient quantities of suitable (i.e., beach-compatible) and cost-effective sediment. As erosion continues and future renourishment cycles become necessary, the availability and preservation of offshore sand resources will become increasingly important to the long-term viability of the program. These resources provide the City with flexibility to address future shoreline losses, respond to storm impacts, and adapt to changing coastal conditions while minimizing reliance on potentially more costly or less desirable sand sources.

This section summarizes recent investigations conducted by Coastal Science & Engineering, Inc. (CSE, 2025) to identify and quantify offshore sand resources potentially available for future beach nourishment. The estimated available volume is compared with the projected sediment

needs of the City's beach management program over the 50-year planning period under the low- and high-loss-rate scenarios evaluated in this study.

Offshore investigations completed by CSE between 2024 and 2025 (CSE, 2025) identified five potential borrow areas encompassing approximately 1,320 acres and containing an estimated 25.6 million cubic yards (Mcy) of beach-quality sand (**Figure 6-1**). The investigation included bathymetric, geophysical, and geotechnical surveys; collection of 87 vibracores; and review of historical boring information. The results indicate that all five borrow areas contain beach-compatible sediment extending to a depth of at least 10 feet below the seafloor.

The combined borrow areas have an average grain size of approximately 0.269 millimeter (mm), compared with approximately 0.292 mm for the native beach sediment, and an average overfill factor (RA) of 1.8. This overfill factor indicates that approximately 1.8 cubic yards of borrow material may be required to provide the equivalent retained volume of 1.0 cubic yard of native beach sediment. Because the borrow material is somewhat finer than the native sediment, it may be more susceptible to erosion and transport, particularly in shoreline areas already subject to elevated erosional stress. Consequently, the placed borrow material may be lost more rapidly than the native beach sediment, which could reduce nourishment longevity and increase future sand demand. This potential should be considered when evaluating expected project performance and the long-term adequacy of the identified offshore resources. Accordingly, the high sand-loss rates evaluated in this study, as well as the possibility of still higher future rates, should not be dismissed as potential future conditions.

Borrow Areas 1 and 5 contain the largest estimated sand volumes, approximately 10.5 Mcy and 10.1 Mcy, respectively. Borrow Areas 2 through 4 collectively contain approximately 5.0 Mcy. Together, the five identified offshore borrow areas provide a substantial sediment reserve capable of supporting multiple future renourishment projects. The extent to which these resources can support the City's long-term beach management program will depend on future erosion rates, nourishment design requirements, sediment performance, storm-related losses, and the availability of supplemental sand sources.

Offshore Sand Resource Sufficiency. In addition to evaluating project costs, it is important to consider the long-term availability of beach-compatible sand resources needed to support future nourishment activities. Offshore investigations completed between 2024 and 2025 identified approximately 25.6 million cubic yards (Mcy) of beach-quality sand within Offshore Borrow Areas 1 through 5. These offshore resources represent the primary long-term sediment source available to support future beach management activities at Isle of Palms.

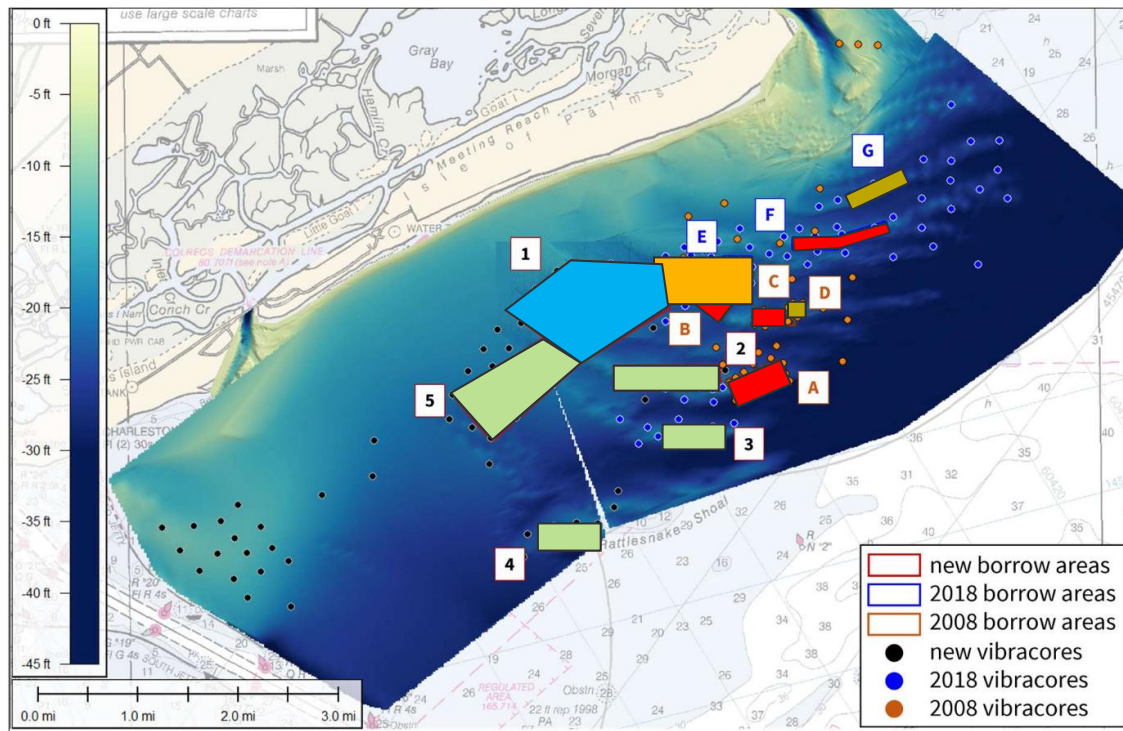


Figure 6-1: Previous and future sand sources identified by CSE.

The volume-change analyses presented in **Section 4.2** indicate that Reaches 1, 2, 5, and 6 currently experience combined net sediment losses ranging from approximately 303,000 cubic yards per year (cy/yr) under the low-loss-rate scenario to approximately 391,000 cy/yr under the high-loss-rate scenario. Assuming these losses are replaced through future nourishment activities and not considering textural differences between native beach and borrow area sediment (i.e., overfill), the cumulative sand demand over a 50-year planning horizon would range from approximately 15.2 Mcy under the low-loss-rate scenario to approximately 19.6 Mcy under the high-loss-rate scenario (**Table 6-1**).

These estimates represent the quantity of sand required to offset documented shoreline losses and maintain existing beach conditions. Additional sand volumes may be required to restore shoreline deficits, construct advance nourishment templates, support shoreline stabilization projects, compensate for storm-related losses, or accommodate future increases in erosion associated with sea level rise. Consequently, actual sand demand over the 50-year planning horizon could exceed these estimates.

Table 6-1: Summary of the estimated 50-year sand demand relative to the currently identified offshore sand resource.

