Town of Seabrook Island
Comprehensive Beach Management Plan

Document Control

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Cover/Document Version

Initial "Beachfront Management Plan" Adopted by the Town of Seabrook Island November 19, 1992

Updated as the "Comprehensive Beach Management Plan" Adopted by the Town of Seabrook Island December 16, 2014

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Town of Seabrook Island
Comprehensive Beach Management Plan

Section 1 Introduction

This Town of Seabrook Island Comprehensive Beach Management Plan is the first update to the Town's original Beach Management Plan finalized in 1992. The Plan is consistent with the South Carolina State Beachfront Management Act and was updated in accordance with the guidelines provided by the South Carolina Department of Health and Environmental Control's Office of Ocean and Coastal Resources Management. This Plan update was a joint effort from the Town of Seabrook Island leadership and staff, the Seabrook Island Property Owners Association, the Seabrook Island Club and St. Christopher Camp and Conference Center. The planning process was intended to gain a common understanding of the important elements of the Plan and a commitment by each of the organizations to carry out its responsibilities under the Plan.

Definitions for the above organization names and other terms used throughout this Plan are provided in Section 7.8 "Definitions" of this Plan.

The format and breadth of items included in the Plan are intended to satisfy the requirements of the State Beachfront Management Act. This Act is designed to protect both life and property, protect unique ecological habitats, and preserve the beach for future use by the citizens of South Carolina. The Act then established eight state policies to guide the management of ocean beaches:

a. Protect, preserve, restore, and enhance the beach/dune system;
b. Create a comprehensive, long-range beach management plan and require local beach management plans for the protection, preservation, restoration, and enhancement of the beach/dune system, each promoting wise use of the state's beachfront to include a gradual retreat from the system over a forty-year period;
c. Severely restrict the use of hard erosion control devices and encourage the replacement of hard erosion control devices with soft technologies which will provide for the protection of the shoreline without long-term adverse effects;
d. Encourage the use of erosion-inhibiting techniques which do not adversely impact the long-term well-being of the beach/dune system;
e. Promote carefully planned nourishment as a means of beach preservation and restoration where economically feasible;
f. Preserve existing public access and promote the enhancement of public access for all citizens including the handicapped and encourage the purchase of lands adjacent to the Atlantic Ocean to enhance public access;
g. Involve local governments in long-range comprehensive planning and management of the beach/dune system in which they have a vested interest; and
h. Establish procedures and guidelines for the emergency management of the beach/dune system following a significant storm event.

The Act further directs DHEC OCRM to implement the forty-year retreat policy by designating a Baseline and Setback Line and regulating development of oceanfront properties seaward of the Setback Line. The Act also provides for establishment of a long-range comprehensive State plan for management of the beach and dune resources that is intended to be consistent with and supportive of the individual local beachfront counties and municipalities beach management plans that address local conditions and issues that may not be addressed in the state plan. The specific DHEC OCRM requirements for subjects to be covered in the plan are included in Section 7.6 "Local and Comprehensive Beach Management Plan Requirements." We believe this Seabrook Island Comprehensive Beach Management Plan meets these policies, requirements and objectives.

Beach Replenishment

The most important issue facing the Town of Seabrook Island with respect to its Beach Management Plan are the preservation of a dry sand beach, a robust dune system and preserving the existing revetment through coverage with wind driven sand and vegetation. The details of how this is to be accomplished are described in Section 5 "Erosion Control Management" of this Plan. Here is a summary of those issues.

Seabrook Island encompasses 3.6 miles of ocean and inlet sandy beach between Captain Sams Inlet and the North Edisto River Inlet. It receives sand from Kiawah Island and has a positive sand budget (increasing total sand on the beach) as evidenced by net gains totaling almost 2 million cubic yards since about 1980. Maintenance of the shoreline is entirely dependent on Captain Sams Inlet and is subject to ongoing encroachment by the migration of the inlet down the coast. The inlet migration results in both erosion and accretion of different sections of the beach that have produced as much as 1,000 ft of deposition in some areas and hundreds of feet of erosion at other sections.

About 30 percent of the shoreline (6000 ft.) on the upcoast portion of the island is an area that is referred to in Seabrook Island beach studies as a conservation zone over which Captain Sams Inlet is allowed to freely migrate. The US Fish and Wildlife Service designated most of this same area as a critical habitat for the piping plover. The community has managed inlet migration by: (a) relocating Captain Sams Inlet back to its 1963 position first in 1983 and then again in 1996; and, (b) allowing normal migration to resume unimpeded within a desired range between those relocations.

Approximately 22 percent of Seabrook Island's shoreline has accreted or added upward of 1,000 feet since 1980, burying seawalls and expanding the Captain Sams Inlet conservation zone. These Beach Trust lands (as described in Section 4.2.4 "Beachfront Development Regulations") beyond the seawall and the property owners' property lines provide a major natural buffer between Seabrook Island's development and the beachfront. Major accumulations of sand along the northern half of Seabrook Island since 1983 have resulted in much greater effective setbacks of oceanfront houses and community infrastructure and provided much added storm protection for those properties.

Approximately 20 percent of Seabrook Island's shoreline (from the North Edisto River Inlet to Renken Point) is situated along a 20-ft-deep marginal channel of the North Edisto River Inlet. There is a natural tendency for this channel to encroach on Seabrook Island. Soon after the island's initial development in the early 1970s, property owners constructed protective seawalls. In the 1980s, sections of the seawall failed or were in danger of catastrophic collapse because of complete erosion of the beach. In 1990, the Property Owners Association sponsored a soft-engineering dredging project that was designed to realign the northern channel seaward and nourish the beach. Since realignment in 1990, this channel remains seaward of its relocated position as a result of periodic mechanical transfers of sand from accretion zones and natural recovery of the beach. No additional dredging has been required since the 1990 realignment.

The remainder of Seabrook Island's beach extends one mile along North Edisto River Inlet. It receives sand from the oceanfront and depends on maintenance of a wet-sand beach fronting the seawall at the southeast corner of the island. When the beach is severely eroded along any portion of the seawall adjacent to the Seabrook Island Club facilities, sand moving down the coast and around the point is lost into the channel of the North Edisto River Inlet. This exacerbates erosion along the Edisto River beach front, including the St. Christopher Camp shoreline.

Seabrook Island installed about 8,800 linear feet of seawalls in response to erosion in the 1970s and early 1980s. Since 1983, soft-engineering solutions have been favored and those soft solutions have effectively buried all but 2,500 linear feet of the seawall and added upward of 100 acres of beach/dune habitat. Seabrook Island has sponsored annual monitoring surveys of the beach since the 1980s and uses the resulting data to track sand movement.

Restoration and maintenance of Seabrook Island's beach over the past 30 years have required two relocations of Captain Sams Inlet and one realignment of the northern channel of North Edisto River Inlet. A third relocation of Captain Sams Inlet has been permitted by all of the required government agencies but has been put on hold pending the results of a legal challenge by an individual Seabrook Island property owner. In addition, there have been 10 small-scale beach maintenance events between 1982 and 2007 involving a cumulative total of about 850 thousand cubic yards of sand taken from beach sections that have been accreting (adding) sand and transferring it down the coast to erosion hot spots. The net result has been an average 175-ft seaward shift of the high-water shoreline since the 1980s. Almost all of Seabrook Island's oceanfront buildings are positioned landward of the OCRM Setback Line with only five structures that are not beach access boardwalks seaward of that Setback Line.

Seabrook Island requires a shorefront management strategy that differs from other South Carolina beaches because of the dynamics of Captain Sams Inlet and North Edisto River Inlet. The Property Owners Association has funded and implemented a three part plan for beach maintenance (a detailed description of this three part plan can be found in Section 5 "Erosion Control Management" of this Plan):

Maintain a 6,000-ft shoreline inlet conservation zone over which Captain Sams Inlet is allowed to migrate.

Relocate Captain Sams Inlet to its 1963 position at the furthest point up the coast every 15–20 years.

Transfer sand periodically from areas of rapid accretion to erosion hot spots, thereby maintaining an uninterrupted flow of sand down the coast and around the southern point of Seabrook Island.

Three decades of beach surveys, which track sand movement along Seabrook Island, confirm that each part of the strategy is critical. In the event that any or all of these strategies cannot be effectively implemented, the ultimate backup plan is to allow the beach to retreat no farther than the existing revetment or seawall.

All beach management activities at Seabrook Island have been funded by the Property Owners Association through assessment of its members. Community expenditures to date total about $6 million in 2014 dollars for all soft-engineering solutions to beach erosion. Prorated over the 12 thousand feet of developed shoreline and the 30-year period since initial beach restoration efforts began, the expenditures have averaged about $200,000 per year or $15–$20 per foot of shoreline per year. Compared to most beachfront communities, this is a very modest investment. A common measurement of beach management costs is how it compares to the values of the beachfront properties, which for Seabrook Island has been about 0.1% of those property values.

Threatened and Endangered Species Critical Habitat

The Town's beach management approach is also beneficial to the piping plover, a threatened species with Seabrook Island as one of its federally designated critical habitats. The piping plover is a species preferring an ephemeral unvegetated habitat. Each time Captain Sams Inlet has been relocated, it has allowed new beaches, ponds, and sheltered mud flats to form and has helped to maintain the sparsely vegetated character of the conservation zone that is Seabrook Island's piping plover habitat. A description of the Town's wildlife protection plans is included in Section 2.4. "Natural Resource and Ecological Habitats" of this Plan.

In early July of 2014, the US Fish and Wildlife Service (USFWS) designated Seabrook Island as a critical habitat for the loggerhead sea turtle. Maintenance of a robust beach along the entirety of the island's coastline, consistent with the island beach replenishment plan, is essential to the continued success of nesting here by this important threatened species. The specifics of any new USFWS requirements applicable to on Seabrook Island's beaches as a result of the critical habitat designation will addressed as they are issued. Most, if not all of what we expect to be required, is already a part of our current operations and future plans. A more detailed discussion of the loggerhead sea turtle and Seabrook Island's nesting habitat is provided in Section 2.4 "Turtle Nesting" below.

Plan Approvals and Maintenance

This Plan has been adopted locally by the involved organizations and submitted to the State of South Carolina DHEC OCRM for review and approval. Upon State approval, the Plan will then become a part of the State Beachfront Management Plan. The Beachfront Management Act calls for updating the Plan every five years in coordination with DHEC OCRM. Accordingly, the Town of Seabrook Island will schedule that update process for completion no later than the fourth quarter of 2019.

Plan Summary

a. The Plan provides a detailed discussion of the history and success of Seabrook Island's soft-engineering beach replenishment strategy. The Seabrook Island Property Owners Association with the full support of the Town of Seabrook Island has a specific plan and schedule to implement the beach replenishment strategy. One of the objectives of this replenishment strategy is to maintain a dry sand beach along the entire Seabrook Island beachfront for the benefit of the beach users and wildlife, particularly the nesting loggerhead sea turtles. We believe this beach replenishment strategy is consistent with the State's policies and objectives of the State Beachfront Management Act. If we are unable to implement some or all of the strategy, the alternative is to maintain the existing revetment or seawall as the last line of defense against erosion of the Island's oceanfront and riverfront. This very important part of our Plan is as described above and in Section 5 "Erosion Control Management" of this Plan.

b. The Plan calls for a continuation of a beach access system for Seabrook Island residents and authorized guests that includes twelve access points that are well marked and well maintained by the Property Owners Association.

c. Seabrook Island's Turtle Patrol organization provides support to nesting loggerhead sea turtles that come to our island. New nests are identified/located, sampled, protected from predators and regularly maintained and monitored. Tracking of the number of nests and the success rate of hatchlings leaving the nest for the ocean indicates this effort has paid off with significant improvements in those success rates.

d. This Plan update has confirmed that Seabrook Island's general zoning and land use plan is consistent with the purposes of the Beach Management Act and thoroughly protects the area seaward of the Setback Line from unwanted development. With the exception of the Seabrook Island Club facility and St. Christopher Camp, all of the beach fronting properties are zoned for residential use and no added commercial activities along the beachfront are anticipated or intended.

e. Seabrook Island is blessed with significant access to ponds and marsh areas that provide storm water drainage to all of the roads and interior properties. The only drainage going directly into the ocean across the beaches comes from the immediately adjacent properties. With a primarily porous sand area adjoining the

beach there is little water even reaching the beach. In the process of updating the Plan, we have not identified any changes in drainage strategy that are contemplated or needed.

f. The Comprehensive Emergency Plan for the Town of Seabrook Island was last updated May 9, 2014. That plan includes provisions for necessary evacuations, rescue of any distressed residents, maintenance of essential services, protection of public health, emergency procedures for removal of refuse and rebuilding of homes and other structures and any damaged roads. Additionally, it establishes priorities for any needed recovery and includes provisions coordinating recovery efforts with the Seabrook Island Club and the Property Owners Association. Where applicable, these provisions extend to the beaches of Seabrook Island.

Section 1.1 Purpose

The purpose of this Plan update is to define how the Town and the Property Owners association will manage the beaches in accordance with the South Carolina Beach Management Act while providing access and preserving its wildlife environment, its critical habitats and recreational value for residents and visitors. Also, the Plan update process provided a platform for gaining support from the affected organizations (Town, Property Owners Association, Seabrook Island Club and St. Christopher Camp and Conference Center) for the provisions of the Plan

Section 1.2 History of Plan Approvals and Revisions

The initial Beachfront Management Plan for the Town of Seabrook Island was approved and adopted by the Town Council on November 21, 1992. This 2014 update is the first revision to that plan and was initiated by the Town Council with a request to the Town Planning Commission to begin the planning process in early 2014.

The Plan update was developed under the leadership of the Planning Commission and the work of a number of the island's staffs and volunteer residents with expertise in the local flora, fauna, beach recreation and beach maintenance issues. The most important beach replenishment plan provisions were developed with the assistance of Coastal Science & Engineering Inc., the firm that has prepared beach restoration plans and monitored the shoreline of Seabrook Island for the past 30 years. CSE prepared the replenishment strategy as described in Section 5 "Erosion Control Management" of this Plan.

The approval process for this Plan update started with the Town of Seabrook Island Planning Commission approval on September 9, 2014. The document was shared with the community for their comment at the end of October 2014. The Property Owners Association Board approved a resolution supporting the Town's proceeding to a public hearing of the Plan in its September 15, 2014 board meeting and the Seabrook Island Town Council formally adopted the Plan on December 16, 2014. Revisions to the Plan were made to accommodate recommendations from each of the approving organizations, including from the community wide distribution/review and a public hearing on December 3, 2014.

Will Salters, the Coastal Services Project Manager, from the South Carolina Department of Health and Environmental Control's Office of Ocean and Coastal Resources Management provided review, direction, and advice throughout the process.

Section 1.3 Overview of Municipality/History of Beach Management Approaches

The Town of Seabrook Island was formed in 1987 upon a vote of a majority of its residents. The Town is made up of a large portion of Seabrook Island that is boarded on: (a) the east and south by the ocean; (b) the south and west by the Edisto River; (c) the west and north by Bohicket Creek up to the northeastern edge of the Bohicket Marina; and then, (d) across an uneven line back to the ocean. Map 2.1 "Town of Seabrook Island" further in this Plan graphically depicts these Town borders. All of the beachfront property within the Town is inside the Property Owners' gate. The Town and the Property Owners Association each have specific responsibilities with respect to the beach area. Some of those responsibilities are as follows:

Responsibilities of the Property Owners Association:

Funds, manages and implements beach replenishment projects.

Provides, supervises and maintains the beach access points and access parking including boardwalks/walkways, handicap access and official vehicle access (maintenance, security, emergency and turtle patrol).

Provides and maintains the island roads that are necessary to reach the beach access points.

Issues fire permits for residents and visitors to build fires on the beach and educates those seeking permits on the rules to be followed in setting and extinguishing fires.

Assists the Town in communicating beach management messages like the turtle friendly "turn out the lights" campaign and preparing signage for display at the beach entrances describing the beach rules and educating visitors on the local wildlife.

Often acts as the first point of contact for residents and visitors with beach issues. Where applicable, notifies the appropriate agency (fire, police, rescue/ambulance or Town) for assistance.

Responsibilities of the Town of Seabrook Island:

Preparation, adoption and update of the Town Beach Management Plan.

Proper signage and enforcement of the Town Code and its beach related provisions as listed in Section 7.5 “Laws and Ordinances, Rules and Regulations” of this Plan.

Provision of beach patrol personnel at times of high beach usage that are between Memorial Day and Labor Day currently from 10 a.m. to 6 p.m. This beach patrol team is made up of off-duty local county law enforcement officers. They patrol the beaches in a 4-wheel drive vehicle provided by the Town and remind beach visitors of the rules and search out any public safety issues.

No changes to the above responsibilities are anticipated.

Section 1.4 Current Beach Management Issues

The Town of Seabrook Island beach management issues are not unlike those of other South Carolina beach communities. Here is a summary of the important areas identified in our beach management planning process:

a. Like many other beach municipalities, beach erosion is the most important issue to address. Without restating the detailed description of our island’s erosion concerns and planned solutions that are fully described in detail in Section 5 “Erosion Control Management” of this Plan, the issue can be simply described as follows: (a) as long as the Captain Sams Inlet on the north shore of the island remains in a well defined band of migration, the natural flow of sand down from Kiawah Island will maintain and even accrete sand along the Island shore; (b) if the inlet migrates too far south (west), much of the dry sand beach and dunes will be lost to erosion; (c) occasional relocation of the inlet is a proven solution to Seabrook Island’s sand erosion; and, (d) some sand scraping from areas of excess sand accretion on the island shoreline may be required to supplement the natural sand migration from Kiawah Island.

b. Providing beach access is an important part of how we manage the island’s beaches. Our conclusion from the process of developing this Plan update is that the current number and placement of access points are sufficient. Continued monitoring of the accessibility of emergency and maintenance vehicles onto the beach at Boardwalk #1 will be required to try to prevent erosion changes from blocking beach entry. Similarly, handicap access will need to be monitored so that repair of erosion damage may be made where required.

c. There are three vehicle beach access points on the island. One is adjacent to Boardwalk #1 with a locked gate accessible only by those authorized to drive on the beach. This access leads to the ocean side of the island beaches but requires a 4-wheel drive vehicle to safely reach the entire ocean-fronting beach. The primary emergency access for the Edisto River area is through St. Christopher Camp. While this access point is not a public one, St. Christopher Camp has consented to its use in emergency situations. As with the other vehicle entrances, a 4-wheel

drive vehicle may be required. The secondary river-fronting beach access point is on the north end of the Pelican Watch Villas property and is accessible through a locked gate that is to be used only in the event of an emergency and only by authorized personnel. As a part of this Plan update, the Town and Property Owners Association have agreed to use the Property Owners 4-wheel drive security vehicles to help where the normal emergency vehicles cannot properly reach the required areas. The Town also has 4-wheel drive vehicle capability that can be used in situations where lead-time to reach the incident is acceptable.

d. Some of the residents and visitors using the beaches may not be aware of the Town Code and Property Owners Association rules dealing with use of the beach. Additional signage listing the more important beach rules of both the Property Owners Association and the Town and enforcement alternatives is under consideration.

e. Over time there have been concerns expressed over dogs being allowed off leash on the beaches. Over the years the Town has listened to both sides of this issue and has arrived at a balance of the interests expressed. The compromise reached by the Town has been to allow dogs on the beach on a leash on all of the beach areas (except those frequented by the piping plover habitat) and to reserve one area, away from the sections used by most beach visitors (350 to 850 yards up the coast from Boardwalk #1), for dogs to run off-leash below the high tide line provided they are constantly supervised by their owners and do not enter the dunes areas. During the summer months, this off-leash rule is limited to early mornings and late afternoons when the beaches are less crowded. This balanced approach allows for dog owners to enjoy and exercise their pets while respecting the wishes of those beach users who may be concerned about dogs on the beach. The specific Town Code provisions for dog owners are provided in Section 7.5 “Laws and Ordinances/Rules and Regulations” of this Plan.

f. An issue on many beaches around the country, for both the human visitors and the loggerhead sea turtles, is holes that beachgoers dig on the beach. If the holes are not filled in by the people digging them, they may constitute a potential danger for beach goers and the loggerhead turtles. The Property Owners Association beach rules require filling of any sand holes when leaving the beach. Enforcement of this rule requires continued attention and added signage to remind users of the applicable rules is under consideration.

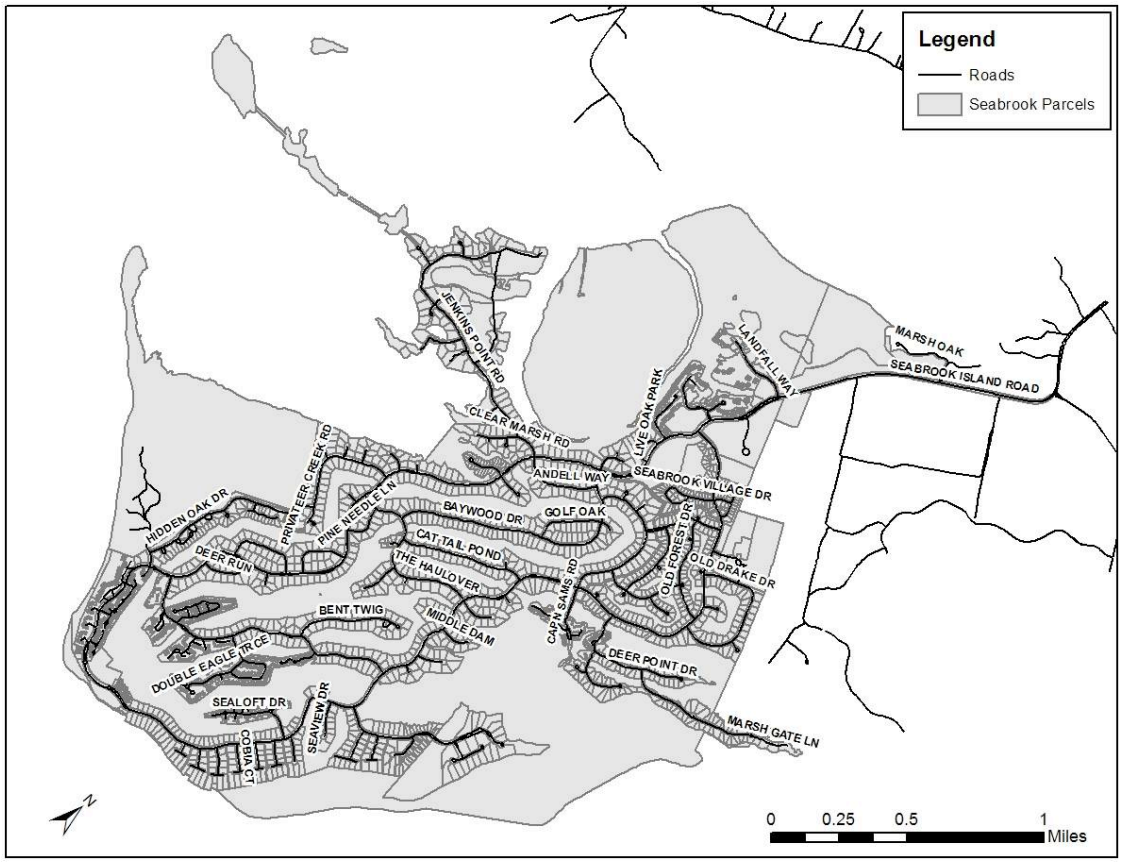
g. Distribution and adequacy of parking is always a concern for support of beach access. As beach usage patterns shift with the amount of dry sand beach available along the coastline, parking needs will correspondingly change. The Property Owners Association has agreed to permit overflow parking on designated grass areas off of the road surface. The number of bicycle racks has been increased to encourage this alternate mode of transportation and the parking load is expected to be better balanced after the Captain Sams Inlet is relocated and the Boardwalk #1 beaches are replenished and become more hospitable to visitors.

h. The designation of the Seabrook Island beaches as a critical habitat for the loggerhead sea turtle by the US Fish and Wildlife Service in July 2014 is a new issue. We believe the current strategies of: (1) a strong and very active Turtle Patrol organization; (2) the applicable Town ordinances and rules and regulations of the Property Owners Association with respect to the use of the beach; (3) the island "lights out" campaign; (4) extensive resident and Island visitor education programs by the Turtle Patrol and, (5) a sound beach replenishment plan that is sensitive to both nesting turtles and emerging hatchlings, are consistent with the federal critical habitat strategies. If and when state and federal agencies provide relevant guidance, action by the Town or the Property Owners may be required. Section 4.2.2 "Turtle Nesting" of this Plan describes our process for support of loggerhead sea turtles.

Section 2. Inventory of Existing Conditions

Section 2.1 General Characteristics of the Beach

Seabrook Island is a two-mile long barrier island with another approximately 1 mile long sandy shoreline extending along the North Edisto River inlet. The Island's maximum length of about 3.6 miles occurs when Captain Sams Inlet is positioned near the Kiawah Seabrook Town line across the Kiawah Spit. The Island is bounded on the northeast by the Kiawah River and Captain Sams Inlet, on the southwest by the Edisto River and on the north by Bohicket Creek. Seabrook Island is about 20 miles southwest of the Charleston Harbor. Map 2.1 below graphically depicts the Town borders.



Map 2.1 Town of Seabrook Island

The Seabrook Island beaches are composed of well-sorted, fine to very fine sands from the Stono and Kiawah Rivers. Some areas, generally on the lower coast portion of the Island, have a dry sand beach that varies from narrow areas that are a few yards wide to areas with widths of 100 yards or more. These dry sand beaches are along the Edisto River shore and between the Seabrook Island Club Facilities and Renken Point. As we are late in the Captain Sams Inlet down coast migration cycle, much of the traditional dry sand beach on the upper half of the coastline has been eroded back into the dune system. This northern section of the beaches has a dune system up to 300 yards wide or more. The dry sand beaches on the Edisto River depend on maintaining a sand bridge around the southwest point of the island and proper location of Captain Sams Inlet to provide the flow of sand down the coast to feed that bridge and maintain the river front beach. The changes in the profile of the various parts of Seabrook Island's beaches are described in great detail in Section 5 "Erosion Control Management" of this Plan.

Tides in the vicinity of Seabrook Island have a mean tide range of about 5 feet. Waves along the shoreline tend to be relatively small due to protection from the south of Deveaux Bank and from the north and east from an almost continuous partially submerged sandbar. These small and low energy waves are a key component of sand movement depositing sand that is released from the Kiawah and Stono Rivers on a

steepening beachfront. The magnitude of these deposits and how they are distributed is highly variable.

The process by which the beaches of Seabrook Island are accreted and eroded are very complex and Section 5 "Erosion Control Management" of this Plan describes this process in detail. In summary sand generally flows down the coast from Kiawah Island and the resulting shape of Seabrook Island's beaches are dependent on the position of Captain Sams Inlet and the adequacy of the sand bridge around the south corner of the island.

2.1.1 General Land Use Patterns

As described elsewhere in this Plan, Seabrook Island is primarily a residential community and, given the location and the Island's highly desirable amenities, it includes a large number of retired residents and many who consider the island a vacation destination. The land use, that this community character suggests, is first residential and then, in support of the residents and visitors, recreational. Section 2.3 "Beachfront Developments and Zoning" describes the various zones in some detail but they can be summarized as: (a) single family; (b) multi family; (c) recreational (Seabrook Island Club golf, tennis, horse stables and swimming); and, (d) conservation (primarily marsh area). Much of the Island is already developed and no major changes in land use are planned or anticipated. A map of the Island's zones is provided in Section 7.1 "Beach Management Overlays."

A part of the logic that leads us to avoid major changes in the Island's land use strategy is that the makeup of the population of the Island is reasonably stable. With a stable population mix and modest growth rates, the usage of the Island beaches is not expected to dramatically change. Paddle boarding, kite surfing and possibly other new technology recreational activities may become more important factors necessitating some changes in beach rules over time but those will be addressed as they are identified. With that in mind, there are no specific plans for rules or other changes in the Plan. In support of this conclusion, below is a summary of the Town population makeup.

Demographic statistics of Table 2.1.1 derived from the US Census Bureau provide a good insight into the makeup of the local residents. These statistics represent only those who self reported as full time residents at the time of the census and would not include the property owners who have primary residences elsewhere or the many vacationers who greatly expand the population, mostly in the summer months. Table 2.1.1 below shows these statistics.

Table 2.1.1 of the Comprehensive Beach Management Plan
Town Of Seabrook Island
Population Statistics

	2010 Census		2000 Census		Change
	#	%	#	%	%
Total Population	1,714		1,250		+37%
Population By Gender					

Table 2.1.1 of the Comprehensive Beach Management Plan Town Of Seabrook Island Population Statistics					
	2010 Census		2000 Census		Change
	#	%	#	%	%
Female	875	51%	659	53%	+33%
Male	839	49%	591	47%	+42%
Population By Age					
Persons 0 to 18 years	72	4%	37	3%	73%
Persons 18 to 64 years	782	46%	698	56%	12%
Persons 65 and over	860	50%	515	41%	+67%

You will note from the table above, the Town of Seabrook Island is over half female as with almost all US communities, particularly those with about half of the residents being over 65 years of age. Significant changes in this population mix are not anticipated as the proximity to schools and major employment opportunities does not support such a change.

The Island visitors are relatives of residents, those who have second homes on Seabrook Island and independent vacationers. While there is no detail data available on the demographics of these groups, we have no reason to believe that there will be meaningful changes in how they use our beaches.

Again, without significant changes in the makeup of the residents and probably only an increase in number of Island visitors, but not a shift in how they use the beaches, major beach management changes are probably not required.

2.2.1 Beach Uses

The Seabrook Island beaches are broadly used by the Town's residents and short-term vacationers for the following activities:

a. Walking on the beach for exercise and enjoyment of the wildlife and other scenery is the most prevalent beach use and starts at sunup and continues until sundown.
b. Dog walking for the above benefits plus exercising the pets and enjoying their company.
c. More passive beach activities like sun bathing, reading, and building sand castles are popular with adults and children alike.
d. Swimming here is always popular when the water is warm enough for at least minimal comfort.
e. Beach bicycle riding attracts mostly the younger crowd but occasionally involves the more athletic senior citizens.
f. Surf fishing attracts some visitors to our beaches.
g. Surfing, Kayaking, Canoeing, Paddle Boarding, wind surfing and kite surfing are all practiced and growing in importance as recreational draws.

h. Horseback riding to and from and along the beach is a regular activity that is and must be organized, coordinated and led by the Seabrook Island Club equestrian staff.
i. Bird watching often complements walking on our beaches.
j. Sailing is occasionally observed with small vessels that can be carried to the water from one of the beach access points, directly from St. Christopher Camp, a private residence or an inland waterway dock.

While there is some skew in where along the shore the above activities are most prevalent, walkers use the entire beach span and the more local types of activities like sunbathing and swimming are more concentrated close to the access points and where the most parking is available. A combination of the height of the tide and therefore the width of the usable beach are also significant factors in how the activities are distributed.

2.2.2 Benefits and Values of the Beach

The beaches of Seabrook Island are a major draw for people relocating here, people establishing vacation homes here and those vacationing here. The many recreational activities listed in Section 2.2.1 above, the simple beauty of the beach and the variety of wildlife to be seen are factors in what makes our Island a "paradise" for many of us. With all of this in mind, a portion of every category of commercial activity inside of the Property Owners Association security gate is supported by the draw of the beach. Outside of a small clothing and sundries shop and golf and tennis pro shops at the Seabrook Island Club there are no retail outlets in this area. The Club has restaurant facilities whose business is stimulated by beach visitors. The Bohicket Marina within the Town of Seabrook Island, but outside of the Property Owners Association gate, does have a group of restaurants, retail establishments, marina facilities and beauty shops that indirectly benefit from the residents and visitors attracted by the beach.

All forms of maintenance and support for the homes of Seabrook Island could also be, in part, attributable to the attraction the beach provides for those living and visiting here. Landscape maintenance, house painting, HVAC or heating/cooling repair, pest control, cleaning services, appliance repair are just some of the categories of this economic activity.

The resale value of homes on Seabrook Island are supported and clearly enhanced by the attractiveness of our access to the ocean

Probably the most direct economic activities that can be attributed to the beach are Town licensing of rental property owners and the revenue those owners receive from renting their homes. The Club (restaurant, sundries shop golf, tennis and stables) and Property Owners Association revenues (Lake House fees) from vacationers might also qualify as being beach related economic activity.

Specific dollar figures for these economic activities are not readily available and precise judgments on how to apportion these amounts between beach related activities and other

factors are not easily established. The attraction of the beach is a central consideration for almost all residents and visitors to the Island. Separating the beach from the other motivations for being here is probably not a fruitful pursuit.

Section 2.3. Beachfront Developments and Zoning

The Town of Seabrook Island is primarily an already developed residential and resort community with appropriate zoning for those purposes. There are Town zones other than for single family and multiple family residences and commercial recreational properties but they do not alter the basic residential/resort nature of the community. Other than continued conversions of a small number of single-family vacant properties into conservation use we do not anticipate significant changes in Town zoning and specifically no changes impacting the beaches are planned or expected. Similarly, other than filling in the few remaining single family dwelling zoned properties adjacent to the beach, there are no anticipated developments along the beach. A detail map of the Town zones is included in Section 7.1 "Beach Management Overlays" of this Plan.

Table 2.3 below lists the various Town zone categories and how they relate to beach use and beach management.

Table 2.3 Land Use/Zone Category

Land Use Zone Category	Use/Beach Implications
Single Family Residential	These properties make up a bulk of the island and are where a majority of the beach users reside. Full time and part time residents and vacationers renting the homes are the primary beach users. Much of the beachfront property is made up of these single-family residences.
Multifamily Residential	As with the single-family residential properties, the multifamily residences provide many of the beach users. These properties occupy some of the beachfront area.
Agricultural	The only island property zoned as agricultural is the St. Christopher Camp facility. This property fronts a section of about 2000 yards at the west end of the Edisto River beachfront. Participants in the St. Christopher Camp programs share this beach area with many of the other Seabrook Island residents and visitors.

Table 2.3 Land Use/Zone Category	
Land Use Zone Category	**Use/Beach Implications**
Commercial	The only commercial properties on the island that involve or relate directly to the beach are those of the Seabrook Island Club facilities. These facilities adjoin the beach and share parking with beach goers, provide a platform for viewing the beach and represent a draw to the island and its beaches. The remaining commercial properties are island support facilities that are used by the Property Owners Association, a few businesses just outside of the gatehouse and at the Bohicket Marina and adjacent facilities that are away from any of the beaches.
Parks and Recreation	The parks and recreation areas are primarily the Seabrook Island Club golf courses. A portion of the Club's Ocean Winds Golf Course is adjacent to the beach. The green area for hole #13 and the tee area for hole #14 extend to the beach Baseline along the ocean side of the Island above Renken Point. This golf course area provides another viewing point over the dunes for enjoyment of the beaches.
Lakes	The Island has a number of lakes on the golf courses, at the Lake House, and spread throughout the residential properties.
Planned Unit Undeveloped	There are no properties in this category
Conservation (includes Wetlands and Marsh)	Much of the conservation zone is made up of the island marsh area. This zoning category also includes nature trails that the Island's Natural History Group has established and maintains. There are individual properties that are zoned conservation and these properties have been created by an island volunteer organization called the Green Space Conservancy that raises funds to purchase individual properties or accepts donations of properties and turns them into conservation areas. Over time, we are hopeful that more of these conservation conversions will happen and maybe even with a beachfront property, as the entire community considers the conversion process very desirable.
Government Property	None of this zone is adjacent to the beach and it is made up of the footprints of the Town Hall and the Town's Utility Commission facility.
Easements	There are easement zones that are narrow corridors in a number of places on the island that have four different uses: (1) the beach access walks (owned by the Property Owners Association); (2) horse trails in support of the Seabrook Island Club stables; (3) two access points for the rivers and marsh; and, (4) a golf course shortcut on the Club's Crooked Oaks course.

Table 2.3 Land Use/Zone Category	
Land Use Zone Category	**Use/Beach Implications**
Pump Stations	This zone is for the many storm water and wastewater pump stations serving the community.

2.3.1 Beachfront Structural Inventory

A table listing all of the structures seaward of the Setback Line is included in Section 7.2 "Structure Inventory Table" as Table 7.2. This table includes tax map numbers, distance to the Setback Line and Baseline and an indication of where there is an erosion control structure included.

The Baseline and Setback Line are established by the State as described in Section 4.1.2 "Beachfront Setback Area." There are, of course, set back lines for property lines not related to the beach but, for purposes of this Plan, Baseline and Setback Line are meant to be the State established lines along the beach.

The pictures/maps on the following pages show the Seabrook Island structures that are seaward of the Setback Line. The orange lines are the beach access boardwalks that are the responsibility of the Property Owners Association. The red lines are private beach access points that are used by individual property owners and town home/condominium residents and visitors. These structures are wood walkways and stairways and bridges over the revetment or seawall that lead from the homes, townhouses, condominiums, villas or beach access entry points (and parking areas) that lead to the sand on the beach. These beach access structures are consistent with OCRM guidelines for such structures.

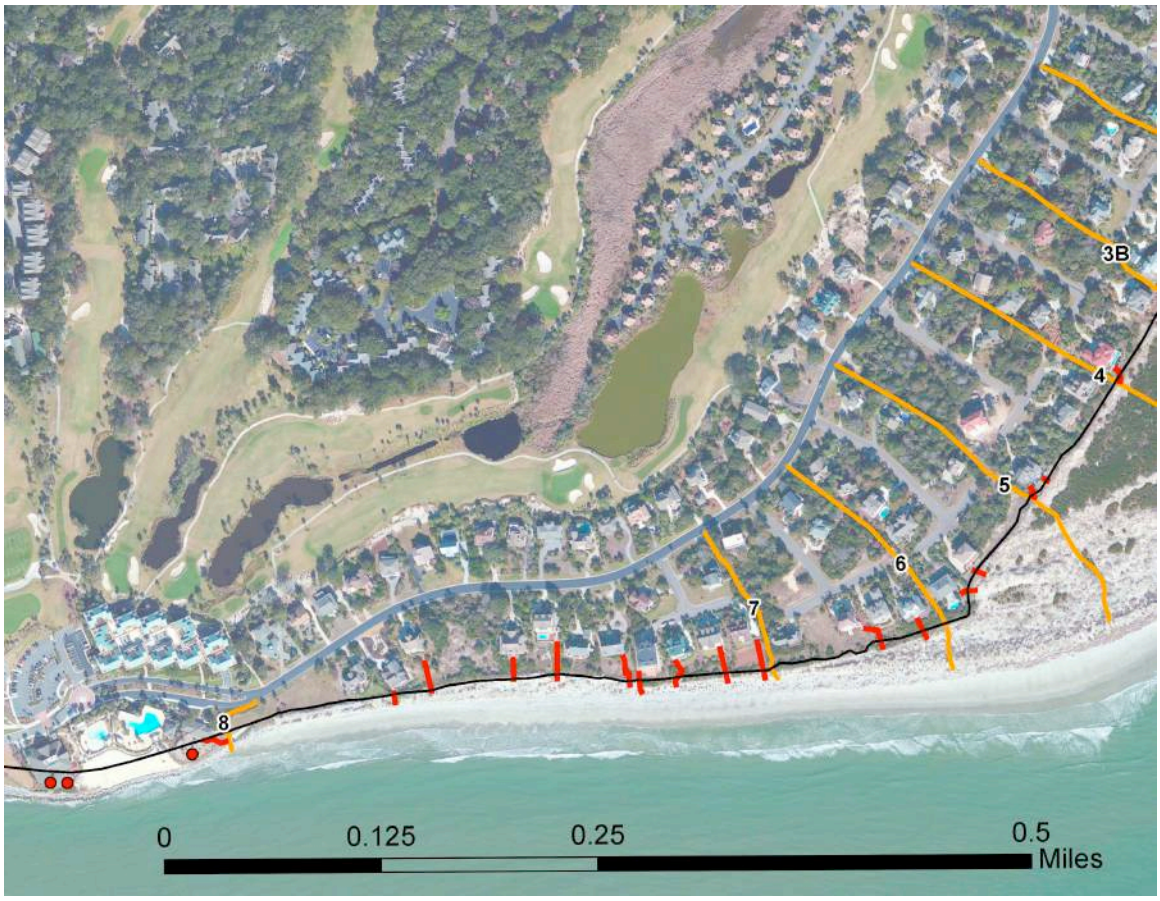
There are 12 Property Owners Association beach access boardwalks and 27 private ones that extend beyond the Setback Line and the Baseline. In addition, there are two swimming pools, one covered patio (the Seabrook Island Club Pelican's Nest restaurant and bar), one building (Seabrook Island Club special events building) and a backyard gazebo that are seaward of the Setback Line. A more detailed description and discussion of these five structures is included later in this Section 2.3.1.