Scenario	Annual Demand on Offshore Sand (cy/yr)	50-Year Demand on Offshore Sand (Mcy)	Percent of 25.6 Mcy Resource
Low Loss Rate	303,200	15.2	59%
High Loss Rate	391,300	19.6	76%
Low Loss Rate with Supplemental Sources	153,200	7.7	30%
High Loss Rate with Supplemental Sources	241,300	12.1	47%

A comparison between the estimated offshore sand inventory and projected nourishment demand indicates that the currently identified offshore borrow areas contain sufficient sediment to support nourishment activities over the 50-year planning horizon under both the low- and high-loss-rate scenarios. However, under the high-loss-rate scenario, approximately 76 percent of the currently identified offshore sand resource would be consumed over the planning period, leaving a relatively limited remaining reserve. In contrast, the low-loss-rate scenario would consume approximately 59 percent of the identified offshore resource.

The supplemental sand-source alternatives evaluated in this study, including Dewees Inlet shoal management and beneficial use of AICWW maintenance dredging material, could reduce the demand on offshore borrow areas. Collectively, these sources are assumed to provide approximately 150,000 cy/yr of supplemental sand, equivalent to approximately 7.5 Mcy over the 50-year planning horizon. If these sources become available, the demand on offshore borrow areas would be reduced proportionally, extending the useful life of the identified offshore sand resource and improving the long-term sustainability of the City's beach nourishment program.

Overall, the analysis indicates that offshore sand availability is unlikely to be a limiting factor over the next 50 years assuming that all available offshore sand is suitable for placement along the Isle of Palms shoreline. However, preserving offshore resources through beneficial use of inlet-derived sediment and other supplemental sand sources could significantly improve the long-term sustainability and cost-effectiveness of future beach management efforts.

7. Cost Analysis

This section presents a comparative engineering cost analysis of the beach management alternatives developed for the City of Isle of Palms. The alternatives evaluated in this study include a range of beach restoration and nourishment strategies, structural erosion control measures such as groins and detached breakwaters, and hybrid alternatives that combine beach nourishment with coastal structures. The purpose of this analysis is to provide a consistent economic framework for comparing the relative costs and long-term financial commitments associated with each management approach.

The cost estimates presented herein are appropriate for a planning-level alternatives analysis and are intended to support comparison of alternatives rather than final budgeting or project implementation. As such, the estimates should be considered order-of-magnitude values based on conceptual-level designs, generalized construction assumptions, current market conditions, and professional engineering judgment. Actual project costs will depend on final design requirements, permitting conditions, material availability, contractor pricing, regulatory requirements, and future economic conditions.

The engineering cost analysis considers both initial implementation costs and long-term lifecycle costs over the study planning horizon. Initial implementation costs include construction, engineering and permitting, construction administration, environmental monitoring, and contingency allowances. Long-term costs account for anticipated maintenance requirements, periodic renourishment needs, monitoring, and replacement or rehabilitation of structural components where applicable. Evaluating both initial and future expenditures provides a more complete understanding of the financial implications associated with each beach management strategy.

For beach nourishment alternatives, the cost analysis includes dredging, transport, and placement of compatible beach-quality sand, as well as the recurring costs associated with future maintenance nourishment projects required to offset ongoing erosion and storm-related sediment losses. Structural alternatives, including a terminal groin in Reach 1 and T-head groins and/or detached breakwaters within Reaches 5 and 6, are evaluated based on anticipated construction costs, expected service life, periodic maintenance requirements, and any associated beach nourishment necessary to establish or maintain desired shoreline conditions. Hybrid alternatives combine both nourishment and structural components and are evaluated using the corresponding cost and performance assumptions of each. In addition, a shore-parallel geotextile tube system is evaluated as an alternative to the T-head groin and breakwater concepts within Reaches 5 and 6.

Cost estimates for future nourishment projects are based primarily on a recent proposal submitted to the City of Isle of Palms by Marinex Construction, Inc. of Charleston, South

Carolina, for mobilization and beach fill placement utilizing the identified offshore borrow areas. The proposal provides a practical and project-specific basis for estimating future nourishment costs. Actual construction costs will be influenced by a variety of factors, including fuel prices, market conditions, environmental restrictions, and the availability of dredging equipment at the time of construction. Equipment availability may represent a particularly important consideration, as future project scheduling may conflict with environmental windows and tourism-related constraints. Despite these uncertainties, the Marinex proposal represents a potentially valuable opportunity and serves as the foundation for the nourishment cost assumptions used throughout this analysis. The principal components of the proposal are summarized in the following section.

Cost estimates for the terminal groin, T-head groins, detached breakwaters, and geotextile tube alternatives were developed using recent bid tabulations from comparable regional coastal projects, available market data, industry-standard estimating practices, and professional engineering judgment. Major cost components include construction, Planning, Engineering, and Design (PED), permitting, Construction Engineering and Inspection (CEI), environmental monitoring, and contingency allowances. Unit costs for sand placement, coastal structure construction, maintenance activities, and related project elements reflect current industry conditions and are intended to provide a consistent basis for comparing alternatives on a planning-level basis in addition to direct construction costs, the analysis recognizes the influence of environmental permitting, resource protection requirements, and long-term project stewardship obligations. Depending on the selected alternative, costs may also be associated with environmental mitigation, monitoring, adaptive management, and regulatory compliance measures. These considerations are incorporated at a planning level to provide a realistic assessment of the total costs likely to be incurred throughout the life of each alternative.

The findings presented in this chapter are intended to support the broader alternatives evaluation process by comparing the economic implications of each management strategy. The cost analysis should be considered alongside assessments of engineering performance, risk reduction benefits, environmental impacts, constructability, resilience, and community objectives. Collectively, these factors will assist the City of Isle of Palms in identifying a sustainable and cost-effective long-term approach for managing shoreline erosion and maintaining the recreational, ecological, and protective functions of the beach system.

7.1 Cost Assumptions and Unit Costs

The cost estimates developed for this study are based on conceptual-level designs of each alternative. Unit costs and estimating assumptions were developed using recent coastal construction bid tabulations, published construction cost data, recent project experience, and professional engineering judgment. Costs reflect current market conditions and are intended to provide a consistent basis for evaluating the relative economic performance of each alternative.

Given the long-term planning horizon of the study, actual implementation costs may vary due to future market fluctuations, material availability, contractor competition, permitting requirements, environmental compliance measures, and project-specific design considerations.

The alternatives evaluated in this study include beach restoration through periodic nourishment, structural erosion control measures such as groins and detached breakwaters, and hybrid alternatives that combine beach nourishment with coastal structures. As a result, the cost analysis incorporates estimates for dredging and beach fill placement, rock structure construction (including foundation preparation), engineering and permitting, construction oversight, monitoring, and contingency allowances.

For nourishment-based alternatives, beach-compatible sand is assumed to be obtained from offshore borrow areas and hydraulically placed along the shoreline. A dredge mobilization and demobilization cost of \$1.5 million per event is assumed for projects requiring offshore dredging operations. Beach fill costs, including excavation, transport, and placement, are estimated at \$9 per cubic yard of material placed. These values are consistent with the proposal submitted by Marinex Construction, Inc. to the City of Isle of Palms (personal communication with Mr. Douglas Kerr). For alternatives requiring periodic renourishment, future nourishment volumes and associated mobilization costs are incorporated into the lifecycle cost analysis.

For the Dewees Inlet Shoal Management alternative, it is assumed that dredging equipment like that used for offshore borrow area operations would be utilized. However, due to the proximity of the shoal to both the placement area and the sheltered waters of Dewees Inlet, reduced mobilization requirements, shorter pumping distances, and improved operating conditions are anticipated compared to offshore dredging operations. Accordingly, a dredge mobilization and demobilization cost of \$1.0 million per event is assumed. Beach fill costs, including excavation, transport, and placement, are estimated at \$7.50 per cubic yard of material placed.

Structural alternatives, including groins and detached breakwaters, are estimated using conceptual designs developed as part of this study. Construction costs are based on an assumed unit cost of \$275 per ton of armor stone furnished and placed, which is consistent with recent rock structure project costs in South Carolina and North Carolina. This unit cost represents an all-inclusive construction cost for complete, riprap coastal structures and includes mobilization and demobilization, foundation preparation, stone procurement, placement, equipment, labor, and associated construction activities.

Because the geotextile tube alternative differs substantially from conventional stone structures, separate unit costs and quantity assumptions were developed specifically for that alternative based on recent project experience, available market information, and professional engineering judgment.

In addition to direct construction costs, the analysis includes allowances for project development, permitting, regulatory compliance, construction administration, and construction-phase monitoring. Consistent with industry practice, Planning, Engineering, and Design (PED) and permitting costs are estimated as 5 percent of construction costs, while Construction Engineering and Inspection (CEI) and monitoring costs are estimated as 7 percent of construction costs. A 10 percent contingency is applied to account for uncertainties associated with conceptual-level designs, future market conditions, quantity assumptions, and construction means and methods. These percentage-based allowances are intended to provide a realistic planning-level estimate of total project costs and are applied consistently across all alternatives.

The principal unit costs and cost factors applied throughout the engineering cost analysis are summarized in **Table 7-1**. These assumptions provide a uniform basis for comparing nourishment-only, structural, and hybrid alternatives and evaluating their relative costs over the 50-year planning horizon considered in this study. The resulting lifecycle cost and Average Annual Equivalent Cost (AAEC) analyses provide a consistent framework for evaluating the long-term financial implications of each beach management strategy.

Table 7-1: Summary of assumed unit process for cost analysis.

Cost Elements	Assumed Unit Cost	Units
Offshore Sand for Beach Renourishment		
Mobilization	\$ 1,500,000	/event
Sand	\$ 9.00	/cy (in-place)
Deweese Inlet Shoal Management Sand		
Mobilization	\$ 1,000,000	/event
Sand	\$ 7.50	/cy (in-place)
Terminal Groin and T-Groins/Breakwaters		
Rip-Rap	\$ 275	/ton (all-in)
Professional Services		
PED/Permitting	5.0%	of total construction cost
CEI/Monitoring	7.0%	of total construction cost
Contingency		
Contingency	10.0%	of total project cost

7.2 Average Annual Equivalent Costs (AAEC)

To provide a consistent economic comparison among alternatives with different implementation schedules, maintenance requirements, and service lives, this study evaluates both total 50-year lifecycle cost and Average Annual Equivalent Cost (AAEC). The lifecycle cost represents the cumulative cost of initial construction, periodic beach nourishment, structural maintenance, monitoring, permitting, and other anticipated expenditures over the 50-year analysis period. However, because lifecycle cost does not account for when expenditures occur, AAEC is also calculated to incorporate the time value of money and convert the lifecycle expenditures associated with each alternative into an equivalent annual cost.

The AAEC methodology allows alternatives involving recurring nourishment activities to be compared directly with alternatives requiring larger initial investments, such as groins, detached breakwaters, geotextile tubes, or hybrid nourishment and structural systems. Together, lifecycle cost and AAEC provide complementary measures of the long-term financial commitment associated with each beach management strategy.

Fourteen beach management alternatives were developed for comparison, ranging from periodic beach nourishment using offshore borrow material at 5-, 7-, and 10-year intervals to more comprehensive management strategies incorporating supplemental sand sources and shore-stabilizing structures. Each alternative was evaluated under the low and high sand-loss-rate scenarios described in **Section 4.2**. As summarized in **Table 7-2**, Alternatives 1 through 8 consist solely of beach nourishment using sand from offshore borrow areas. The remaining alternatives evaluate the use of supplemental sand from AICWW maintenance dredging or Dewees Inlet shoal management, as well as structural measures including a terminal groin, detached breakwaters, and shore-parallel geotextile tubes in combination with periodic nourishment. These alternatives were evaluated only for the 7-year nourishment interval, which was subsequently determined to be the most cost-effective beach nourishment frequency considered in this study.

The most comprehensive alternative consists of periodic beach renourishment using offshore borrow material on a 7-year cycle, supplemented by sand obtained through the Dewees Inlet Shoal Management Program and the beneficial use of material generated by Breach Inlet AICWW maintenance dredging. Structural components include a terminal groin at the southern end of Isle of Palms and a series of T-head groins and detached breakwaters within Reaches 5 and 6.

Alternative 13 is presented as an example of the cost-development and AAEC methodology. This alternative is based on the low sand-loss-rate scenario and includes periodic beach renourishment using offshore borrow material on a 7-year cycle, supplemental sand from Dewees Inlet shoal management and Breach Inlet AICWW maintenance dredging, a terminal

groin within Reach 1, and T-head groins and detached breakwaters within Reaches 5 and 6. The anticipated project elements and associated costs over the 50-year analysis period are presented in **Table 7-3**.

Table 7-2: Summary of the fourteen project alternatives evaluated for intercomparison using the Average Annual Equivalent Cost (AAEC) analysis.

AAEC Alternatives	
Renourishment Only - Scheduled Interval - Offshore Sand Only	
1	5-Yr Interval (Low Sand Loss Rate)
2	5-Yr Interval (High Sand Loss Rate)
3	7-Yr interval (Low Sand Loss Rate)
4	7-Yr Interval (High Sand Loss Rate)
5	10-Yr Interval (Low Sand Loss Rate)
6	10-Yr Interval (High Sand Loss Rate)
Renourishment Only - Triggered Interval - Offshore Sand Only	
7	3-Yr Interval (Low Sand Loss Rate)
8	1-Yr Interval (High Sand Loss Rate)
Renourishment - Scheduled Interval Offshore Sand with Supplemental Sand (Breach Inlet AICWW and Dewees Inlet Shoal Mgt)	
9	7-Yr Interval (Low Sand Loss Rate)
10	7-Yr Interval (High Sand Loss Rate)
Renourishment - Scheduled Interval Offshore Sand with Supplemental Sand & Terminal Groin (Rch 1)	
11	7-Yr Interval (Low Sand Loss Rate)
12	7-Yr Interval (High Sand Loss Rate)
Renourishment - Scheduled Interval Offshore Sand with Supplemental Sand & Terminal Groin (Rch 1) & T-Groins/Breakwaters (Rch 5 & 6)	
13	7-Yr Interval (Low Sand Loss Rate)
14	7-Yr Interval (High Sand Loss Rate)

Table 7-4 presents the computational details used to determine the AAEC for Alternative 13. Project expenditures are assigned to the years in which the associated construction, nourishment, maintenance, monitoring, or other activities are anticipated to occur. The cost of the 2026 Beach Renourishment Project is treated as a sunk cost and is therefore excluded from the evaluation of future financial commitments since the expenditure has already occurred.