Picture/Map 2.3.1 (a) shows the west end of the Island's beach from the Pelican Watch Villas to the Seabrook Island Club facilities.

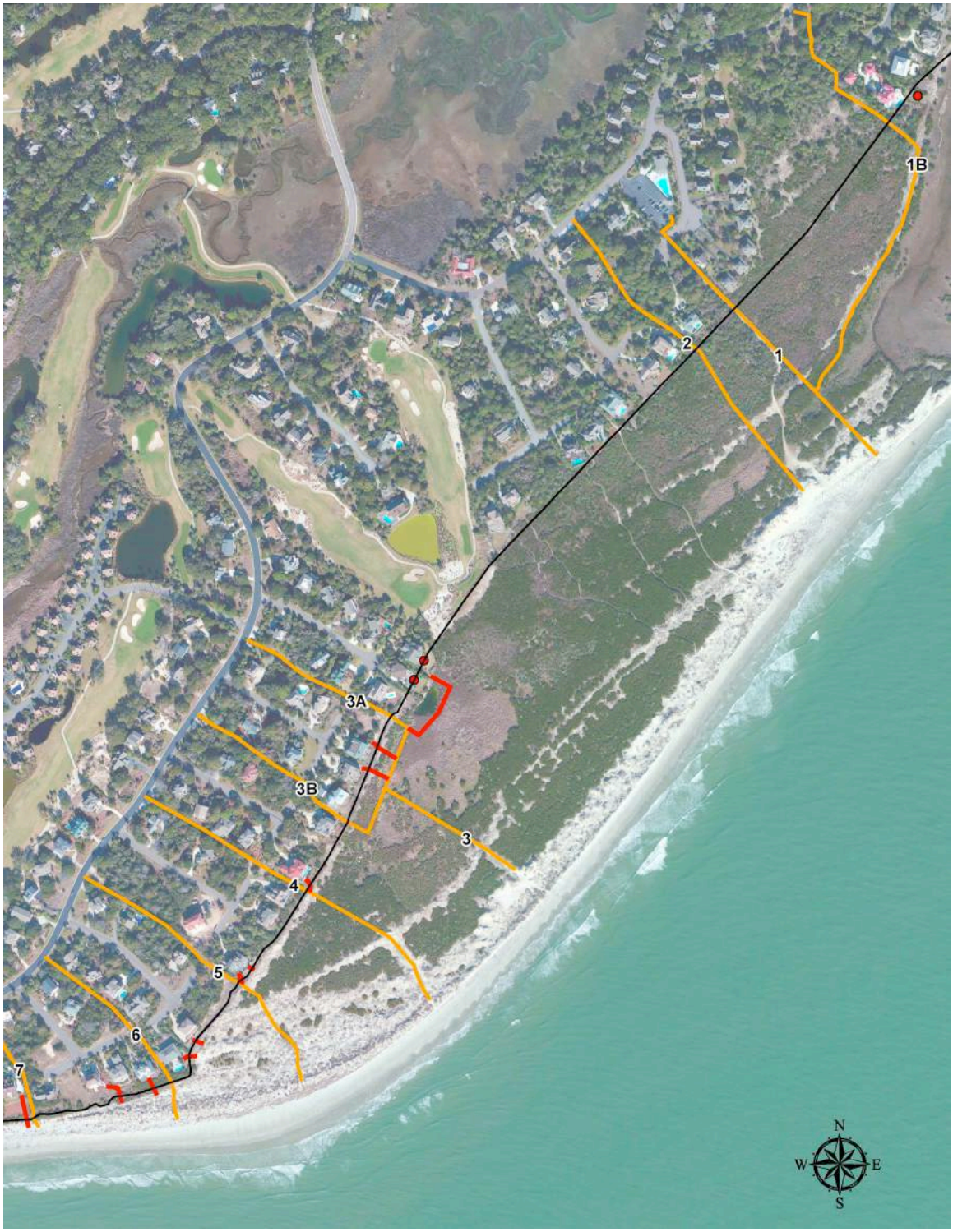
Picture/Map 2.3.1 (b) shows the Island's beach from the Seabrook Island Club facilities to Boardwalk #5 or Renken Point.

Picture/Map 2.3.1 (c) shows northeast end of the Island's beach from Boardwalk #5 or Renken Point to Boardwalk # 1b or North Beach.

Picture 2.3.1 (a) West Seabrook Island Beach accesses and structures seaward of the Setback Line



Picture 2.3.1 (b) South Beach Seabrook Island beach accesses and structures seaward of the Setback Line



Picture 2.3.1 (c) Boardwalk #5 or Renken Point to Boardwalk #1b or North Beach Seabrook Island beach accesses and structures seaward of the Setback Line

Again there are five structures that are not beach access boardwalks that are Seaward of the Setback Line. Two of the structures are swimming pools that were built before incorporation of the Town. They are both consistent with the State's policy requiring that they be located as landward as possible of an existing, functional erosion control device. The revetment seaward of these two pools also meets this criteria. The picture below shows these two pools that are on adjacent properties on the beach end of Beachcomber Run.

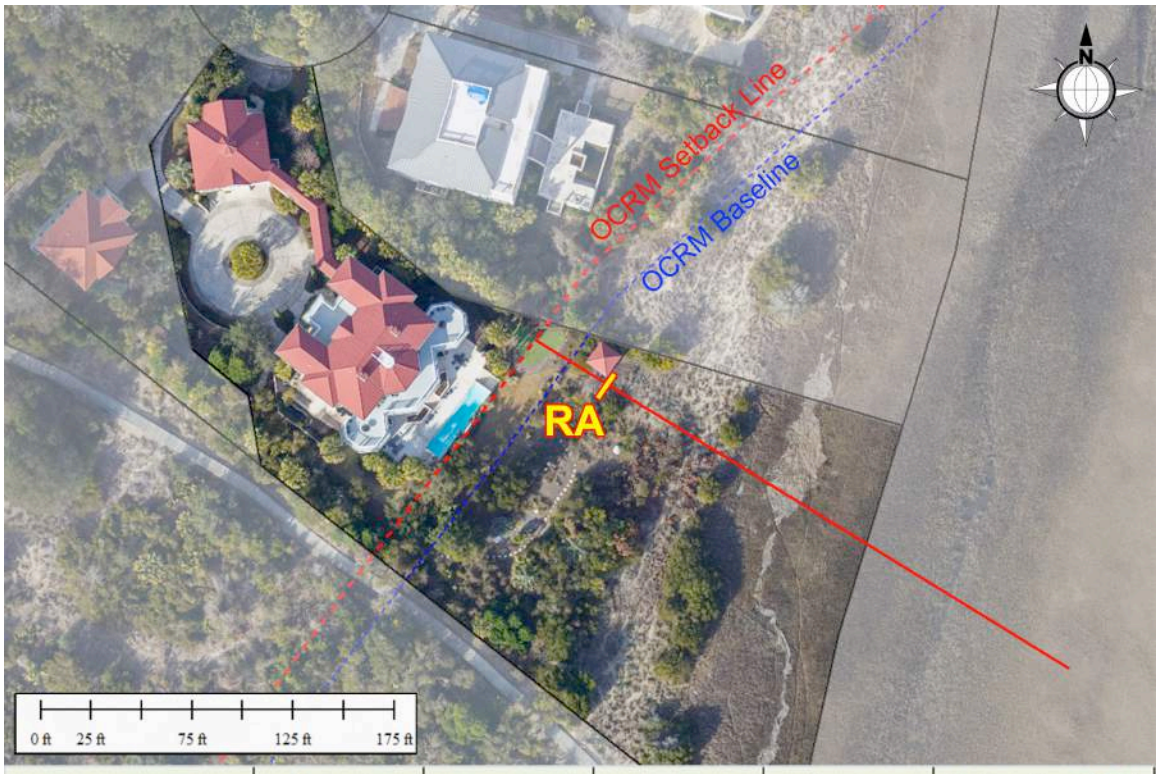
Parcel Address	Property Description	Plat DB #	Parcel No.	Structure Inventory	Distance from OCRM 40-Yr Setback Line (ft)	Erosion Control Structure
3612 Beachcomber Run	Private	W-77	1471400064	P, D, QSR, B-Pv	8, 22, 70, 145	x
3610 Beachcomber Run	Private	W-77	1471400065	P, D, QSR, B-Pv	15, 20, 75, 145	x

The third structure is the patio cover over the Pelican's Nest bar and restaurant area. This structure replaced a much older, larger and less robust structure and it is less infringing on the Setback Line. When the Town approved the project and the county granted the necessary permits, this structure was landward of the setback line. Changes in the location of the Baseline and Setback Line in 2009 changed the status to seaward of the line. Another Seabrook Island Club structure seaward of the Setback Line is a special events building that has been a part of the Club facilities for many years. It was remodeled, without change to its footprint, with the overall Club facility improvements as a part of the "Horizon Plan" project in 2007. It has remained within the original footprint since it was built. The project implementing these major improvements to the Seabrook Island Club facilities that include these two structures reduced the total floor space for

Club structures seaward of the Setback Line. The picture below shows the position of these structures in relation to the current Setback Line, Baseline and to each other.

Parcel Address	Property Description	Plat DB #	Parcel No.	Structure Inventory	Distance from OCRM 40-Yr Setback Line (ft)	Erosion Control Structure
3772 Seabrook Island Rd	e Club At Seabroc	BD-3	1470500085	A, CS-QS, QS-G	60, 100, 200	x
3772 Seabrook Island Rd	e Club At Seabroc	Null	1470500188	C, B-Pv	36, 62	

The fifth and last structure on Seabrook Island that is seaward of the Setback Line is a gazebo behind the property at 1121 Ocean Forrest lane. This small structure was properly permitted when it was built along with the home on that lot. The picture below shows the position of this structure in relation to the current Setback Line and Baseline.



Parcel Address	Property Description	Plat DB #	Parcel No.	Structure Inventory	Distance from OCRM 40-Yr Setback Line (ft)
1121 Ocean Forest Ln	Private	EB-458	1491300003	RA	40

Section 2.4. Natural Resource and Ecological Habitats

Seabrook Island is typical of South Carolina barrier islands in that it is characterized by a beach and dune ridge system. Where wave energy is low or virtually nonexistent, the island is surrounded by tidal marsh. Navigable waters occur on the Atlantic and North Edisto River sides of the island, providing access to the island at various beach points. On the north and northeast margins of the island, Captain Sams Inlet and the Kiawah River provide limited access for kayaks, canoes or other small boats without motors. The Town Code prohibits landing of any motored craft on the island anywhere on the beach seaward of the mean high-water mark, except in the case of emergency. Prior to its development, the Island was dominated by a maritime forest ecosystem, and much of the island still reflects the characteristics of that ecosystem. The live oak trees have never been logged.

Seabrook Island contains significant saltwater wetlands, maritime forest, maritime shrub thicket, dune fields and sand beaches. Additionally there are small, isolated freshwater wetlands. These interlocking and interacting habitats provide for a variety of plant and animal species. Ecologically, barrier islands such as Seabrook Island are comprised of habitats that are characterized to varying degrees by instability.

The **maritime forest** exhibits the greatest stability. The tree canopy is dominated by southern live oak (*Quercus virginiana*), laurel oak (*Q. laurifolia*), southern magnolia

(*Magnolia grandiflora*), and loblolly pine (*Pinus taeda*). Conspicuous understory plants include sabal palmetto (*Sabal palmetto*), southern red cedar (*Juniperus silicicola*), and yaupon holly (*Ilex vomitoria*) among others. The maritime forest forms the relatively stable core of Seabrook Island that has endured over long periods of time (decades through centuries). One can view the maritime shrub thickets, saltwater wetlands, dune fields, and sand beaches as being progressively less stable over time.

Because of their high mobility, the more conspicuous animals that occupy the maritime forest can also be found in the maritime shrub thicket and to some extent the dune fields. These include whitetail deer (*Odocoileus virginianus*), raccoons (*Procyon lotor*), grey fox (*Urocyon cinereoargenteus*), grey squirrel (*Sciurus carolinensis*), bobcat (*Felis rufus*) and coyote *(Canis latrans)*. Other species occur with less frequency. Birds are conspicuous inhabitants of all habitats. An exhaustive list of species is beyond the scope of this Beach Management Plan. For example there have been approximately 170 species of birds seen (including rare sightings) on Seabrook Island. The Property Owners website has an extensive list of the mammals, birds, reptiles, amphibians, arachnids, and insects that can be found on Seabrook Island in all of these habitats. This list can be viewed on http://www.sipoa.org under the "Resources" tab by selecting "Wildlife Resources".

Marsh margins, back dune areas, and road margins along properties that are not heavily landscaped are dominated by **maritime shrub ticket**. Dominant plants here include wax myrtle (southern bayberry) (*Myrica cerifera*), southern red cedar (*Juniperus silicicola*), and the sea myrtle or groundsel-tree (*Baccharis spp.*). Other, less common, species form an important part of the plant community here. In addition to the animal species listed under the maritime forest, the Virginia opossum (*Didelphis virginiana*) is a common inhabitant seen throughout the island.

The **saltwater wetlands** are dominated by salt marsh cordgrass (*Spartina alterniflora*). Black needle rush (*Juncus roemerianus*) grows along the upper reaches of the marsh. Glasswort (*Salicornia virginica*), saltwort (*Batis maritime*), salt meadow hay (*Spartina patens*), and sea ox-eye (*Borrichia frutescens*) are common along the upper margin of the marsh. Marsh rats (*Holochilus sciureus*) and Norway rats (*Rattus norvegicus*) are common mammals found here. One consequence of Seabrook Island's positive sand budget has been the natural addition of several dozen acres of salt marsh in the Captain Sams Inlet conservation zone.

Because they can build and disappear over very short time spans (a twenty foot high dune can disappear completely in less than a year, even without a heavy storm), **dune fields** are one of the least stable habitats on Seabrook Island. Because the sandy soil drains rapidly, plants here are drought and salt tolerant. Sea oats (*Uniola paniculata*) have widely branching roots that extend deep into the sand, providing some stability. Other conspicuous species include bitter panicgrass (*Panicum amarum*), American beachgrass (*Ammophila*), silver-leaf croton (*Croton punctatus*), dune prickly-pear (*Opuntia pusilla*), beach morning-glory (*Ipomoea stolonifera*), dune sandbur (*Cenchrus tribuloides*, mound-lily yucca (*Yucca gloriosa*), and seashore elder (*Iva imbricate*) among others.

The least stable habitat is the **dry sand beach**. Harsh conditions (constantly shifting soil, salt exposure, etc.) preclude plants from growing here. Beaches are in a constant state of flux. There are invertebrate animals that live on and in the beach and these serve as food for shorebirds and crabs. The sand beach above the spring high tide level is important for nesting loggerhead sea turtles. See Section 2.4.2 "Turtle Nesting" of this Plan for more detailed information.

All relevant entities (The Town of Seabrook Island, the Seabrook Island Property Owners Association, The Seabrook Island Club, and St. Christopher Camp and Conference Center) share the goal of the protection and conservation of coastal natural resources, ecological habitats and native wildlife.

2.4.1 Threatened and Endangered Species

Several plant and animal species have been designated by either federal or state agencies as endangered or threatened. A number of other species have been identified as being of special concern by the South Carolina Department of Natural Resources (SCDNR) because of threats to habitat and food resources and therefore exhibit restricted or declining populations. These species are, or may be, found along the beachfront of Seabrook Island.

Endangered, Threatened and Protected Species Regularly or Potentially Found Along the Shoreline of Seabrook Island, South Carolina.

Species	Scientific Name	Federal Status *	State Status*	Habitat
Loggerhead Sea Turtle	*Caretta caretta*	T	T	Beach
Leatherback Sea Turtle	*Dermochelys coriacea*	E	-	Beach
Island Glass Lizard	*Ophisaurus compressus*	-	SC	Dunes
Brown Pelican	*Pelecanus occidentalis*	-	SC	Beach
Wilson's Plover	*Charadrius wilsonia*	-	T	Beach/Dunes
Piping Plover	*Charadrius melodus*	T	T	Beach/Dunes
Red Knot	*Calidris canutus*	C	-	Beach
Least Tern	*Sternula antillarum*	-	T	Beach/Dunes
Seabeach Amaranth	*Amaranthus pumilus*	T	T	Dunes
Sweetgrass	*Muhlenbergia filipes*	-	SC	Dunes
Beach Morning Glory	*Ipomoea pes-caprae*	-	SC	Dunes
*E = endangered, T = threatened, SC = species of concern, C = candidate for listing				

The leatherback sea turtle, the only federally endangered species on the above list, is occasionally seen in the vicinity of Seabrook Island. It rarely if ever nests here with longtime Turtle Patrol members reporting no known nests in the last 20 years. There are three federally threatened species. Of these, only the loggerhead sea turtle nests here (see Section 2.4.2 "Turtle Nesting"). Suitable habitat for the seabeach amaranth occurs here

but it is not known to exist here at this time. The SCDNR and the USFWS regularly monitor Seabrook Island for the presence of this plant. The Wilson's plover and least tern are listed as state threatened. Both species have nested here in recent years (approximately 6-8 years ago) but, extensive erosion at the northeast end of the island has removed suitable nesting habitat and they no longer nest here. The island glass lizard, brown pelican, sweetgrass, and beach morning glory are state listed as being of special concern. The red knot is a candidate for federal listing as a threatened species. The SCDNR and the USFWS regularly monitor the presence and abundance of these species.

The diamondback terrapin occurs on Seabrook Island. It is believed to be the only turtle that lives exclusively in brackish water. Although they live in tidal marshes, estuaries, and lagoons, diamondback terrapins prefer to nest on sand beaches where their nests are susceptible to predation by crabs, raccoons, canids (foxes, coyotes, dogs), and others. Diamondback terrapin populations are rapidly declining, mostly due to habitat destruction in other parts of the State (e.g., road construction) and nest predation, so they are of concern to many naturalists. Their population is not monitored on Seabrook Island.

The US Fish and Wild Life Service has designated Seabrook Island as a critical habitat for the piping plover. The northeast end of the island, from just north of Boardwalk #1, is part of the critical habitat for the piping plover. The piping plover do not nest on Seabrook Island but do overwinter here to rest and feed. These birds move around between Seabrook Island, Kiawah Island and Deveaux Bank. The Town of Seabrook Island advises visitors and residents not to approach any shorebirds or to allow their dogs to chase them. If and when Captain Sams Inlet is again relocated as described in Section 5 "Erosion Control Management" of this Plan, there will be a more meaningful habitat for the piping plover on our island and volunteers from the Town of Seabrook Island and the Seabrook Island Property Owners Association will monitor this important population. Today the USFWS and SCDNR do this monitoring.

The Town of Seabrook Island Code prohibits dogs either on leash or off leash in the area north of where dogs are permitted off leash under supervision of their owners. This is intended to leave a piping plover habitat without any dogs in the northeast corner of the island where they have historically visited.

As described elsewhere in this Plan, enforcement of the Town of Seabrook Island Ordinances is through the Town's normal Code enforcement procedure with one full time and one part time employee of the Town authorized to issue a summons for violations. These enforcement officers are made aware of out-of-code activities through the beach patrol staff that are on the beach during the spring and summer seasons (normally off-duty deputy sheriff officers working for the Town), from the Property Owners' security staff and through complaints from local property owners who are very sensitive to the preservation objectives that the code is intended to achieve. The Property Owners Association security staff enforces its rules and regulations relating to the beach above the high watermark. The Town's beach patrol enforces its beach ordinances. In both cases, enforcement is supplemented by notice from local residents who may observe

activities constituting violations of either SIPOA rules or the Town's ordinances.

2.4.2 Turtle Nesting

The Seabrook Island Turtle Patrol has been active for more that 20 years. There are over 100 patrol members supporting the main objective of maximizing the successful migration of turtle hatchlings from the nest into the ocean. The patrol members are thoroughly trained and work under a permit from the State of South Carolina Department of Natural Resources or DNR. Each patrol member is registered with the State and given an official copy of the permit to carry with them for identification purposes if their activities are challenged. Eight members of the team are given special training and certifications by the DNR to probe for fresh turtle eggs and, where necessary, relocate nests that are at high risk of being destroyed by over-wash, beach erosion or excess plant root incursion.

Seabrook Island participates in the University of Georgia loggerhead sea turtle DNA study that was initiated in 2009 with funding from the federal stimulus program. The Turtle Patrol collects a single egg from each nest they locate to be used in identifying the mother turtle laying the eggs. Many new insights into the nesting habits of this important species have been gained through this study.

The process used to protect and optimize the loggerhead sea turtle nests is as follows:

a. Teams of patrol members patrol the entire Seabrook Island beach each morning from early May until the last nest has hatched sometime in October. As the teams find evidence of a mother turtle visiting the beach or a "crawl" (identified by a distinctive track pattern on the beach) that might have lead to a new nest, they report that finding.
b. The patrol members report all observed crawls to a dispatch desk and the dispatcher calls out a more thoroughly trained "first responder" to locate the nest/eggs.
c. The first responder then carefully probes and/or digs to find the location of the turtle eggs.
d. A judgment is then made as to whether the nest is to be left in situ (where it was laid) or if the situation requires a move of the eggs.
e. Where required, a new nest is dug in a safe location and the eggs are moved to the new nest and reburied.
f. When the nest is secure, whether left in situ or moved, a wire covering is staked out over the nest to prevent small mammals from stealing the eggs. The nest is then marked with a sign cautioning the public from disturbing the site.
g. In this process, the DNA sample is collected and submitted to the DNR for analysis.
h. The GPS coordinates of the final nest and, where applicable, the original nest location is recorded for reporting to the patrol leadership and the State DNR.

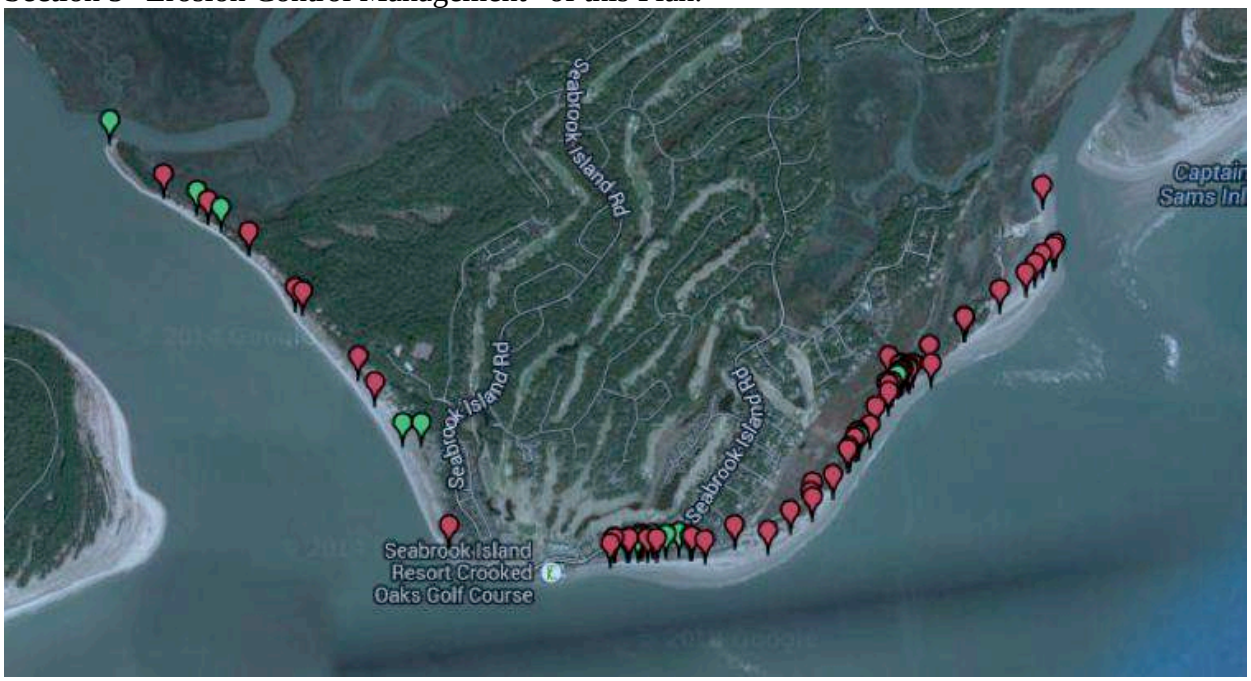
In addition, while patrolling the beach, the patrol members inspect the previously found and protected nests to identify any nest changes including ghost crab holes and fire ants along with evidence of hatchling activity or their emerging from the nest. When there is evidence a number of hatchlings have left the nest, a follow-up inventory team is

scheduled for three days later to excavate the nest to count the hatched and un-hatched eggs along with any live or dead hatchlings remaining with the nest. These statistics are then reported to the DNR.

As a side task in the daily beach activity, the patrol members carry trash bags and remove any trash items they find to reduce the impact on turtles and other wildlife from the hazard that this trash often represents.

Below are some of the results from the Seabrook Island Turtle Patrol Activities.

Map 2.4 below depicts the Seabrook Island loggerhead sea turtle nests for the year 2013. The green figures indicate in situ nests and the red figures indicate the pre move location of the nests that were relocated. The high level of nest moves was due to concerns about erosion causing over wash or complete destruction from erosion. This map shows the fairly even spread of nests along the entire Seabrook Island shore. In 2014, much of the upper coast part of Seabrook Island lost its dry sand beach due to erosion resulting from delays in relocation of Captain Sams Inlet. This erosion has eliminated a large section of beach where the turtles laid their nests in prior years. This process should be reversed if we are able to relocate the inlet. The inlet relocation project is discussed in detail in Section 5 “Erosion Control Management” of this Plan.



Picture 2.4 2013 Loggerhead sea turtle nests for Seabrook Island (as described above)

The table below shows the last four years of progress in meeting the objective of supporting the highest number of hatchlings getting to the ocean.

Seabrook Island Turtle Patrol Loggerhead Sea Turtle Nest Inventories				
	2013	2012	2011	2010
Total Nests	74	73	38	68
Total Nests Inventoried	74	72	35	68
Total Eggs Deposited	8193	8380	3933	6953
Total Live Hatchlings	6266	6289	2735	4663
Eggs/Nest Average	111	116	112	109
Average Incubation Days	54	56	55	50
Total % Hatch Success	79	79	75	69
Total % Live Hatchlings	76	74	70	67
Nests Relocated	61	54	25	51

Figure 2.4 below shows the numbers of nests located over recent years with 2014 showing only the first few weeks of nesting. The trend has been encouraging and it is hoped that trend has, at least in part, been due to the efforts of the Turtle Patrol.

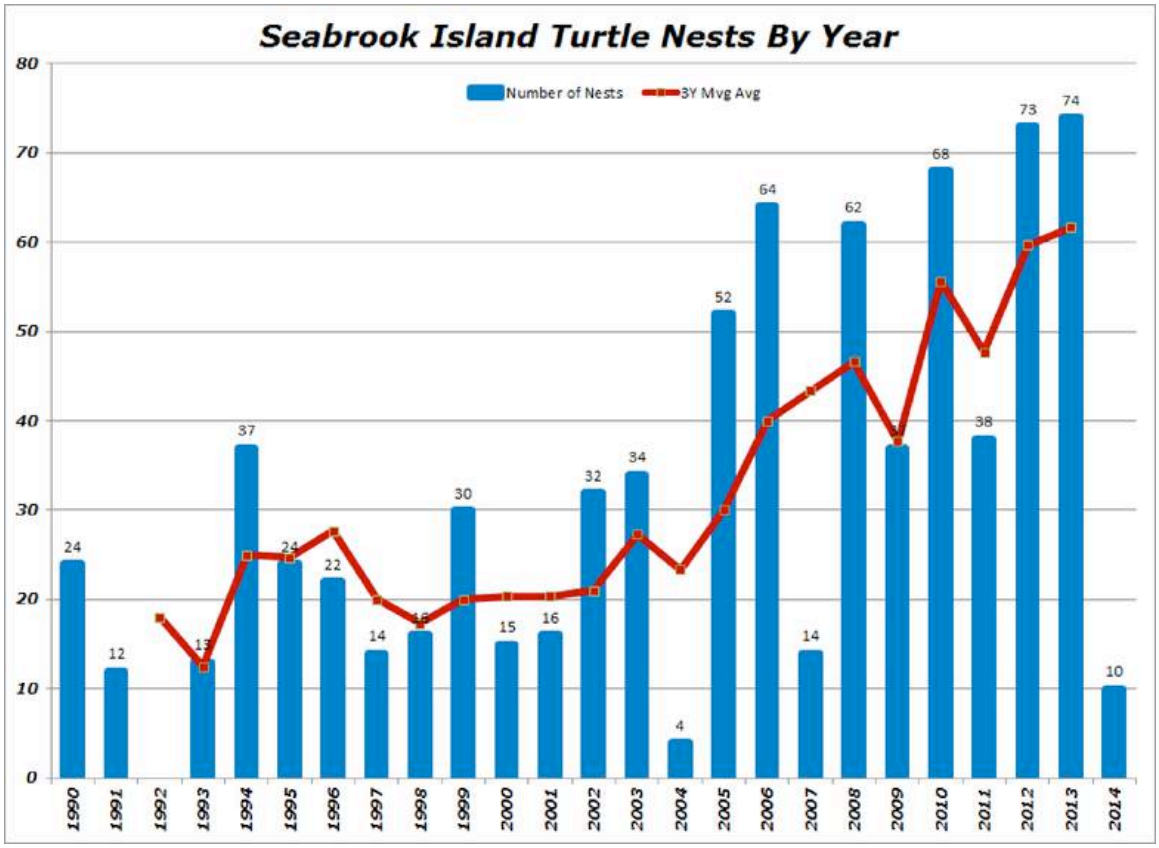


Figure 2.4 Seabrook Island loggerhead sea turtle nests over time

Section 2.5. Existing Beach Access and Map

The Seabrook Island Property Owners portion of the Town of Seabrook Island, that includes all of the Town's beaches, was planned and designed as a private residential and

resort community with the beaches as a major recreational attraction. For purposes of this Plan, resident/visitor access is intended to include access by Seabrook Island property owners and their invited guests.

The property through which these resident/visitor beach access points go is deeded to the Property Owners Association. They manage, monitor and maintain these access boardwalks.

The Island's designers understood the importance of beach access and included 12 separate access points for island residents and visitors to easily reach the entire beach along the ocean as well as the area up to the St. Christopher Camp property line along the Edisto River front. All of the access points except #7, #8 and #9 have wood boardwalks starting at the parking areas and leading to the beach. For the three without complete wood walkways, the surfaces are concrete and/or sandy/dirt paths that are well maintained with good drainage and are not prone to be muddy. Where they are needed, the boardwalks include stairways and ramps over the seawalls/revetments. Parking was also included in the design to accommodate the likely visitor load at each entry point and larger parking lot facilities were included both at Boardwalk #1 and, as a part of and shared by the Seabrook Island Club main facilities, supporting boardwalks #8 and #9. For the access points without parking lots, there are concrete pads for normal parking and overflow parking is permitted on the adjacent grass off of the roadway surface.

The access point entrances include trashcans, dispensers for dog waste bags, clearly visible signs indicating the access point and its identification number and parking spaces as well as overflow parking off of the street on the shoulder grass areas. All of the walkways have bicycle racks making one of the more common arrival modes more practical. These racks were installed to reduce the need for parking facilities and to reduce vehicle traffic on the roads. Table 2.5 "Resident/Visitor and Private Beach Access Points" lists both these resident/visitor beach access points as well as the some twenty seven private beach accesses that allow for individual residences, villas or other multi family projects to access the beach. Some of these private beach accesses have walks connecting with the resident/visitor boardwalks, minimizing the number of paths through the dunes. St. Christopher Camp also has four private beach access points for the use of its visitors. Public bathrooms are available as portable toilets at Boardwalk #1 and at the Club facilities between Boardwalks #8 and #9.

Each private access point added subsequent to the Town's incorporation has been approved by the Town, permitted by the county where required and is constructed consistent with the OCRM guidelines. All of the accesses meet the requirements of being no more than 6 feet wide with no more than a 144 Sq. Ft. pad or landing area seaward of the Setback Line. All are built entirely of wood to meet the State requirements. The Town considers these accesses to be consistent with the community's needs by: (a) supporting beach use; (b) providing a safe beach path for beach adjacent properties that doesn't require climbing over the revetment; and, (c) reducing parking and foot traffic load on the more public access points. Most properties where this private access approach is practical have already implemented their own access and, if any of the few

remaining properties request authorization to add their own access, the Town's policy is to approve those requests provided they meet the State and Town requirements.

All of the island area up the coast from the Boardwalk #1b is fronted by marsh, lakes or ponds that preclude direct access to the beach area from the Island and, therefore, beach access points up the coast from Boardwalk #1 are considered impractical or "not applicable" (as noted in the Table 2.5 "Public and Private Beach Access Points").

Section 2.3.1 "Beachfront Structural Inventory" includes pictures/maps of both the public and private access points as Pictures 2.3.1 (a), (b) and (c).

Table 2.5 below (on the next page) lists each of the resident/visitor and private access points. For the resident/visitor access points the local facilities and distances from adjacent public entry points are listed. The numbers of parking spaces are also indicated with available overflow spaces listed in parenthesis. Boardwalks #1, #2, #8 and #9 all have the prerequisite parking and other facilities to match the access point amenities requirements specified by OCRM to be classified as Neighborhood Public Access Parks or Community Access Parks. As a consequence of its beach accesses, the Seabrook Island beaches meet the State's criteria for parking, signage and other amenities in support of beach access from Captain Sams Inlet down around the Edisto River Inlet to St. Christopher Camp.

Table 2.5
Seabrook Island Beach Management Plan
Resident/Visitor and Private Beach Access Points

Type of Facility	Location (approximate)	Description	Distance to adjacent boardwalks	Facilities
Resident/Visitor			Up/Down the Coast	
"Resident/Visitor Access Point"	Oystercatcher / Ocean Forest Lane	Boardwalk #1B	NA/450 yards	Trash receptacle and clear beach access signage – No parking provided
Neighborhood Resident/Visitor Access Park	Rolling Dune Rd	Boardwalk #1	450 yards/125 yards	Trash receptacle; walkover / boardwalk surface access, signage, on-street parking for 60 vehicles
Neighborhood Resident/Visitor Access Park	Rolling Dune Rd	Boardwalk #2	125 yards/940 yards	Trash receptacle; walkover / boardwalk surface access, signage, on-street parking for 29 vehicles
Resident/Visitor Access Point	3627 Loggerhead Ct	Boardwalk #3A	940 yards/135 yards	Trash receptacle; walkover / boardwalk surface access, signage, on-street parking for 7 (+3) vehicles
Resident/Visitor Access Point	3640 Pompano Ct	Boardwalk #3B	135 yards/130 Yards	Trash receptacle; walkover / boardwalk surface access, signage, on-street parking for 7 (+10) vehicles
Resident/Visitor Access Point	3652 Cobia Ct	Boardwalk #4	130 yards/120 yards	Trash receptacle; walkover / boardwalk surface access, signage, on-street parking for 10 (+8) vehicles
Resident/Visitor Access Point	3718 Bonita Ct	Boardwalk #5	120 yards/125 yards	Trash receptacle; walkover / boardwalk surface access, signage, off-street parking for 8 (+3) vehicles
Resident/Visitor Access Point	3738 Amberjack Ct	Boardwalk #6	125 yards/110 yards	Trash receptacle; walkover / boardwalk surface access, signage, off-street parking for 3 (+8) vehicles

Table 2.5
Seabrook Island Beach Management Plan
Resident/Visitor and Private Beach Access Points

Type of Facility	Location (approximate)	Description	Distance to adjacent boardwalks	Facilities
Resident/Visitor Access Point	3738 Amberjack Ct	Boardwalk #7	110 yards/550 yards	Trash receptacle; walkover / boardwalk surface access, signage, off-street parking for 4 (+7) vehicles
Community Resident/Visitor Access Park	3756 Seabrook Island Rd	Boardwalk #8	550 yards/425 yards	Trash receptacle; walkover / boardwalk surface access, signage, off-street parking for 90 vehicles
Community Resident/Visitor Access Park	3810 Seabrook Island Rd	Boardwalk #9	425 yards/350 yards	Trash receptacle; walkover / boardwalk surface access, signage, off-street parking for 121 vehicles
Resident/Visitor Access Point	1301 Pelican Watch Villas	Boardwalk #12	350 yards/350 yards	Trash receptacle; walkover / boardwalk surface access, signage, off-street parking for 4 (+6) vehicles
Private				
Private Access Point	2810 Seabrook Island Rd	St. Christopher Camp	Not Applicable	None
Private Access Point	2810 Seabrook Island Rd	St. Christopher Camp	Not Applicable	None
Private Access Point	2810 Seabrook Island Rd	St. Christopher Camp	Not Applicable	None
Private Access Point	2810 Seabrook Island Rd	St. Christopher Camp	Not Applicable	None
Private Access Point	1301 Seabrook Island Rd	Pelican Watch Villas	Not Applicable	None
Private Access Point	1301 Seabrook Island Rd	Pelican Watch Villas	Not Applicable	None
Private Access Point	338 Seabrook Island Rd	Beach Club Villas	Not Applicable	None
Private Access Point	332 Seabrook Island Rd	Beach Club Villas	Not Applicable	None
Private Access Point	328 Seabrook Island Rd	Beach Club Villas	Not Applicable	None
Private Access Point	3804 Seabrook Island Rd	Dolphin Point Villas	Not Applicable	None

Table 2.5 **Seabrook Island Beach Management Plan** *Resident/Visitor and Private Beach Access Points*				
Type of Facility	Location (approximate)	Description	Distance to adjacent boardwalks	Facilities
Private Access Point	3752 Seabrook Island Rd	Private Residence	Not Applicable	None
Private Access Point	3748 Seabrook Island Rd	Private Residence	Not Applicable	None
Private Access Point	3736 Seabrook Island Rd	Private Residence	Not Applicable	None
Private Access Point	3732 Seabrook Island Rd	Private Residence	Not Applicable	None
Private Access Point	3724 Seabrook Island Rd	Private Residence	Not Applicable	None
Private Access Point	3755 Beach Ct	Private Residence	Not Applicable	None
Private Access Point	3759 Beach Ct	Private Residence	Not Applicable	None
Private Access Point	3758 Beach Ct	Private Residence	Not Applicable	None
Private Access Point	3756 Beach Ct	Private Residence	Not Applicable	None
Private Access Point	3715 Bonita Ct (Renken Pt)	Private Residence	Not Applicable	None
Private Access Point	3723 Bonita Ct	Private Residence	Not Applicable	None
Private Access Point	3629 Loggerhead Ct	Private Residence	Not Applicable	None
Private Access Point	3632 Loggerhead Ct	Private Residence	Not Applicable	None
Private Access Point	3630 Loggerhead Ct	Private Residence	Not Applicable	None
Private Access Point	3611 Beachcomber Run	Private Residence	Not Applicable	None
Private Access Point	3612 Beachcomber Run	Private Residence	Not Applicable	None
Private Access Point	3610 Beachcomber Run	Private Residence	Not Applicable	None

Section 3. Beachfront Drainage Plan

The Town of Seabrook Island is fortunate that its roads, golf courses, private properties and other surfaces that generate storm water runoff into a system of storm drains that empty into marshes and ponds and not onto or across the beaches. Runoffs from the residential lots, the Seabrook Island Club commercial property, and from the St. Christopher Camp facility, where the properties are immediately adjacent to the beach, reach the ocean from the portion of the properties that tilt towards the water. However, as much of this property is made up entirely of a deep sandy base (20+ feet), most of the normal rain runoff is absorbed before it reaches the beach.

All storm water from the roads, parking lots and golf courses on the Island drain away from the beach and into the ponds or marsh area. For the Seabrook Island Club commercial property that is adjacent to the revetment, there are two swimming pools with associated decks and walks, a restaurant and bar with a large wood deck/patio and a special events building with a brick patio that all, at least partially, drain directly into the ocean but which are graded such that even in a major storm, there should not be any beach erosion or pollution from drainage. All wastewater generated on the Island is directed via pumps and/or piping to the Town's wastewater treatment facility.

The Seabrook Island Property Owners Association Storm Drainage Report is included in this Plan in Section 7.7 "Storm Drainage Report." The Association manages drainage for the beachfront areas within the Town.

Section 4. Beach Management and Authorities

Below is a summary of the federal and state agencies that participate in or support the Town of Seabrook Island Beach Management Plan and beach management process.

Federal Agencies

There are six federal agencies that directly affect Seabrook Island beach management.

a. The US Army Corps of Engineers (USACE) is responsible for providing engineering services to the United States and plays a major role in permitting beach renourishment projects including those like our planned Captain Sams Inlet relocation.

b. The US Fish and Wildlife Service (USFWS) is the federal agency responsible for the protection of federal fish and wildlife species and their habitats, specifically those that are imperiled, threatened, or endangered. This is the agency that declared Seabrook Island as a critical habitat for the loggerhead sea turtle and the piping plover. They support the federal permitting process with expertise to evaluate the impact of planned projects on fish and wildlife.

c. The Federal Emergency Management Agency (FEMA) is part of the Department of Homeland Security and is responsible for reducing the loss of life and property and protecting the United States from hazards, including natural disasters. They provide a wide variety of support functions that are key to disaster preparedness and response.

d. The National Oceanic and Atmospheric Administration (NOAA) is a federal agency housed within the Department of Commerce. The mission of the NOAA is to protect federal trust resources, provide mapping of navigation channels, monitor and forecast weather, monitor coastal dynamics and conditions, and managing the nation's coast. The groups under this service combine to manage all of the staffs that monitor and manage our coastal resources. This includes the National Marine Fisheries Service (NMFS), which oversees NOAA's fisheries and sea turtles while they are in the water, and which designates Essential Fish Habitat under the Magnuson-Stevens Act of 1976 (Amended 2013).

e. The United States Coast Guard (USCG) is the federal agency responsible for protecting the nation's waterways and coastline as part of the Department of Homeland Security. For the Town of Seabrook Island, this group's major support functions are security, water safety and rescue.

f. The United States Geological Survey (USGS) is a federal agency housed within the Department of the Interior. The mission of the USGS is to serve the nation by providing reliable scientific information to describe the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy and mineral resources; and enhance and protect our quality of life. This group provides Seabrook Island with the best scientific information available in support of our disaster planning and recovery activities.

State Agencies

There are four State agencies that are the most critical to the Seabrook Island beach management process:

a. The Department of Health and Environmental Control (DHEC) is the state's health and environmental management agency and houses the Office of Ocean and Coastal Resource Management (OCRM). The DHEC OCRM (formerly known as the South Carolina Coastal Council) is the State's coastal management agency. As such, this State department is Seabrook Island's major interface for all beach management questions and support including this Comprehensive Beach Management Plan. This group plays a major role in reviewing and permitting the beach renourishment projects that are critical to the Town's beach management strategy.

b. The South Carolina Department of Natural Resources (DNR) is the principal advocate for and steward of the State's natural resources. For Seabrook Island, this is the group providing direct support to the island's wildlife preservation efforts.

c. The South Carolina Department of Transportation (DOT) is responsible for planning, constructing and maintaining State roads and bridges, and providing mass transit services in the State. From Seabrook Island's beach management perspective, this agency's most important function is maintaining the evacuation routes to be used in any disaster event that calls for an evacuation.

d. The South Carolina Emergency Management Division (EMD) provides major disaster preparation, response, and recovery assistance. For Seabrook Island a major disaster would include a hurricane, tsunami, tornado, wildfire or earthquake.

Section 4.1 State Authorities

4.1.1 Overview of State Policies (Beachfront Management Act)

The South Carolina, Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management (DHEC-OCRM) is responsible for the management of the state's beaches and coastal areas. In 1988, the State Beachfront Management Act was adopted by the General Assembly. This Act increased the state's authority to manage the coastal zone and beaches.

The Act includes several key legislative findings, including (summarized):

a. the importance of the beach and dune system in protecting life and property from storms, providing significant economic revenue through tourism, providing habitat for important plants and animals, and providing a healthy environment for recreation and improved quality of life of all citizens;
b. unwise development has been sited too close to and has jeopardized the stability of the beach/dune system;
c. the use of armoring in the form of hard erosion control devices such as seawalls, bulkheads, and rip-rap to protect erosion-threatened structures has not proven effective, has given a false sense of security, and in many instances, have increased the vulnerability of beachfront property to damage from wind and waves while contributing to the deterioration and loss of the dry sand beach;
d. inlet and harbor management practices, including the construction of jetties which have not been designed to accommodate the longshore transport of sand, may deprive downdrift beach/dune systems of their natural sand supply;
e. it is in the State's best interest to protect and promote increased public access to beaches for visitors and South Carolina residents alike: and,
f. a coordinated state policy for post-storm management of the beach and dunes did not exist and that a comprehensive beach management plan was needed to prevent unwise development and minimize adverse impacts.

As previously described in Section 1 "Introduction," the Beachfront Management Act then established eight state policies to guide the management of ocean beaches:

a. Protect, preserve, restore, and enhance the beach/dune system;
b. Create a comprehensive, long-range beach management plan and require local beach management plans for the protection, preservation, restoration, and enhancement of the beach/dune system, each promoting wise use of the state's beachfront to include a gradual retreat from the system over a forty-year period;
c. Severely restrict the use of hard erosion control devices and encourage the replacement of hard erosion control devices with soft technologies which will provide for the protection of the shoreline without long-term adverse effects;
d. Encourage the use of erosion-inhibiting techniques which do not adversely impact the long-term well-being of the beach/dune system;
e. Promote carefully planned nourishment as a means of beach preservation and restoration where economically feasible;
f. Preserve existing public access and promote the enhancement of public access for all citizens including the handicapped and encourage the purchase of lands adjacent to the Atlantic Ocean to enhance public access;
g. Involve local governments in long-range comprehensive planning and management of the beach/dune system in which they have a vested interest; and,
h. Establish procedures and guidelines for the emergency management of the beach/dune system following a significant storm event.

DHEC-OCRM is responsible for implementing these policies through a comprehensive management program that includes research and policy development, state and local planning, regulation and enforcement, restoration, and extension and education activities.

4.1.2 Beachfront Setback Area

Sections § 48-39-280 of the Beachfront Management Act, as amended, requires DHEC-OCRM to establish and periodically review (once every eight to ten years) the position of the two lines of beachfront jurisdiction, the Baseline and the Setback Line, as well as the average annual erosion rate for all oceanfront land that is developed or potentially could be developed. The purpose of these jurisdictional lines is to implement § 48-39-280(A) of the statute, which reads as follows:

"A forty-year policy of retreat from the shoreline is established. The department must implement this policy and must utilize the best available scientific and historical data in the implementation. The department must establish a baseline which parallels the shoreline for each standard erosion zone and each inlet erosion zone."

The Baseline is the more seaward line of jurisdiction and is typically located at the crest of the primary sand dune. The Setback Line is the landward line of jurisdiction and is established landward of the Baseline at a distance equal to 40 times the average annual erosion rate, as calculated from the best historical and scientific data, or at a minimum distance of 20 feet landward of the Baseline for stable or accretional beaches.

To establish the Baseline position, the shoreline must first be classified as an inlet zone or a standard zone. Areas that are close to inlets and have non-parallel offshore bathymetric contours and non-parallel historical shoreline positions are classified as inlet zones, while all other areas are classified as standard zones. Inlet zones are further classified as stabilized if jetties, groins, or seawalls are present, or as unstabilized. In unstabilized inlet

zones, the Baseline is located at the most landward shoreline position at any time during the past 40 years, unless the best available data indicates the shoreline is unlikely to return to its former position. No other data such as: historical inlet migration; inlet stability; channel and ebb delta changes; sediment bypassing; or sediment budgets indicated other data should be considered for Seabrook Island. This Baseline position was established by reviewing historical aerial photographs and selecting the most landward shoreline position.

In stabilized inlet zones and standard zones, the Baseline is located at the crest of the primary oceanfront sand dune using beach survey data or dune field topographic data such as LiDAR or Light Detection and Ranging. If the shoreline is armored with a seawall or bulkhead and no sand dune exists, then a theoretical dune crest position is calculated from beach survey data.

Setback Area Regulations (summary)

- No new construction is permitted in the setback area, with the exception of wooden walkways not more than six feet wide, wooden decks no larger than 144 square feet, public fishing piers, golf courses, normal landscaping, pools that were located landward of existing functioning erosion control structures, groins, or structures permitted by an OCRM special permit. An OCRM permit is required for all of the above actions except the construction of wooden walkways.
- Owners may replace habitable structures within the setback area that have been destroyed beyond repair by natural causes after notifying OCRM. The new structure must not exceed the original square footage and can be no further seaward than the original structure.
- No new erosion control devices are allowed in the setback area except to protect a public highway that existed prior to the enactment of the Beachfront Management Act.
- No new pools are allowed in the setback area, unless they are located as landward as possible of an existing, functional erosion control device. Pools that existed prior to 1988 may be repaired or replaced if destroyed beyond repair. The owner must certify that the new pool is located as landward as practical, is no larger than the original pool, and is constructed in such a manner that it cannot act as an erosion control device.

Maps of the Baseline and Setback Lines for the Town of Seabrook Island can be found in Section 7.2 “Structure Inventory Table” of this Plan.

Section 4.2 Local Government and Authorities

The Town of Seabrook Island is a municipality that was incorporated under the laws of the State of South Carolina in 1987. The Seabrook Island Property Owners Association, locally referred to as SIPOA, is a South Carolina non-profit mutual benefit corporation. The Town of Seabrook Island and SIPOA cooperatively manage Seabrook Island’s beaches and land adjacent to the Atlantic Ocean and portions of the North Edisto River Inlet.

Here are the general boundaries for beach related responsibilities of the Town, the

Property Owners Association as well as for St. Christopher Camp and the Seabrook Island Club that also play a role in beach management.

a. The Town of Seabrook Island is responsible for issues relating to the beach from the high water mark to 150 yards seaward of the low watermark including access by watercraft.
b. The Property Owners Association is responsible for the Beach Trust Properties (as described in Section 4.2.4 "Beachfront Development Regulations") between the property owners' property lines and the high water mark, for all of the island's roads inside the gate and the beach access boardwalks. The Association also has the management and financial responsibility for the beach replenishment projects as described in Section 5 "Erosion Control Management."
c. St. Christopher Camp, as the owner of much of the Island's Edisto River beach front, has an important role in beach management by agreeing to provide access through their property and use of their beach vehicle access road for emergencies. St. Christopher Camp has deed covenant based rights to use the Property Owners' roads for access to their property.
d. The Seabrook Island Club, as another significant beachfront owner, supports beach access adjacent to their Club facilities and shares their parking lots with beach visitors. They also have deed covenant based rights for their members, guests and employees to use the Property Owners Association roads for access to their property.

4.2.1 The Town of Seabrook Island's Comprehensive Plan

The Comprehensive Plan of the Town of Seabrook Island was adopted in 1999 and most recently revised in 2009. It specifically recognizes that the "ocean and beach front areas" of the island "are critically important to the community." Overall, the Comprehensive Plan seeks to support the community's vision that Seabrook Island is to be:

> *"…a residential community where growth is managed, commercial development activities are limited and the natural environment is preserved, while respecting the rights of individuals and their property."*

In support of this vision, the Town's comprehensive plan articulates multiple goals, including to protect and preserve the island's wetlands, sand dunes, wildlife and trees, and to ensure that future development on the island compliments and enhances the natural beauty and residential character of the community. Similarly, the Seabrook Island Property Owners Association has articulated a goal of protecting Seabrook Island's "pristine beach environment…while providing easy access and accommodations to owners and guests alike."

The full text of the Comprehensive Plan for the Town of Seabrook Island may be viewed at the Town Hall at 2001 Seabrook Island Road.

4.2.2 Hazard Mitigation Plan

The Town of Seabrook Island was among the original signatories to The Charleston Regional Hazard Mitigation Plan, adopting it as an official plan of the Town in 1999. From the inception, the Regional Hazard Mitigation Plan sought to identify and determine appropriate mechanisms to address the various types of hazards facing the Charleston region. See, www.charlestoncounty.org/ Charleston Regional Hazard Mitigation Plan.

4.2.3 Disaster Preparedness and Evacuation Plans

The Town of Seabrook Island, the Seabrook Island Property Owners Association and the Seabrook Island Club have each developed detailed emergency plans. The development of these plans was carefully coordinated to make them complimentary to each other and they include agreements to cooperate in emergencies with detailed and robust preparedness and specific emergency response actions. All three of these plans were developed with the help of Scott Cave of Atlantic Business Continuity Services. They address a wide variety of emergencies including hurricanes, tornados, earthquakes, tsunamis, fires, floods, and other less likely or lesser impact situations.

The organizations have agreed to jointly participate in a Disaster Recovery Council, including representatives of the Town, the Property Owners Association, the Seabrook Island Club and St. Christopher Camp. In the event of a disaster, this council will share information and coordinate the response and recovery efforts.

Major components of the Town's and other Island organizations' disaster plans, the Town Code and the associated letters of understanding among the Island's responsible entities provide:

a. The organizations have agreed to reasonably coordinate and share their individual assets and facilities for use during an emergency or disaster event. They have agreed to use these assets and facilities during times of emergency for the benefit of "citizens of the Town and all those in need within the Town's municipal limits," consistent with each entity's obligations to its own constituents.
b. The Town has been designated as having primary responsibility to communicate with island residents concerning potential or imminent threats. The Town has the final authority for the content of those communications. All of the organizations have mutually pledged to coordinate message content in communications to their respective constituencies.
c. The Town's Mayor is designated as the official with authority to declare a state of emergency and to order an evacuation of the Town when determined to be appropriate in respect of a disaster event.
d. The Seabrook Island Property Owners Association, which normally has responsibility for security operations for the gated portion of the Town, is authorized to arrange for disaster security services, such as those needed to deny access through the Property Owners Association security gate to all persons not engaged in emergency response.

e. The Town will identify the individuals responsible to make the preliminary damage assessment and establish initial recovery roles of those who are to be the first and second groups of persons to reenter the Island following an evacuation. In addition, the Town is responsible for communicating information to governmental entities and Island residents.
f. The Town and Property Owners Association have agreed that as a general proposition, the removal of debris from the roadways of private communities is the responsibility of such communities. However, there are occasions where the magnitude of the disaster may compel the involvement of the Town. Following an emergency or disaster, the Town will determine, based on the criteria set forth in the applicable Town ordinance, whether such conditions exist sufficient to warrant removal of all or a portions of the debris from private roadways in the manner set forth in Title 14 of the Town code and will notify the Property Owners Association of its determination.
g. Where applicable, the Town will determine when resident reentry to the island is permitted, how to best communicate information regarding reentry and to coordinate with Charleston County concerning damage inspections.

4.2.4 Beachfront Development Regulations

Beach Trust Property

The original developer of Seabrook Island agreed by recorded protective covenant that it would hold in trust for the benefit of Seabrook Island residents all property lying between the high water marks of the Atlantic Ocean and North Edisto River, and the front property lines of oceanfront property. The Property Owners Association succeeded to the Beach Trust Obligations of the covenant upon assuming ownership of the property. Because of the Association's 1983 and 1996 projects to relocate Captain Sams Inlet, significant amounts of new beach trust property were created seaward of the 1983 line totaling between 165 and 220 acres of accreted beaches, dunes, washover, lagoons and marsh habitat.

As trustee of this and all other land constituting beach trust property, the Seabrook Island Property Owners Association is enjoined by *protective covenant from ever subdividing, selling or otherwise disposing of that property in any manner that would "permit its use for the erection of any structure whatsoever," absent agreement of contiguous landowners.* In addition, beachfront property owners are prohibited from ever removing or otherwise lowering the elevation of sand dunes or ridges located on beach trust property. Finally, it is unlawful for any person to destroy, cut or trim flora or trees in the beach trust area absent permits from the Town, OCRM and SIPOA. Even with the requisite permits, such trimming is prohibited below 6 feet from ground level.

Development Regulation of Other Property

As part of the Environmental Performance Standards' portion of its 2011 Development Standards Ordinance or DSO, and in recognition of the environmental sensitivity of the island, the Town has expressly agreed to enforce, "to the letter of the law," Chapter 39 of

the South Carolina Coastal Management Act when considering any construction permit application. Adding to the stringency of this overall position, the Town's DSO also provides that adherence to the minimum setback specified by Chapter 39 for construction within a half mile of the Atlantic Ocean is required, but only if that setback is greater (more landward) than two other alternative construction setbacks that are set forth in the DSO itself. Also, according to the DSO, guidelines of OCRM relating to storm water management must be complied with in zoning, building or other construction permits for Seabrook Island property within a half mile of the Atlantic Ocean. And similarly, prior approval must be sought and obtained from OCRM before seeking approval from the Town for a permit to construct any walkway or stairs seaward of the OCRM forty-year Setback Line if the structure is to exceed six feet in width.

The Environmental Performance Standards (Article 9) portion of the DSO may be found at the Town's website www.townofseabrookisland.org/ Forms & Permits/ Building & Zoning/ Development Standards Ordinance.

4.2.5 Regulations on Beach and Shoreline Protection

As described immediately above and elsewhere in this Plan update, the Town Development Standards Ordinance does not allow new structures seaward of the Setback Line except for beach access walkways. There are only five existing structures seaward of that Setback Line that are not beach access boardwalks. There are two swimming pools, a gazebo and two Seabrook Island Club facilities buildings. These five structures are described in Section 2.3.1 "Beachfront Structural Inventory" and were built with the proper permits that were consistent with the State's policy. The Town of Seabrook Island does not intend to approve any added structures that do not meet the requirements of the South Carolina Coastal Management Act or its own Development Standards Ordinance. The Town plans, building code and zoning preclude any new development that is not consistent with the South Carolina forty-year retreat policy.

4.2.6 Other Regulations on Beach Management

Further evidencing its view that the "ocean and beach front areas" of the Island "are critically important to the community," the Town of Seabrook Island has enacted an array of other protections for those areas, including: regulating dune alteration, removal and/or fencing; prohibiting removal or destruction of sea oats and other dune vegetation; prohibiting unauthorized overnight use of the beaches; prohibiting unauthorized use of non-official vehicles on the beaches; prohibiting disturbance or otherwise causing harm to the nests of loggerhead sea turtles and the nests of endangered species of birds; excluding domestic animals from the beaches, except dogs on lead or off lead at the specified times in designated areas; prohibiting littering of the beaches; prohibiting negligent or under the influence operation of watercraft; prohibiting the non-emergency launching or retrieval of watercraft from the beaches, except for sailboats, surfboards, paddleboards, rafts, inner tubes, canoes, kayaks or other similar (non motorized) vessels; and prohibiting any commercial activity seaward of the State established Setback Line (except for the grandfathered and Town licensed Seabrook Island Club facilities on the south corner of the island).

Unless otherwise specified, violation of any of these restrictions subjects the violator to a fine up to $500, or imprisonment up to 30 days, or both. A copy of the applicable sections of the Town Code, entitled “Beachfront Management,” are included in Section 7.5 “Laws and Ordinances/Rules and Regulations” of this Plan.

Section 5.0 Erosion Control Management

This section of the Town of Seabrook Island Comprehensive Beach Management Plan addresses the shoreline history, condition of the beach, long-term erosion rates, and various beach maintenance and shore protection projects implemented by the community and individual property owners. It draws on 40 years of coastal erosion studies and annual beach monitoring surveys dating back to 1978 (Table 5.1).

Seabrook Island is a mixed-energy, mesotidal barrier island (Hayes 1975, 1994) fully under the influence of North Edisto River Inlet and Captain Sams Inlet. Its 18,940-ft-long (~3.6 miles) shoreline* includes:

~5,930-ft-long inlet conservation zone (Captain Sams Inlet migration area) at the updrift end (northeast of OCRM 2575).

~4,085-ft-long developed oceanfront (“North Beach” north of Renken Point—OCRM 2540).

~3,755-ft-long developed shoreline along the “northern marginal” channel of North Edisto River Inlet.

~5,170-ft-long developed shoreline along the main channel of North Edisto River (Fig 5.0a).

Renken Point marks a turn in the shoreline (vicinity of OCRM 2540) between the Kiawah–Seabrook strand beach and two beach segments along North Edisto River Inlet.

OCRM (formerly South Carolina Coastal Council) classified the Seabrook Island shoreline northeast of OCRM monument 2565 (Seabrook Island Beach Monitoring Line 24) as an unstablized inlet zone. The remainder of the island was classified as a stabilized inlet zone under the Beach Management Act (BMA) of 1988 (amended 1990) (Town of Seabrook 1991) (Fig 5.0b). The latter classification was made due to the presence in 1988 of a continuous line of shore-protection structures (seawalls, revetments, and bulkheads) extending ~8,800 ft from OCRM 2565 (vicinity of the 13th hole of the Seabrook Island Club’s Ocean Winds golf course) to Pelican Watch Villas (near OCRM 2505—Line 06).

[*Measured from the 1963, 1983, and 1996 position of Captain Sams Inlet to a point ~2,500 ft west of the Seabrook Island development/St. Christopher Camp border along North Edisto River Inlet (i.e. – between

local beach survey lines 1 to 40—CSE 2014, Table 2). The Kiawah–Seabrook boundary is situated ~100 ft north (east) of the 1963 inlet position.]

Section 5.1 Shoreline Change Analysis

Shoreline change along Seabrook Island has been analyzed by Stephen et al (1975), Hayes et al (1979), NOAA-NOS (1983), Anders et al (1990), and Kana and Andrassy (1993). Hayes (1977) demonstrated that Kiawah Island and Seabrook Island are accreting "beach-ridge" barrier islands isolated from adjacent segments of the coast by Stono Inlet and North Edisto River Inlet, two of the largest tidal rivers emptying along the South Carolina coast. The Kiawah-Seabrook beach strand is divided by Captain Sams Inlet, a relatively small, unstable inlet with a history of (south) westerly migration and periodic breaching of the updrift spit on the Kiawah Island side of the Inlet (Hayes et al 1979).

Coastal Erosion Studies

The following Table 5.1 shows the coastal erosion studies and annual beach monitoring surveys that have been implemented at Seabrook Island dating back to 1978.

Table 5.1 *Seabrook Island Coastal Erosion Studies and Annual Beach Monitoring Surveys*
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Basco, DR. 1993. Review of beach management plans: Seabrook Island, SC. Review Rept., Seabrook Island Property Owners Association; Coastal Engineering Center, Norfolk, VA, 25 pp.
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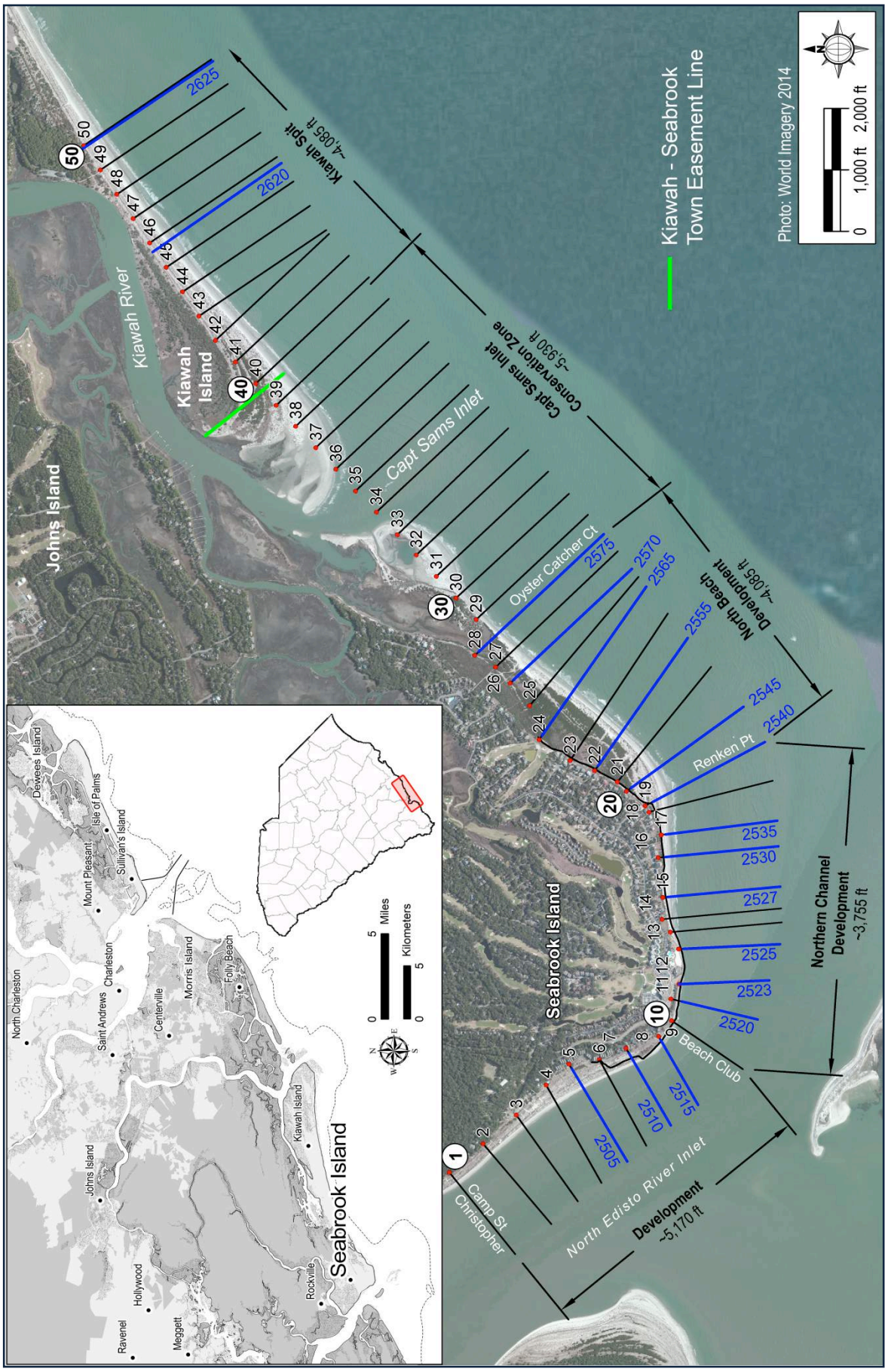

FIGURE 5.0a Seabrook Island showing the major features along the coast. Approximately one-third of the shoreline is the Captain Sams Inlet conservation zone over which the inlet has migrated during the past 50 years (1964–2014).

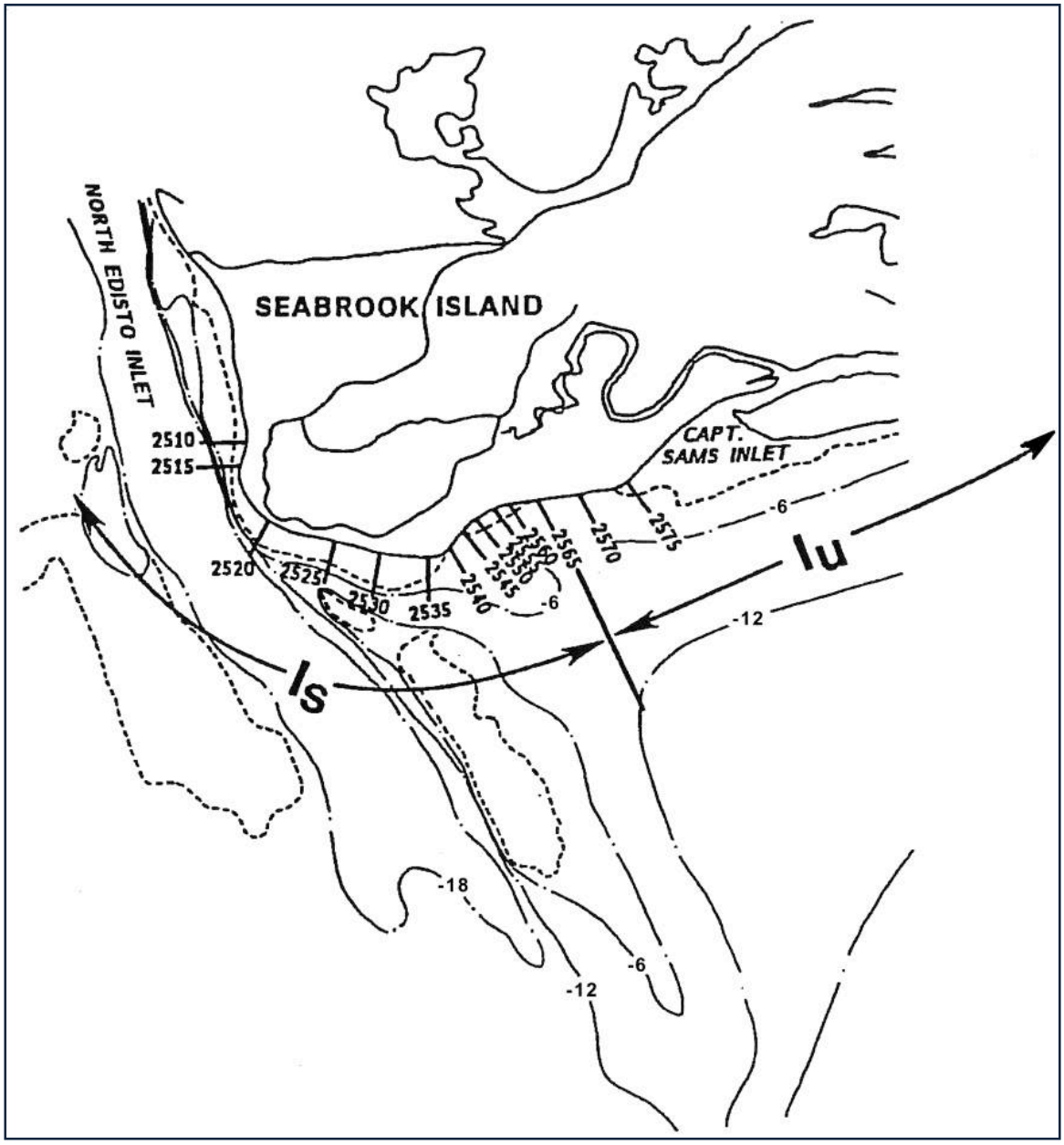

FIGURE 5.0b Delineation of unstabilized (Iu) and stabilized (Is) inlet zones along Seabrook Island under the 1988 Beach Management Act (Town of Seabrook 1991).

Seabrook Island derives its sand supply from Kiawah Island, and Kiawah receives its sand from Stono Inlet via the process of "shoal bypassing" (Gaudiano and Kana 2001). Kiawah has a positive sand budget that has served to provide Seabrook Island with a relatively healthy sand supply over the past couple of centuries. By comparison, Botany Island, the adjacent barrier island to the (south) west, has a negative sand budget as reflected in its severe shoreline recession since the 1850s (Fig 5.1a). Hayes et al (1979) sketched the developing shoreline offset between Seabrook Island and Botany Island that was over 1 mile by the 1970s (Fig 5.1a).

A 1924 US Coast & Geodetic Survey (now NOAA National Ocean Service—NOS) chart illustrates the shoreline offset at North Edisto River Inlet as well as the presence of a small inlet at the southern tip of Seabrook Island and another small inlet at the updrift end of the Island (Fig 5.1b). Hayes et al (1979) compiled sketches of the various small inlets along Seabrook Island dating back to 1661 (Fig 5.1c). This led Hayes et al to conclude that the Kiawah River Inlet (aka Captain Sams Inlet) has a history of downcoast migration and periodic breaching of the Kiawah Spit on a "40–80 year cycle." The most recent natural breach of the Kiawah Spit occurred in 1948 or 1949 (Hayes et al 1979) and is clearly visible on historical aerial photos, the earliest of which dates back to 1939 (source: US Dept of Agriculture Soil Conservation Service). As Figure 5.1c suggests, Captain Sams Inlet has at various times over the past century discharged along most of Seabrook Island's oceanfront.

The NOAA–NOS (1983) Cooperative Shoreline Study, used by Anders et al (1990) in their US Army Corps of Engineers report, provided six "official" historical shorelines for Seabrook Island between 1851/54 and January 1983 (Fig 5.1d). These data confirm that the Seabrook Island shoreline jumped thousands of feet seaward between the 1850s and 1920 and since then has undergone slower rates of change. The NOAA data also confirm that Captain Sams Inlet has migrated over a nearly 2-mile-long corridor between "Beachwalker Park" (a public access area at the western end of Kiawah Island near OCRM 2625) and the present development along Seabrook Island (vicinity of "Oyster Catcher Court" near OCRM 2575).

Anders et al (1990) computed average shoreline movement every 50 meters along the South Carolina coast, demonstrating that Seabrook Island grew seaward by upward of 5 meters per year (m/yr), while adjacent Botany Island receded at rates well over 5 meters per year since the 1850s (Fig 5.1e). The actual rate of shoreline change for Seabrook Island determined by Anders et al (1990) generally diminishes over time (Table 5.1a). By 1983, Seabrook Island was developed and upward of 8,800 linear feet of shoreline was stabilized by shore-protection structures (discussed in Sections 2.3.1 and 5.3 of this Plan). Thus, shoreline changes since then have been influenced by the presence of structures as well as various beach-restoration measures.

TABLE 5.1(a). Average shoreline change rates for Seabrook Island determined by Anders et al (1990) using official NOAA–NOS (1983) shorelines. [*Minor <3.0 ft/yr — Moderate <10 ft/yr — Major >10 ft/yr]

TABLE 5.1(a)			
Period	**Rate (m/yr)**	**Rate (ft/yr)**	**Trend***
1852–1921	6.4	21.0	Major Accretion
1921–1933	3.9	12.8	Major Accretion
1933–1964	0.8	2.6	Minor Accretion
1964–1974	2.1	6.9	Moderate Accretion
1974–1983	0.5	1.6	Minor Accretion

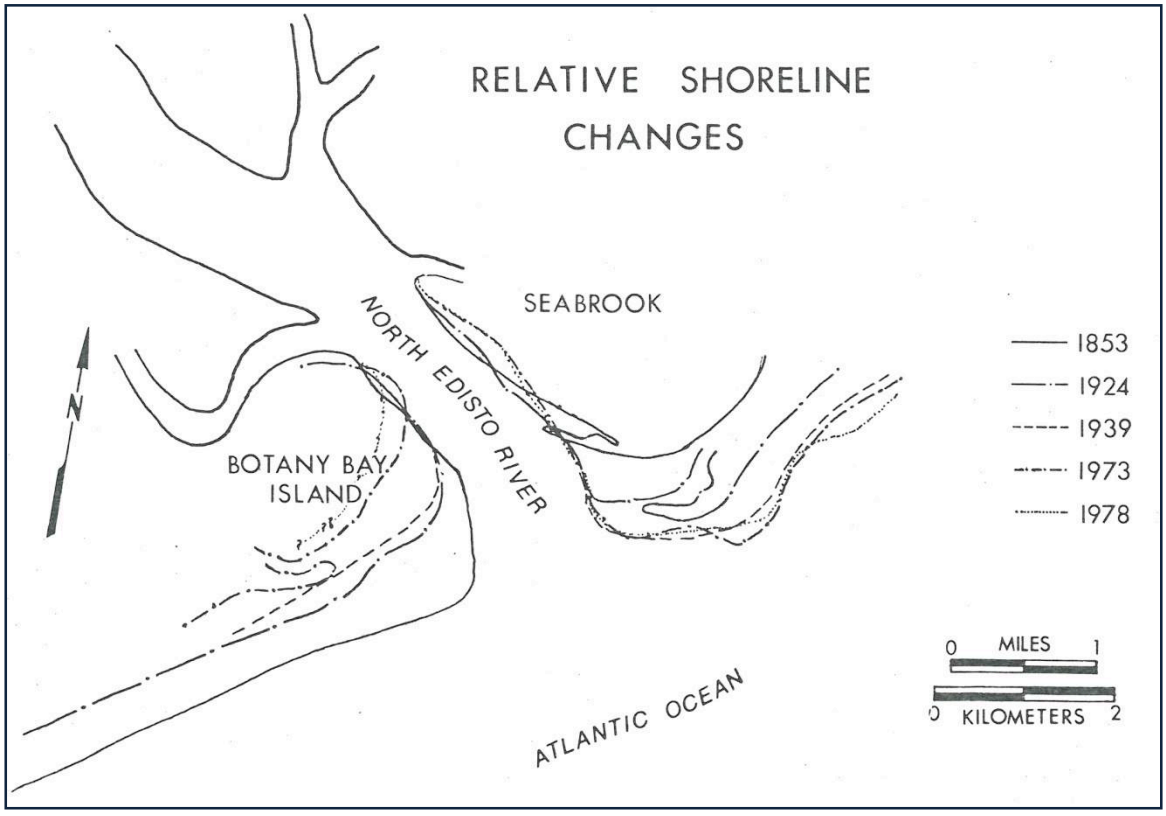

FIGURE 5.1a Sketch of historical shorelines at North Edisto River Inlet (from Hayes et al 1979).