Future costs are escalated from present-day values using an assumed annual inflation rate of 2.5 percent. The escalated expenditures are then discounted to present value using an annual discount rate of 3.25 percent, consistent with applicable 2026 USACE planning guidance. The resulting present value is converted to an equivalent uniform annual cost over the 50-year analysis period. The same methodology and economic assumptions are applied consistently to all alternatives to support an equitable comparison of their long-term financial requirements.

Table 7-5 summarizes the project costs and AAEC for the 14 alternatives. Among the nourishment-only alternatives using offshore sand, the 7-year interval is the most cost-effective of the fixed intervals evaluated. The corresponding AAEC is approximately \$6.21 million under the low sand-loss-rate scenario and \$8.28 million under the high sand-loss-rate scenario. The baseline-trigger alternatives (i.e., 7 & 8) do not reduce AAEC because the more frequent projects increase mobilization and implementation costs; however, they provide the greatest assurance that the minimum beach condition will be maintained following the 2026 project.

Supplemental sand from Dewees Inlet shoal management and Breach Inlet AICWW maintenance dredging improves cost-effectiveness by reducing the quantity of offshore borrow material required. The analysis assumes that beach-compatible AICWW material is available to the City at no cost and that Dewees Inlet sand can be obtained at a lower unit cost than offshore sand. Under these assumptions, Alternatives 9 and 10 have estimated AAEC values of approximately \$5.27 million and \$7.34 million under the low and high sand-loss-rate scenarios, respectively. These values are approximately 15 percent and 11 percent lower than the corresponding 7-year nourishment-only alternatives. Potential benefits of Dewees Inlet shoal management beyond lower-cost sand, including possible reductions in shoal-induced erosion, were not credited in the cost analysis.

Alternatives 11 and 12 combine the 7-year nourishment cycle and both supplemental sand sources with a terminal groin at the southern end of Reach 1. Alternative 11 applies the low sand-loss-rate scenario and has an estimated AAEC of approximately \$5.25 million. Alternative 12 applies the high sand-loss-rate scenario and has an estimated AAEC of approximately \$6.25 million. In both cases, the assumed reductions in sand losses within Reaches 1 and 2 offset the terminal groin's initial capital and maintenance costs, making these alternatives the lowest-cost approaches evaluated under their respective sand-loss-rate scenarios. The cost-effectiveness of these alternatives depends on the assumed performance of the terminal groin and continued availability of supplemental sand from Dewees Inlet shoal management and Breach Inlet AICWW maintenance dredging.

Table 7-3: Example cost development for **Alternative 13** that consists of periodic beach renourishment utilizing an offshore borrow area every seven years, supplemental sand placement from the Dewees Inlet Shoal Management Program and Breach Inlet ICWW beneficial use dredged material, a terminal groin at the southern end of each island, and a series of T-groins and detached breakwaters along Reaches 5 and 6.

Restore Baseline and Replace Advance Fill with First Renourishment				
Item	Quantity	Unit Cost	Units	Total
Dredge Mob/Demob	1	\$ 1,500,000.00	LS	\$ 1,500,000.00
Sand	1,227,000	\$ 9.00	cy	\$ 11,043,000.00
subtotal Construction				\$ 12,543,000.00
PED/Permitting			5%	\$ 627,150.00
CEI/Monitoring			7%	\$ 878,010.00
subtotal Project				\$ 14,048,160.00
Contingency			10%	\$ 1,404,816.00
Total				\$ 15,452,976.00
Future Maintenance (Normal Advance Fill after First Renourishment)				
Item	Quantity	Unit Cost	Units	Total
Dredge Mob/Demob	1	\$ 1,500,000.00	LS	\$ 1,500,000.00
Sand	1,008,000	\$ 9.00	cy	\$ 9,072,000.00
subtotal Construction				\$ 10,572,000.00
PED/Permitting			5%	\$ 528,600.00
CEI/Monitoring			7%	\$ 740,040.00
subtotal Project				\$ 11,840,640.00
Contingency			10%	\$ 1,184,064.00
Total				\$ 13,024,704.00
Dewees Shoal Dredging				
Item	Quantity	Unit Cost	Units	Total
Dredge Mob/Demob	1	\$ 1,000,000.00	LS	\$ 1,000,000.00
Sand	700,000	\$ 7.50	cy	\$ 5,250,000.00
subtotal Construction				\$ 6,250,000.00
PED/Permitting			5%	\$ 312,500.00
CEI/Monitoring			7%	\$ 437,500.00
subtotal Project				\$ 7,000,000.00
Contingency			10%	\$ 700,000.00
Total				\$ 7,700,000.00
Terminal Groin (Reach 1)				
Item	Quantity	Unit Cost	Units	Total
Terminal Groin	15,000	\$ 275.00	tons	\$ 4,125,000.00
subtotal Construction				\$ 4,125,000.00
PED/Permitting			5%	\$ 206,250.00
CEI/Monitoring			7%	\$ 288,750.00
subtotal Project				\$ 4,620,000.00
Contingency			10%	\$ 462,000.00
Total				\$ 5,082,000.00
T-Groins/Breakwaters (Reaches 5 and 6)				
Item	Quantity	Unit Cost	Units	Total
Breakwaters	6,400	\$ 275.00	tons	\$ 1,760,000.00
T-groins	19,600	\$ 275.00	tons	\$ 5,390,000.00
subtotal Construction				\$ 7,150,000.00
PED/Permitting			5%	\$ 357,500.00
CEI/Monitoring			7%	\$ 500,500.00
subtotal Project				\$ 8,008,000.00
Contingency			10%	\$ 800,800.00
Total				\$ 8,808,800.00

Table 7-4: Details for computation of the Average Annual Equivalent Cost (AAEC) for **Alternative 13** detailed in **Table 7-3**.