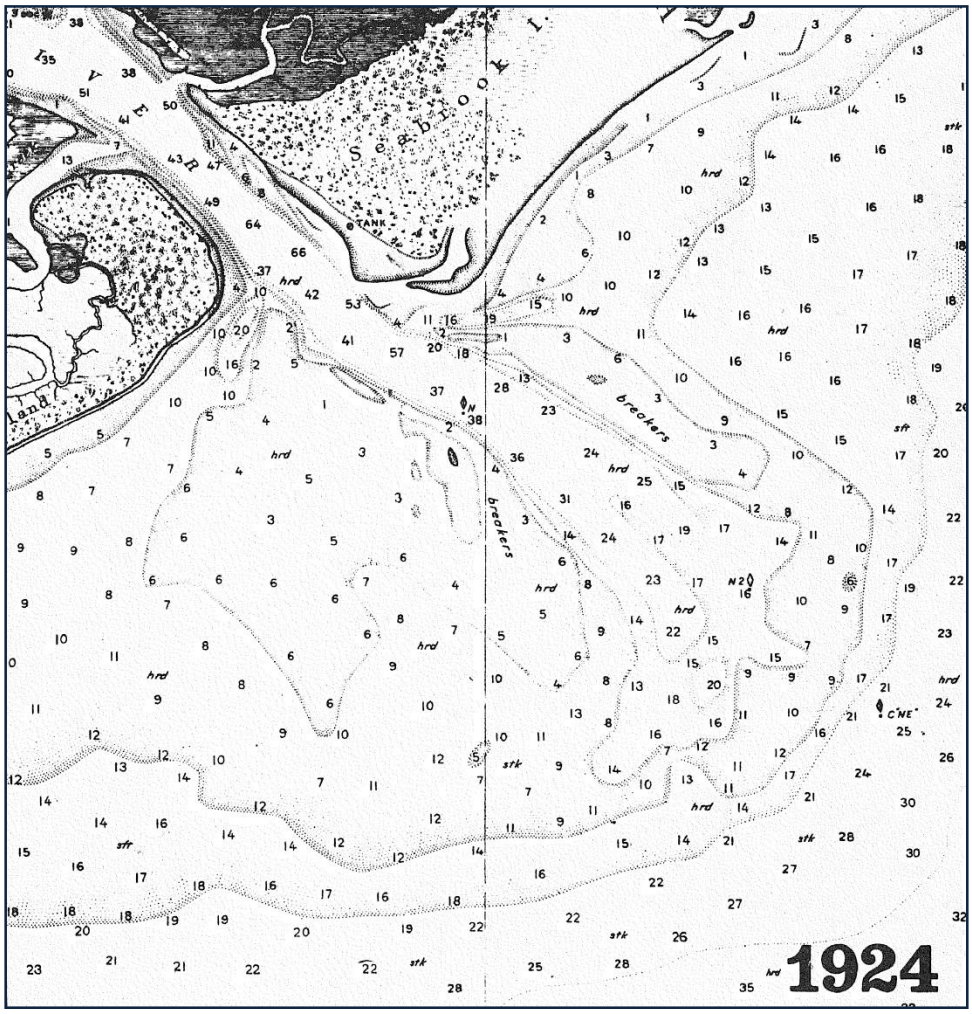

FIGURE 5.1b Section of USCGS (now NOAA–NOS) chart of Seabrook Island prepared in 1924. Note two small inlets discharging at either end of Seabrook Island prior to any development. [From Hayes et al 1979]

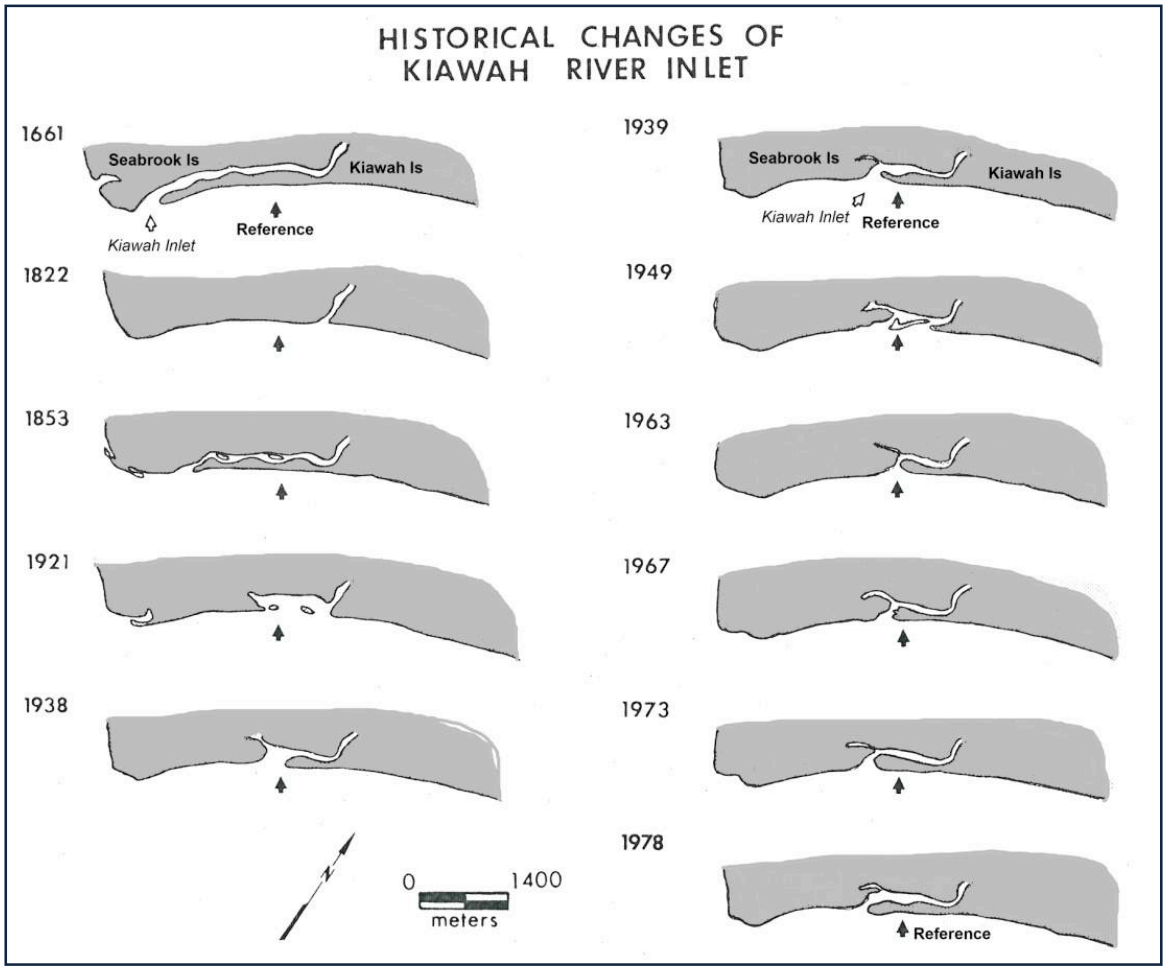

FIGURE 5.1c Sketch of Seabrook Island shorelines showing various locations of Captain Sams Inlet (aka Kiawah River Inlet). [From Hayes et al 1979]

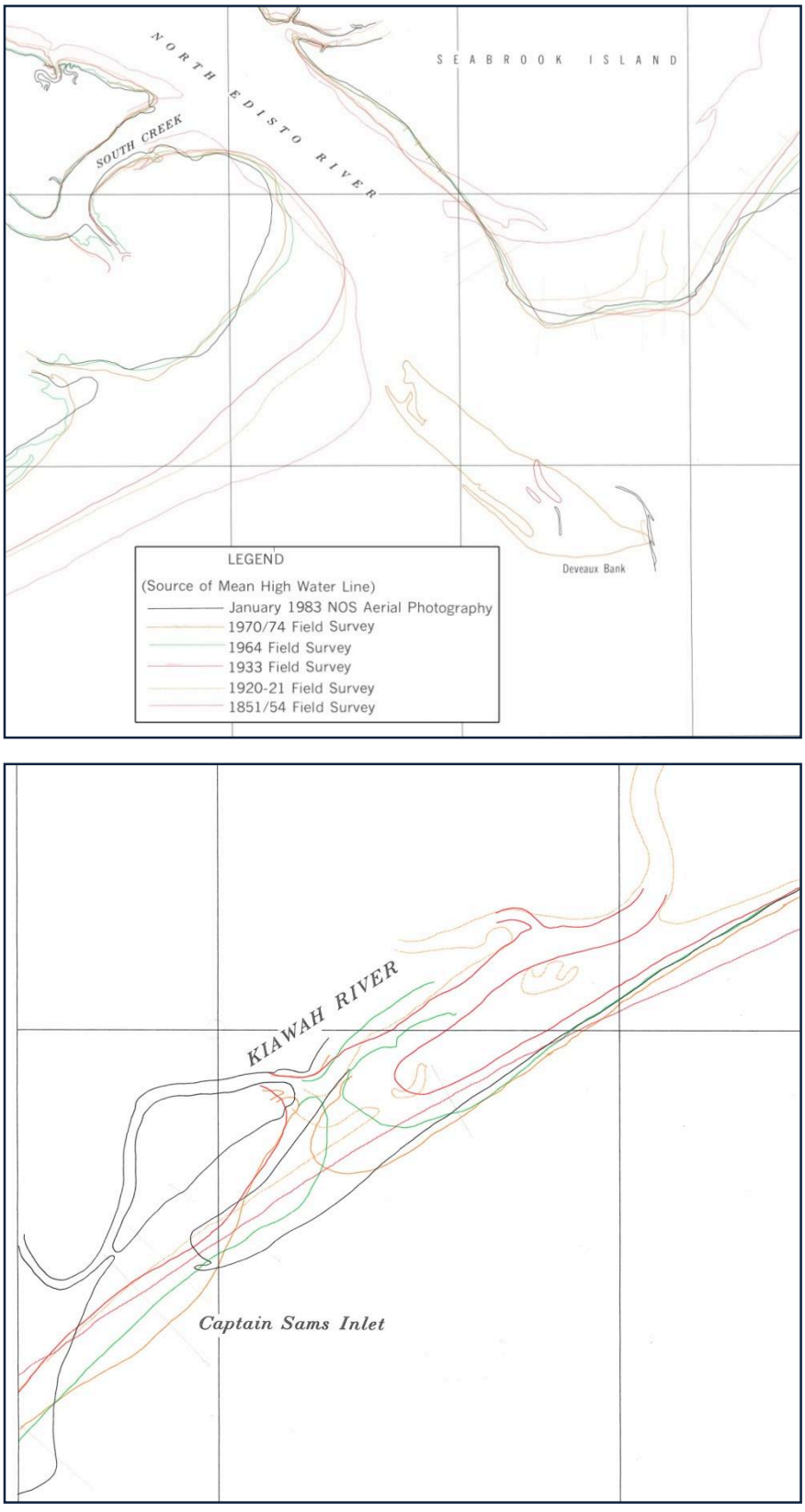

FIGURE 5.1d Official historical shorelines developed by NOAA–NOS Cooperative Shoreline Study (1983) for the Seabrook Island area.

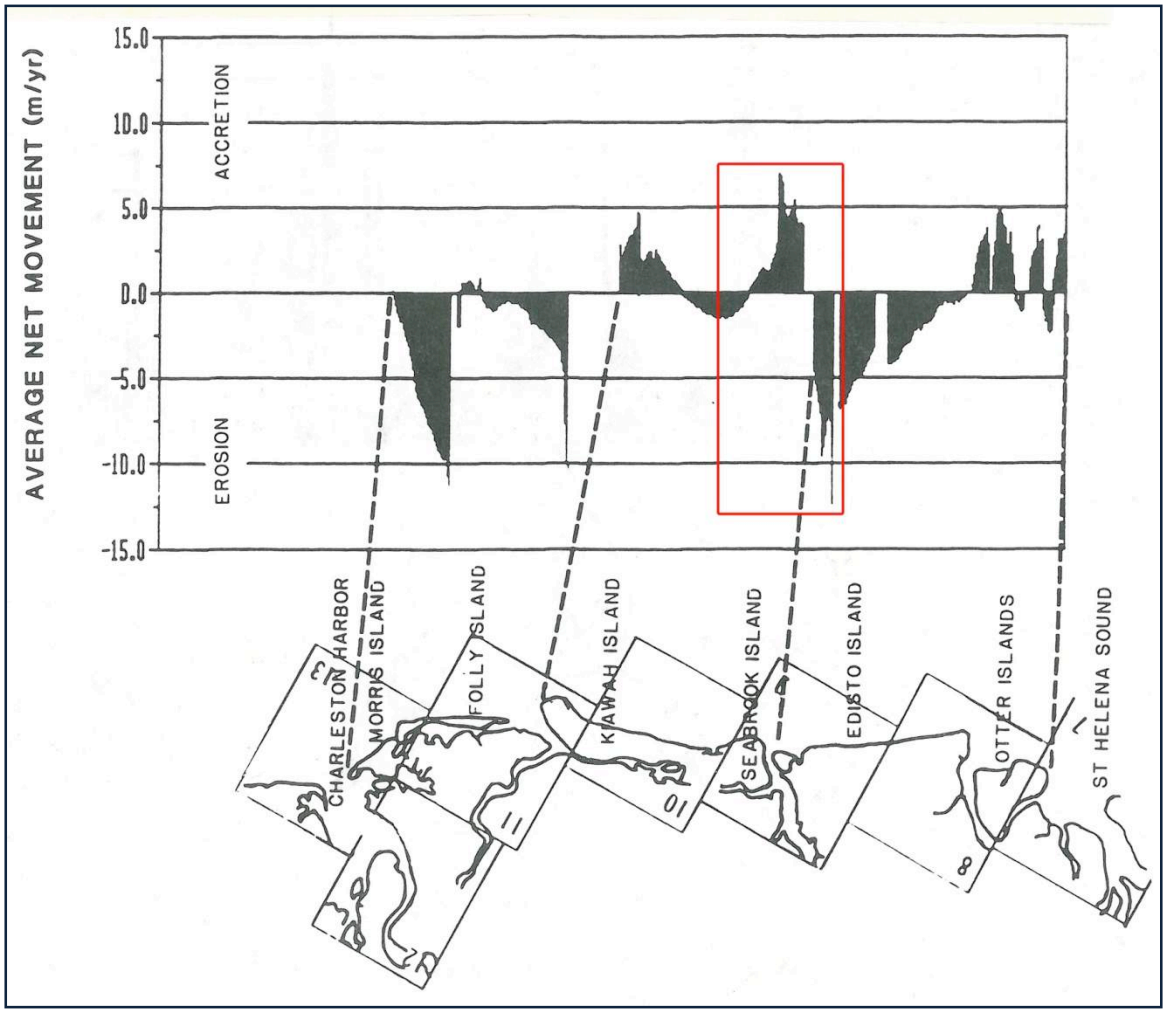

FIGURE 5.1e Average net shoreline movement along the central South Carolina coast for the period 1851–1983. [From Anders et al 1990, Fig 27]

Hayes et al (1979) were the first to recognize that Seabrook Island's shoreline is impacted by the position of Captain Sams Inlet. Not only does inlet migration shorten the island, it produces more irregularity in the downcoast beach the further the inlet migrates. Figure 5.1f shows the 1972 (and 1963) aerial photo with the 1982 shoreline superimposed. As the inlet moves toward Seabrook Island, land in area D is lost while new land forms in area C. The shoals of Captain Sams Inlet (referred to as the "ebb-tidal delta" by Hayes 1980) trap sand and interrupt normal sand transport to Seabrook Island. One important effect is an increasing curvature of the downcoast area (between B and C on Fig 5.1f). The erosion arc near the leading edge of the ebb-tidal delta is produced by changes in wave angles (and energy) such that focused, rapid erosion impacts a segment of the shoreline.

One of the earliest sites needing coastal structures for shore protection was the 13th hole of the golf course in 1975 (Hayes et al 1979). Figure 5.1f shows the fairways to and from the hole under construction in 1972 (v-shaped, cleared land between labels B and C). During the 1970s and early stages of Seabrook Island's development, some segments of shoreline were losing dozens of feet per year while others were gaining land rapidly. The area along segment A was eroding at a moderate rate leading to the first shore-protection structures around 1973 (Hayes et al 1979).

Hayes et al (1979) recommended relocation of Captain Sams Inlet to mitigate the direct impacts of the inlet on Seabrook Island. A relocation was expected to allow sand in the ebb-tidal delta to migrate onshore and rebuild the beach. Sexton (1981) and Sexton and Hayes (1982) had documented natural "bypassing" events whereby a small shoal of Captain Sams Inlet accreted along the downcoast side of the ebb-tidal delta after a channel avulsion (forceful separation or detachment), adding new sand to Seabrook Island in area C. This produced a sudden jump in shoreline position hundreds of feet seaward and demonstrated the importance of "episodic bypassing" of sand between tidal deltas and the beach.

Since the 1980s, Seabrook Island's shoreline has evolved primarily in relation to the artificial relocations of Captain Sams Inlet (1983 and 1996) and a channel-realignment/beach nourishment project. This latter project addressed encroachment of the northern channel on the Island's development in the area between Renken Point and the Seabrook Island Club facilities (OCRM 2520) in 1990 (area A on Fig 5.1f).

Kana and Andrassy (1993) compiled historical high-water and low-water shorelines from aerial photography obtained between November 1963 and January 1992 (Fig 5.1g). Bold arrows and lines highlight the major trends in shoreline movement and inlet position. The maize of lines northeast of the "1982" inlet represents the corridor over which Captain Sams Inlet migrated (Seabrook Island's present inlet conservation zone). The remaining segment along the oceanfront (east of Renken Point) has grown seaward to form "North Beach." A shoal off the southern end of Seabrook Island (off Renken Point) grew and moved landward, forcing the northern channel of North Edisto River Inlet toward Seabrook Island and undermining downcoast section of the beach sometimes

referred to as South Beach. Figure 5.1h isolates two dates from the Kana and Andrassy (1993) analysis showing the relationship between the 1963 low-water shoreline and the 1983 (post-inlet relocation) shoreline. After the inlet was relocated, the shoals of the abandoned inlet gradually migrated onshore and spread downcoast.

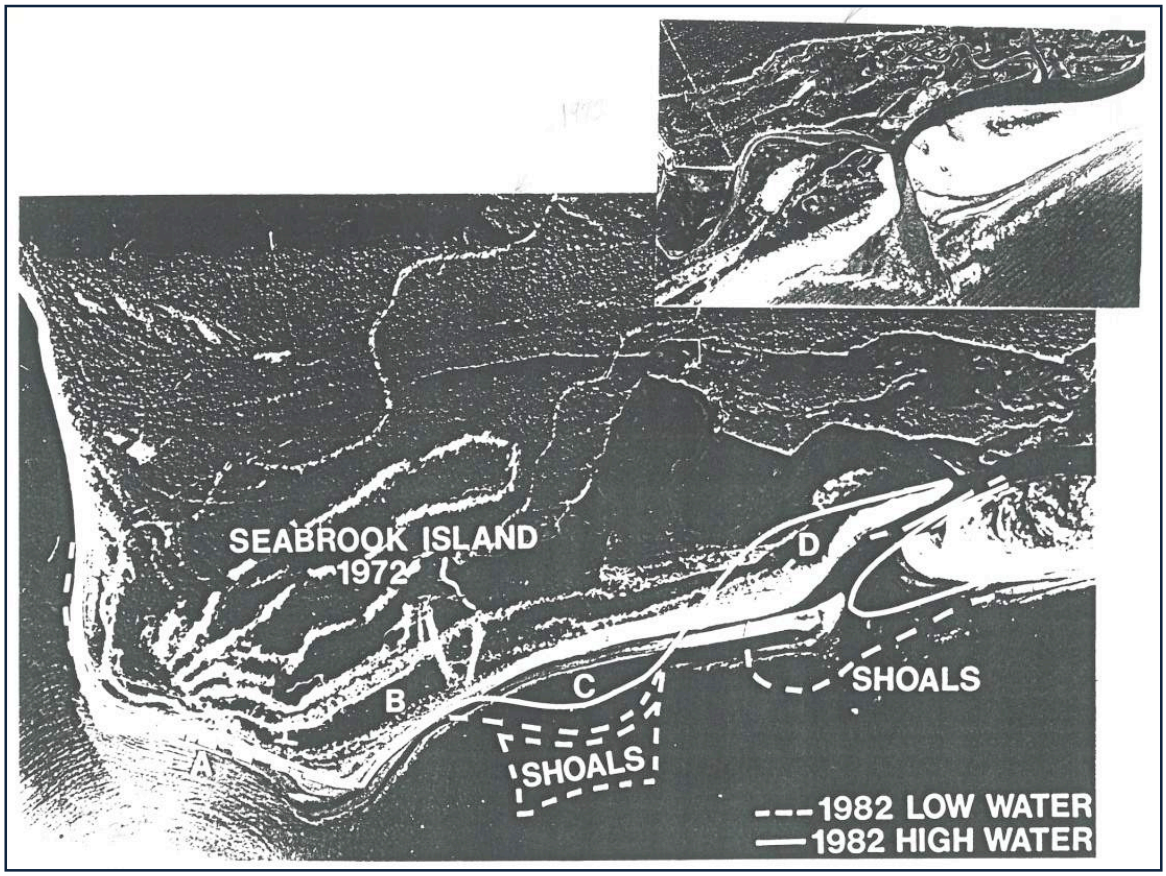

FIGURE 5.1f Seabrook Island in 1972 with the 1982 shoreline superimposed. Reaches A, B, C, and D are referenced in the text. The shoreline morphology becomes increasingly irregular as Captain Sams Inlet (Reach D) migrates toward North Edisto River Inlet (Reach A and left margin of the image). The inset photo shows Captain Sams inlet in 1963. [After Kana 1989]

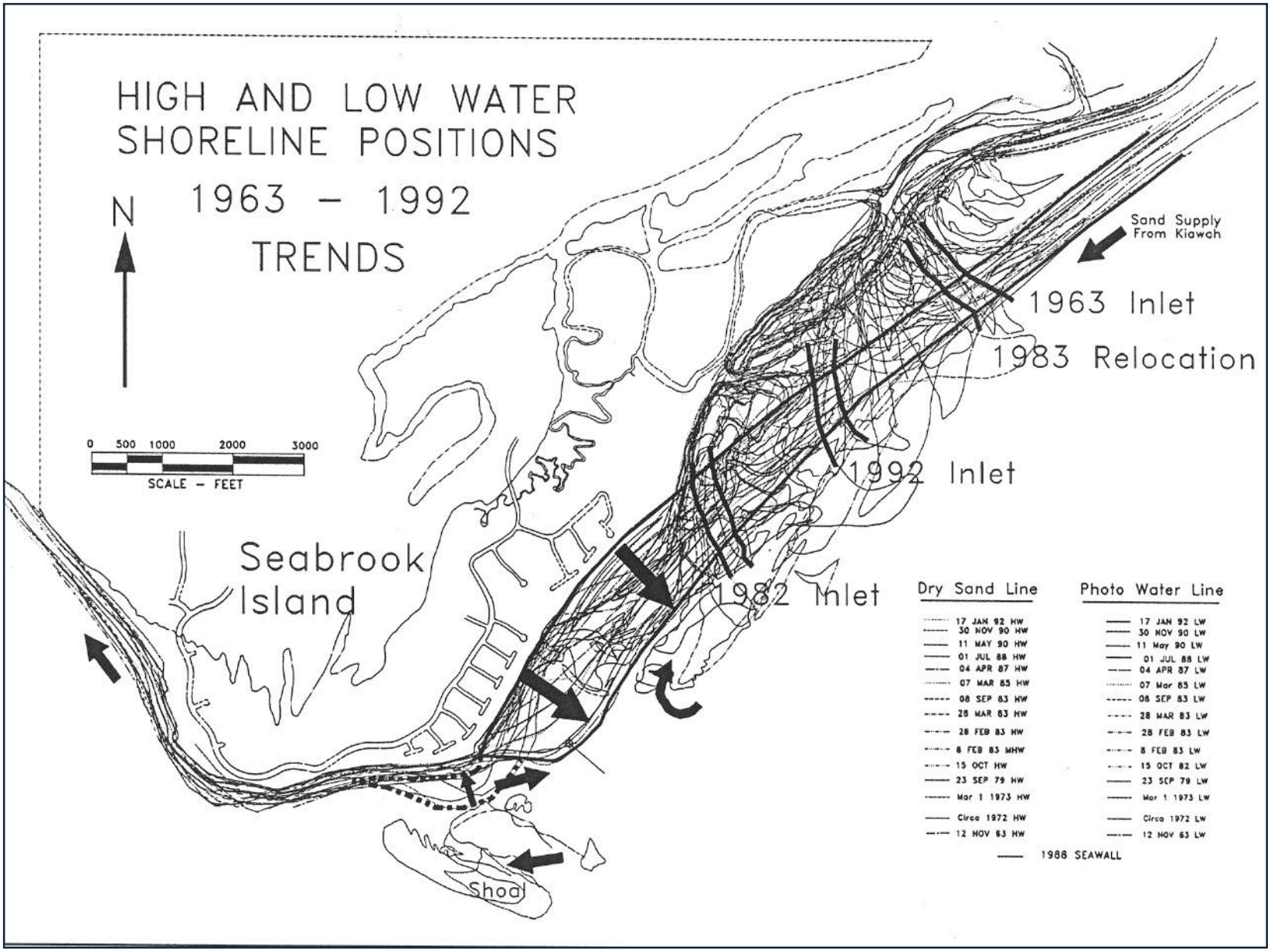

FIGURE 5.1g. High and low water shoreline positions along Seabrook Island between November 1963 and January 1992. Bold lines and arrows highlight trend of accretion along North Beach and erosion at Renken Point. Positions of Captain Sams Inlet at various times are highlighted. [After Kana and Andrassy 1993]

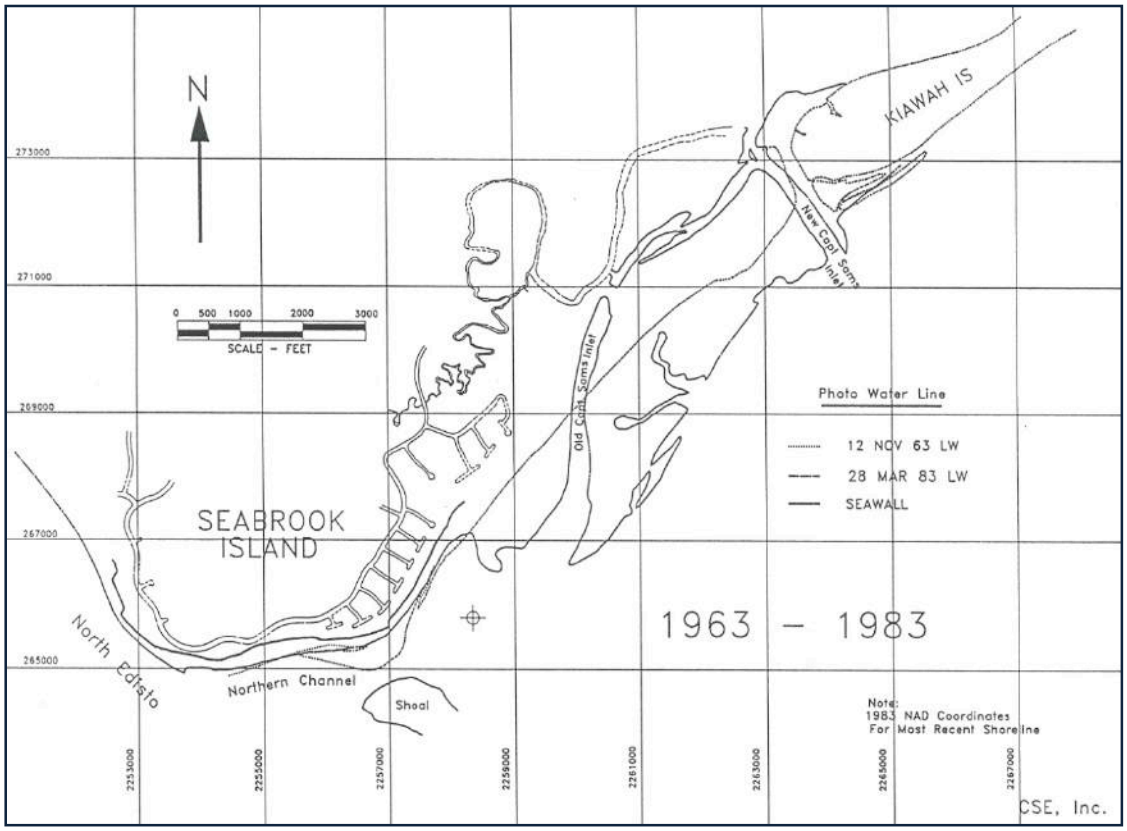

FIGURE 5.1h Low-water shorelines in November 1963 (on which the 1983 inlet relocation point was based) and 28 March 1983, one month after Captain Sams Inlet was relocated. The extensive intertidal bars of the abandoned inlet migrated onshore and downcoast over the next several years. [After Kana & Andrassy 1993]

Figure 5.1i provides updated historical shorelines for Seabrook Island, adding data from 2000 and 2011. These most recent dates reflect conditions after the 1996 relocation of Captain Sams Inlet (back to its 1963 and 1983 position). The 2011 shoreline is well seaward of the 1964 shoreline in nearly all segments of the coast. A developing erosional arc is visible along North Beach, repeating the previously observed finding of focused erosion associated with inlet migration.

OCRM sets official erosion rates for the island and determines placement of development control lines. Figure 5.1j shows the present OCRM Baseline (set in 2012) and the OCRM Setback Line. OCRM has determined that Seabrook Island has a long-term (nominally 40-year) accretion trend. Therefore, the Setback Line is a minimum of 20 ft landward of the Baseline as prescribed under the Beach Management Act. For most of Seabrook Island, the Baseline follows the seawall (most landward shoreline during the past ~40 years). As described in Section 2.3.1 "Beachfront Structural Inventory," only five structures encroach on the Setback Line. The official OCRM Baseline/Setback Line maps are included in Section 2.3.1 and table of coordinates are provided in Section 7.2 "Structure Inventory" of this Plan.

Seabrook Island's shoreline history after 1970 is directly linked to development of the Island and various shore-protection and beach-restoration measures. Table 5.1b provides a summary of major shoreline events to give context for subsequent sections of this Plan.

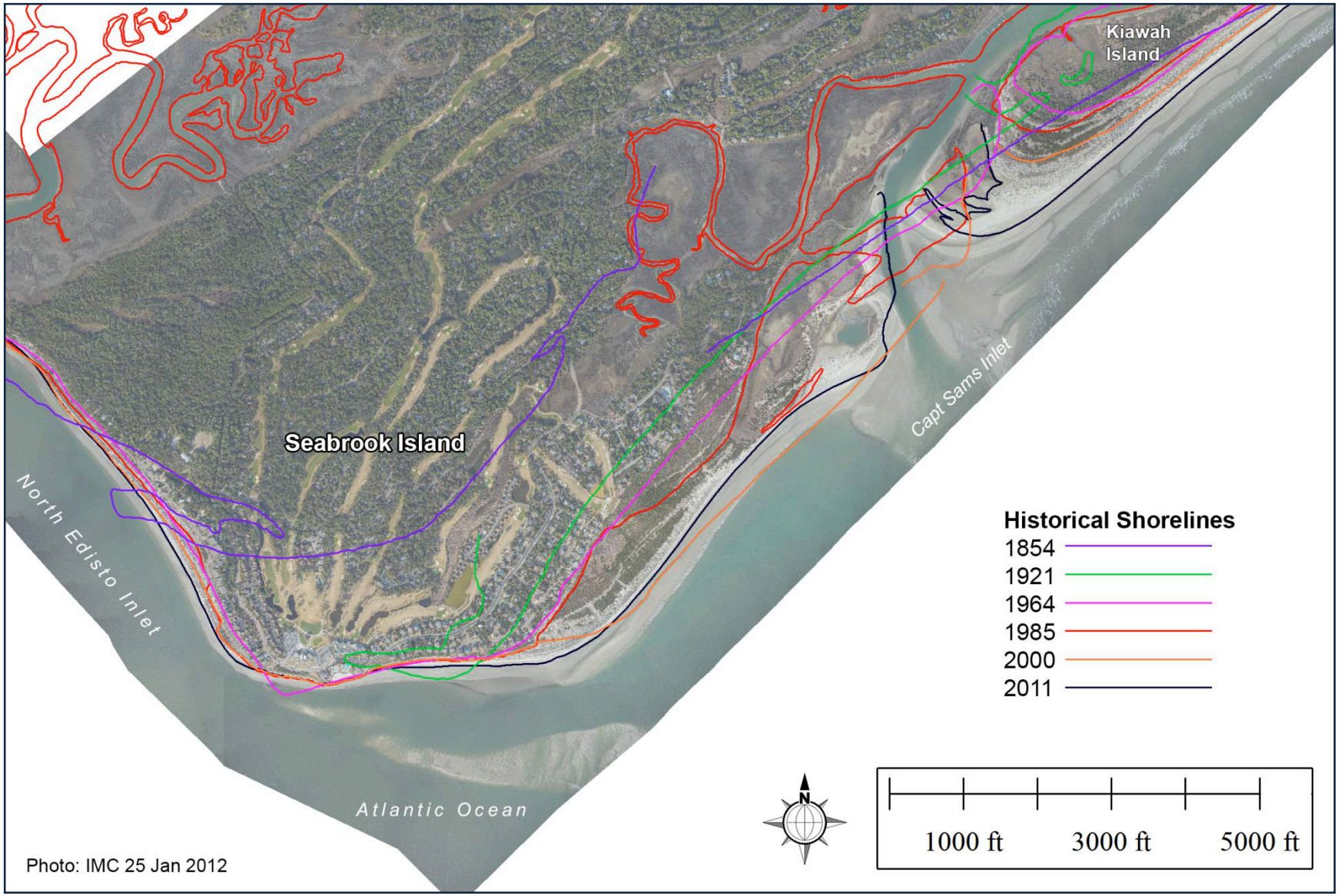

FIGURE 5.1i Updated historical shorelines combining the NOAA–NOS (1983) data with shorelines from 2000 and 2011 superimposed on a January 2012 ortho-rectified aerial image of Seabrook Island.

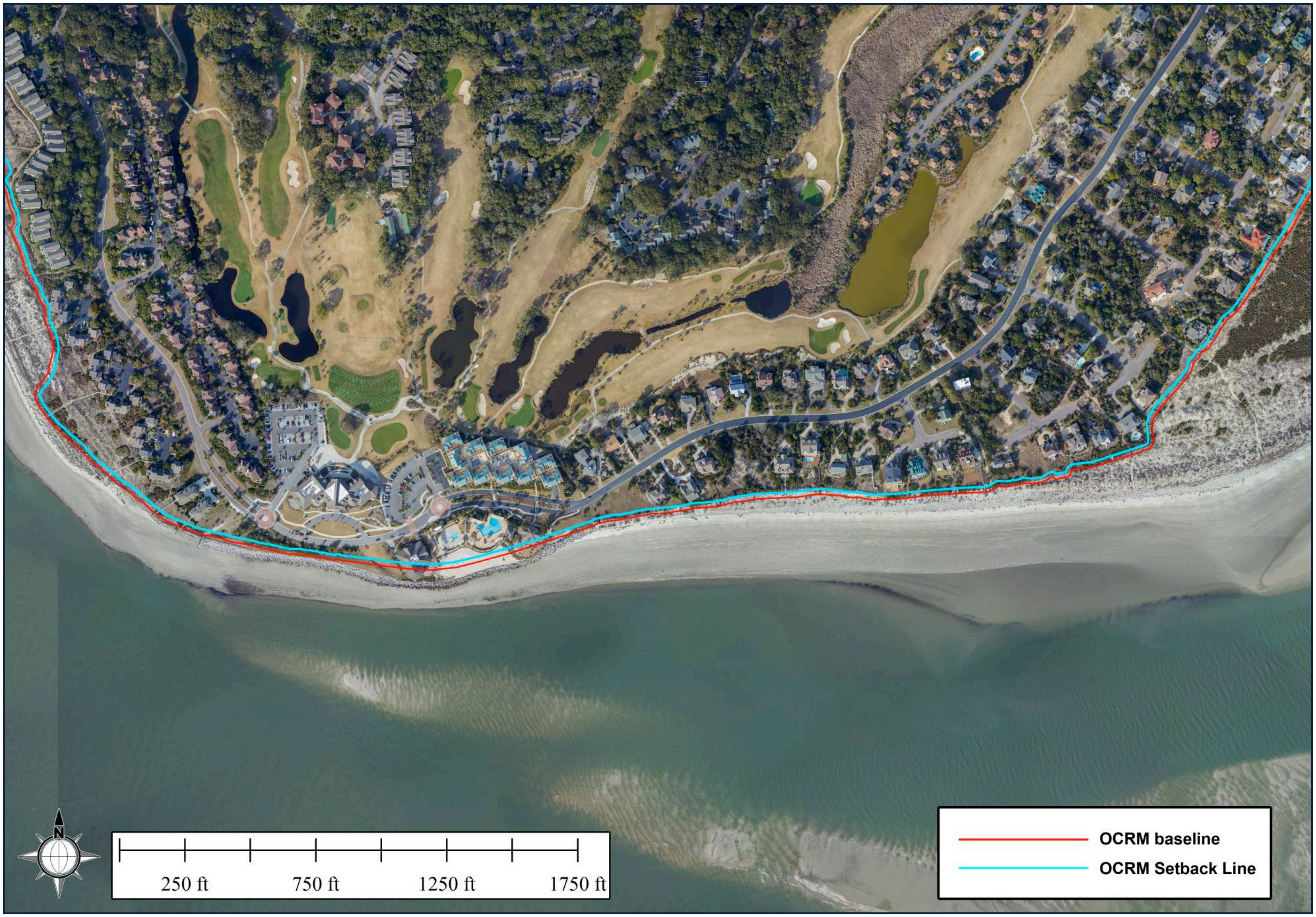

FIGURE 5.1j Official 2012 OCRM Baselines and Setback Line for a portion of Seabrook Island superimposed on a 2012 rectified aerial orthophotograph. The only structure encroached by the lines is the “Beach Club” at the lower left side of the image.

TABLE 5.1b (shown on 7½ pages). Seabrook Island — major shoreline events (after CSE 2007).

FIGURE T-1. Aerial view of Seabrook Island in November 2013.

1948 Captain Sams Inlet breaches the Kiawah Spit near present-day Beachwalker Park, creating multiple channels. A single channel becomes dominant by early 1950s (Fig T-2).

1963 Mouth of Captain Sams Inlet is aligned with the mouth of Captain Sams Creek about 1.5 miles north of the present-day Oyster Catcher beach access. This shoreline and inlet configuration becomes the model for the 1983 and 1996 inlet relocations (Fig T−3).

1960s Seabrook Island's beach is healthy and generally growing seaward. In some places like Renken Point, the rate of growth is over 30 feet per year (ft/yr).

Circa 1970 Seabrook Island becomes a planned-unit development. Roads, golf course, and lots are platted using the existing dune/vegetation line as a basis for the plan. (Development allowed behind the normal limit of tides and waves without regard to historical shoreline trends.)

FIGURE T-2. Vertical photograph (1949) of Seabrook Island before development. Sometime in 1948, Captain Sams Inlet breached the Kiawah Spit near present-day Beachwalker Park (right side of image). The northeastern channel became dominant in the 1950s.

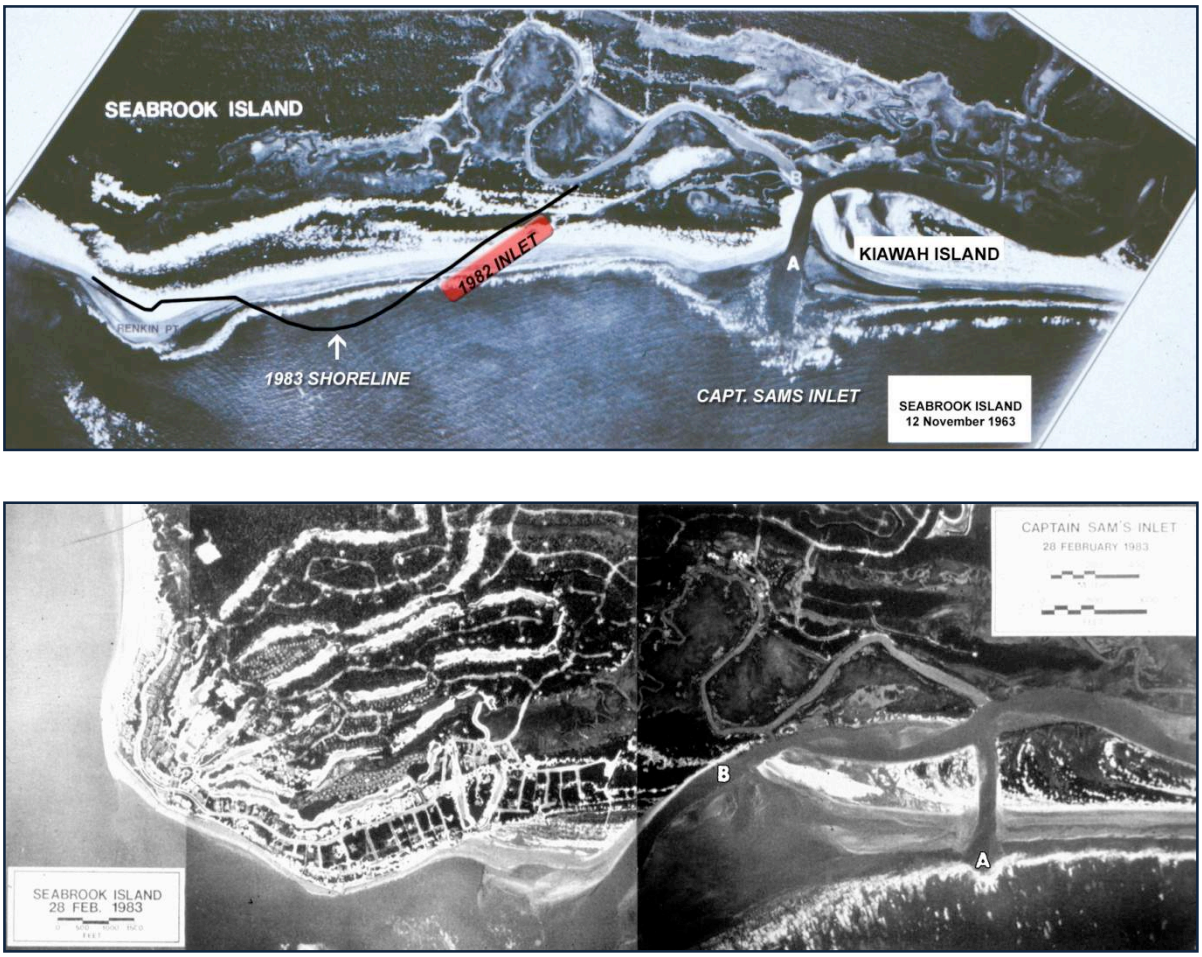

FIGURE T-3. Seabrook Island and Captain Sams Inlet in 1963 (upper) and 1983 (lower). The 1963 condition served as a model for the plan to relocate Captain Sams Inlet. Lower photo shows the new channel (A) open before the old channel (B) was closed on 4 March 1983.

1970s Seabrook Island is in a rapid erosion cycle with some areas like Renken Point eroding at over 20 ft/yr.

1973 Beach Club under construction.

1974 Erosion impacts the Beach Club before construction is complete. First shore-protection measures consist of large sand bags, sandbag groins, and sheet-pile bulkheads (Fig T-4).

FIGURE T-4. Shore-protection structures at the Beach Club in September 1974 prior to the club's opening.

1975–1981 Succession of sandbag revetments, timber and concrete bulkheads/seawalls, and quarry-stone revetments are installed along Seabrook Island between Pelican Watch Villas and the 13th fairway of the golf course (~2 miles). Individual property owners are generally responsible for the cost of shore-protection structures that, by the late 1980s, totals over $5 million for the island (Fig T-5).

1979 RPI (c/o Prof Miles Hayes) completes the first shoreline assessment of the island, identifies three principal erosion-causing processes, and recommends soft solutions involving inlet relocation and nourishment.

SEP 1979 Hurricane *David* causes extensive damage to the seawall (Fig T-6). Mouth of Captain Sams Inlet is near the Oyster Catcher beach access. Seabrook Island's only dry beach areas are a 2000-ft reach around Oyster Catcher and the North Edisto Inlet shoreline along Pelican Watch Villas.

FIGURE T-5. During the early 1980s, much of Seabrook lacked any beach even at low tide. [UPPER] View north from Renken Point at mid tide. [LOWER] Oblique aerial (1982) looking north at low tide showing no beach around Renken Point.

FIGURE T-6. Collapse of the concrete seawall at Renken Point in September 1979 during Hurricane *David*.

MAR 1983 First relocation of Captain Sams Inlet ~1.5 miles north to its 1963 position. Old inlet closed by trucks hauling sand from the new channel basin. Cost of project is (~)$300,000 (Fig T-7).

LATE 1980s North Beach is restored by natural processes as sand from the delta of abandoned Captain Sams Inlet migrates onshore, adding over 1 million cubic yards to Seabrook Island's beach. North Beach is upward of 1,000 ft wide in places, a dry beach is restored, and the rock revetment north of Renken Point begins to be buried by windblown sand.

FIGURE T-7. February-March 1983.

[UPPER] Excavation of the basin for the new channel by land-based equipment.

[MIDDLE] The new channel across the Kiawah Spit and closure dike under construction in the distance on 18 February two weeks before project completion.

[LOWER] Closure of the old channel on a falling tide on 4 March 1983.

1980s Several sections of the seawall (south of Renken Point) breach during minor storm events (Fig T-8). No new sand reaches Beach Club Villas or Pelican Watch Villas for nearly a decade, causing loss of the dry beach.

1989 The northern channel of North Edisto Inlet is forced shoreward by the shoal off Renken Point, causing dangerous encroachment along the seawall (Fig T-8). At Amberjack Court, the channel 50 ft from the wall is 22 ft deep. Property owners continue to add rock in this area to shore up the seawall.

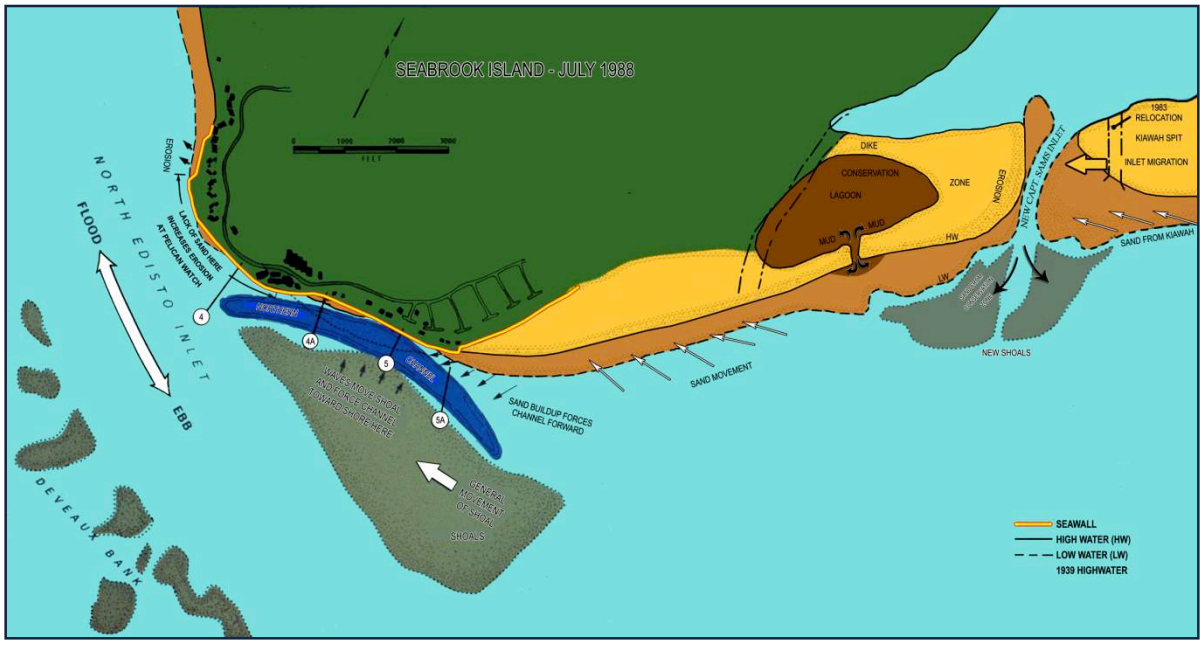

FIGURE T-8. [UPPER] Encroachment of the northern channel (deep blue area) of North Edisto Inlet and lack of maintenance leads to [LOWER] collapse of a section of seawall near Beach Court in 1983.

FEB 1990 The northern channel is realigned by an ocean-going dredge (Great Lakes Dredge & Dock Company – dredge *Illinois*) that builds a parallel channel 600 ft seaward while filling the existing channel along the seawall (Fig T-9). The project adds 685,000 cubic yards to the beach between Renken Point and Pelican Watch Villas. A narrow dry beach exists south of Renken Point for less than one year before the project adjusts. A narrow wet-sand beach persists through the 1990s, giving the seawall protection. Cost of nourishment project is $1.6 million.

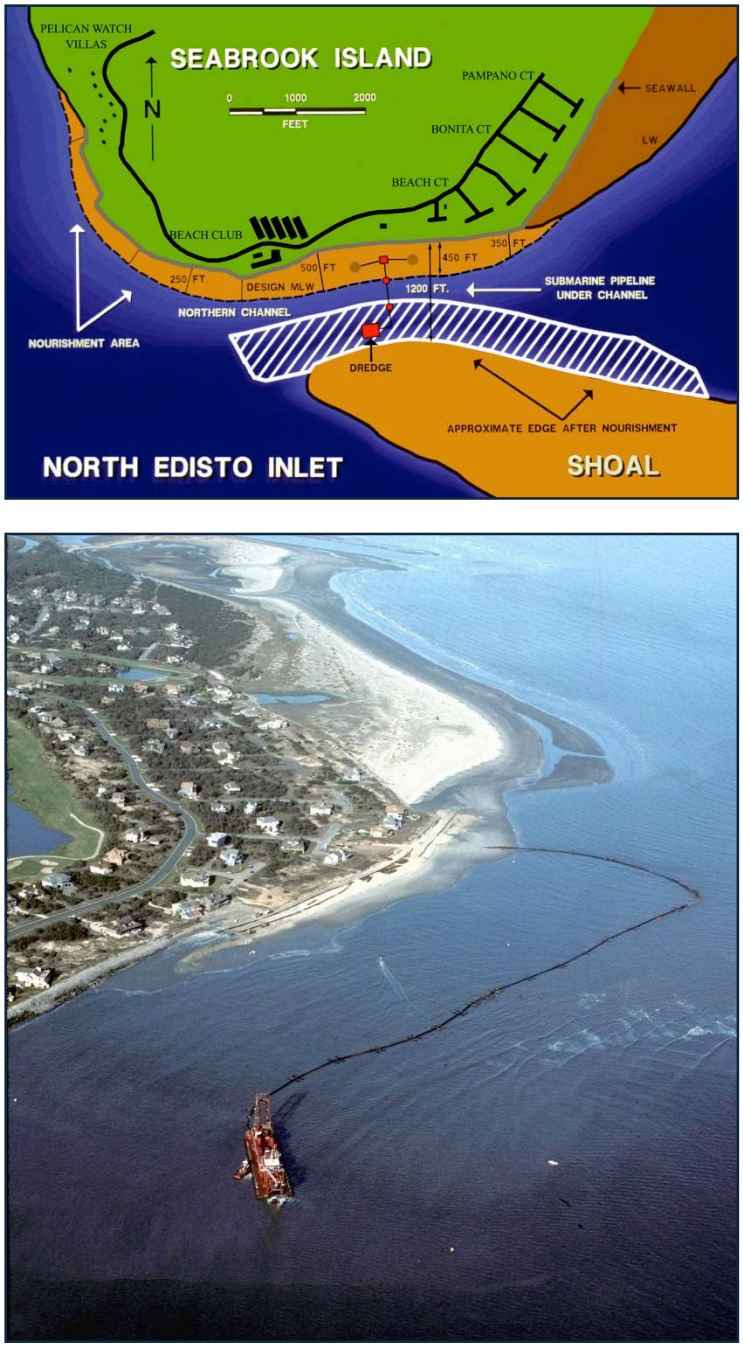

FIGURE T-9. [UPPER] 1989 plan for realignment of the northern channel and nourishment south of Renken Point. [LOWER] Start of dredging operations in February 1990 at Renken Point.

CIRCA 1995 Nourishment losses south of Renken Point begin to reverse as the area stabilizes and begins a long period of accretion by natural and artificial means. Captain Sams Inlet has migrated about 3,000 ft since the 1983 relocation.

APR 1996 Captain Sams Inlet relocated again to its 1963/1983 position (Fig T-10). Cost of construction is (~)$400,000, which is comparable to the cost of one oceanfront lot at this time.

1998–2001 Winter sand scraping around the abandoned inlet is implemented to accelerate adjustment of the shoreline. An outer dike is constructed 500 ft seaward of the closure dike, leaving a small lagoon between the two dikes. This creates a straighter, longer North Beach and leads to more efficient sand transport to the south.

2002–2007 Winter sand scraping from North Beach is performed to transfer ~350,000 cubic yards to South Beach. This adds to the natural sand transport from north to south and accelerates recovery of South Beach. By 2005, only about 1,200 ft of shoreline (vicinity of the Beach Club and Beach Court) lack a dry beach during normal high tides.

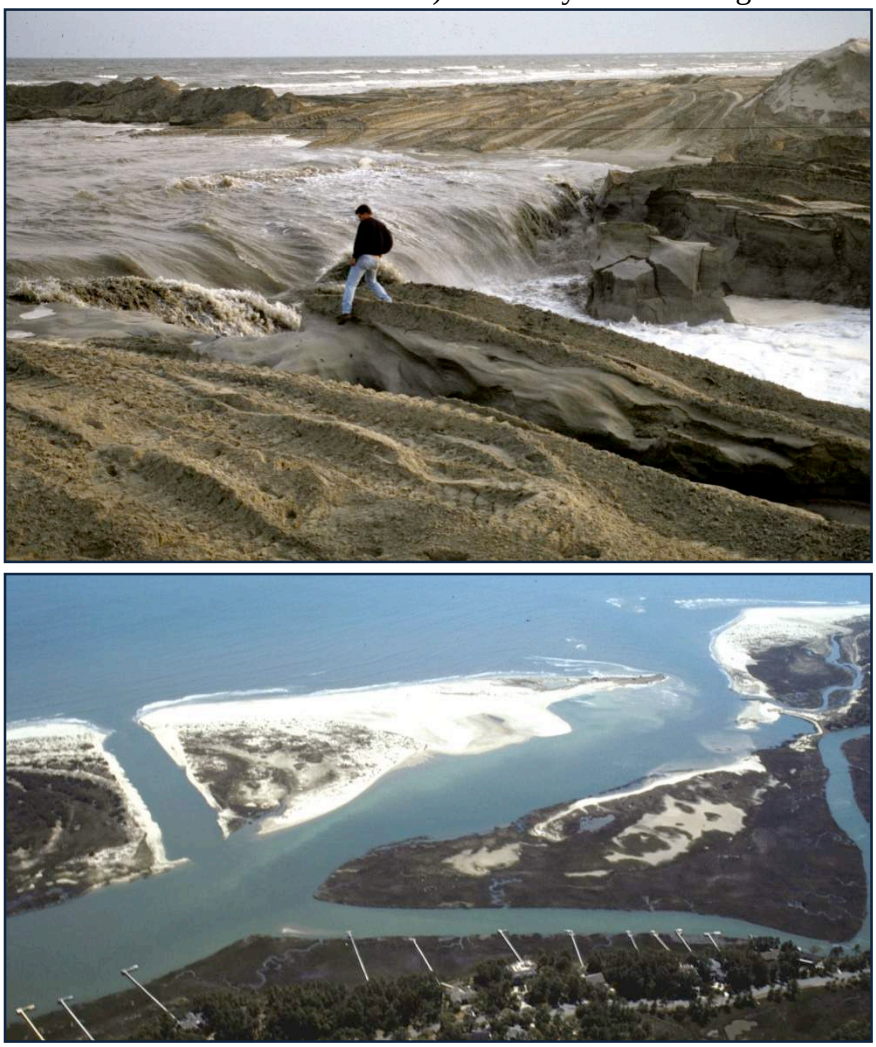

FIGURE T-10. The second relocation of Captain Sams Inlet in April 1996. [UPPER] First tide into the channel basin on 4 April during a rising tide. [LOWER] The new channel (left side) before completion of the closure dike across the old channel.

2007–2008 Migration of Captain Sams Inlet leads to focused erosion along North Beach. After review of outside opinions and alternatives, the POA Environmental Committee decided to initiate engineering and permitting for the third inlet relocation project.

2008 Permit application submitted for third relocation of Captain Sams Inlet.

2009–2012 Additional reviews, studies, and revisions to permit application. Permit application resubmitted in 2010 and issued by SC DHEC OCRM in January 2012 and by USACE in October 2012. The SC permit was appealed by one Seabrook Island property owner and is presently being decided in court.

2008–Present Captain Sams Inlet continues to migrate to the west, reaching the approximate location of the 1996 channel. Erosion intensifies along portions of North Beach. Without sand-scraping, sediment supply to the rest of Seabrook Island is reduced, resulting in erosion of the area near the Seabrook Island Club facilities.

FIGURE T-11. Composite image of Captain Sams Inlet area from the Seabrook side in January 2014. The lagoon formed in the abandoned 1996 channel is on the left side of the image.

5.1.1 Beach Profiles

OCRM maintains a statewide network of monuments and control points for beach profiles established in the late 1980s (Eiser et al 1988). Seabrook Island has 14 OCRM profile lines (see Fig 5.0b) numbered 2510 to 2575. Several additional lines (e.g. – 2505) were added by the Property Owners Association using the OCRM numbering system to track changes in more detail. Some of these lines are coincident with earlier survey lines established and monitored by Hayes et al (1979). The Seabrook Island Company (early developer of the island in the 1970s) retained Research Planning Institute Inc or RPI to conduct annual beach profile and shoreline monitoring studies following the Hayes et al (1979) shoreline erosion assessment. Annual reports (e.g. – Sexton & Hayes 1980, 1981; Sexton et al 1982) began a long-running series of beach erosion surveys of Seabrook Island that continues through the present (2014).

Beginning in 1985, responsibility for annual beach monitoring was transferred to RPIs successor company, Coastal Science & Engineering Inc (CSE). The Seabrook Island

Company also transferred responsibility for oceanfront monitoring and maintenance to the Seabrook Island Property Owners Association around that time. All subsequent beach surveys and restoration activities have been funded by the Property Owners Association with data and results made available to the Town of Seabrook Island and OCRM.

Yearly measurements of beach conditions are a critical element of Seabrook Island's beach management strategy. Given the complexity and variability of beach conditions over the length of Seabrook Island under the influence of two inlets, beach measurements provide an objective means of tracking sand volumes, detecting cycles of erosion or accretion, and identifying developing erosion hot spots. Seabrook Island's profile network has expanded over time to the present suite of 50 survey lines (includes lines along the Kiawah Spit) (Fig 5.1.1a and Table 5.1.1a). The network of profiles along with supplementary field surveys has provided data for preparation of digital terrain models or DTMs of beach topography and channel bathymetry. Figure 5.1.1b is an example DTM from 1997 using data collected ~1.5 years after the 1996 Captain Sams Inlet relocation project (see Table 5.1.1a for station equivalents to present survey lines).

Seabrook Island profiles were originally surveyed by the Emery (1961) method (Sexton & Hayes 1981), then by rod and level or total station in the mid 1980s (Kana et al 1984) to low tide wading depth. By the late 1980s, surveys were extended further offshore to capture data in the adjacent channels or to map inlet shoals associated with old and new Captain Sams Inlet (e.g. – Mason 1986, Kana & Mason 1988). In 1996, surveys were performed with the aid of a differential geographic positioning system or GPS. By 2000, real-time kinematic or RTK GPS equipment became available for public use. RTK-GPS increased productivity in the field and provided a denser network of data points compared with prior surveys.

Since the 2000s, surveys have been performed using a Trimble™ model R8 GNSS RTK GPS that provides centimeter-level accuracy in the horizontal and vertical direction and coordinate data in x–y–z format (geographic position and datum-based elevation). Bathymetry data are obtained by linking the GPS data collector to a precision fathometer. Raw data over water are typically collected at 5 Hz (5 points per second), and then filtered during post-processing to provide manageable data sets. Raw data in x–y–z format are converted to x–z pairs (distance-elevation) to yield profiles that can be directly over lain and compared with earlier surveys (see CSE 2014).

Seabrook Island's beach and bathymetry data are analyzed by standard methods for evaluating the profile condition (CERC 1984, Kana 1993, Kana et al 2014–in press). Basic units of measure are the absolute quantity of sand contained within a given length of beach and the change in the quantity of sand between two surveys. Quantity estimates are derived by applying profile changes over representative shoreline reaches and cross-shore boundaries, using the average-end-area method. Normally, along straight beaches, some uniform depth limit for volume calculations can be established and used over time for consistency of comparisons. Seabrook Island's shoreline, by contrast, is fronted by two major channels of varying depth as well as by Captain Sams Inlet.

Surveys in the early 1980s had only limited coverage into deeper water and did not include sand to the bottom of the channels. By the 1990s, more profiles were established and most were surveyed into deeper water. Therefore, over time, Seabrook Island's computation boundaries along the northern channel (Seabrook Island Club facility to Renken Point) have been modified to more or less match the local depth of the channel (where data were available), which yields more realistic estimates of sand volumes connected with the beach.

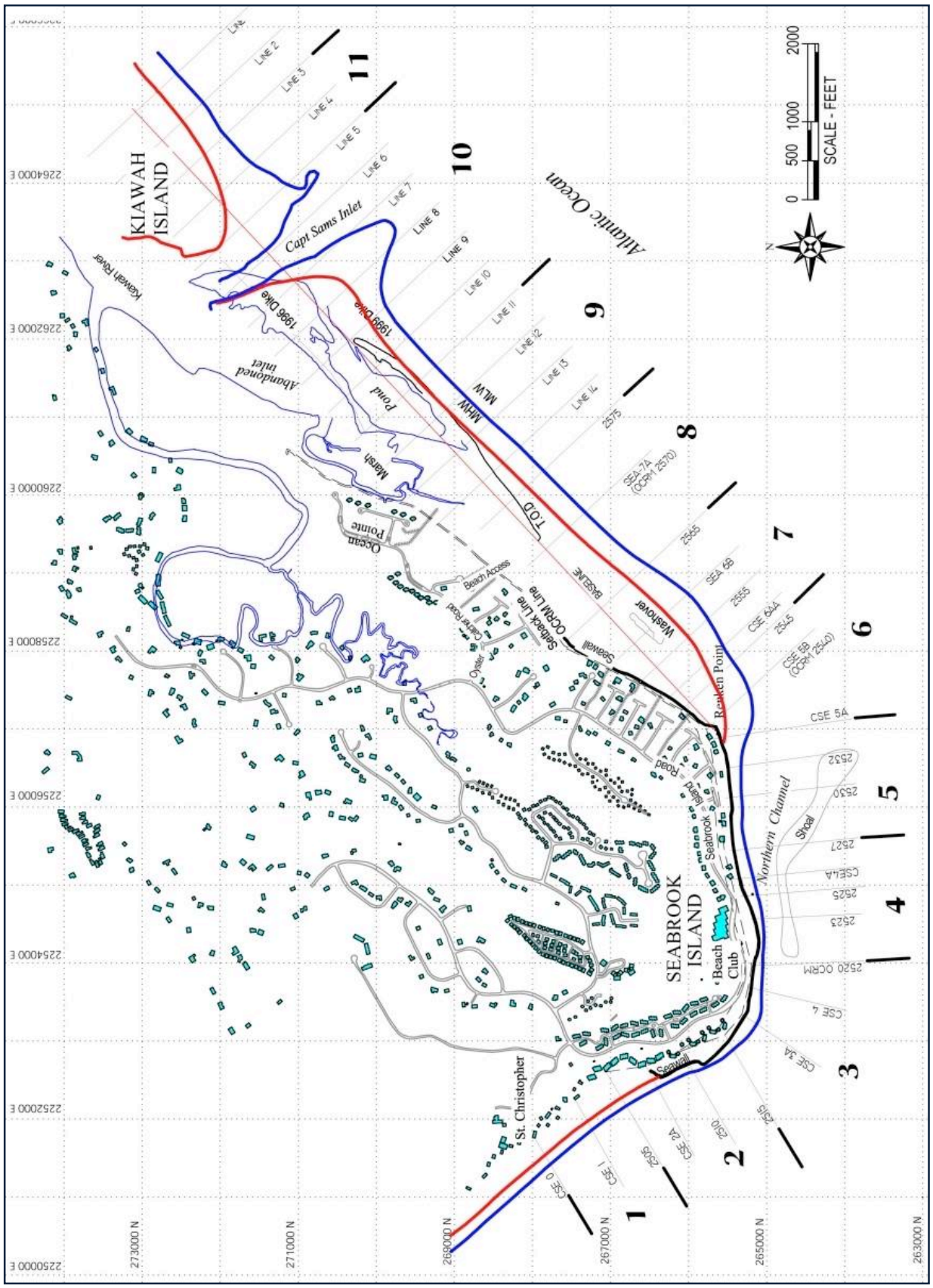

FIGURE 5.1.1a. Network of beach monitoring lines used between 1997 and 2011. The equivalent OCRM line numbers are indicated. Groups of lines define erosion analysis "reaches" described in Section 5.1.2. In 2011, several lines were added to the network (see Fig 5.0a) and the azimuths around Renken Point were modified (CSE 2011, 2014).

TABLE 5.1.1a. Seabrook Island beach monitoring lines utilized in 2014 using prior profiles established by RPI, CSE, and OCRM. New line names (1–50) were developed to simplify locating profiles. Previous names are provided for reference with earlier reports. Offsets and cutoffs reference volume calculation starting and ending points along each profile in 2014 based on the location of adjacent channel centerlines and other factors (CSE 2014).

Seabrook Line #	Previous Name	Northing	Easting	Offset (ft)	Cutoff (ft)	Distance to Next (ft)	Lens Limit (ft NAVD)
1	SBK40	269,104	2,250,763	150	500	760	-14
2	SBK39	268,533	2,251,249	125	600	720	-14
3	CSE0	267,962	2,251,736	80	3000	691	-4
4	CSE1	267,455	2,252,247	120	3000	455	-4
5	2505	267,066	2,252,603	125	3000	480	-5
6	CS2A	266,551	2,252,678	35	3000	500	-9
7	2510	266,096	2,252,874	60	3000	638	-8
8	CSE3	265,541	2,253,074	40	3000	446	-18
9	CS3A	265,319	2,253,340	20	3000	479	-11
10	CSE4	265,332	2,253,710	115	3000	364	-11
11	2520	265,195	2,253,962	20	450	639	-15
12	2523	265,201	2,254,560	0	250	323	-15
13	2525	265,342	2,254,848	20	500	246	-16
14	CS4A	265,483	2,255,066	110	600	342	-16
15	2527	265,471	2,255,437	15	460	652	-19
16	2530	265,550	2,256,113	96	550	390	-23
17	2532	265,495	2,256,502	0	700	505	-23
18	5A	265,706	2,256,889	100	1000	295	-23
19	5B	265,771	2,256,994	20	1400	480	-16
20	CSE6	266,089	2,257,244	20	1400	450	-6
21	6AA	266,245	2,257,402	20	1400	490	-6
22	6A	266,631	2,257,592	20	3000	470	-6
23	6B	267,047	2,257,768	10	3000	610	-6
24	2565	267,575	2,258,121	20	3000	400	-6
25		267,735	2,258,700	420	3000	430	-6
26	7A	268,069	2,259,083	160	3000	370	-6
27		268,316	2,259,356	150	3000	385	-6
28	2575/CSE8	268,670	2,259,557	118	2000	430	-6
29	SBK14	268,646	2,260,165	-367	3000	500	-8.5
30	SBK13	268,988	2,260,530	-390	3000	500	-8.5
31	SBK12	269,325	2,260,897	-440	3000	500	-8.5
32	SBK11	269,667	2,261,262	-700	3000	500	-8.5
33	SBK10	269,989	2,261,606	-600	3000	500	-8.5
34	SBK9	270,346	2,261,990	-800	3000	500	-8.5
35	SBK8	270,700	2,262,349	-800	3000	500	-8.5
36	SBK7	271,034	2,262,722	-800	3000	500	-8.5
37	SBK6	271,376	2,263,087	-800	3000	500	-8.5
38	SBK5	271,718	2,263,451	-800	3000	500	-8.5
39	SBK4	272,051	2,263,807	-800	3000	500	-8.5
40	SBK3	272,399	2,264,179	-370	3000	500	-8.5
41	SBK2	272,744	2,264,546	0	3000	500	-8.5
42	SBK1	273,085	2,264,911	0	3000	360	-8.5
43	-500	273,365	2,265,325	340	3000	500	-8.5
44	-1000	273,645	2,265,740	280	3000	500	-8.5
45	-1500	273,924	2,266,154	230	3000	500	-8.5
46	-2000	274,204	2,266,569	150	3000	500	-8.5
47	-2500	274,484	2,266,983	140	3000	500	-8.5
48	-3000	274,763	2,267,398	110	3000	500	-8.5
49	-3500	275,043	2,267,812	90	3000	500	-8.5
50	-4000	275,323	2,268,227	125	3000	0	-8.5

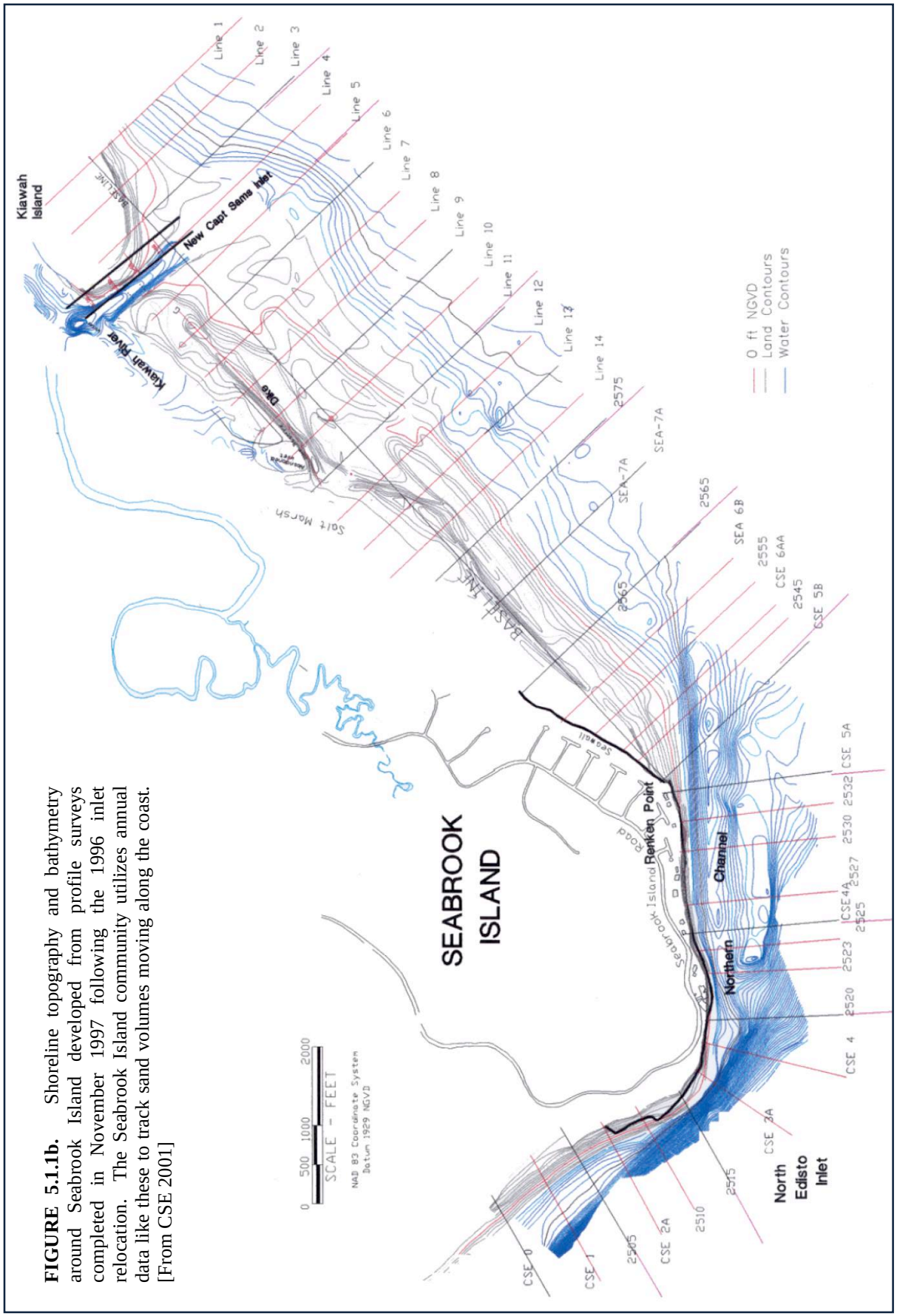

FIGURE 5.1.1b. Shoreline topography and bathymetry around Seabrook Island developed from profile surveys completed in November 1997 following the 1996 inlet relocation. The Seabrook Island community utilizes annual data like these to track sand volumes moving along the coast. [From CSE 2001]

Seabrook Island's beach volumes are tracked by "unit-volume" results as well as aggregate totals by reach. Unit volume is the quantity of sand contained in one unit-length of shoreline between defined cross-shore boundaries (typical units are given in cubic yards per foot—cy/ft). Figure 5.1.1c illustrates the concept of unit volume for a range of beach conditions.

Seabrook Island has tracked sand volumes by "reaches," which are segments of shoreline having similar orientations or exposures to inlet channels (see Fig 5.1.1a). Each reach can be considered a sand box containing a particular volume of sand between the backshore and some limiting depth offshore. The volume of sand in each reach has been measured yearly and compared with earlier data to compute volumetric erosion or accretion rates and track the movement of sand along the island (discussed in Section 5.1.2).

Figures 5.1.1d–g provide a sample of comparative profiles for several localities along Seabrook Island. These are placed by survey line number and proceed upcoast from North Edisto River Inlet to North Beach (see Fig 5.1.1a for profile locations). Figures 5.1.1d and 5.1.1e illustrate conditions around the southern tip of the island along North Edisto River Inlet and along the northern marginal channel of the inlet. Shoals on the north side of North Edisto River Inlet are separated from the beach by a shallower channel that has periodically encroached on Seabrook Island. Beach monitoring by the community tracks the movement of the north shoal (Fig 5.1.1e) as well as the volume of sand between the seawall and middle of the northern channel. Ten reaches are referenced between St. Christopher Camp and Captain Sams Inlet. An 11th reach covers the southern end of the Kiawah Spit.

Figure 5.1.1f (Line 17) is situated along the deepest part of the northern marginal channel in Reach 5. Severe encroachment of the channel into the seawall in 1990 led to a channel realignment project by dredge in February (see Table 5.1b). Since 1990, sand has accumulated along this segment of beach, leaving a wider dry beach and dune area while pushing the northern channel further from the seawall.

Figure 5.1.1g shows example profiles from the developed section of North Beach at Line 20 (OCRM 2555). This segment of Seabrook Island (Reach 6) has widened considerably since the 1980s as a result of sand bypassing after each inlet relocation event. The beach in this area is upward of 600 ft wider in 2014 compared with 1989 (25 years) and contains multiple, low dune ridges.

The next section summarizes volumetric changes developed from the network of profiles along Seabrook Island.

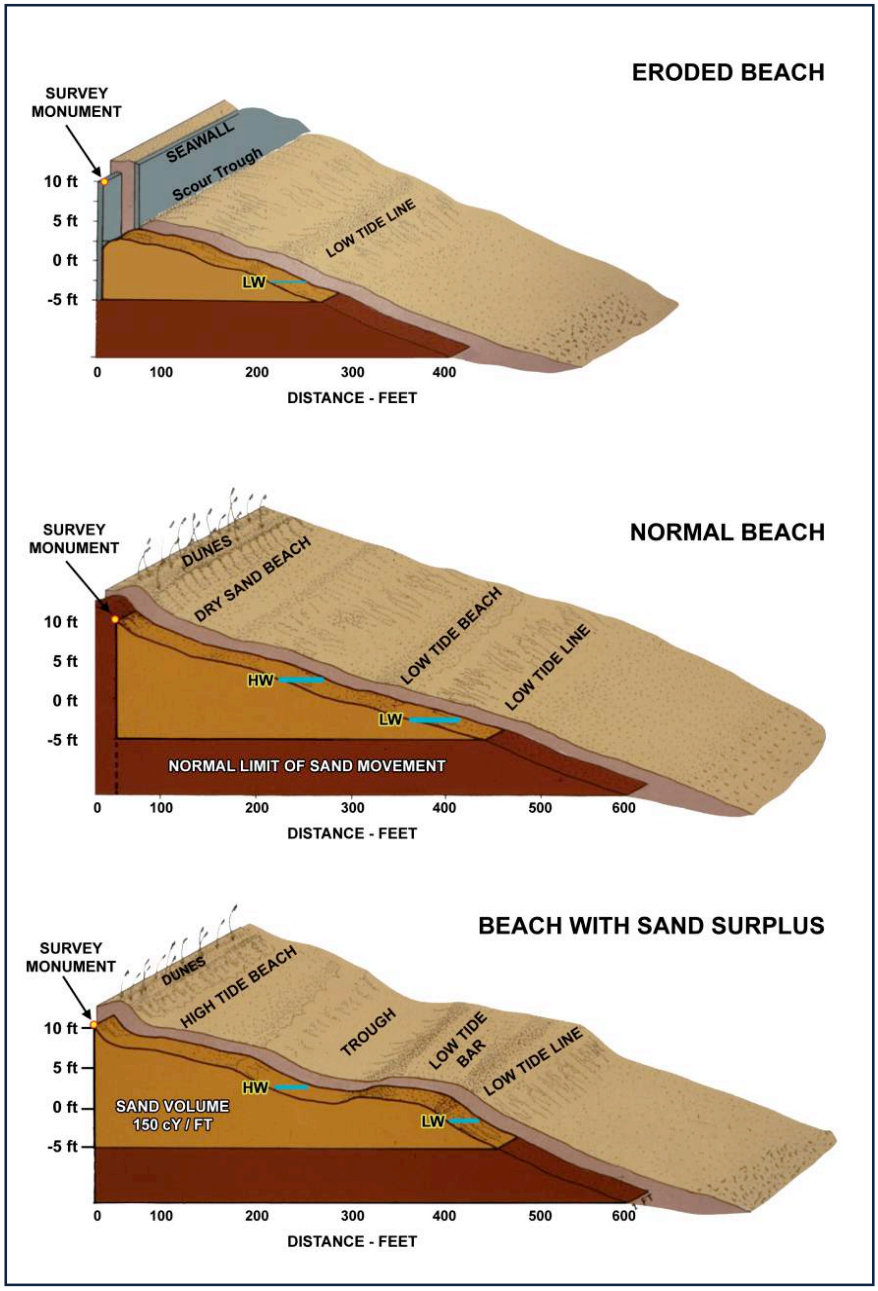

FIGURE 5.1.1c. Concept of unit volume—the quantity of sand contained in one unit length of shoreline between defined cross-shore boundaries. The examples illustrate relative volumes for an eroding beach backed by seawalls, a normal beach, and an accreting beach. Seabrook Island typically exhibits all three conditions at any time (from Kana 1990).

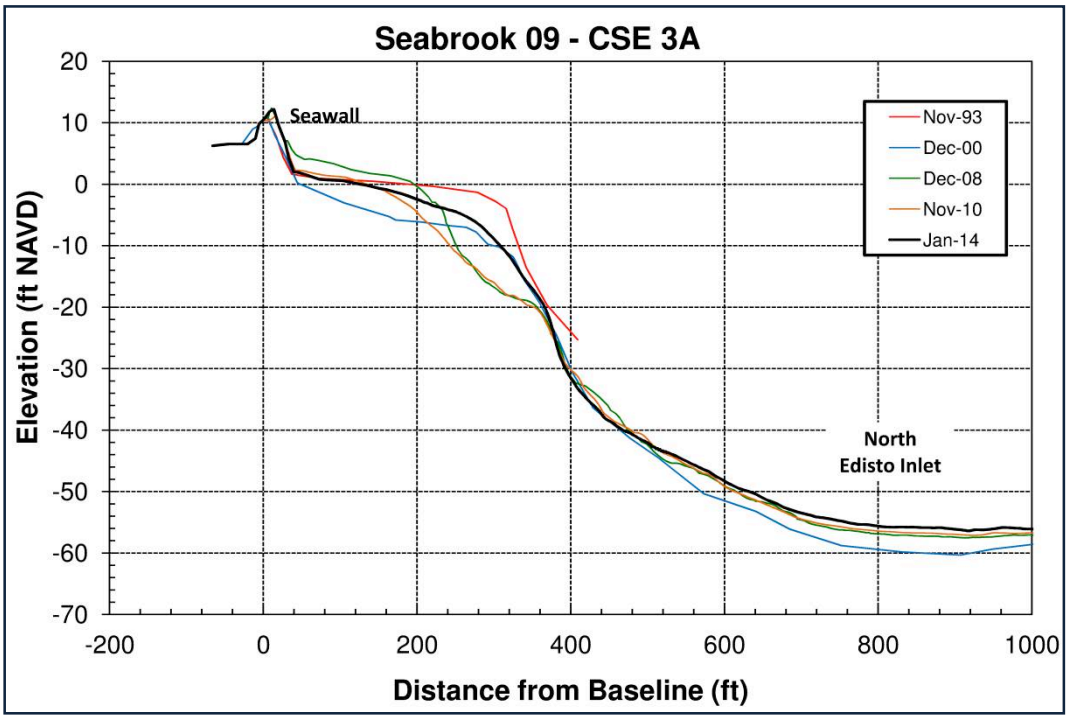

FIGURE 5.1.1d. Profiles from **Reach 3** (see Fig 5.1j) at Line 09 (old CSE 3A) near Beach Club Villas on North Edisto River Inlet. The beach is a relatively narrow platform fronting a seawall at the edge of the main channel of North Edisto River Inlet, one of the deepest natural inlets along the South Carolina coast.

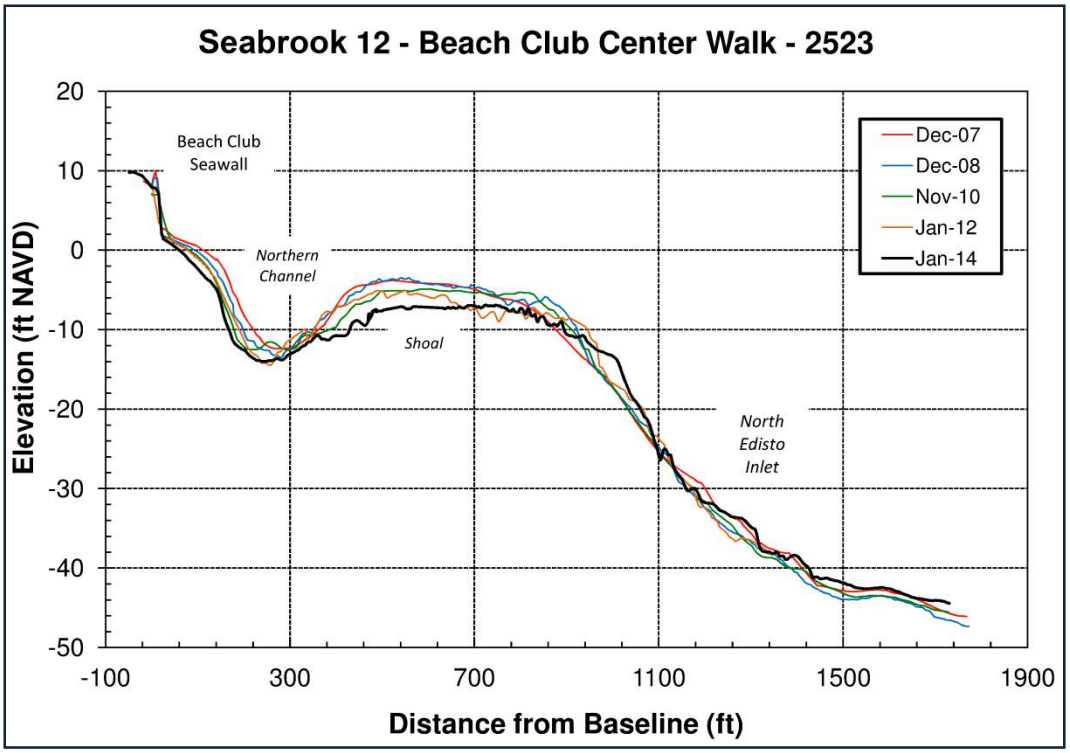

FIGURE 5.1.1e. Profiles from **Reach 4** in the vicinity of the Seabrook Island Club facilities.