Year	Base Costs						Escalated Costs					Present Worth				
	Total Cost	Renourishment (Offshore Sand)	Terminal Groin (Reach 1)	T-Groins/ Breakwaters (Reaches 5 & 6)	Dewees Shoal Mgt	Cost Escalation Factor	Renourishment (Offshore Sand)	Terminal Groin (Reach 1)	T-Groins/ Breakwaters (Reaches 5 & 6)	Dewees Shoal Mgt		Renourishment (Offshore Sand)	Terminal Groin (Reach 1)	T-Groins/ Breakwaters (Reaches 5 & 6)	Dewees Shoal Mgt	Present Worth Cost
0	2026	\$ -	\$ -	\$ -	\$ -	1260.04	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
1	2027	\$ -	\$ -	\$ -	\$ -	1292.80	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
2	2028	\$ 5,082,000	\$ -	\$ 5,082,000		1326.42	\$ -	\$ 5,349,724	\$ -	\$ -		\$ -	\$ 5,018,200	\$ -	\$ -	\$ 5,018,200
3	2029	\$ 8,808,800	\$ -	\$ 8,808,800		1360.90	\$ -	\$ -	\$ 9,513,901	\$ -		\$ -	\$ -	\$ 8,643,500	\$ -	\$ 8,643,500
4	2030	\$ -	\$ -			1396.29	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
5	2031	\$ -	\$ -			1432.59	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
6	2032	\$ -	\$ -			1469.84	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
7	2033	\$ 23,152,976	\$ 15,452,976		\$ 7,700,000	1508.05	\$ 18,494,540	\$ -	\$ -	\$ 9,215,569		\$ 14,784,700	\$ -	\$ -	\$ 7,367,000	\$ 22,151,700
8	2034	\$ -	\$ -			1547.25	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
9	2035	\$ -	\$ -			1587.49	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
10	2036	\$ -	\$ -			1628.77	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
11	2037	\$ -	\$ -			1671.12	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
12	2038	\$ -	\$ -			1714.56	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
13	2039	\$ -	\$ -			1759.14	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
14	2040	\$ 20,724,704	\$ 13,024,704		\$ 7,700,000	1804.88	\$ 18,656,573	\$ -	\$ -	\$ 11,029,472		\$ 11,922,600	\$ -	\$ -	\$ 7,048,500	\$ 18,971,100
15	2041	\$ -	\$ -			1851.81	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
16	2042	\$ -	\$ -			1899.96	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
17	2043	\$ -	\$ -			1949.35	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
18	2044	\$ -	\$ -			2000.04	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
19	2045	\$ -	\$ -			2052.04	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
20	2046	\$ -	\$ -			2105.38	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
21	2047	\$ 20,724,704	\$ 13,024,704		\$ 7,700,000	2160.13	\$ 22,328,699	\$ -	\$ -	\$ 13,200,375		\$ 11,407,000	\$ -	\$ -	\$ 6,743,600	\$ 18,150,600
22	2048	\$ -	\$ -			2216.29	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
23	2049	\$ -	\$ -			2273.92	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
24	2050	\$ -	\$ -			2333.04	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
25	2051	\$ -	\$ -			2393.70	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
26	2052	\$ -	\$ -			2455.94	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
27	2053	\$ -	\$ -			2519.79	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
28	2054	\$ 20,724,704	\$ 13,024,704		\$ 7,700,000	2585.30	\$ 26,723,570	\$ -	\$ -	\$ 15,798,554		\$ 10,913,700	\$ -	\$ -	\$ 6,452,000	\$ 17,365,700
29	2055	\$ -	\$ -			2652.52	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
30	2056	\$ -	\$ -			2719.73	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
31	2057	\$ -	\$ -			2788.65	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
32	2058	\$ -	\$ -			2859.31	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
33	2059	\$ -	\$ -			2931.77	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
34	2060	\$ -	\$ -			3006.06	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
35	2061	\$ 20,724,704	\$ 13,024,704		\$ 7,700,000	3082.23	\$ 31,860,172	\$ -	\$ -	\$ 18,835,232		\$ 10,401,500	\$ -	\$ -	\$ 6,149,200	\$ 16,550,700
36	2062	\$ -	\$ -			3160.33	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
37	2063	\$ -	\$ -			3240.41	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
38	2064	\$ -	\$ -			3322.52	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
39	2065	\$ -	\$ -			3406.71	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
40	2066	\$ -	\$ -			3493.03	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
41	2067	\$ -	\$ -			3581.55	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
42	2068	\$ 20,724,704	\$ 13,024,704		\$ 7,700,000	3672.36	\$ 37,959,606	\$ -	\$ -	\$ 22,441,122		\$ 9,906,900	\$ -	\$ -	\$ 5,856,800	\$ 15,763,700
43	2069	\$ -	\$ -			3765.35	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
44	2070	\$ -	\$ -			3860.77	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
45	2071	\$ -	\$ -			3958.60	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
46	2072	\$ -	\$ -			4058.90	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
47	2073	\$ -	\$ -			4161.75	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
48	2074	\$ -	\$ -			4267.21	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
49	2075	\$ 20,724,704	\$ 13,024,704		\$ 7,700,000	4375.34	\$ 45,226,739	\$ -	\$ -	\$ 26,737,337		\$ 9,435,900	\$ -	\$ -	\$ 5,578,300	\$ 15,014,200
50	2076	\$ -	\$ -			4486.21	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -
Total Present Worth												\$ 78,772,300	\$ 5,018,200	\$ 8,643,500	\$ 45,195,400	\$ 137,629,400
Discount Rate												3.25%	3.25%	3.25%	3.25%	3.25%
Amortization Period (years)												50	50	50	50	50
Capital Recovery Factor												0.04073	0.04073	0.04073	0.04073	0.04073
Avg Annual Equivalent Cost												\$ 3,208,400	\$ 204,400	\$ 352,100	\$ 1,840,800	\$ 5,605,700

Alternatives 13 and 14 incorporate the full suite of management measures evaluated, including 7-year nourishment, both supplemental sand sources, a terminal groin in Reach 1, and T-head groins and detached breakwaters in Reaches 5 and 6. The northern structures provide a last line of defense for upland infrastructure and may improve beach access and use compared with geotextile tubes. For this analysis, however, they are not assumed to reduce sand-loss rates in Reaches 5 and 6. Their initial capital cost is therefore not offset by a modeled reduction in long-term sand demand. The resulting AAEC is approximately \$5.61 million under the low sand-loss-rate scenario and \$7.69 million under the high sand-loss-rate scenario.

Table 7-5: Summary of Project Costs and Average Annual Equivalent Costs for the Fourteen Beach Management Alternatives.