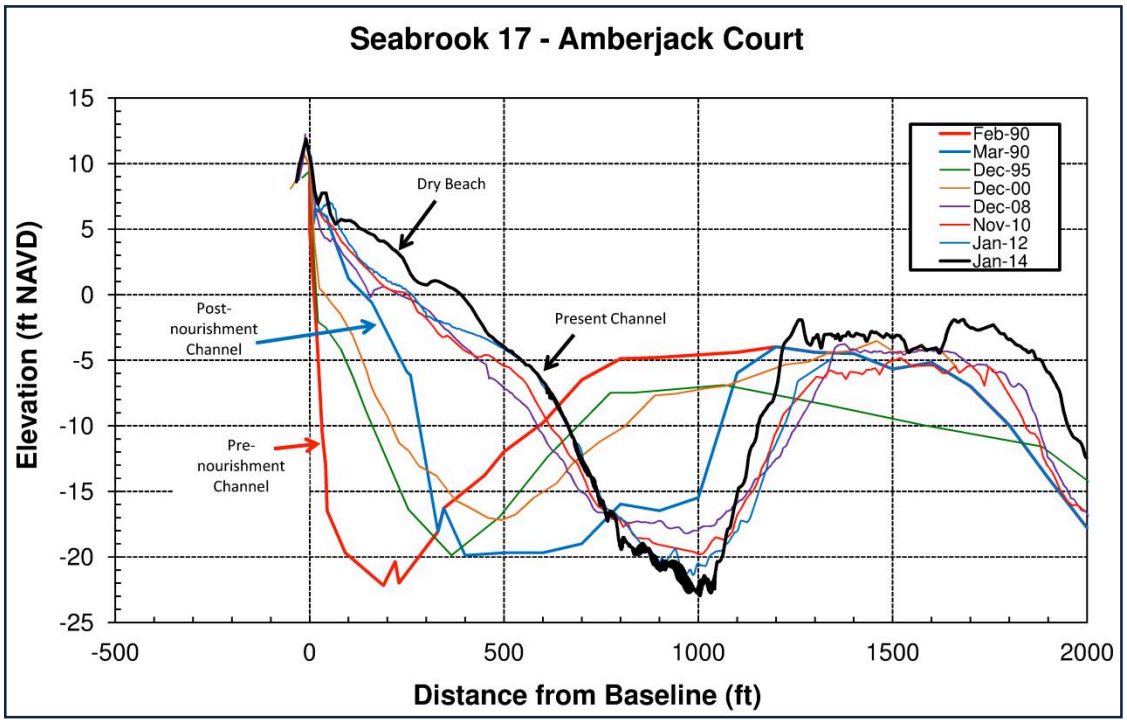

FIGURE 5.1.1f. Profiles from Line 17 in **Reach 5** adjacent to the northern marginal channel of North Edisto River Inlet. Severe encroachment of the channel in 1990 led to a channel realignment by dredge.

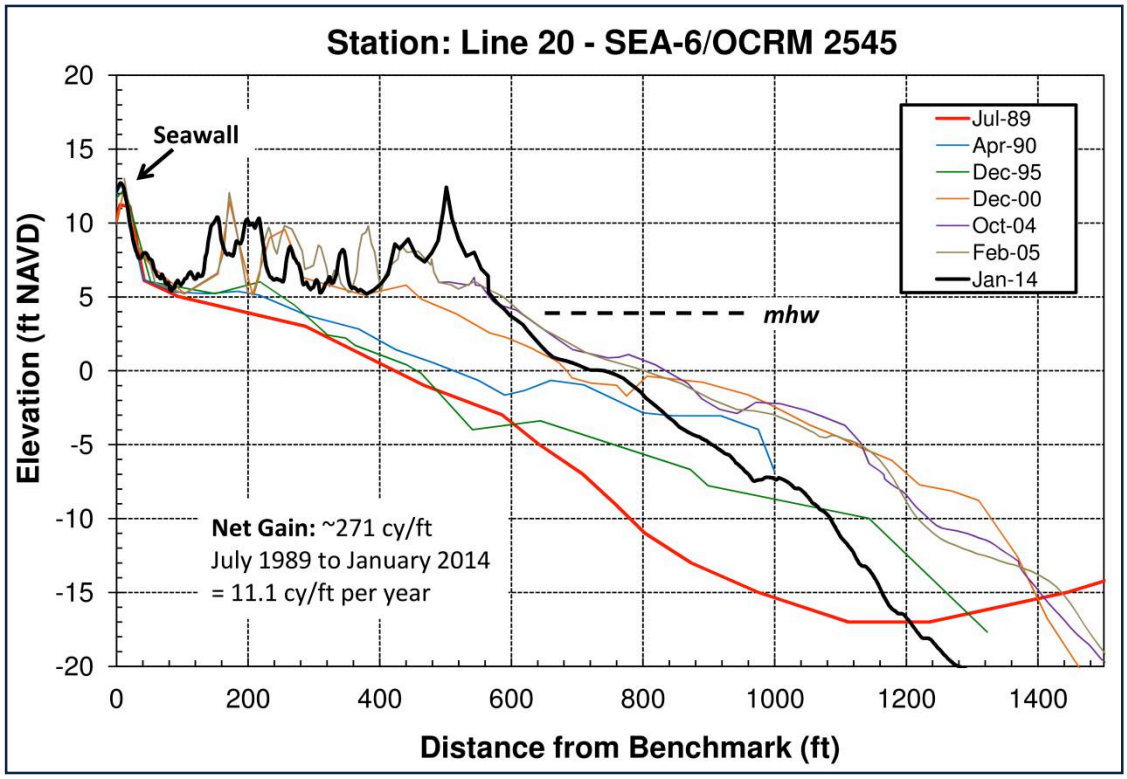

FIGURE 5.1.1g. Profiles from Line 20 (**Reach 6**) along Seabrook Island dating back to 1989, illustrating major growth of the beach and dune system along this section of the island.

5.1.2 Long Term Erosion Rates and Shoreline Change

CSE (1989) evaluated shoreline/volume changes prior to the 1990 channel realignment/nourishment project along the northern channel using four reaches (A–D, see Fig 5.1f). They detected a cycle of changes along Reach A (beach downcoast of Renken Point—OCRM 2540) linked to the position of Captain Sams Inlet (Fig 5.1.2a). Shoreline change data suggested that erosion tends to precede each inlet relocation and continues for several years after Captain Sams Inlet shifts upcoast before Reach A begins to accumulate sand. As Figure 5.1.2a indicates, this cycle of erosion and accretion is super-imposed on a long-term trend of accretion, consistent with NOAA-NOS (1983) and Anders et al (1990).

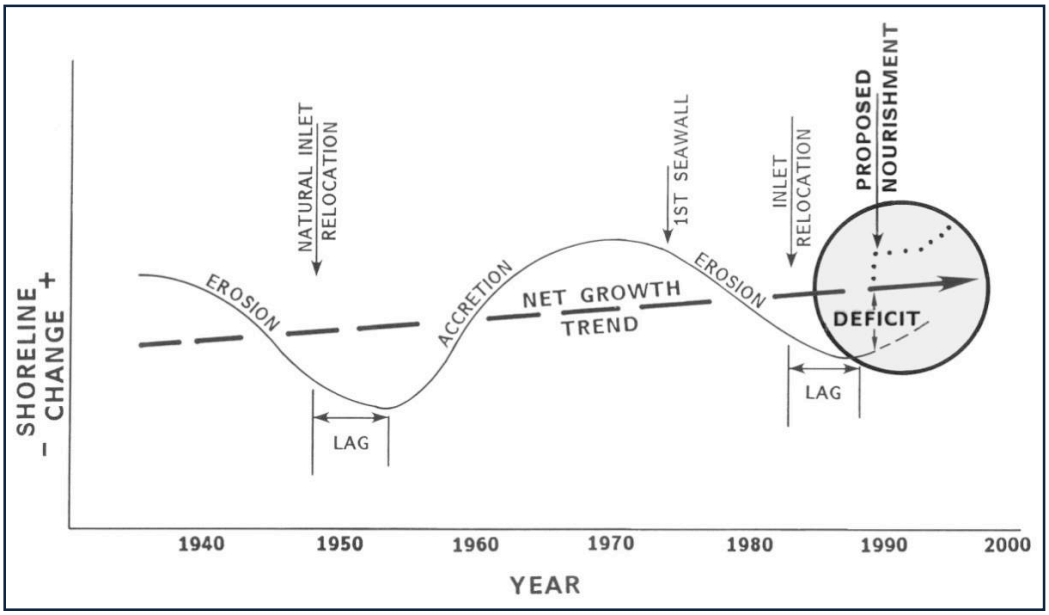

FIGURE 5.1.2a. Cycle of shoreline change along the downcoast half of Seabrook Island (south of OCRM 2540) based on historical shoreline analysis. Net trend is accretion at century time scales. Accretion periods lag inlet relocations by about five years. A 1990 project (proposed nourishment) involved placement of sand from North Edisto River Inlet in an attempt to accelerate recovery of the beach. [From CSE 1989]

Other reaches along Seabrook Island were determined to change in relation to the position of Captain Sams Inlet with periods of rapid accretion followed by erosion. Figure 5.1.2b (from Kana & McKee 2003) shows the reach trends between 1983 and 2004. After the 1983 inlet relocation, Reach D (closest to the inlet) and Reach C rapidly gained sand. Reach B (southern half of North Beach) continued to erode for two years, and Reach A (northern channel and North Edisto River Inlet area) eroded for six more years after inlet relocation before the erosion trend reversed. The cycles of erosion and accretion for the four reaches combined show a net gain in sand volume over time (Fig 5.1.2c). Between 1983 and 2004, Seabrook Island gained over 1.75 million cubic yards. (Note: ~685,000 cy were added by dredging and channel realignment in 1990, and the balance was gained by way of Captain Sams Inlet relocation projects.)

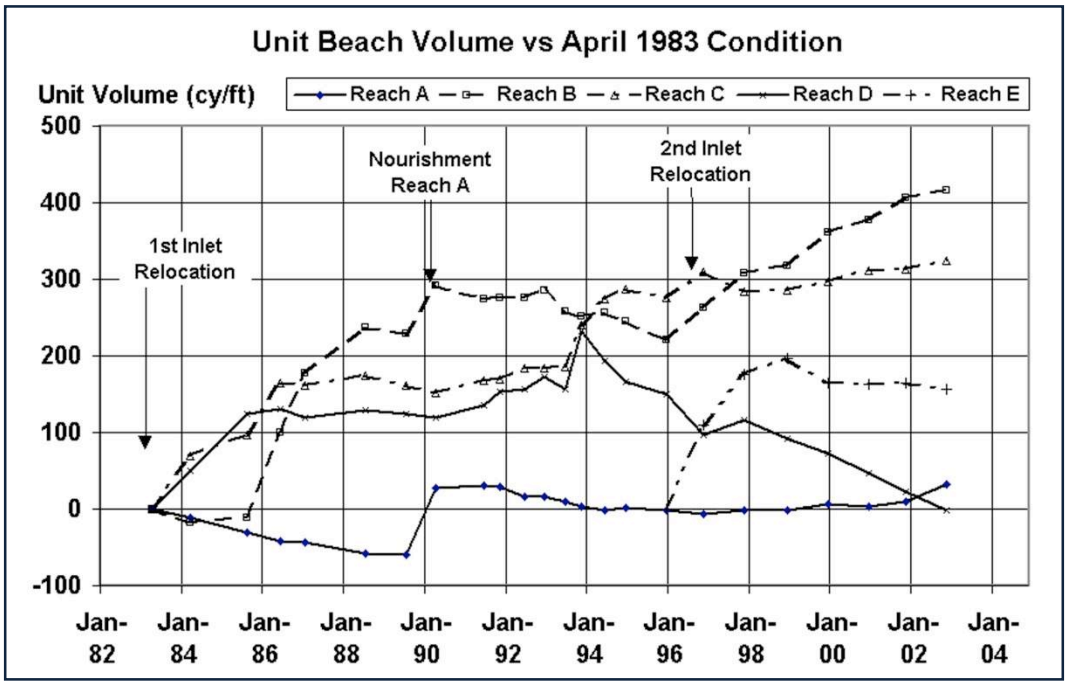

FIGURE 5.1.2b. Average unit-volume profile changes by reach along Seabrook Island since inlet relocation (March 1983). See Figure 5.1f for reach locations. [After Kana & McKee 2003]

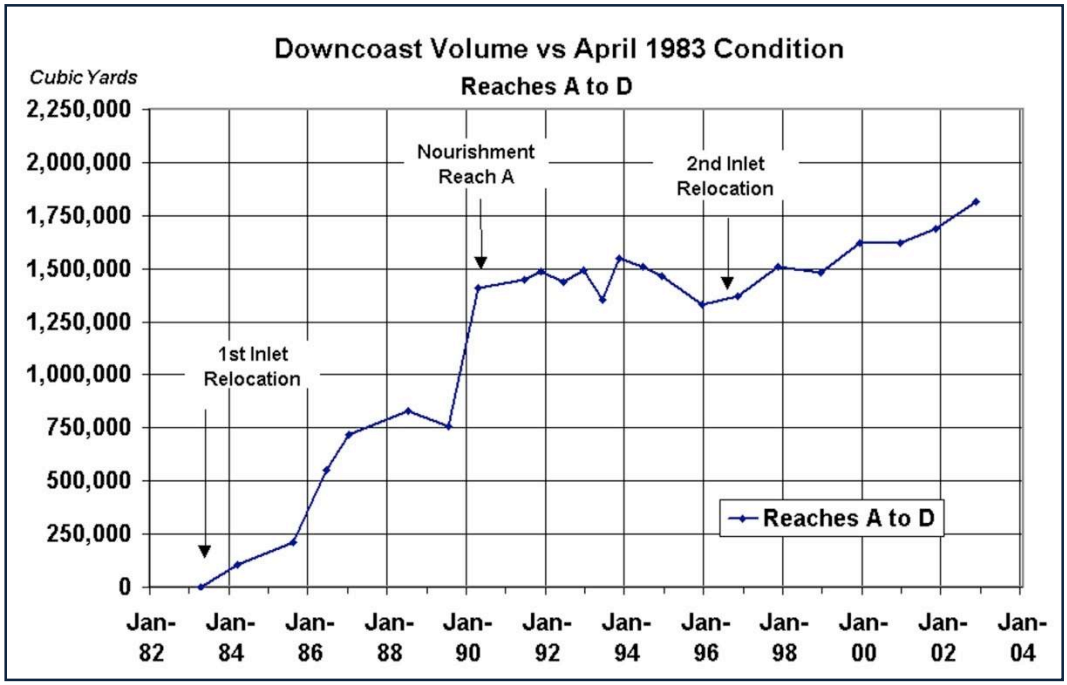

FIGURE 5.1.2c. Net volume change along Seabrook Island after the first inlet relocation (March 1983). The northern channel was realigned in February 1990, adding ~685,000 cy to the total. [After Kana & McKee 2003]

Figure 5.1.2d shows the impact of the 1983 inlet relocation along North Beach between February 1983 and January 1987. Soon after the old inlet was closed by a sand dike, the shoals of the ebb-tidal delta coalesced into intertidal sand bars and migrated onshore. By late 1984, the bars attached to the beach and began spreading downcoast, finally reaching Renken Point (OCRM 2540—promontory at lower left corner of each image) by January 1987. Conditions in April 1987 are shown in Figure 5.1.2e (source: Kana 1989).

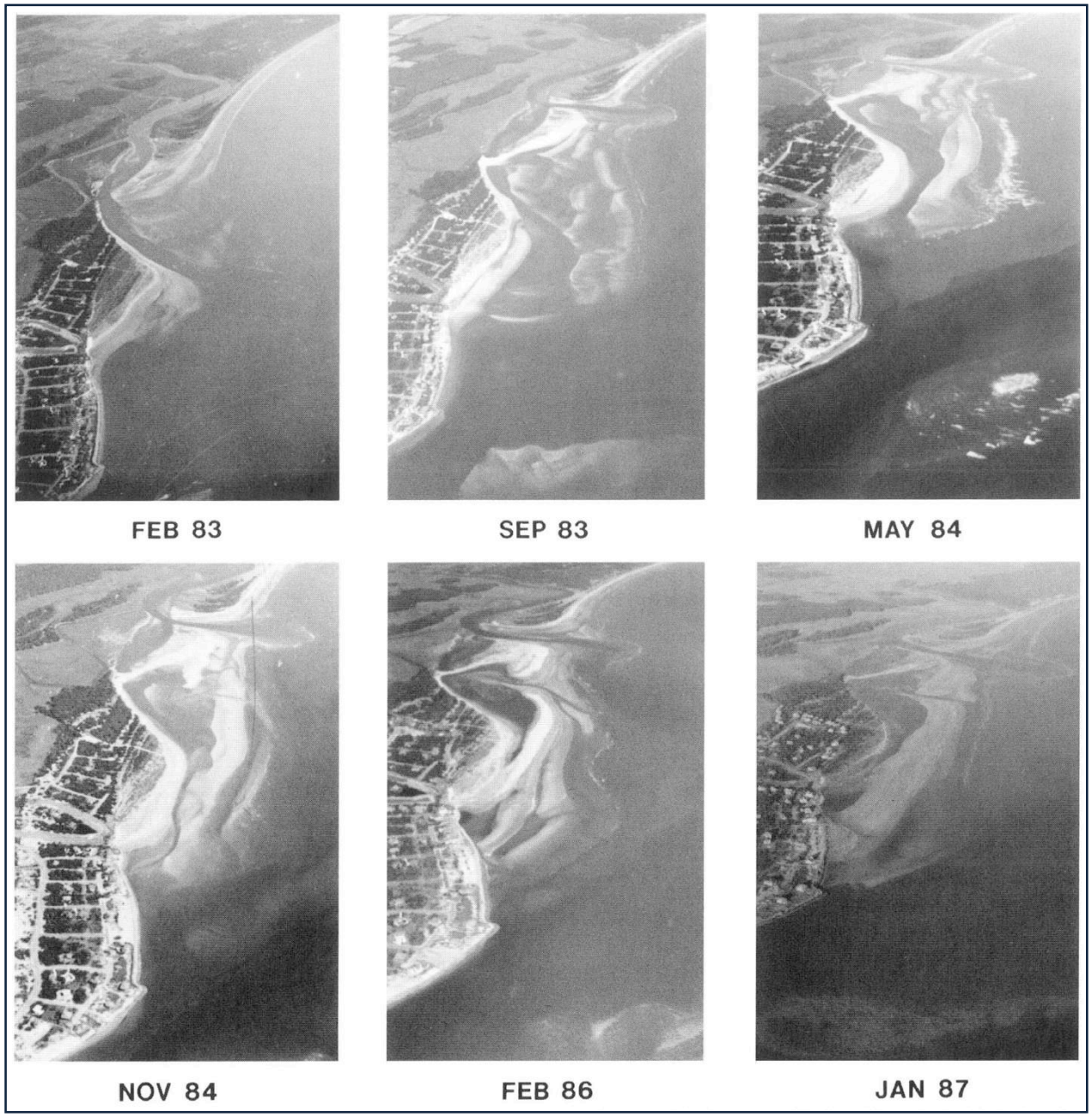

FIGURE 5.1.2d. Collapse of abandoned delta shoals and eventual accretion along the downdrift shoreline of Seabrook Island after the 1983 inlet relocation. New channel is at the top of each photo. [After Kana 1989]

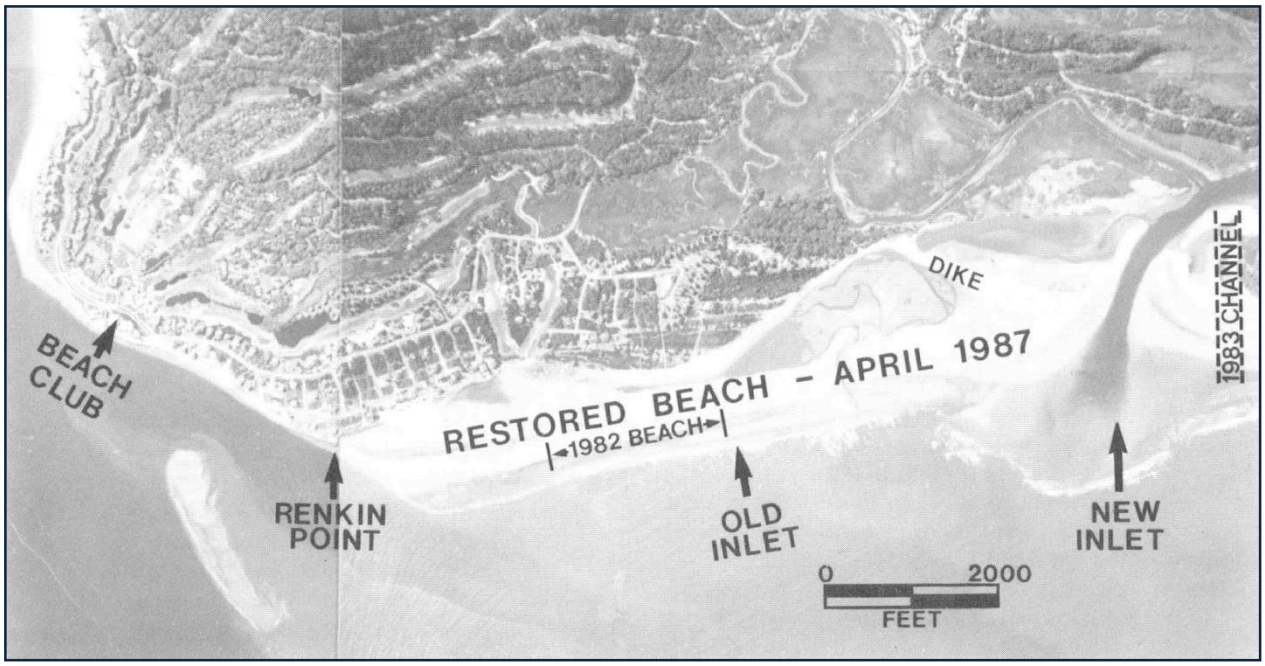

FIGURE 5.1.2e. Seabrook Island in April 1987 after natural restoration by inlet relocation. Area south of Renken Point remained unrestored. (Photo: Courtesy of Seabrook Island POA) [After Kana 1989]

Since the 1990 northern channel realignment, the erosion and accretion are tracked using 8–11 reaches (number varies in relation to Captain Sams Inlet position). The first eight reaches encompass a portion of St. Christopher Camp (Reach 1) and the developed shoreline of Seabrook Island. Reaches 2–6 are south of Renken Point and the remaining reaches are north of the area. December 1989/February 1990 are the reference conditions on which annual surveys have been compared. Each year, the condition of the beach is updated and the sand volumes contained within each reach are tracked to fixed cross-shore boundaries or the center of the adjacent channel. Unit volumes are averaged by reach and the differences between the earliest and most recent survey provides a measure of the net change. Erosion or accretion rates are then annualized over the available time period.

Figures 5.1.2f to 5.1.2h show the 24-year average, unit-volume change rate by reach. The cross-shore calculation limits were given earlier in Table 5.1.1a. These results incorporate the impact of the 1990 northern channel realignment project which placed ~685,000 cy of sand along the southern half of Seabrook Island, the 1996 relocation of Captain Sams Inlet, and several projects in which excess sand was excavated from Captain Sams Inlet shoals and placed south of Renken Point (detailed in Section 5.2.1). Figure 5.1.2f shows the 24-year accretion rates for profile lines along the North Edisto River Inlet:

- Reach 1 (St. Christopher Camp) has gained 3.3 cy/ft/yr.
- Reach 2 (Seabrook Island development at Pelican Watch Villas) has gained 4.1 cy/ft/yr.
- Reach 3 (Beach Club Villas area) has gained 2.1 cy/ft/yr.

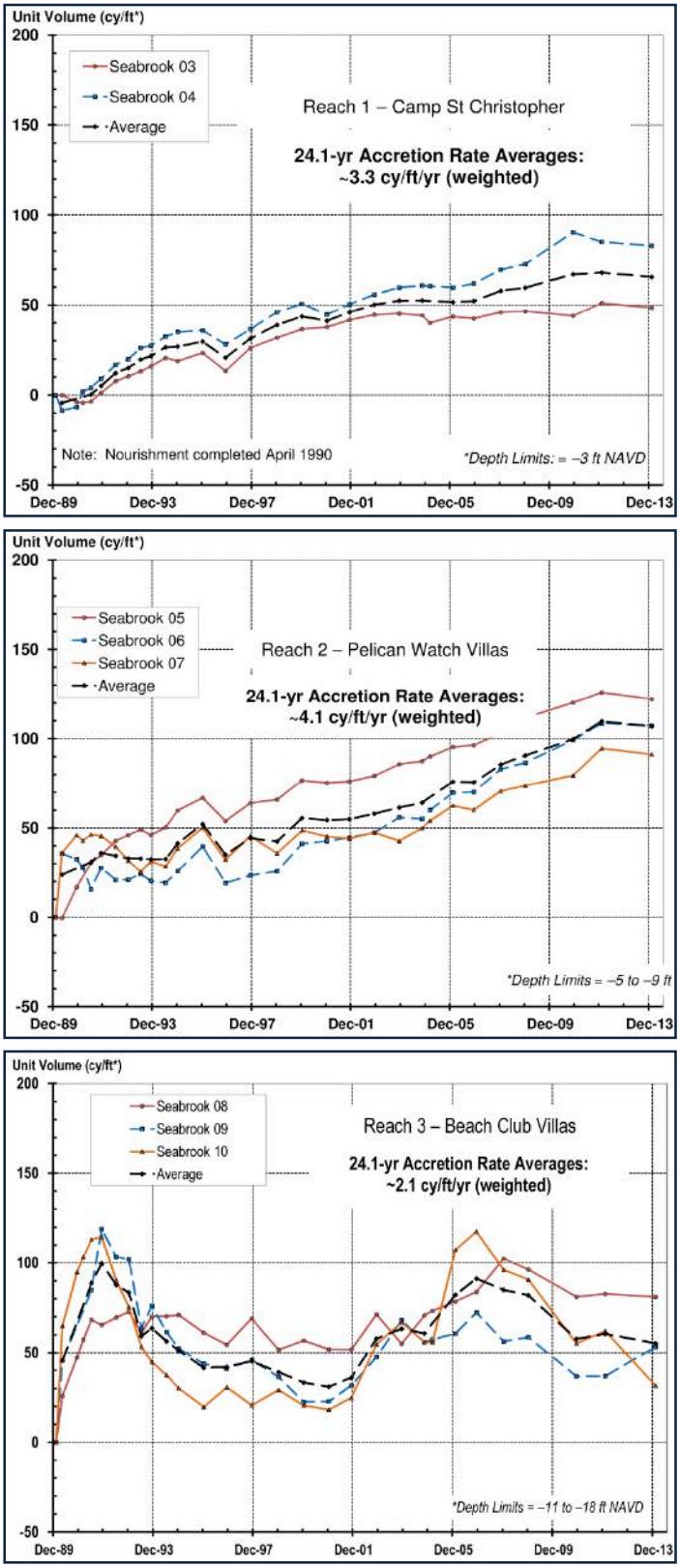

FIGURE 5.1.2f. Reaches 1–3 showing the 24-year average, unit-volume change rate by reach. Order of transects is from downcoast to upcoast (generally southwest to northeast). [Source: CSE 2014]

The gains along Reaches 1 and 2 have been relatively steady, whereas Reach 3 has undergone an ~15 year cycle of accretion and erosion. These results somewhat underestimate the full change because calculations are cut off well before the centerline of the North Edisto River Inlet.

Figure 5.1.2g shows the 24-year accretion rates for South Beach along the northern marginal channel of the North Edisto River Inlet:

- Reach 4 (Seabrook Island Club area) has gained an average of 3.9 cy/ft/yr.
- Reach 5 (Beach Court–Amberjack Court area) has gained 15.8 cy/ft/yr.
- Reach 6 (Renken Point) has gained ~15.2 cy/ft/yr.

Each reach exhibited a period of erosion for about 5–6 years after the 1990 nourishment project followed by rapid accretion.

Fig 5.1.2h shows the 24-year accretion/erosion trends for North Beach between Renken Point and Seabrook Island's north (eastern) most development near Oyster Catcher beach access: Reach 7 has gained 2.7 cy/ft/yr; Reach 8 has lost an average of 0.9 cy/ft/yr. As both graphs illustrate, this section of Seabrook Island has experienced large fluctuations in the shoreline (unit beach volume) but little net change. Both reaches were much healthier in 1990 than the rest of Seabrook Island as a result of the large gains in beach width after the 1983 inlet relocation (see Fig 5.1.2e).

It can be shown that volumetric erosion/accretion rates are related to linear beach-width changes (or unit area changes) according to the dimensions of the active littoral zone (CERC 1984, Kana et al 2013). For example, along high-energy beaches where the average dry-beach level is (~)+6 ft NAVD and the limit of measureable bottom change is −21 ft NAVD, 1 cy/ft of erosion/accretion equates to 1 ft of beach recession/growth. Along Seabrook Island's ocean coast, the normal cross-shore limit of yearly sand transport and bottom change is (~) −12 ft NAVD (Kana et al 2013). Thus, 1 cy/ft of erosion/accretion equates to ~1.5 ft of beach recession/growth.

Table 5.1.2a lists the estimated equivalent linear erosion/accretion rates for 1990 to 2014 for the previously referenced reaches along Seabrook Island. Note the rates along the northern channel and the North Edisto River Inlet use different factors according to the assumed depth limit for the active littoral zone.

Three additional reaches are tracked around Captain Sams Inlet in conjunction with its annual beach surveys (Fig 5.1.2i). Figure 5.1.2j shows the yearly unit volumes by reach for the period 1995 to 2014. The relatively high unit volumes measured to −8.5 ft NAVD reflect the initial large surplus of sand in the area associated with the ebb-tidal delta of Captain Sams Inlet.

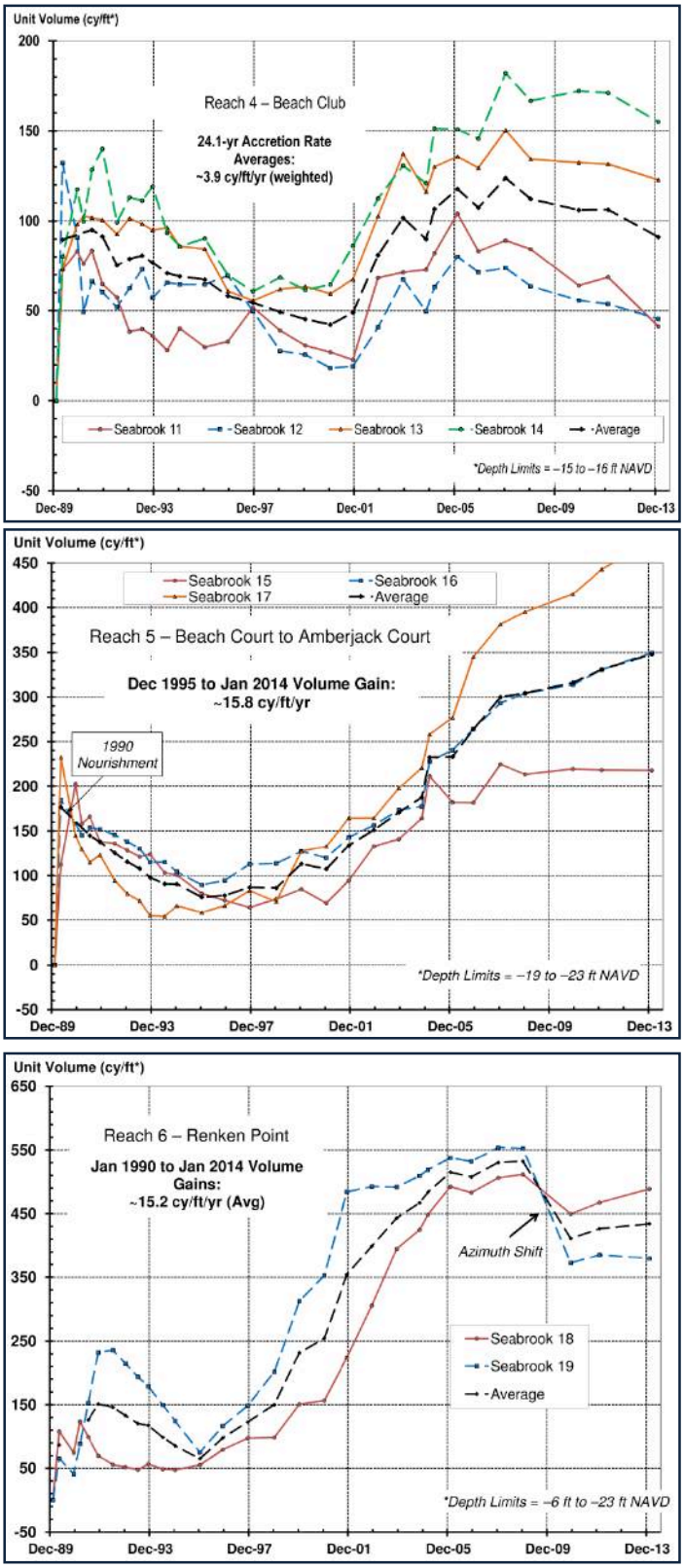

FIGURE 5.1.2g. Reaches 4–6 showing the 24-year average, unit-volume change rate by reach. Order of transects is from downcoast to upcoast (generally southwest to northeast). [Source: CSE 2014]

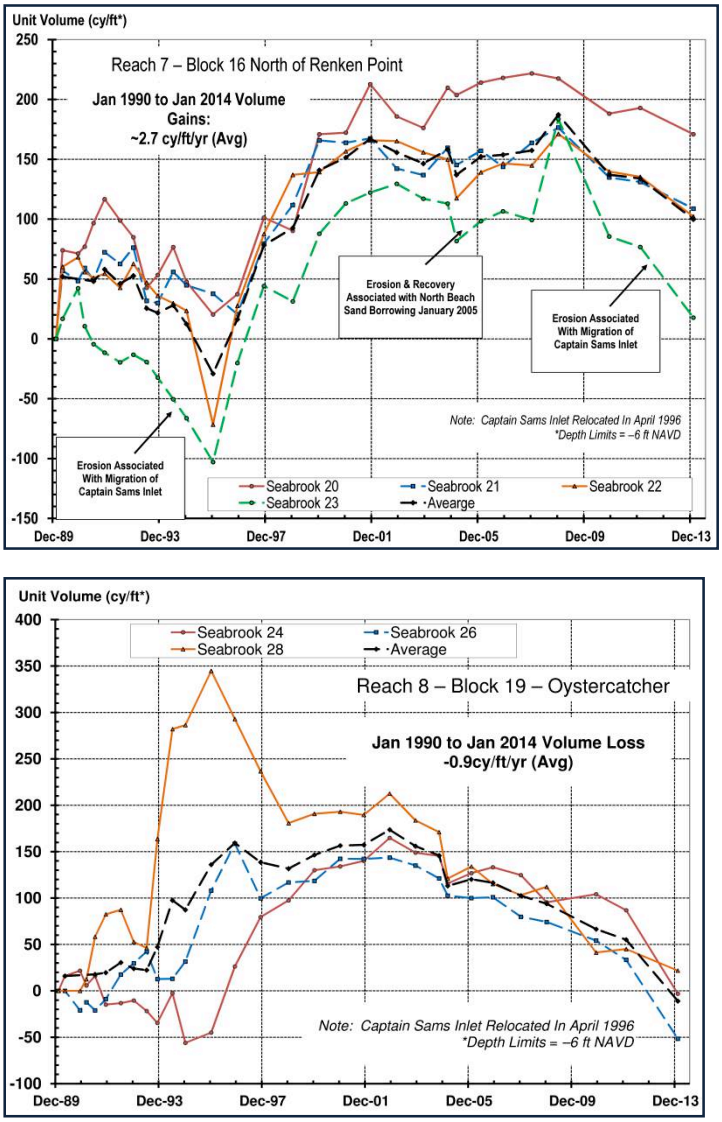

FIGURE 5.1.2h. Reaches 7–8 showing the 24-year average, unit-volume change rate by reach. Order of transects is from downcoast to upcoast (generally southwest to northeast). [Source: CSE 2014]

TABLE 5.1.2a. Summary of volumetric and estimated equivalent linear erosion/accretion rates for the period 1990 to 2014 (source: CSE 2014). *DOC (depth of closure) — The estimated offshore depth in feet NAVD beyond which there is no measureable change in bottom elevation in connection with cross-shore sand transport at yearly to decadal scales (Kraus et al 1998). **Source: CSE (2014) — See original source for profile calculation limits. ***Factor assumes berm elevation is +6 ft NAVD and DOC as indicated in the table. Factor = 27/(6−DOC)

Reach	Applicable Profiles	Locality	DOC*	Volume Change Rate** (cy/ft/yr)	Factor***	Equivalent Linear Rate (ft/yr)
1	3–4	North Edisto River Inlet	−5	+3.3	2.4	+7.9
2	5–7	North Edisto River Inlet	−8	+4.1	1.9	+7.8
3	8–10	Northern Channel	−12	+2.1	1.5	+3.2
4	11–14	Northern Channel	−21	+3.9	1.0	+3.9
5	15–17	Renken Point	−12	+15.8	1.5	+23.7
6	18–19	North Beach	−12	+15.2	1.5	+22.8
7	20–23	North Beach	−12	+2.7	1.5	+4.1
8	24–28	North Beach	−12	−0.9	1.5	−1.4

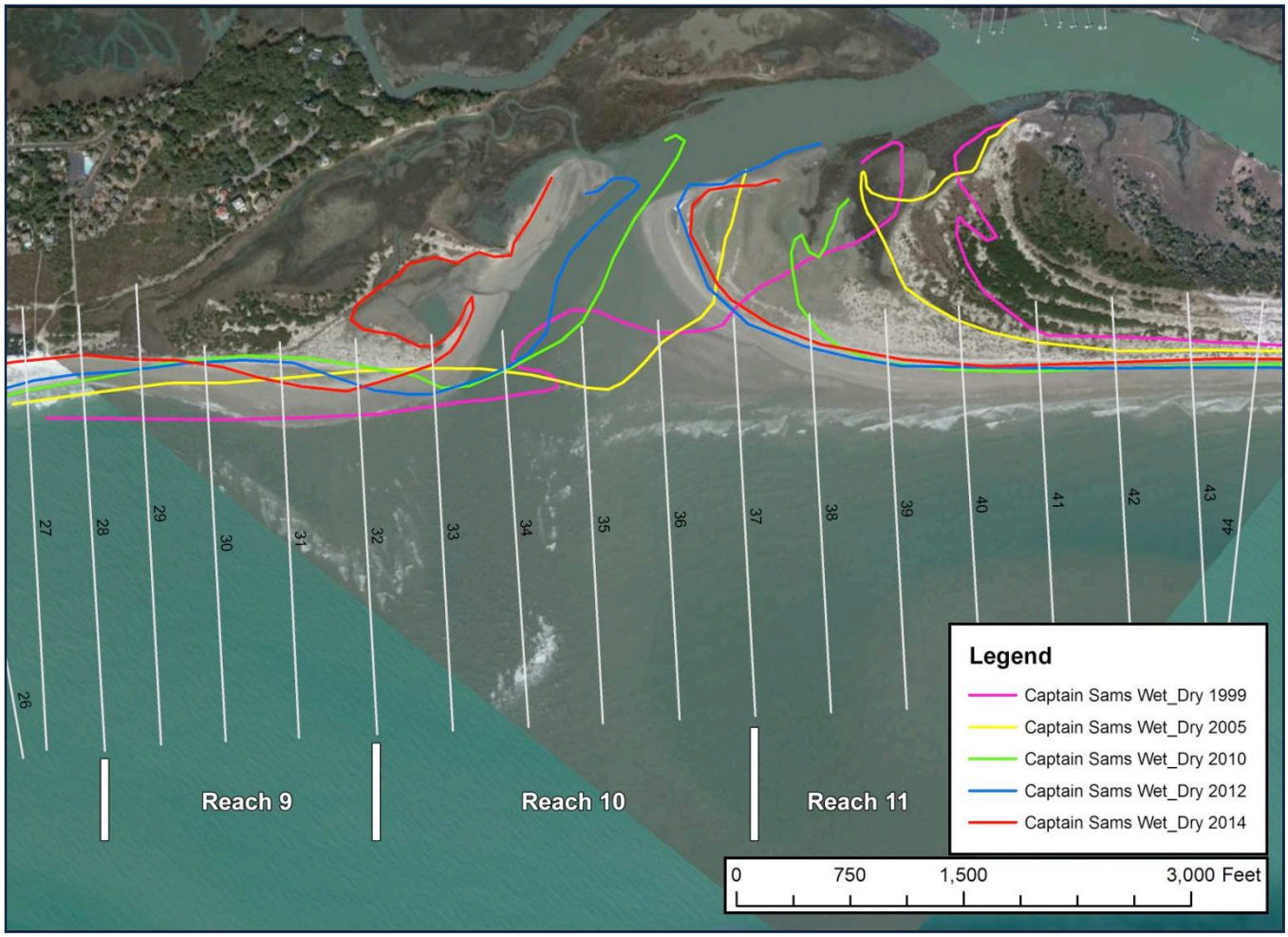

FIGURE 5.1.2i. Shoreline positions (delineated from the observable wet/dry contact) between 1999 and 2014, showing the westward migration of Captain Sams Inlet following the 1996 relocation along with the location of three of the annual monitoring reaches. [Underlying aerial photography is from Google Earth™ March 2014.]

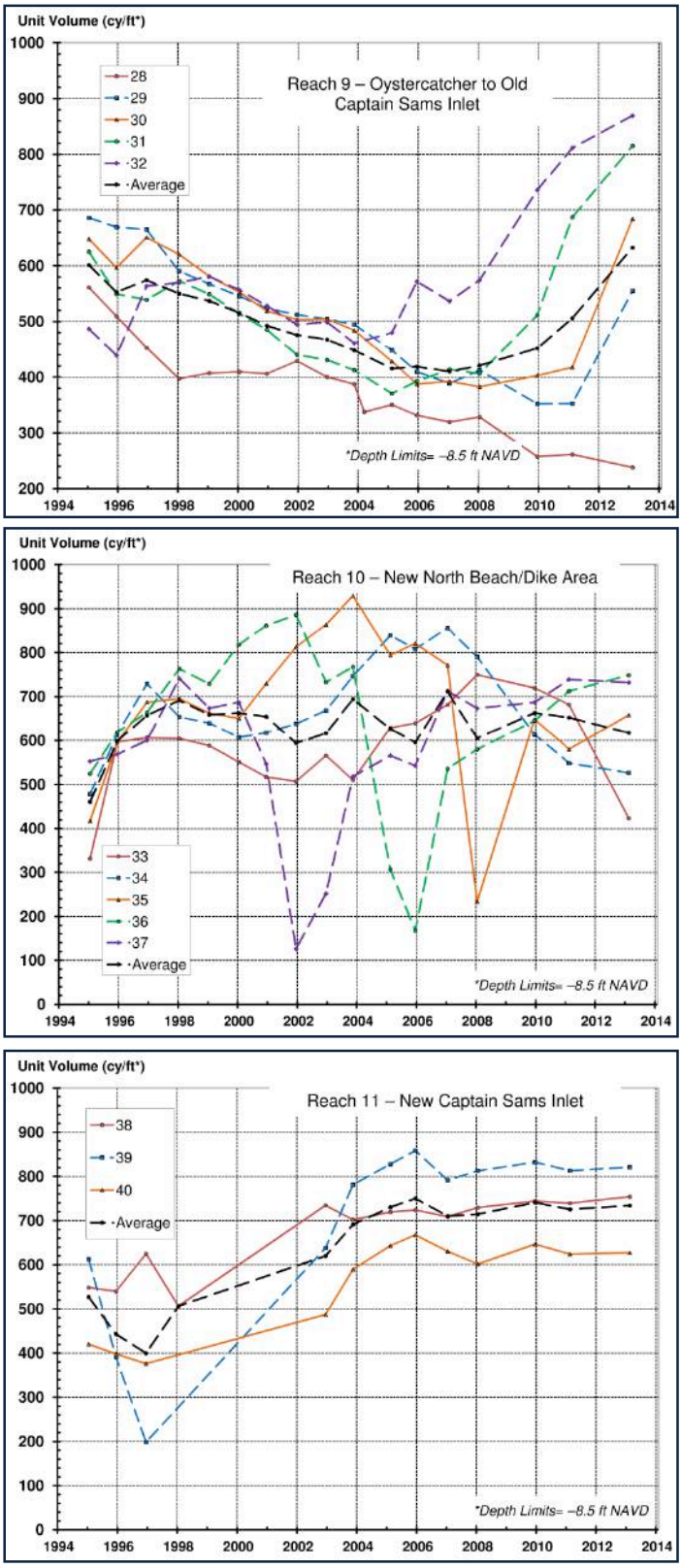

FIGURE 5.1.2j. Reaches 9–11 showing the 24-year average, unit-volume change rate by reach. Order of transects is from downcoast to upcoast (generally southwest to northeast). [Source: CSE 2014]

Reach 9 (Fig 5.1.2j, upper) lost volume for a decade following the 1996 inlet relocation project. This reflects onshore movement and downcoast spreading of sand from the abandoned inlet. (Note some of the reduction was associated with excavations and downcoast transfers of sand between 1998 and 2007.) Since 2008, the reach has gained rapidly as Captain Sams Inlet shoals have migrated into the area.

Reach 10 (Fig 5.1.2j, middle) is at the recent mouth of Captain Sams Inlet (2005–2012). As the inlet migrates, the channel passes each monitoring line in sequence, producing a rapid loss of sand followed by recovery of the profile volume. The recovery of volume occurs on the Kiawah side of the channel after the inlet migrates through each profile line.

Reach 11 (Fig 5.1.2j, lower) is situated around the 1963/1983 and 1996 position of Captain Sams Inlet. Soon after each inlet relocation, profiles in this reach tend to rapidly recover then gain sand at a steadier pace in connection with the sand supply moving downcoast along Kiawah Island (CSE 2009; Kana et al 2013). Selected approximate mean high water (~MHW) (wet/dry line) shorelines around Captain Sams Inlet digitized from aerial orthophotos (eliminates the distortions caused by the tilt of the camera) (1999–2014) were shown in Figure 5.1.2i. The data mark the channel boundaries and illustrate growth of spits on either side of the channel. CSE (2014) reported that Reach 11 gained an average of 16.7 cy/ft/yr between 2008 and 2014 (surveys in December/January of each year). This gain represents accretion on the Kiawah Island side of Captain Sams Inlet. Changes along the Kiawah Spit are also tracked in anticipation of future inlet relocation projects.

Figure 5.1.2k shows recent results of surveys along the Kiawah Spit. Between 2012 and 2014, the south half of the spit eroded (Lines 41–45) while the northern half of the spit to Beachwalker Park accreted (Lines 46–50). The short-term erosion trend at the southern end of the spit is counter to the long-term trend for the area (CSE 2009). Kana and Mason (1988) and Kana et al (2013) hypothesized that the ebb-tidal delta of Captain Sams Inlet acts to hold sand along the Kiawah Spit in much the same way as a jetty backs up sand moving along the coast. As the inlet and delta migrate toward Seabrook Island, the point of maximum trapping moves, causing the “salient” in the updrift shoreline to move with it. The salient, a minor protrusion in the beach strand, then erodes back to the normal strand line. For additional details on Kiawah Island beach changes, see CSE (2009) and Kana et al (2013).

Captain Sams Inlet migrates (north) east to (south) west due to spit growth under the influence of net longshore transport (Hayes et al 1979, Kana & Mason 1988, CSE 2009, Kana et al 2013) (Fig 5.1.2l, upper). Prior to the 1983 inlet relocation, average annual migration rates were around 200–225 ft/yr (Hayes et al 1979). The rate of migration since the 1996 relocation has averaged 160 ft/yr. The rate of inlet migration is faster at the ocean end of the channel than the river end because of the natural tendency for the new channel to rotate south over time. When relocated, the channel typically discharges directly offshore, perpendicular to the strand line. As it migrates toward Seabrook Island, it tends to rotate and discharge obliquely to the strand. This demonstrates the dominant

influence of longshore transport along the seaward side of the Kiawah Spit (CSE 2009, Kana et al 2013).

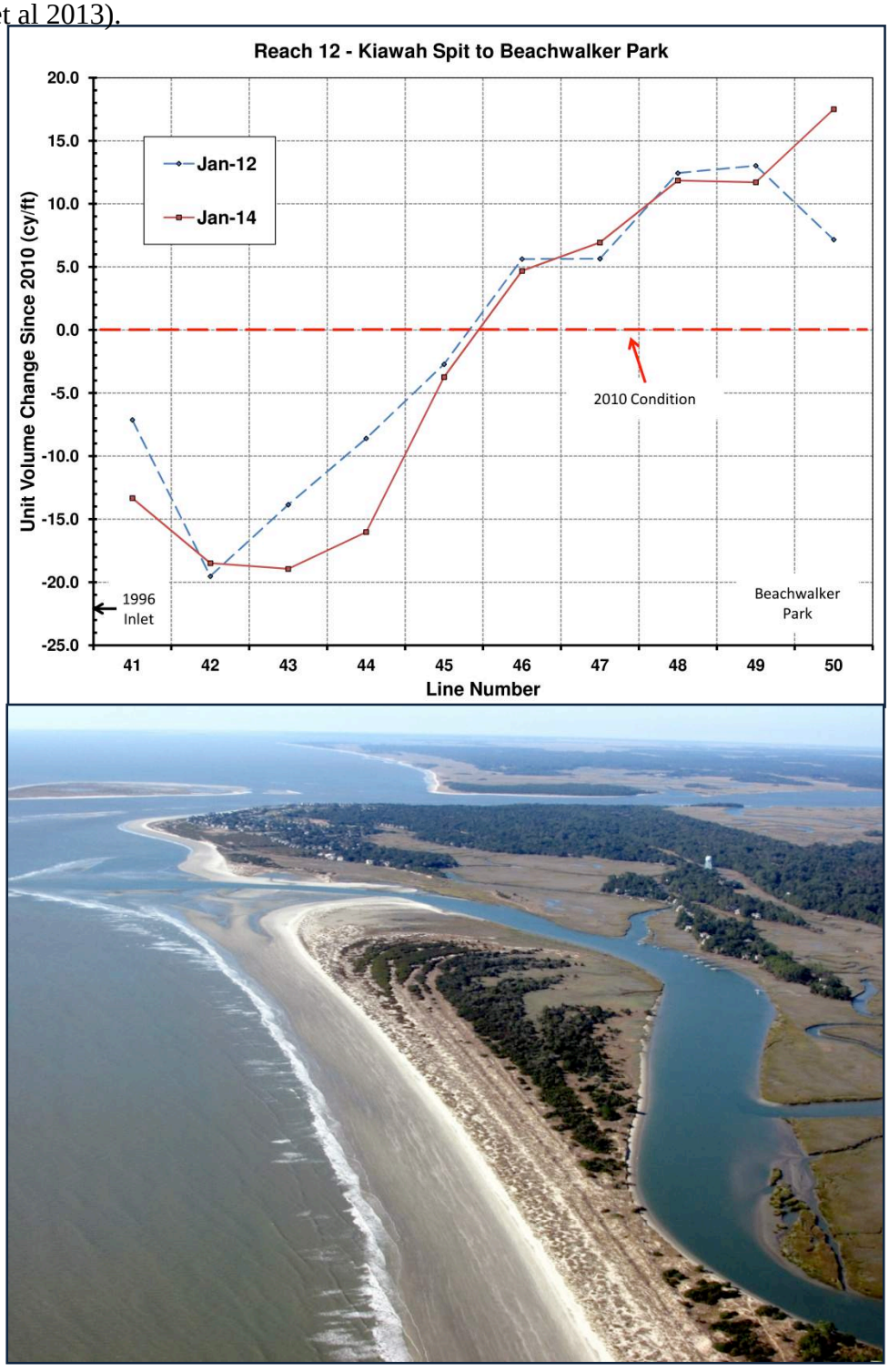

FIGURE 5.1.2k. [UPPER] Volume changes in reach 12 along Kiawah Spit compared to the 2010 condition. The western half of the reach has eroded since 2010, while the eastern half (including the area near the neck of the spit) has accreted. **[LOWER]** Kiawah Spit at low tide in November 2013. Note the multiple dune ridges seaward of the waxed myrtle line, confirming accretion along the seaward side of the spit for at least four decades.

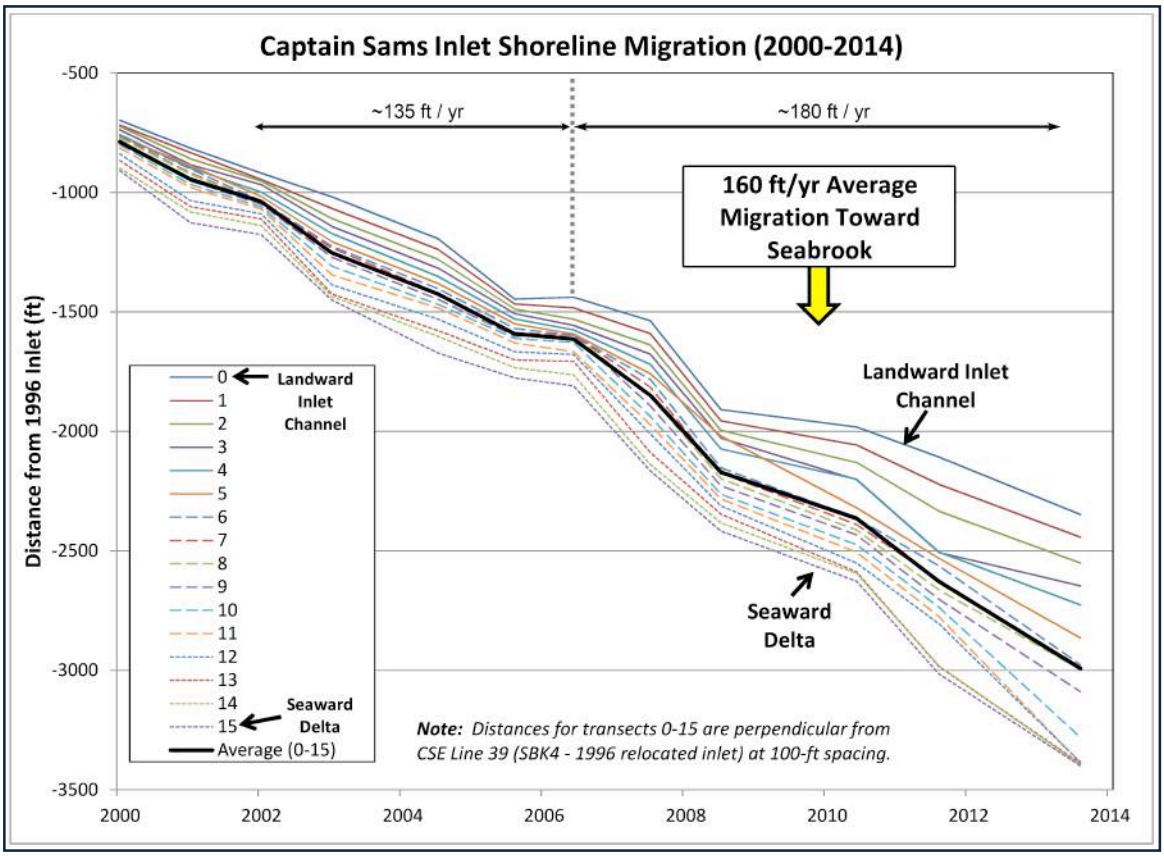

FIGURE 5.1.2l. **[UPPER]** Approximate distances from the downcoast edge of the 1996 Captain Sams Inlet to the low-water shoreline on the indicated date. The average migration rate is 160 ft/yr. **[LOWER]** Captain Sams Inlet in November 2013. [Source: CSE 2014]

Figure 5.1.2l (upper) shows the rates of channel migration along 15 shore-parallel channel sections. The average rate of migration the first decade after inlet relocation was ~135 ft/yr. Since 2006, the rate has accelerated to ~180 ft/yr. This acceleration is due to channel rotation as well as the increasing dominance of south (westerly) sand transport. The further south Captain Sams Inlet migrates, the more it is sheltered by the shoals of the North Edisto River Inlet. Waves from the south diminish and have less effect than conditions when the inlet is situated further upcoast along the Kiawah Spit. As Hayes et al (1979) demonstrated, variations in longshore transport around the shoals of inlets accounts for the varying and cyclic shoreline changes along the beach.

Section 5.2 Beach Alteration Inventory

Seabrook Island has required numerous beach alterations in response to localized erosion since the mid 1970s. The primary measures implemented in the 1970s were sandbags, quarry-stone groins, sandbag revetments, concrete sheet-pile bulkheads/seawalls, and quarry-stone revetments. Sand scraping was also performed at various localities in the late 1970s with some small-scale projects involving transfers of sand from accreting shoals on the Seabrook Island side of Captain Sams Inlet to erosion hot spots such as the area around the 13th hole of the golf course. Records of specific 1970s projects by the Seabrook Island Company (developer) or individual homeowners are not available.

The last segments of the seawall/revetment were constructed in the early 1980s with an ~1,800-ft section connecting the Renken Point and golf course segments and an ~900-ft-long bulkhead extending west along the North Edisto River Inlet fronting Pelican Watch Villas. No structures have been placed north (east) of the 13th hole (~OCRM 2565) or along St. Christopher Camp property.

By 1983, the community shifted to an emphasis on soft solutions to erosion. While individual property owners funded, maintained, and upgraded most of the seawalls (the SIPOA maintains wall segments at beach accesses), the Seabrook Island Company initiated work on the first relocation of Captain Sams Inlet. The Seabrook Island Company also funded larger-scale sand transfers immediately after the 1983 project.

Since 1984, there has been one nourishment (channel realignment) project via hydraulic dredge (February 1990), a second relocation of Captain Sams Inlet (April 1996) and several transfers of sand by trucks from accreting zones around Captain Sams Inlet to the area south of Renken Point. Figure 5.2a highlights the location of various erosion control structures along Seabrook Island. Sandbag and quarry-stone groins were short-lived and became non-functional within a couple of years after installation (Hayes et al 1979). Therefore, no shore-perpendicular structures have interrupted sand flow along the Seabrook Island beach since ~1980s.

FIGURE 5.2a Location of shore-protection projects along Seabrook Island since the 1970s. Captain Sams Inlet relocation (1983, 1996) occurred between OCRM 2575 and the Kiawah/Seabrook Town easement line (outside image range, see Fig T-3).

5.2.1 Beach Renourishment

Beach nourishment is generally defined as the addition of sand from non-littoral sources to restore a deficit and otherwise advance the shoreline (CERC 1984, NRC 1995). Only one project at Seabrook Island meets this definition—the 1990 channel realignment project in which the shoal on the seaward side of the northern channel was dredged to create a new channel and the material was discharged into the existing channel, restoring a beach along ~5,600 ft of Seabrook Island's seawall. All other beach-widening projects involved manipulation of existing littoral sand sources:

- Two projects involving relocation of Captain Sams Inlet, the result of which was accelerated sand bypassing by natural processes to downcoast areas of Seabrook Island.
- Ten projects involving mechanical transfer of sand by trucks from accreting intertidal areas (vicinity of Captain Sams Inlet) to downcoast eroding areas.

All known soft-engineering projects are listed herein under Beach Renourishment (Table 5.2a) and are discussed in chronological order.

Event 1 1982 — Sand scraping and transfer involving ~70,000 cy was completed in October 1982 prior to the first relocation of Captain Sams Inlet. Excessive sand had accumulated off Oyster Catcher beach access at the expense of downcoast areas. Sand was excavated by pan earthmover, hauled to Renken Point at low tide, and placed along the seawall (Kana et al 1984).

Event 2–3 1983 — The first relocation of Captain Sams Inlet was accomplished between 23 January and 4 March 1983. Under a permit restriction that prohibited excavation during flood tide, the new channel was excavated "in-the-dry" as an enclosed basin. The new inlet was formed by a breach of the outer berm/dike (seaward end of the basin) during a rising tide and a breach of the inner berm/dike at high tide. Tidal action cut the full channel over several days. The abandoned inlet was closed during a falling tide by dozers pushing stockpiled sand from either side of the channel. See Figures T-3, T-7, and T-10 herein, and CSE (2011) for details of the project. Following inlet relocation, ~230,000 cy were excavated in the area of the abandoned inlet delta by earth movers and transferred to North Beach between the golf course and Renken Point for purposes of accelerating restoration of that section of beach. (Source: Kana et al 1984)

Event 4 1990 — The only true nourishment project to date along Seabrook Island was completed by dredge in February 1990. The borrow area was the north shoal of the North Edisto River Inlet in the area between Renken Point and the Beach Club (Lines 13–17). The borrow area paralleled the existing northern channel with its edge ~1,000 ft from the seawall. Because of severe encroachment of the northern channel against Seabrook Island's shoreline, no sand could pass Renken Point and migrate under waves to the Beach Club and St. Christopher Camp. The project restored an intertidal beach and a shallow platform for longshore transport by waves (Kana 1989).

TABLE 5.2a. Beach renourishment* events along Seabrook Island. [* Includes mechanical sand transfers from one section of beach to another and inlet relocation. Applicable state permit numbers: (1) P/N 81-4C-192, (2) P/N 89-2T-120P, (3) P/N 95-1W-305P, (4) P/N 2001-1W-352P.]

Event	Date	Type*	Applicable Permit #	Method	Borrow Source	Locality	Placement Area / Lines	Volume (cy)	Cost	Sources	Contractor
1	Oct 1982	Transfer	N/A	Trucks	Intertidal bars	Lines 26-28	Beach 17-21	~70,000	N/A	Kana et al 1984	N/A
2	Jan-Feb 83	Inlet Relocation	1	Trucks	Kiawah Spit	Lines 39-40	Abandoned Inlet 31-38	175,000	$300,000 (1983)	Kana et al 1984, Kana 1989	Palmetto Land Clearing Inc
3	Mar-Apr 83	Transfer	1	Trucks	Abandoned Inlet Shoals	Lines 25-29	North Beach 20-24	230,000	~$290,000 (1983)	Kana et al 1984, CSE 1989	Palmetto Land Clearing Inc
4	Feb 1990	Nourishment	2	Dredge	North Shoal/ North Edisto Inlet	Lines 13-17	Renken Pt to Pelican Watch Villas 8-20;3-6	685,000	$1,660,000 (1980)	CSE 1990	Great Lakes Dredge & Dock Co
5	Mar-Apr 96	Inlet Relocation	3	Trucks	Kiawah Spit	Lines 39-40	Abandoned Inlet 31-38	140,000	$400,000 (1996)	SIPOA unpublished	Pace Construction Co
6	Apr-May 96	Transfer	3	Trucks	Abandoned Inlet Shoals	Lines 27-29	Closure Dike 31-34	~45,000	$110,000 (1996)	SIPOA unpublished	Westbank Construction Co
7	Feb-Apr 97	Transfer	3	Trucks	North Beach	Lines 28-32	Renken Point 18-21	75,560	$130,000 (1997)	SIPOA unpublished, CSE Baird 1998	RE Goodsen Construction Co
8	Feb 1998	Transfer	3	Trucks	North Beach - Inlet Shoals	Lines 24-36	Outer Dike 30-36	~80,000	~$80,000 (1998)	SIPOA unpublished, CSE Baird 1999	RE Goodsen Construction Co
9	Dec 99-Jan 00	Transfer	3	Trucks	North Beach - Inlet Shoals	Lines 25-33	Build up Dry Beach 25-33	~60,000	N/A	CSE 2001	RE Goodsen Construction Co
10	Jan 2002	Transfer	4	Trucks	North Beach - Inlet Shoals	Lines 25-33	South Beach 13-18	~65,000	N/A	CSE 2004	RE Goodsen Construction Co
11	Jan 2003	Transfer	4	Trucks	North Beach - Inlet Shoals	Lines 25-33	South Beach 13-18	~65,000	N/A	CSE 2005	RE Goodsen Construction Co
12	Jan-Feb 05	Transfer	4	Trucks	North Beach - Inlet Shoals	Lines 25-33	South Beach 12-18	93,100	$149,000 (2005)	CSE 2005	RE Goodsen Construction Co
13	Dec 06-Feb 07	Transfer	4	Trucks	North Beach - Inlet Shoals	Lines 25-33	South Beach 12-18	70,997	N/A	CSE 2008	RE Goodsen Construction Co

Fill placement extended ~5,850 ft in the aggregate with the primary placement area between Line 8 and Line 20 (Beach Club to Renken Point). Approximately 10 percent of the fill was placed along the North Edisto River Inlet between Line 3 and Line 6. A gap was left between the fill areas because of the steep drop-off at the confluence of the northern channel and the North Edisto River Inlet (Lines 6–8). The 1990 project was the first nourishment in South Carolina to use an ocean-certified hydraulic dredge and the third to utilize sand from an active ebb-tidal delta (Hunting Island in 1975 and 1980 utilized ebb tidal delta shoals—Kana 2012). The project has performed well and has not required maintenance renourishment by dredge or realignment of the northern channel in 24 years (see results of beach surveys in Section 5.1.1).

As of 2014, the project area contains approximately twice the sand volume placed via the 1990 project. The primary maintenance of the project area has consisted of addition of ~223,000 cy (2003–2007) via sand transfers from North Beach to enhance the sand supply. This addition represents about 20 percent of the added sand volume between Renken Point and the Beach Club since 1990. Natural additions make up between 40 and 50 percent of the present sand volume. The rate of sand movement into the area has offset the natural tendency of the northern channel to encroach on the seawall and help push the channel further from Seabrook Island's development. This has allowed formation of a wider dry beach and protective dune along a major portion of the Renken Point—Beach Club beach (i.e. – Lines 13–19).

Events 5–6 1996 — The second relocation of Captain Sams Inlet was accomplished between 24 February and 12 April 1996. Construction methods and the position of the new inlet matched the 1983 inlet relocation. However, the closure dike was positioned ~500 ft seaward of the 1983 dike to closely align with the new strandline that formed after the 1983 project. A number of mechanical delays reduced the initial excavation volumes in the basin to ~140,000 cy (CSE unpublished project records). Upon opening of the new channel on 4 April and closure of the old channel on 12 April, a second contractor completed work on the closure dike to improve its integrity and achieve the design dimensions (listed as Event 6). Final work on the closure dike was completed by 15 May 1996.

Events 7–9 1997–2000 — As part of the second inlet relocation project, Seabrook Island POA performed sand scraping and beach reshaping in the vicinity of the abandoned shoals of Captain Sams Inlet. In three winter events between February 1997 and January 2000, ~215,000 cy were shifted from attaching shoals of the ebb-tidal delta to North Beach. The stated purpose (CSE 1995, CSE-Baird 1999) was to accelerate onshore attachment of the abandoned shoals of the old inlet; straighten the shoreline along North Beach to promote a flow of sand to the south under northeasterly waves, and build a protective outer dike (dune line) to protect habitat and preserve the littoral budget seaward of the new strandline. The outer dike was positioned about 500 ft seaward of the 1996 closure dike. Once established, the new "outer beach" provided an 8,000-ft-long contiguous dry-sand beach along Seabrook Island by 2000. This was the longest, continuous dry beach for the island since the 1970s.

Events 10–13 2002–2007 — Seabrook Island performed four sand transfer events under a 2001 permit in which ~294,000 cy were transferred by trucks from North Beach and the attached shoals of Captain Sams Inlet to South Beach between Renken Point and the Beach Club. The purpose of this project was to extend the dry-sand beach, augment the flow of sand around Renken Point, and reduce exposure of existing seawalls. The dry-sand beach created by the project provided a source for dune growth, eventually leading to natural burial of the seawall around Beach Court and Amberjack Court as well as Renken Point. The dry-sand beach terminated at the Beach Club in 2007 but resumed 1,500–2,000 ft downcoast at Beach Club Villas.

Beach nourishment and sand transfer volumes are approximately as follows:

1) Beach Nourishment	1990	1 project	685,000 cy	Placed south of Renken Point
2) Inlet Relocations	1983, 1996	2 projects	~1,125,000 cy	Bypassed from ebb-tidal delta
3) Sand Transfers	1982, 1983, 1996, 1997, 1998, 2000, 2002, 2003, 2005, 2007	10 projects	~855,000 cy	Moved from accretion zone at North Beach and Captain Sams Inlet shoals to North Beach and South Beach

These projects have improved Seabrook Island's beach well beyond its condition of 1980 (Kana et al 2013). A majority of shore-protection structures are buried as of 2014 with a field of vegetated dunes providing a buffer between the active beach and the seawall. Beach improvements have required a combination of nourishment, channel realignment, inlet relocation, and sand transfers to increase the sand supply and redistribute sand from accreting to eroding areas. Ongoing sand management is a fundamental need along Seabrook Island because of the cyclic beach changes associated with migration of Captain Sams Inlet. Soft-engineering solutions to erosion are now favored over the hard solutions implemented in the 1970s and early 1980s.

5.2.2 Emergency Orders and Sandbags

The following are the emergency orders and sandbagging events on Seabrook Island over the last several decades:

a. September 1979 – Post Hurricane David seawall repairs
b. September 1995 – Sandbagging
c. October 2005 – Sand scraping
d. May 2006 – Sand scraping

5.2.3 Previous Hurricane or Storm Events

Seabrook Island's shoreline dynamics are controlled primarily by Captain Sams Inlet and the North Edisto River Inlet. The shoreline moves in direct response to inlet migration and changes in offshore shoals and channel migration. Storms have played a secondary role in this setting (Hayes et al 1979, Kana 1989, Kana et al 2013).

Over the past 40 years, only one hurricane has caused significant damage along the oceanfront. Hurricane David (September 1979) generated high waves that propagated from the south, crossed the shoals of Deveaux Bank, and severely damaged the seawall in the vicinity of the Beach Club and Renken Point (Fig 5.2.3a). A section of the seawall breached and armor stone was washed across Seabrook Island Road in the event (R Cowan, pers comm, September 1979). This led to reconstruction of the sand dike to a higher elevation and addition of new, larger armor stone along the seaward face of the structure. Prior to David, concrete sheet-pile bulkheads and "riprap" revetments were commonly constructed with a crest elevation around +10 ft NGVD (approximate +9.0 ft NAVD). As the beach eroded along the seawall in the 1970s and 1980s; wave heights and run-up increased at the wall. This led to ad-hoc improvements by property owners at various levels of structural support (Katmarian 1995a,b)

South of the Beach Club, the dike crest was raised to between +13 ft and +15 ft NGVD (CSE 1995a,b). Armor-stone size was increased by adding 1–2 ton units (typical) over the original riprap-sized stones. Where vertical, concrete, sheet-pile bulkheads had been installed (e.g. – Renken Point) a face of riprap and larger armor stone was added for scour protection.

For upward of a decade between 1975 and 1985, nearly all sections of the seawall required addition of larger rock because of settlement as the beach eroded. Two quarry-stone groins visible across the wet sand beach in October 1978 disappeared by 1980, likely due to continued settling into the sand as the profile eroded. Hurricane David likely cut away the beach more severely than any single event in the 1970s and left the groins well below the low-tide level. As the northern channel encroached on the seawall south of Renken Point, any armor stone from the groins settled and mixed with riprap that slumped downslope from the seawall.

Hurricane Hugo (Category 4) impacted the South Carolina coast on 21 September 1989. Making landfall at Isle of Palms about 35 miles to the north, its most damaging surge was north of Charleston Harbor. Seabrook Island, on the back side of the storm, did not sustain direct impact along the ocean coast. Damages were primarily due to high winds backing off the land and downing trees (R. Cowan, pers comm, 22 September 1989).

The US Army Corps of Engineers (USACE 2013) discussed the storms that have impacted nearby Edisto Island during the past century. Edisto Beach is ~6 miles south of Seabrook Island and is similarly exposed to tropical and extra-tropical storms. According to USACE (2013), significant tropical storms impact the area at a frequency of one event per every four years. Extra-tropical storms, generating gale-force winds out of the northeast, occur several times per year but significant events have a frequency of one event per 1.5 years.

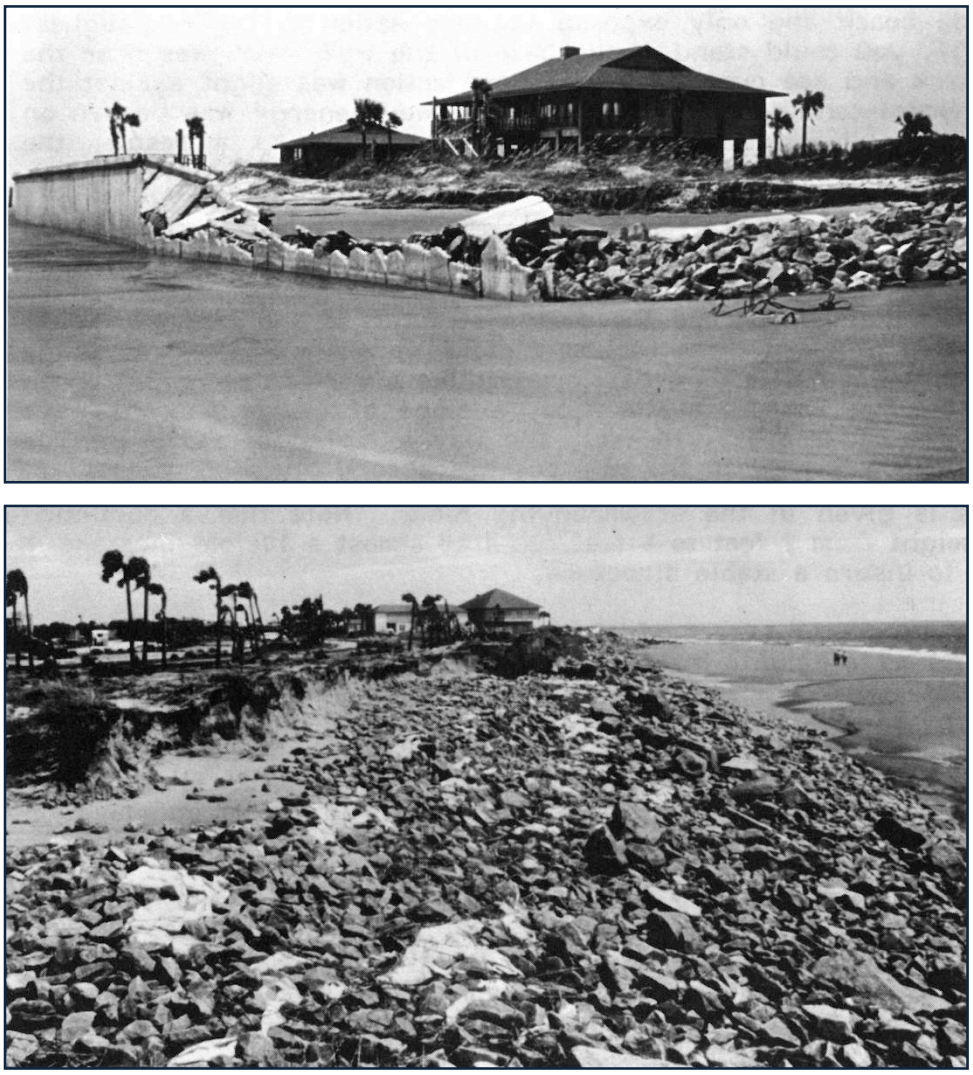

FIGURE 5.2.3a. Damages along Seabrook Island due to Hurricane *David* (5 September 1979). **[UPPER]** The concrete seawall and armor-stone "wingwall" at Renken Point on 7 September 1979. **[LOWER]** Collapsed riprap revetment south of the Beach Club on 5 September 1979. [Photos by WJ Sexton]

Major damaging events at Edisto Beach occurred in 1940, 1952, 1959, 1979, and 1989 (Table 5.2.3). During the past 25 years, there have been no significant damaging events impacting Edisto Beach (USACE 2013, pg 36) or Seabrook Island.

TABLE 5.2.3. Damaging storms at Edisto Beach (Source: USACE 2013)

11 August 1940	An unnamed hurricane impacted Edisto Island at high tide "damaging nearly every house on the island and completely destroying more than half of the approximately two hundred beachfront homes at the time." Seabrook Island was undeveloped at that time.
31 August 1952	Hurricane *Able* "completely destroyed many beach cottages and damaged many others." It also damaged Palmetto Boulevard along the north end of Edisto Beach near the Pavilion. This event likely triggered the first nourishment project in South Carolina (USACE 1952, 1965; Kana 2012) and construction of timber groins by the South Carolina Highway Department to protect the beachfront road along part of Edisto Beach (USACE 1952, Kana et al 2004).
29 September 1959	Hurricane *Gracie*, a Category 3 storm, made landfall on the south side of Edisto Island. The fishing pier was destroyed, 16 homes were "wrenched from their foundations, and 65 other homes severely damaged" (USACE 2013). The storm entered the coast at low tide, likely lessening damages.
5 September 1979	Hurricane *David* made landfall at Savannah (GA) as a Category 1 storm, then tracked north-northeast toward Charleston. It generated high waves and a 3–5 ft storm surge (en.wikipedia.org/wiki/Hurricane_David). The storm produced severe damage to the seawall, leading to a major failure south of the Beach Club and collapse of an ~100-ft section of concrete sheet-pile wall at Renken Point (Fig 5.2.3a) (Kana & Sexton 1982).
21 September 1989	Hurricane *Hugo* entered South Carolina as a Category 4 storm, producing tides up to elevation 16.0 ft NGVD at Isle of Palms (Garcia et al 1989). The track of the storm ~40 miles to the north placed Seabrook Island in the favorable quadrant where the most damaging winds were directed offshore. There were no reported damages along the oceanfront at the Island because of the minimal storm surge and backing winds.

The impact of storms along Seabrook Island is partially buffered by protective shoals of the North Edisto River Inlet. Deveaux Bank is presently an island at the mouth of the inlet encompassing hundreds of acres of dunes and wetland habitat (Fig 5.2.3b). It serves to intercept waves from the south before they strike Seabrook Island's shoreline. At some times during the past 50 years, Deveaux Bank has been much smaller and offered less sheltering. For example, between 1973 and 1978, much of the emergent portion of Deveaux Bank eroded and left a remnant island further west (Fig 5.2.3c, Kana & Sexton 1982). This may have exacerbated damages during Hurricane David by allowing waves to propagate directly toward the Beach Club and Renken Point. By the mid 1980s, an emergent dune line had reformed to produce the nucleus of today's Deveaux Bank (CSE 1989).

FIGURE 5.2.3b. Aerial photo of Deveaux Bank in 2012. Deveaux Bank is presently a well-established island, which serves as a natural breakwater to the south shoreline of Seabrook Island.

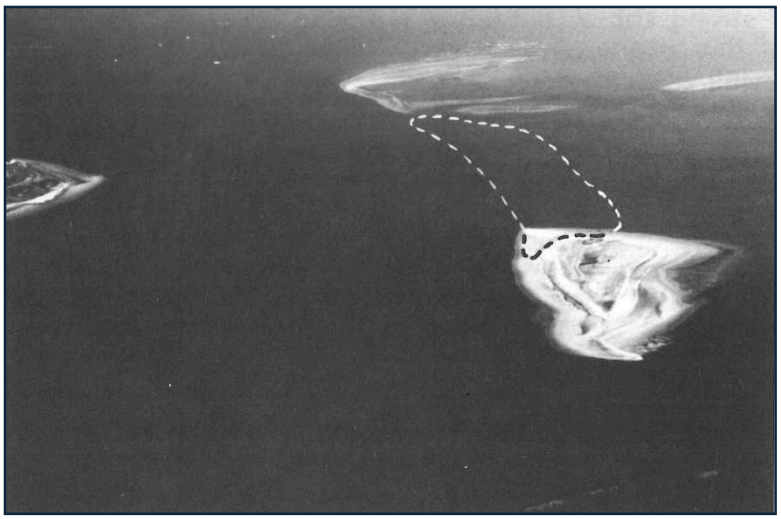

FIGURE 5.2.3c.

Deveaux Bank (D) off Seabrook Island in 1973 (upper), July 1978 (middle), and December 1979 (lower).

The middle oblique aerial shows the approximate location of the 1973 island that had eroded completely, leaving a gap for storm waves to propagate from the south toward Seabrook Island (left edge of photo).

[From Kana & Sexton 1982]

Section 5.3 Discussion of Erosion Control Alternatives

Seabrook Island has had to deal with erosion since the earliest days of the development dating back to the early 1970s (Hayes et al 1979). A full spectrum of erosion-control alternatives has been applied ranging from hard structural solutions (seawalls and groins) to soft-engineering solutions (beach nourishment, inlet relocation, sand transfers, and establishment of a no-development conservation zone). These measures, for the most part, have been implemented to control the migration of Captain Sams Inlet at the upcoast end of Seabrook Island.

Without periodic relocation or stabilization of the channel, Captain Sams Inlet would likely migrate through several rows of homes and shorten Seabrook Island by a rate of ~150–200 ft/yr. In similar settings (e.g. – Breach Inlet/Sullivan's Island or Midway Inlet/Pawleys Island), the normal shore-protection approach is to stabilize the downcoast side of the inlet by hard structures so that migration is halted. This approach typically leaves a hardened shoreline along the inlet, inhibiting a natural flow of sand and eliminating the public beach (e.g. – Fripp Inlet/Fripp Island).

Seabrook Island's beach management approach has shifted from hard solutions (1970s to early 1980s) to soft solutions (1980s to present). Hard structures remain in place along ~8,800 linear feet of shoreline. However, ~75 percent of these structures are fronted by a dry-sand beach in 2014. For brief periods between 1998 and 2005, over 95 percent of Seabrook Island's coast had dry-sand beach for the benefit of users as well as threatened species such as sea turtles.

Some key lessons learned from various soft-engineering solutions at Seabrook Island over the past 30 years include:

- Inlet relocation is a cost-effective and environmentally compatible method of managing an unstable migratory inlet (NRC 1994). It must be repeated at 15–20 year intervals so as to maintain adequate sand supplies to downcoast areas.