Alternative		"First" Renourishment after 2026 Project (\$)	Future Renourishments after "First" (\$)	Dewees Inlet Shoal Mgt (every 7 years) (\$)	Breach Inlet AICWW Beach Disposal (every 3 years) (\$)	Terminal Groin (Rch 1) (\$)	T-Groins/ Breakwater (Rch 5/6) (\$)	Average Annual Equivalent Cost (AAEC) (\$/yr)
Renourishment Only - Scheduled Interval - Offshore Sand								
1	5-Yr Interval (Low)	\$ 19,917,005	\$ 18,652,973	\$ -	\$ -	\$ -	\$ -	\$ 6,442,200
2	5-Yr Interval (High)	\$ 29,318,520	\$ 24,020,674	\$ -	\$ -	\$ -	\$ -	\$ 8,440,800
3	7-Yr interval (Low)	\$ 29,024,688	\$ 25,374,518	\$ -	\$ -	\$ -	\$ -	\$ 6,208,500
4	7-Yr Interval (High)	\$ 43,651,978	\$ 32,889,965	\$ -	\$ -	\$ -	\$ -	\$ 8,282,300
5	10-Yr Interval (Low)	\$ 45,428,275	\$ 35,459,054	\$ -	\$ -	\$ -	\$ -	\$ 6,357,200
6	10-Yr Interval (High)	\$ 68,244,053	\$ 46,194,456	\$ -	\$ -	\$ -	\$ -	\$ 8,628,400
Renourishment Only - Triggered Interval - Offshore Sand								
7	3-Yr Interval (Low)	\$ 12,154,296	\$ 11,931,427	\$ -	\$ -	\$ -	\$ -	\$ 6,636,500
8	1-Yr Interval (High)	\$ 6,395,189	\$ 6,284,309	\$ -	\$ -	\$ -	\$ -	\$ 10,915,400
Renourishment - Scheduled Interval - Offshore Sand / Supplemental Sand (Breach Inlet AICWW and Dewees Inlet Shoal Mgt)								
9	7-Yr Interval (Low)	17,382,288	\$ 13,732,118	\$ 7,700,000	\$ -	\$ -	\$ -	\$ 5,266,000
10	7-Yr Interval (High)	32,009,578	\$ 21,247,565	\$ 7,700,000	\$ -	\$ -	\$ -	\$ 7,339,800
Renourishment - Scheduled Interval - Offshore Sand / Supplemental Sand & Terminal Groin (Rch 1)								
11	7-Yr Interval (Low)	15,452,976	\$ 13,024,704	\$ 7,700,000	\$ -	\$ 5,082,000	\$ -	\$ 5,253,600
12	7-Yr Interval (High)	24,750,541	\$ 16,206,960	\$ 7,700,000	\$ -	\$ 5,082,000	\$ -	\$ 6,252,700
Renourishment - Scheduled Interval - Offshore Sand / Supplemental Sand / Terminal Groin (Rch 1) & T-Groins/Breakwaters (Rch 5 & 6)								
13	7-Yr Interval (Low)	15,452,976	\$ 13,024,704	\$ 7,700,000	\$ -	\$ 5,082,000	\$ 8,808,800	\$ 5,605,700
14	7-Yr Interval (High)	24,750,541	\$ 16,206,960	\$ 7,700,000	\$ -	\$ 5,082,000	\$ 8,808,800	\$ 7,687,800

Cost Analysis Summary. The lowest cost approach evaluated is Alternative 11 under the low sand-loss-rate scenario, with an estimated AAEC of approximately \$5.25 million. This alternative combines 7-year offshore nourishment with supplemental sand from Dewees Inlet shoal management and Breach Inlet AICWW maintenance dredging and adds a terminal groin at the southern end of Reach 1. Its cost advantage results primarily from maximizing lower-cost or no-cost supplemental sediment and reducing modeled sand losses in Reaches 1 and 2 sufficiently to offset the terminal groin's initial capital cost. Under the high sand-loss-rate scenario, the corresponding terminal-groin alternative has an estimated AAEC of approximately \$6.25 million and remains the lowest-cost approach identified for that scenario. These results indicate that the most cost-effective long-term strategy is not nourishment alone, but a combined program that uses a 7-year nourishment cycle, maximizes supplemental sand sources, and applies a terminal groin where the assumed reduction in sediment losses provides a measurable lifecycle benefit. The findings remain planning-level and are sensitive to future sand availability, unit costs, erosion rates, and the assumed performance of the terminal groin.

8. Regulatory Considerations

As part of this alternatives analysis, Foth conducted discussions with representatives from the USACE Charleston District and the SCDES to evaluate the permitting, regulatory, and implementation considerations associated with the beach management alternatives evaluated herein. These discussions were intended to identify regulatory constraints, assess preliminary agency perspectives regarding permitability, and evaluate the practical feasibility of these management alternatives considered for Isle of Palms. The discussions do not imply agency approval of any specific alternative; however, they provide useful insight regarding the relative feasibility of future permitting and implementation efforts.

Discussions with USACE and SCDES focused primarily on proactive shoal management at the north end of the island, the use of shore-stabilizing structures, and potential opportunities for maintenance-style permitting. Both agencies were briefed on the recurring erosion challenges associated with the Dewees Inlet shoal attachment cycle and the concept of implementing more proactive management measures intended to reduce the adverse effects caused by approaching shoals. The agencies generally acknowledged the challenges presented by the shoal attachment process and recognized that the timing and occurrence of future shoal events are inherently difficult to predict.

8.1 Proactive Shoal Management

A principal management concept evaluated under this study is proactive shoal management along Reaches 5 and 6. This builds upon earlier concepts developed through the Second Opinion Memorandum, which recommended exploring methods to manipulate approaching shoals before they induce severe localized erosion through wave focusing along the island's north end (Foth, 2025). Potential approaches include dredging portions of the shoal prior to attachment, creating a designated offshore sand-trap or management area, and placing excavated material directly along vulnerable shoreline segments. The objective would be twofold: accelerate the delivery of shoal sand to the beach while also reducing the erosional impacts associated with the shoal attachment cycle.

Discussions with USACE suggested that such an approach may be permissible and that a maintenance-style authorization could potentially be formulated that would allow multiple shoal management dredging events to occur under a single permit. USACE personnel indicated that similar, multi-event authorizations may exist elsewhere within the Charleston District. USACE noted that permit durations within the Charleston District generally do not exceed ten years but could potentially authorize multiple dredging events within the permit lifespan, in lieu of a typical single-event permit. Additional considerations identified by the Corps include potential ESA

consultation requirements and the possible need for offshore hardbottom surveys depending upon the final project configuration.

Discussions with SCDES were similarly encouraging. State representatives indicated that South Carolina has previously issued permits that authorize multiple construction events under a single permit, provided that total project volumes and event limitations are defined in advance. SCDES indicated that proactive shoal management would generally be reviewed in a manner consistent with an offshore borrow area dredging project and noted that recent programmatic biological opinions may streamline portions of the permitting process. Although SCDES permit durations are generally limited to five years, agency staff indicated that permit amendments could potentially be used to extend project authorizations or accommodate additional volume if warranted.

Collectively, these discussions suggest that proactive shoal management is feasible from a regulatory perspective. Permitting would likely require substantial supporting documentation, which may include demonstration of need, project limits, potential environmental impact evaluation, and the anticipated benefits associated with reducing shoal-induced erosion. Continued coordination with State and Federal agencies would be required before the feasibility of any specific shoal management configuration could be confirmed.

8.2 Shore-Stabilizing Structures

The alternatives considered in this study include various combinations of nourishment with shore-stabilizing structures, including a terminal groin, detached breakwaters, T-head groins, and geotextile tube systems. USACE representatives indicated that the Corps itself does not maintain a general prohibition against hardened shoreline stabilization structures along ocean-facing shorelines and suggested that State regulatory requirements would likely be the principal permitting consideration. Corps representatives specifically encouraged additional consultation with State regulators and recommended future interagency coordination if structural alternatives are pursued (discussion with USACE on April 28, 2026).

Discussions with SCDES indicated that revetments, seawalls, and bulkheads along the oceanfront are generally prohibited as erosion-control measures under current State policies. However, agency representatives indicated that breakwaters may be permissible under appropriate circumstances, although project review would likely be extensive and complex. Agency personnel also indicated that a low-crested terminal groin at the south end of the island may be worthy of consideration and potentially suitable as a pilot project, particularly if configured to allow some degree of sediment transport through and around the structure. The State also acknowledged that breakwater systems would not eliminate the need for beach nourishment and would instead function as a means of reducing sediment losses and increasing the interval between nourishment events (discussion with SCDES on May 26, 2026).

These discussions suggest that structural alternatives may be permissible, but would be expected to face greater permitting scrutiny, require detailed engineering evaluation, and involve substantial environmental review. Engineering design, numerical modeling, and agency coordination would likely be necessary to demonstrate project need and expected performance and to evaluate the potential impact to adjacent shorelines and coastal resources. This conclusion is consistent with recommendations developed through the Second Opinion Memorandum, which identified strategic shore stabilization as a potential component of a long-term management strategy but noted that such projects would require comprehensive engineering investigation and regulatory coordination.

8.3 Implications for Alternatives Evaluation

These regulatory discussions suggest that traditional beach nourishment alternatives remain the simplest and most familiar permitting pathway; however, both the USACE and SCDES suggest that proactive shoal management may represent a realistic and permissible approach to future north-end management efforts. Likewise, while structural stabilization alternatives would likely involve the greatest regulatory scrutiny, neither agency identified them as categorically infeasible. Instead, the principal challenges associated with structural alternatives appear to be regulatory complexity, project justification, environmental review, and design development.

Accordingly, the relative feasibility of the alternatives evaluated herein should not be viewed solely in terms of engineering performance or cost. The level of permitting effort, agency coordination, environmental documentation, and implementation complexity required for each alternative are also expected to be significant factors in future decision-making. Alternatives that combine traditional nourishment with proactive shoal management or strategically applied stabilization measures may ultimately provide the greatest opportunity to reduce future erosion risks and beach management costs. These alternatives would require more substantial planning, engineering evaluation, and regulatory coordination prior to implementation.

9. Summary

This Beach Management Alternatives Analysis was completed to evaluate potential long-term strategies for maintaining desired beach and dune conditions along the Isle of Palms shoreline. The study included a review of historical shoreline behavior, beach management activities, monitoring data, coastal processes, sediment resources, potential management alternatives, lifecycle costs, and regulatory considerations. The analyses were developed to provide the City with a planning-level understanding of the relative benefits, limitations, implementation considerations, and long-term implications associated with various beach management approaches.

The analyses indicate that Reaches 1, 2, 5, and 6 have historically experienced the greatest rates of shoreline change and beach-volume loss and are expected to continue requiring active management to maintain desired beach conditions. These reaches are strongly influenced by Breach Inlet, Dewees Inlet, and periodic shoal attachment processes, which result in recurring erosion and localized shoreline instability. In contrast, Reaches 3 and 4 have generally exhibited greater shoreline stability and are not expected to require the same level of future management intervention.

The no-action analysis demonstrates that the benefits associated with the 2026 Beach Restoration Project are expected to diminish over time as sand losses continue. Under both the low and high sand-loss-rate scenarios evaluated, portions of Reaches 1, 5, and 6 are projected to erode to the study baseline condition within approximately five years following completion of the 2026 project. These results indicate that future management actions will likely be necessary to maintain desired shoreline conditions and associated storm damage reduction, recreational, environmental, and economic benefits.

Periodic beach nourishment remains the foundation of any long-term beach management strategy for Isle of Palms. The analyses indicate that fixed nourishment intervals of five, seven, and ten years are all capable of maintaining shoreline conditions; however, each interval involves tradeoffs between project frequency, nourishment volume, lifecycle cost, and the degree of shoreline degradation permitted between renourishment events. Of the fixed nourishment intervals evaluated, the *seven-year interval* was determined to be the most cost-effective based on the Average Annual Equivalent Cost analysis.

A significant finding of this study is the potential value of supplemental sediment sources. Beneficial use of material generated through Atlantic Intracoastal Waterway maintenance dredging and potential future Dewees Inlet shoal management activities could provide approximately 150,000 cubic yards of supplemental sediment annually, reducing future demand on offshore borrow areas. Collectively, these sources could provide approximately 7.5 million cubic yards of sediment over the 50-year planning period, reducing lifecycle costs, extending the

useful life of offshore sand resources, and improving the long-term sustainability of the beach management program.

The analyses also indicate that the currently identified offshore borrow areas contain enough beach-compatible sediment to support future nourishment activities under both the low and high sand-loss-rate scenarios evaluated. However, the higher erosion-rate scenarios would consume a substantial portion of the currently identified offshore sand inventory over the planning period. Consequently, preservation of offshore resources through beneficial use of supplemental sediment sources should be considered an important component of the City's long-term beach management strategy.

Several structural stabilization alternatives were evaluated, including a terminal groin at the southern end of the island, detached breakwaters and T-head groins within Reaches 5 and 6, and shore-parallel geotextile tubes. The analyses suggest that a terminal groin may provide measurable reductions in sand losses along Reaches 1 and 2, thereby reducing future nourishment requirements and lifecycle costs. Detached breakwaters and T-head groins may provide additional shoreline stabilization and infrastructure protection benefits, although their performance and associated costs would require further refinement through detailed engineering analyses. Geotextile tubes may provide a last line of defense for upland infrastructure under severely eroded conditions but are not expected to significantly reduce future nourishment requirements or maintain recreational beach widths.

Preliminary discussions with the U.S. Army Corps of Engineers and the South Carolina Department of Environmental Services indicate that future nourishment projects, beneficial use of maintenance dredging material, and proactive Dewees Inlet shoal management may be feasible from a regulatory perspective. Structural alternatives may also be permissible but would likely require substantially greater engineering analyses, environmental documentation, agency coordination, and regulatory review.

The cost analysis demonstrates that the most cost-effective alternatives generally combine periodic beach nourishment with the use of supplemental sediment sources. Alternatives that incorporated both Dewees Inlet shoal management and beneficial use of Atlantic Intracoastal Waterway maintenance dredging material consistently produced lower Average Annual Equivalent Costs than nourishment-only alternatives. The lowest-cost alternatives evaluated were those that combined a seven-year nourishment interval, supplemental sediment sources, and a terminal groin at the southern end of the island.

Overall, the analyses indicate that the most sustainable long-term beach management strategy is likely one that continues periodic beach nourishment while maximizing opportunities to utilize supplemental sediment resources and further evaluating targeted measures capable of reducing future sand losses. Additional investigation of Dewees Inlet shoal management,

beneficial use opportunities associated with Atlantic Intracoastal Waterway maintenance dredging, and a terminal groin at the southern end of the island is warranted. These measures offer the greatest potential to improve shoreline resiliency, reduce future nourishment requirements, preserve offshore sand resources, and improve the overall cost-effectiveness of the City's long-term beach management program.

The analyses presented herein are intended to support future planning and decision-making and should not be interpreted as final engineering designs or implementation recommendations. Additional engineering investigations, environmental studies, permitting evaluations, stakeholder coordination, and economic analyses will be required before any specific alternative or combination of alternatives is advanced to design and implementation. However, the results provide a technical framework for evaluating future beach management decisions and developing a long-term strategy for maintaining the recreational, environmental, economic, and protective functions of the Isle of Palms shoreline.

Recommendations. Based on the findings of this feasibility study, the following actions are recommended to support the long-term sustainability and cost-effectiveness of the Isle of Palms beach management program:

- **Establish an appropriate beach management baseline condition** to serve as the foundation for future planning, project evaluation, and performance assessment.
- **Pursue an agreement with Marinex Construction, Inc.** to secure the proposed beach renourishment pricing assumptions and improve confidence in future project implementation costs.
- **Coordinate with the U.S. Army Corps of Engineers (USACE)** to evaluate opportunities for beneficial use of beach-compatible sediment generated during Breach Inlet AICWW maintenance dredging, with a focus on placement within Reaches 1 and 2.
- **Advance the evaluation of Dewees Inlet shoal management** through additional engineering, environmental, permitting, and economic analyses to better define its feasibility, implementation requirements, and lifecycle benefits. A pilot or demonstration project should be considered to validate the planning-level assumptions and quantify project performance.
- **Conduct a more detailed investigation of a terminal groin at the southern end of Reach 1**, including engineering feasibility, anticipated performance, permitting considerations, environmental impacts, constructability, and lifecycle cost-effectiveness.
- **Consider structural stabilization measures within Reaches 5 and 6 as a potential last line of defense**, particularly if future monitoring indicates continued shoreline recession

despite nourishment and sediment management efforts. These measures should be evaluated as complementary components of a broader beach management strategy that includes Dewees Inlet shoal management and periodic nourishment.

- **Continue annual beach monitoring efforts** to maintain awareness of the current condition of the Isle of Palms shoreline, evaluate project performance, establish pre- and/or post-storm beach conditions suitable to support FEMA public assistance requests, and build upon the historical record of beach condition surveys to further understand island-wide processes.

Overall, the most cost-effective long-term management strategy appears to be one that continues periodic beach nourishment while maximizing the use of available supplemental sediment resources, including AICWW maintenance dredging material and potential Dewees Inlet shoal management. Additional investigation of a terminal groin at the southern end of Reach 1 is warranted because the planning-level analysis indicates that reductions in sand losses within Reaches 1 and 2 could offset the structure's initial capital and maintenance costs. Targeted structural stabilization within Reaches 5 and 6 should also remain available for further consideration as a potential last line of defense where continued erosion threatens upland infrastructure. Collectively, these measures offer the greatest potential to reduce long-term sediment losses and nourishment requirements, preserve finite offshore sand resources, and improve the resilience, sustainability, and cost-effectiveness of the City's beach management program.

10. Limitations of Analyses and Report

The analyses presented in this report were conducted at a planning level to support comparison of potential beach management alternatives and inform the City of Isle of Palms' long-term decision-making. The results are intended to provide a consistent basis for comparing the relative performance, costs, benefits, risks, and implementation considerations associated with the alternatives evaluated. They should not be interpreted as final engineering designs, construction plans, definitive predictions of future shoreline conditions, or estimates suitable for budgeting, procurement, or project authorization.

The analyses rely substantially on historical beach monitoring data, previous analyses, and other information provided by or on behalf of the City. Historical shoreline and beach-volume changes were used to develop the low and high sand-loss-rate scenarios applied throughout the study. Although these scenarios provide a reasonable basis for planning-level comparisons, past shoreline behavior does not guarantee that similar erosion or accretion rates will occur in the future. Actual shoreline response may differ because of natural variability in storm frequency and intensity, inlet dynamics, shoal migration and attachment, sediment supply, longshore sediment transport, and other coastal processes.

The future sand-loss projections developed for this study do not explicitly account for potential changes associated with sea level rise. Sea level rise could influence shoreline position, erosion rates, storm vulnerability, sediment demand, nourishment performance, and the frequency of future management actions. Accordingly, the projected beach-fill volumes, renourishment intervals, sand-resource demands, and lifecycle costs should not be interpreted as upper limits on future needs. These assumptions should be periodically revisited as additional monitoring data become available and as projections of future coastal conditions are refined.

Future nourishment requirements were estimated using documented historical sand-loss rates and assumed management intervals. An overfill ratio was not applied in developing the future project sand volumes presented in the alternatives and cost analyses. The actual quantity of borrow material required for a future project may therefore be greater than the estimated in-place nourishment volume, particularly if the selected borrow material is finer or otherwise differs from the native beach sediment. Future design-level investigations should evaluate sediment compatibility, grain-size characteristics, expected losses during construction and equilibration, and an appropriate overfill ratio for each proposed borrow source.

The structural and sediment-management alternatives were developed conceptually and do not represent engineered designs. Assumptions regarding structure type, location, dimensions, quantities, crest elevations, foundations, alignments, performance, sand-retention benefits, and maintenance requirements were established solely to support comparative evaluation. Detailed coastal-process analyses, numerical modeling, geotechnical and geophysical investigations,

topographic and hydrographic surveys, environmental studies, constructability reviews, and regulatory coordination would be required before implementing any alternative. These subsequent investigations may result in material changes to the configurations, quantities, anticipated performance, environmental effects, permitting requirements, and costs presented in this report.

Similarly, the estimated availability and suitability of offshore and supplemental sand resources remain subject to additional investigation. The quantity of material ultimately available for beach nourishment may be affected by sediment compatibility, environmental resources, excavation limits, dredging access, construction methods, regulatory requirements, and competing uses. The assumed timing, volume, and cost of material derived from Dewees Inlet shoal management or AICWW maintenance dredging are not guaranteed. Additional sediment testing, surveys, environmental documentation, engineering analyses, and agency coordination would be necessary to confirm the feasibility and reliability of these sources.

The cost estimates presented in this report are planning-level opinions of probable cost based on conceptual quantities, assumed unit costs, available construction information, recent project experience, and professional engineering judgment. Actual costs may vary because of final design requirements, contractor availability, market conditions, fuel and material prices, equipment selection, construction sequencing, environmental restrictions, permitting conditions, mitigation requirements, monitoring obligations, and other project-specific considerations. A contingency equal to 10 percent of estimated project costs was included for all alternatives to account for uncertainties in conceptual quantities, future costs, and construction requirements. This allowance does not eliminate the possibility that actual costs may differ materially from the estimates presented.

The alternatives were evaluated individually to provide a consistent basis for comparison. Future beach management may instead involve a phased, adaptive, or combined program that changes in response to observed shoreline conditions, funding availability, regulatory requirements, project performance, storm impacts, community priorities, and the availability of compatible sand. Continued beach monitoring and periodic reassessment will therefore be essential. All material assumptions regarding future erosion rates, nourishment needs, structural performance, sand availability, constructability, permitting, and cost should be verified and refined through subsequent investigations before a specific alternative or combination of alternatives is selected, designed, permitted, or implemented.

11. References

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Personal communication with Douglas Kerr

Personal communication with Tom Payne, Marinex Construction, Inc.

Personal communication with Steven Traynum (CSE) with data exchange

Personal communication with City – data exchange (reports, etc.)

City of Isle of Palms, Beach Management website: <https://www.isleofpalms.gov/beach>