- Seabrook Island has a positive sand budget because of the ample supply from Kiawah Island. However, its sand supply is intercepted and interrupted by Captain Sams Inlet. Each relocation project frees sand trapped in the shoals of the inlet, allowing waves to transport it downcoast where it can naturally re-supply eroding areas.

- The southern half of Seabrook Island (south of Renken Point) is also under the influence of the northern channel and North Edisto River Inlet. When the upcoast sand supply declines, the south half of Seabrook Island erodes, exposing the seawalls. A steady supply of sand is needed to prevent encroachment of these

channels on the beach and to maintain a sand supply that feeds the shoreline along St. Christopher Camp. One realignment of the northern channel (1990) has been sufficient for the past 24 years. The northern channel position in 2014 remains favorable for Seabrook Island. Recent surveys (CSE 2014) indicate the centerline of the northern channel has shifted seaward over the past decade, lessening the tendency of the channel to undermine the beach.

- Deveaux Bank provides sheltering for the southern half of Seabrook Island. In 1978, only a small remnant of Deveaux Bank extended above the normal high waterline (Hayes et al 1979, Kana & Sexton 1982). With less protective shoals of Deveaux Bank, Hurricane David (September 1979) caused extensive damage to the seawall. Hayes et al (1980) recommended restoration of Deveaux Bank as one of three key soft-engineering solutions for Seabrook Island (inlet relocation and northern channel realignment were the other two). Of the three recommendations, the community implemented two and the third (Deveaux Bank restoration) occurred naturally. Today Deveaux Bank is broad and provides a one-mile-long barrier beach with well-established dunes that block waves from the south (Fig 5.2.3b).

- Beach growth following each inlet relocation has been greater along North Beach than south of Renken Point, creating a wide dune field fronting the seawall. Rapid beach widening—as much as 1,000 ft in five years along parts of Seabrook Island's North Beach—has produced extensive habitat without a concomitant development of high protective dunes. Highest dunes formed along North Beach after the 1996 inlet relocation project by removing some of the sand freed by the second relocation and transferring it downcoast. A single dune ridge grew in height and volume because the Property Owners Association helped maintain a dry beach in the same area (particularly around the Boardwalk #1).

- Periodic sand transfers from rapid accretion zones to erosional areas are an important strategy for Seabrook Island. Such activities have been performed at least ten times since the early 1980s for an average of ~85,000 cy moved during each event. These transfers have been accomplished during winter months to minimize environmental impacts. Without such transfers, Seabrook Island would now have less dry-sand beach and thus a greatly reduced turtle nesting habitat.

- Seabrook Island benefits from a long section of shoreline over which Captain Sams Inlet can migrate. The beach renourishment projects have established an inlet conservation zone nearly 6,000 ft long (~33 percent of Seabrook Island's coastline) between the Kiawah/Seabrook Town line (across the Kiawah Spit) and Oyster Catcher beach access. This no-development area has also been designated as critical habitat for the piping plover by the US Fish & Wildlife Service (USFWS 2002). Such designation provides additional safeguards and ensures the Captain Sams Inlet corridor will not be developed.

- The piping plover, an endangered shorebird that roosts in South Carolina, favors newly formed, unvegetated sand spits and tend to avoid areas with stable vegetated dunes, shrubs, or marsh grasses. Such ephemeral habitats are created with each inlet relocation project and, to some degree, each sand-transfer project. Therefore, the Seabrook Island's approach to sand management is consistent with the USFWS goal of maintaining habitat for piping plover. If Captain Sams Inlet were stabilized on the downcoast side in the future, the updrift spit would become more stable with mature vegetation, and provide less habitat for the piping plover over time. The Kiawah Spit would develop stable vegetated dunes similar to the south end of Isle of Palms. Excess sand moving down the spit would "over extend" and build bars along the north end of Seabrook Island (similar to conditions at the north end of Sullivan's Island). Over time, the bars would break free and weld to the north end of the Island, widening the dune/beach system even more in the area where it is presently >1,000 ft wide.

- Existing shore-protection structures are for the most part buried (2014) and are not interrupting littoral processes. Groins built in the 1970s have settled well below the sand and low-water level, leaving no obstructions to longshore currents. The remaining shore-parallel structures serve the role of providing a last line of defense between the beach and development. In some areas, the seawall remains higher than the protective dunes in front of it. It is well established that high dunes/seawalls with wide beaches fronting them provide better storm protection and reduce upland property damages relative to low dunes and dense vegetation (FEMA 1988, CSE/SW/Dewberry 2010).

- Seabrook Island monitors its beach and closely tracks its sand supply, using this information to anticipate developing problems and plan remedial work. Seabrook Island has a 35-year continuous record of historical profiles that are objective measures of beach conditions.

- The gain of ~1.8 million cubic yards along Seabrook Island's 3-mile shoreline since 1983* has widened the beach by an average of ~175 ft. This has created a wider protective beach and dune buffer for the existing development. [*Inlet relocation in 1983 and 1996 added ~1.1 million cubic yards, and beach nourishment in 1990 added ~685,000 cy.]

- Seabrook Island's experience with hard shore-protection structures and sand management confirms that maintenance of a sand cover over the seawall reduces damage to the seawall during storms, lessens the height of wave runup, and reduces the need for repairs or upgrades in the form of large armor stone. Prior to implementing soft solutions, such as inlet relocation, the seawall sustained frequent damage and required continued upgrades with larger armor stone.

Seabrook Island has considered a range of erosion-control measures with a goal of providing increasing shore protection to existing development and setting aside no-development conservation areas. Extensive accretion north of Renken Point following

inlet relocations (1983 and 1996) has produced a wide dune field seaward of the seawall and the 1972 shoreline. Roughly 100 acres of dunes and wetlands that have formed since the initial development of the island are now protected as "Beach Trust" lands. The only structures allowed within this zone are three beach access boardwalks to provide beach access with the least impact to the dunes and wetlands. The seawall north of Renken Point is now set back from the dry beach an average of 765 ft. The majority of the seawall was underwater at high tide in 1980.

South of Renken Point, most segments of beach are significantly wider in 2014 relative to conditions in 1980 (Kana et al 2013, CSE 2014). There was no dry-sand beach between Renken Point and Pelican Watch Villas in 1980. By 2014, a dry beach existed over 80 percent of the shoreline, leaving a short segment (~1,800 ft long) around the Beach Club as the only area without a dry-sand beach.

Only five structures along Seabrook Island encroach on the OCRM Baseline and Setback Line (see Fig 5.1j). As discussed in Section 2.3.1 "Beach Structural Inventory," two of these structures are part of the Seabrook Island Club facilities, two are swimming pools between the revetment wall and two homes at the end of Beachcomer Run and the fifth structure is a gazebo on the beach side of the home at the very south end of Ocean Forrest Lane. In 2007, the owners removed most of the original Seabrook Island Club buildings along the beach and relocated those functions across Seabrook Island Road to the new Island House. A replacement building, which encroaches on the OCRM Setback Line, is an open-porch cabana with support facilities for the Club's Pelican's Nest bar and restaurant. The other structure is the only remaining original beach front Club building. The average dry-beach/dune width seaward of the seawall (south of Renken Point) in 2014 is 100 ft.

Seabrook Island has a three-part strategy for improving the conditions of the beach–dune system and increasing the setback of existing structures from the ocean:

a) Maintaining an ~6,000-ft-long inlet conservation zone and beach trust lands seaward of the seawall where no development is allowed.
b) Relocating Captain Sams Inlet on a 15–20 year cycle to release trapped sand and maintain ephemeral habitat favored by the piping plover.
c) Transferring sand periodically from areas of rapid accretion to erosion hotspots so as to maintain an adequate supply of sand to downcoast areas.

The strategy requires all three elements, otherwise interruptions to the sand supply will re-expose segments of the seawall, diminish building setbacks, and degrade beach habitat.

Over a 30-year period, the community has spent approximately $6 million ($2012) on soft solutions and beach monitoring. This equates to (~)$200,000 per year. The value of oceanfront property in 2014 is in the range $100–$150 million. Cost of abandoning or setting back existing buildings along Seabrook Island would be comparable to this range. Given the relatively low cost and sustainability of past beach improvements, the community's management strategy continues to emphasize beach-building efforts.

5.3.1 Beach Renourishment

Seabrook Island has implemented one beach nourishment project (1990) since development began in the 1970s. The project had a dual purpose—realign the northern channel while restoring a viable beach. The project has functioned for 24 years with the primary maintenance consisting of sand transfers between 1996 and 2007 (detailed in Section 5.2.1) from North Beach to the project area. In 2014, the segments nourished in 1990 retain over twice the volume dredged into place (see Section 5.1.2). The northern channel has also shifted seaward of its initial position upon completion of the dredging. Beach nourishment from a non-littoral (or non-beach connected) source has been evaluated by the Property Owners Association (CSE 2011). It would potentially build up the beach south of Renken Point and restore a dry beach along the Beach Club. This is not a favored alternative for the following reasons.

- Dredging and placement of sand along the Beach Club area would have a relatively short design life because of the short length of the critically eroded area. Project longevity increases with the square of the project length (Dean 2002).

- Placement of sand along the northern channel and confluence of the North Edisto River Inlet would constrict both channels and lead to increased flow velocities and scour. The 1990 project created a wider channel for purposes of reducing the scour rate along the seawall. Nourishment without concomitant channel realignment would not provide a lasting solution to erosion in the vicinity of the Beach Club.

- Seabrook Island has a positive sand budget because of the healthy supply of sand from Kiawah Island. Periodic inlet relocation adds to the sand budget with each event. There is no critical need for a supplemental supply of sand by way of nourishment.

- Funds for dredge mobilization would provide greater benefits if applied to sand transfers and periodic inlet relocation.

5.3.2 Other Measures Considered

Seabrook has evaluated other shore-protection measures and finds them less advantageous or cost effective as follows.

Stabilization of Captain Sams Inlet — This alternative would eliminate the need for periodic inlet relocation. However, it would impact the critical habitat area for the piping plover and eliminate the ephemeral washover habitat associated with each inlet relocation. Hard structures are discouraged under existing coastal zone management (CZM) rules under the Beach Management Act.

Installation of Groins — This alternative would help retain sand south of Renken Point and reduce the threat of channel encroachment against the seawall. The greatest benefit would be in the vicinity of the Beach Club where maintenance of a dry-sand beach has been problematic for over 35 years. The Property Owners Association has elected to continue a soft approach involving sand transfers as needed in lieu of groins.

Installation of Breakwaters — This alternative is not needed north of Renken Point and is not considered viable south of Renken Point because of the influence of deep channels and tidal currents in the northern channel and North Edisto River Inlet. Breakwaters are generally designed to reduce wave heights and retain sand along the lee shoreline. Deveaux Bank presently functions effectively as a natural breakwater. Its large scale suggests the likelihood that Deveaux Bank will persist for several decades, serving to function as a breakwater for the south end of Seabrook Island.

Dune Heightening — This alternative would provide improved storm-surge protection for the Island. However, to be effective and long lasting, dune enhancement should occur well landward of the present high watermark so as to accommodate the large-scale changes in the shoreline around the inlets. Under present state CZM rules, such dune enhancement over existing vegetated dunes is not allowed.

Seabrook Island recognizes that future sea-level rise (SLR) should be considered. Accordingly, it has tracked the rate of rise over the past several decades and will continue to monitor it using Charleston and Savannah tide records. The USACE (2013) reports the century trend for Edisto Island is 3.19 millimeters per year (mm/yr) (~1.05 ft per century). Kana et al (2013) reported SLR equaled 3.46 inches in Charleston for the period 1980 to 2010 (~2.93 mm/yr) based on records maintained by the Permanent Service for Mean Sea Level (Liverpool UK). Kana et al (2013), using Bruun (1962) and Hand (1981), demonstrated that a rise of this magnitude over 30 years would equate to ~8.5 ft (~0.28 ft/yr) of beach recession along the Seabrook Island oceanfront. A shoreline change of ~0.3 ft/yr is well below the magnitude of change documented along Seabrook Island (see Section 5.1). SLR will be tracked and measures along the oceanfront to keep pace with rising tides will be implemented, if required or otherwise deemed appropriate.

A wide beach and healthy dunes are the primary measures available to Seabrook Island for mitigation of SLR. Dry-beach elevations naturally keep pace with SLR as long as sufficient sand feeds the littoral system. If the dry beach is maintained, dunes will persist, thereby reducing the height of surges and waves at existing structures. Of more immediate concern are potential increases in flooding along sheltered estuarine shorelines of Seabrook Island where the land is much closer to the elevation of mean high water. These lands do not receive influxes of littoral sands and do not have sufficient wave energy to build up a profile on pace with SLR. Such lands are not the subject of the present Beachfront Management Plan.

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Section 6 Needs, Goals and Implementation Strategies

Section 6.1 Retreat Strategy

The Town of Seabrook Island's "retreat strategy" is to have a stable or accreting beachfront that is compatible with the State's retreat policy. The intent is for this to be accomplished while not requiring change to any of the structures behind the Baseline or employing or adding any structures like groins or other hard engineering solutions seaward of the Setback Line. The strategy includes three components:

1. Relocation of Captain Sams Inlet to support the continued migration of sand down the coast from Kiawah Island. This is a proven approach that was successfully

implemented in 1983 and again in 1996. These two events demonstrated that the model works and provides a surplus of sand down the coast from the inlet as long as that inlet migrates within a range of about 2000 yards at the furthest up-coast corner of the island. This inlet relocation strategy provides a long-term solution to beach erosion with repeating the process every time the inlet migrates beyond the established limits. This is expected to result in a relocation action to be repeated about every 15 to 20 years.

2. Maintaining a "shelf" down to and around the corner of the Edisto River inlet is essential to continued renourishment of the Edisto River shoreline of Seabrook Island. This shelf, that is at least a wet sand beach, provides a continuous bridge for sand to migrate down the coast, around the corner and up the riverfront to maintain the desired dry sand beach and to protect the property along the river. To maintain this shelf, the North Channel of the Edisto River needs to be separated from the down-coast portion of the oceanfront to provide this wet sand beach around the north entrance of the river. Without the separation, there would be no beach along the north channel of the river and sand migrating to the Channel would be lost into the Edisto River. Relocation of the channel to achieve the desired separation was implemented in 1990. The sand bars off the revetment/seawall were dredged to fill in the then existing channel and create a new channel further off of the point of the island. The channel-revetment separation provided by the 1990 action provided an acceptable solution that is still effective today.

3. The above two processes have been supplemented by sand scraping from sections of excess accretion along the north shore of the island and moving that sand to the south beach area.

If the above strategy is not successfully implemented for any reason, the Town strategy is for the existing seawall/revetment to be used as the last point of protection and for that structure to be maintained in order to support this line of last retreat.

The Town building code and permitting process will prevent any new structures other than beach access walks and stairways to be built seaward of the Setback Line. With this in mind, retreating to the revetment, while not the desired solution, will be sufficient to protect the structures of the seaside properties. Also, given that much of the beach adjacent property is occupied by single-family dwellings, it wouldn't be practical to move buildings to allow for shoreline retreat. The first row of homes would have to be abandoned and removed, making the second row the new beachfront property. For the area occupied by the Seabrook Island Club facilities, a retreat strategy calling for moving the buildings would also be impractical.

The initial implementation of the current beach replenishment strategy began over 30 years ago before the Town was incorporated. The Town Code is consistent with the replenishment and retreat strategies and there are no changes contemplated or required to support this Plan.

Implementing the three actions outlined above is critical. If this cannot be carried out, both the wildlife habitat and the beach recreational opportunities will be greatly damaged. The backup plan may need a hard-engineering solution of added revetment or some sandbagging to stop the migration of the inlet down the coast. The existing revetment should provide most of the protection needed for the current structures. Any changes to this protection solution will, of course, require full review and permitting by the OCRM and other government agencies.

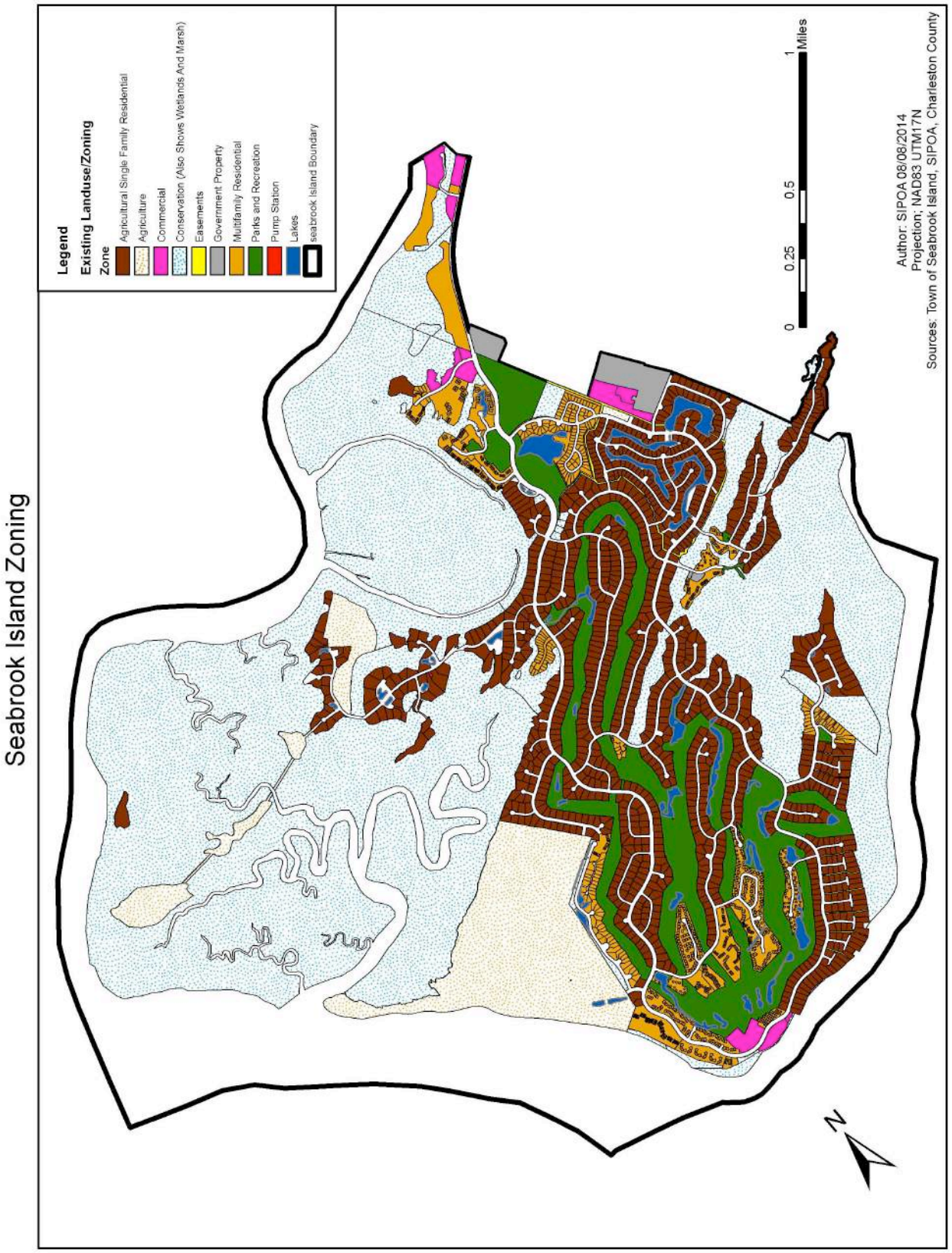
Section 6.2 Strategy for Preserving and Enhancing Public Beach Access

As described in Section 2.5 "Existing Public Access and Map" of this Plan, the original design of Seabrook Island included a full set of beach access points with boardwalks from the parking areas and bicycle racks onto the beach. Beach access parking areas were also a part of the island layout. Each of the access entry points includes adequate signage, trashcans and dispensers for dog waste bags. The Property Owners Association maintains the boardwalks and associated amenities. These beach access facilities are believed to be sufficient to meet the foreseeable needs of the Island's residents and invited guests.

Section 7.0 Appendix

Section 7.1 Beach Management Overlays

Map 7.1 on the page below is the current Zoning Map for the Town of Seabrook Island.


Seabrook Island Zoning
Legend
Existing Landuse/Zoning
Zone
Agricultural Single Family Residential
Agriculture
Commercial
Conservation (Also Shows Wetlands And Marsh)
Easements
Government Property
Multifamily Residential
Parks and Recreation
Pump Station
Lakes
seabrook Island Boundary
0
0.25
0.5
1
Miles
N
Author: SIPOA 08/08/2014
Projection: NAD83 UTM17N
Sources: Town of Seabrook Island, SIPOA, Charleston County

Section 7.2 Structure Inventory Table

As discussed in Section 4.2.4 “Beachfront Development Regulations”, the Town of Seabrook Island strictly enforces restrictions on building of structures seaward of the Setback Line. The inventory of structures meeting this criteria is almost all beach access boardwalks and stairs over the revetment and on to the beach. There are only five structures that are not of this type and those structures are discussed in detail, along with the beach access boardwalks, in Section 2.3.1 “Beachfront Structural Inventory” of this Plan. Table 7.2 below provides the beach structure inventory information,

Table 7.2 Seabrook Island Beach Management Plan *Structures Inventory Table*						
Parcel Address	Property Description	Plat DB #	Parcel No.	Structure Inventory	Distance from OCRM 40- Yr Setback Line (ft)	Erosion Control Structure
2810 Seabrook Island Rd	St. Christopher Camp	H-133	1470000003	B-Pv	14	
2810 Seabrook Island Rd	St. Christopher Camp	H-133	1470000003	B-Pv	40	
2810 Seabrook Island Rd	St. Christopher Camp	H-133	1470000003	B-Pv	50	
2810 Seabrook Island Rd	St. Christopher Camp	H-133	1470000003	RA	180	
2810 Seabrook Island Rd	St. Christopher Camp	H-133	1470000003	B-Pv	42	
1301 Seabrook Island Rd	Pelican Watch Villas	AV-88	1470500091	B-Pv	96	
1301 Seabrook Island Rd	Pelican Watch Villas	AV-88	1470500091	B-Pv	135	
1301 Seabrook Island Rd	Pelican Watch Villas	AV-88	1470500091	TB	27	x
1301 Seabrook Island Rd	Pelican Watch Villas	AV-88	1470500091	CS-QS		x
1301 Seabrook Island Rd	Pelican Watch Villas	AV-88	1470500091	CS-QS	150	x
1301 Seabrook Island Rd	Pelican Watch Villas	AV-88	1470500091	B-Pb	180	
337 Beach Club Villas	SIPOA @ Beach Club Villas	EC-580	1470500183	CS-QS	140	x
338 Beach Club Villas	Beach Club Villas	W-56	1470500017	B-Pv	170	
332 Beach Club Villas	Beach Club Villas	W135	1470500001	B-Pv	24	
328 Beach Club Villas	Beach Club Villas	W135	1470500002	B-Pv	48	
3804 Seabrook Island Rd	Dolphin Point	DD-294	1470500187	B-Pv (2), CS-QS	48,68,50	
3810 Seabrook Island Rd	Vacant Lot	EC-580	1470500184	B-Pb, CS-QS	78,75	x
SIPOA	Property Owners Lot	Null	1470500189	CS-QS	78	x
3772 Seabrook Island Rd	The Club At Seabrook	BD-3	1470500085	A, CS-QS, QS-G	60, 100, 200	x
3772 Seabrook Island Rd	The Club At Seabrook	Null	1470500188	C, B-Pv	36, 62	
3760 Seabrook Island Rd	Private - Vacant Lot	AD-78	1471300001	CS-QS	42	x

Table 7.2 Seabrook Island Beach Management Plan *Structures Inventory Table*						
Parcel Address	Property Description	Plat DB #	Parcel No.	Structure Inventory	Distance from OCRM 40- Yr Setback Line (ft)	Erosion Control Structure
3765 Seabrook Island Rd	Private - Vacant Lot	AD-78	1471300002	CS-QS	42	x
3756 Seabrook Island Rd	Private	AD-78	1471300003	CS-QS	35	x
3752 Seabrook Island Rd	Private	AD-78	1471300004	CS-QS, B-Pv	25,32	x
3748 Seabrook Island Rd	Private	AD-78	1471300005	CS-QS, B-Pv	10, 20	x
3744 Seabrook Island Rd	Private - Vacant Lot	AD-78	1471300006	CS-QS	10	x
3740 Seabrook Island Rd	Private - Vacant Lot	AD-78	1471300007	CS-QS	10	x
3736 Seabrook Island Rd	Private	AD-78	1471300008	B-Pv	16	
3732 Seabrook Island Rd	Private	AD-78	1471300009	CS-QS, B-Pv	15, 30	x
3728 Seabrook Island Rd	Private	AD-78	1471300010	CS-QS	18	x
3724 Seabrook Island Rd	Private	AD-78	1471300011	CS-QS, B-Pv	12, 34	x
3755 Beach Ct	Private	AD-78	1471300013	CS-QS, B-Pv	40, 48	x
3759 Beach Ct	Private	AD-78	1471300014	CS-QS, B-Pv	30, 40	x
3758 Beach Ct	Private	AD-78	1471300015	CS-QS, B-Pv	26, 42	x
3756 Beach Ct	Private	AD-78	1471300016	CS-QS, B-Pv	25, 40	x
3756 Seabrook Island Rd	SIPOA Public Beach Access	AD-77	1470000001	CS-QS, B-Pb	32, 42	x
3739 Amberjack Ct	Private	AE-82	1471400004	CS-QS	44	x
3743 Amberjack Ct	Private - Vacant Lot	BB-88	1471400005	CS-QS	30	x
3747 Amberjack Ct	Private	AE-82	1471400006	CS-QS	40	x
3738 Amberjack Ct	Private	AE-82	1471400007	CS-QS, B-Pv	28, 35	x
3738 Amberjack Ct	SIPOA Public Beach Access	AD-77	1471400008	CS-QS, B-Pb	25, 35	x
3715 Bonita Ct (Renken Pt)	Private	AE-82	1471400016	CS-QS, B-Pv	30, 42	x

Table 7.2 Seabrook Island Beach Management Plan *Structures Inventory Table*						
Parcel Address	Property Description	Plat DB #	Parcel No.	Structure Inventory	Distance from OCRM 40- Yr Setback Line (ft)	Erosion Control Structure
3723 Bonita Ct	Private	AE-82	1471400017	QSR, B-Pv	35, 40	x
3722 Bonita Ct	Private - Vacant Lot	AE-82	1471400018	QSR	30	x
3718 Bonita Ct	Private - Vacant Lot	AE-82	1471400019	QSR	50	x
3718 Bonita Ct	SIPOA Public Beach Access	AD-77	1470000001	QSR, B-Pb	45, 65	x
3661 Cobia Ct	Private - Vacant Lot	AJ-4	1471400073	QSR	30	x
3654 Cobia Ct	Private	AJ-4	1471400075	QSR	35	x
3652 Cobia Ct	Private	AJ-4	1471400076	QSR	38	x
3652 Cobia Ct	SIPOA Public Beach Access	AD-77	1470000001	QSR, B-Pb	40, 310	x
3645 Pompano Ct	Private	AS-86	1471400083	QSR	45	x
3642 Pompano Ct	Private - Vacant Lot	AU-29	1471400085	QSR	45	x
3640 Pompano Ct	Private	AU-29	1471400086	QSR	45	x
3640 Pompano Ct	SIPOA Public Beach Access	AD-77	1470000001	QSR, B-Pb	40, 95	x
3627 Loggerhead Ct	Private	AS-86	1471400097	QSR, B-Pb	45, 95	x
3629 Loggerhead Ct	Private	AS-86	1471400098	QSR, B-Pv, B-Pb	45, 90, 520	x
3630 Loggerhead Ct	Private	AS-86	1471400099	QSR, B-Pv	45, 90	x
3632 Loggerhead Ct	Private	AS-86	1471400100	QSR, B-Pb	50, 90	x
3632 Loggerhead Ct	SIPOA Public Beach Access	AD-77	1470000001	QSR, B-Pb	40, 130	x
3611 Beachcomber Run	Private	W-77	1471400063	QSR, B-Pv	50, 130	x
3612 Beachcomber Run	Private	W-77	1471400064	P, D, QSR, B-Pv	8, 22, 70, 145	x

Table 7.2
Seabrook Island Beach Management Plan
Structures Inventory Table

Parcel Address	Property Description	Plat DB #	Parcel No.	Structure Inventory	Distance from OCRM 40- Yr Setback Line (ft)	Erosion Control Structure
3610 Beachcomber Run	Private	W-77	1471400065	P, D, QSR, B-Pv	15, 20, 75, 145	x
3565 Seaview Dr	Ocean Winds Golf Course	D178427	1470000027	SBR	25	x
2273 Seascape Ct	Private	S-97	1471600015	D	10	
Rolling Dune Rd	SIPOA Access Oyster Catcher	AD-77	1470000001	B-Pb	615	
Rolling Dune Rd	SIPOA Public Ocean Forest	EB-458	1491300001	B-Pb	380	
1121 Ocean Forest Lon	Private	EB-458	1491300003	RA	40	

Note: All distances are maximum distance seaward of the OCRM Setback Line within each parcel.
B-Pb = Boardwalk Public
B-Pv = Boardwalk Private
CS-QS = Concrete Sheetpile - Quarry Stone QSR = Quarry Stone Revetment
SBR = Sandbag Revetment
A = Habitable Structure >5,000 ft D = Deck
P = Pool
RA = Recreational Amenity
TB - Timber Bulkhead

Section 7.3 Access Inventory Table

The table below provides the details of the Seabrook Island beach access points. The structure inventory column coding is intended to mirror the State designation of Community Public Access Points, Neighborhood Public Access Points and Public Access Points as the Seabrook Island beach area is not publically accessible. A detail discussion of these access points is included in Section 2.5 "Existing Public Access and Map."

Street Address	Description	Plat DB #	Parcel No.	Structure Inventory
341 Seabrook Island Rd	Boardwalk #12		1470500025	AP
(west) 3772 Seabrook Island Rd	Boardwalk #9	EC-580	1470500184	CAP
(east) 3772 Seabrook Island Rd	Boardwalk #8	AD-77	1470000001	CAP
Amberjack Ct/Beach Ct	Boardwalk #7	AD-77	1470000001	AP
3738 Amberjack Ct	Boardwalk #6	AD-77	1470000001	AP
3718 Bonita Ct	Boardwalk #5	AD-77	1470000001	AP
3652 Cobia Ct	Boardwalk #4	AD-77	1470000001	AP
3640 Pompano Ct	Boardwalk #3B	AD-77	1470000001	AP
3622 Loggerhead Ct	Boardwalk #3A	AD-77	1470000001	AP
Rolling Dune Rd	Boardwalk #2	AD-77	1470000001	NAP
Rolling Dune Rd	Boardwalk #1	EB-458	1491300001	NAP
2055 Oyster Catcher Court	Boardwalk #1B	EB-458	1491300001	N/A

CAP = Community Access Point
NAP = Neighborhood Access Point
AP = Public Access Point

Section 7.4 Prior Studies

Since incorporation of the Town of Seabrook Island (in 1987), all of the studies relating to its beaches have been in relation to the important subject of beach erosion. A thorough list of all of those studies of the beach erosion dynamics is included in Section 5 "Erosion Control Management" of this Plan going back to well before Town incorporation. Without restating the details of these studies, the overall conclusion, consistently over time, has been that: (a) the periodic relocation of Captain Sams Inlet; (b) maintaining a separation of the North Edisto Inlet from the adjacent seawall; and, (c) occasional sand scraping to take from excess accretion areas and supplementing high erosion zones, have been an effective beach replenishment strategy. These three actions have been proven to be very successful over multiple implementations as evidenced by the annual studies to assess progress and status. The combined impact has been to advance the shoreline significantly and increase the setback of buildings and manmade structures from the active beach zone by an average of over 175 feet.

Studies relating to changes in the beach area have not been conducted because the island remains as the residential and resort community laid out by its developers in the 1970's with a consistent community overall strategy since that time.

There was one major review of island's amenities, the "Horizon Plan" initiative work in 2006, that resulted in major updating of the Seabrook Island Club and Property Owners facilities, only two of which directly related to the beach. Only the Horizon Plan replacement and/or refurbishment of the Seabrook Island Club facilities along the sea wall at the south corner of the island impacted the areas seaward of the Setback Line. The position of those structures and their relation to the Setback Line is discussed in Section 2.3.1 "Beachfront Structural Inventory" of this Plan.

Section 7.5 Laws and Ordinances/Rules and Regulations

The Town of Seabrook Island ordinances include the following provisions relating to beachfront management under Chapter 32 Water Ways and Beaches of the Town Code last amended 1-24-2012:

Town Code

Sec. 32-21. Beach defined

For purposes of this article, the term "beach" means that area lying between the low-water mark of the Atlantic Ocean and any property line of the property owned by private individuals or corporations, lying adjacent or in proximity to the Atlantic Ocean or the North Edisto River, and shall extend out from the mean low-water mark for a distance of 150 yards into the water. *(Code 2004, § 5.7.20; Ord. No. 1991-03, 7-11-1991)*

Sec. 32-41. Beach and Dune Protection

(a) No person shall alter, destroy or remove any portion of a sand dune, except by obtaining a valid permit from all required governmental authorities, including the Town.

(b) No person shall remove, place foreign objects upon, or otherwise destroy sea oats or any other vegetative matter growing out of the sand dunes.

(c) All sand fencing installed on or seaward of the sand dunes shall comply with the South Carolina Department of Health and Environmental Control (SCDHEC), Office of Coastal Resource Management guidelines contained in the South Carolina Coastal Zone Management Act, and may not be installed until all applicable state, federal or Town permits have been issued.

(d) No alterations to the natural shoreline, inlet location, dune system, existing natural beach elevation, or to growing flora and trees without the Town

Council's approval and until all applicable state, federal, or Town permits have been issued.

(e)

Unless the Town grants special permission, it shall be unlawful to place, store, or leave overnight on the beach, including under or upon dune walkovers, items of any kind whatsoever. These items include, but are not limited to, tents, tent frames, chairs, umbrellas, clothing, coolers and toys. A violation of this provision shall be punishable to the full extent provided under state law.

(Code 2004, § 5.7.30; Ord. No. 1991-03, 7-11-1991; Ord. No. 2008-01, § I, 6-24-2008)

Sec. 32-42. Vehicle use

The driving or operation of any motor vehicle, of any kind or nature, on the beach within the Town is prohibited, except as provided in subsections (1) through (3) of this section:

(1) Emergency vehicles, law enforcement vehicles, Town vehicles and Seabrook Island Property Owners Association (SIPOA) security or maintenance vehicles may operate on the beach if necessary for the conduct of official duties.
(2) Private vehicles under SIPOA control may be authorized by the SIPOA to utilize approved beach access roads to launch or retrieve small boats.
(3) The use of dune buggies, motorcycles, or four-wheel drive vehicles for recreational use on the beach is not permitted.

(Code 2004, § 5.7.40; Ord. No. 1991-03, 7-11-1991)

Sec. 32-43. Wildlife and marine life protection.

No person shall physically harm, harass or otherwise disturb any loggerhead turtle nest. Similarly, no person shall harm, harass or disturb any bird designated as an endangered species, including eggs and young, or its nest. Beached or stranded sea turtles, whales or dolphins shall be reported immediately to the Town, SIPOA, or county police department.

(Code 2004, § 5.7.50; Ord. No. 1991-03, 7-11-1991)

Sec. 32-44. Domestic animals/pets.

Domestic animals/pets are not allowed on any beach except under the provisions set forth herein.

(1)

A designated area is established from a point beginning approximately 300 yards east of a line extending from the Community Center boardwalk to the Atlantic Ocean and continuing for approximately 550 yards. This designated area is shown on a map attached hereto and incorporated by reference. Within the designated area from May 1 until October 31, dogs will be allowed off leads below the apparent

high water mark prior to 10:00 a.m. and after 5:00 p.m. provided they remain subject to voice control of the person supervising them. From November 1 until April 30, dogs will be allowed off leads below the apparent high water mark at all times provided they remain subject to voice control of the person supervising them. No dog shall be allowed beyond the designated area on the Cap'n Sams Inlet side.

(2)

In all other beach areas, which are outside of the designated area set forth in subsection (1), from May 1 until October 31, no dogs or other domestic animals shall be allowed that are not on a lead at all times. From November 1 until April 30, dogs on leads will be allowed between 10:00 a.m. and 5:00 p.m. and off lead prior to 10:00 a.m. and after 5:00 p.m.

(3)

No person shall permit any excrement from any animal under that person's control to remain on the beach, but shall dispose of same in a sanitary manner.

(Code 2004, § 5.7.60; Ord. No. 1991-03, 7-11-1991; Ord. No. 2006-02, § 1, 5-23-2006; Ord. No. 2007-03, § I, 5-22-2007; Ord. No. 2011-08, § 1, 1-24-2012)

Sec. 32-45. Littering prohibited.

No person shall place or deposit litter, waste or refuse on the beach or within the waters adjacent to the beach.

(Code 2004, § 5.7.70; Ord. No. 1991-03, 7-11-1991)

Sec. 32-46. Negligent operation of vessels.

(a)

Vessel defined. The term "vessel" means every description of watercraft on the water, used or capable of being used as a means of transportation on the water.

(b)

Prohibited. No person may use any vessel or manipulate any water skis, aquaplane, surfboard or similar device in a negligent manner so as to endanger the life, limb or property of any person.

(c)

Use of alcohol, narcotic, etc., prohibited. No person may use any vessel, or use any water skis, aquaplane, surfboard or similar device while under the influence of alcohol, any narcotic drug, barbiturate, marijuana, or hallucinogen.

(Ord. No. 2007-02, § 1(5.7.80), 4-24-2007)

Sec. 32-47. Launching or retrieving vessel.

(a)

No person shall launch or retrieve a vessel, excluding sailboats, surfboards, rafts, inner tubes, kayaks or similar devices, anywhere on the beach seaward of the mean high-water mark, except in the case of emergency.

(b)

No person shall propel or cause to move any vessel, except sailboats, surfboards, rafts, inner tubes, kayaks or similar devices from the water onto the sand anywhere on the beach above the mean low-water mark, except in case of emergency.

(Ord. No. 2007-02, § 1(5.7.81), 4-24-2007)

Sec. 32-48. Commercial activity.

No person shall sell or offer for sale any goods or merchandise, or solicit any trade or business on the beach seaward of the OCRM 40-year Setback Line, except under license from the Town.

Seabrook Island Property Owners Association Rules and Regulations

In addition to the Ordinances of the Town of Seabrook Island, the Seabrook Island beaches are controlled or managed through the Seabrook Island Property Owners Association rules and regulations. Those pertaining to beach management are as follows:

Section 7. The Use of SIPOA Amenities.

The following Section 7 Use of the SIPOA Amenities complements the Town of Seabrook Island Code in controlling and managing the island beaches. There is a structure of fines and an active security organization to help in enforcing the Rules and Regulations. Here are those SIPOA rules and regulations:

Association Property Owners, their Family Members and Guests, and other Persons authorized by the SIPOA shall have access to, and use of, SIPOA amenities under terms and conditions established from time to time by the Board. Tenants and their guests are permitted access to, and use of, SIPOA amenities, except the SIPOA Oyster Catcher Community Center and pool area, under terms and conditions established from time to time by the Board. Access to SIPOA amenities by any other Persons is prohibited.

a. In the case of a Property that is owned by more than one natural person, Property Owners shall designate a Family Unit which shall be entitled to exercise the use of privileges afforded to a Property Owner at any one time (the “Designated Family Unit”) and in the case of a Property that is owned by an Entity, the Property Owner shall likewise identify a Designated Family Unit. The names of the Designated Family Unit members shall be submitted to SIPOA in written form by all of the Property Owners or, in the case of an Entity Property Owner, by a duly authorized officer of the Entity, and may be changed from time to time in like manner. Persons other than the Designated Family Unit members who rely on such multiple-owned or Entity-owned Property for use of or access to SIPOA amenities will be considered and treated as Guests of the Designated Family Unit and will be subject to the policies and requirements related to usage by Guests. The Property Owner and all members of the Designated Family Unit shall be jointly and severally personally liable for all obligations of the Property Owner and their Guests, Family Members and Invitees.

b. All Persons authorized to use SIPOA amenities shall abide by the rules posted at SIPOA facilities. Those Persons authorized to use SIPOA pool facilities shall follow directions of authorized SIPOA employees. Persons who fail to do so may be excluded from the use of the

pool for such period as the Board directs, and are subject to assessments in accordance with the Assessment Schedule.

c. The use of the boat ramp located between the SIPOA crab dock and the Creek Watch Villas is limited to Property Owners and their accompanied Guests. No trailers or boats may be left overnight in this area. Boats launched at the boat ramp may not exceed fourteen (14) feet in length and, if motorized, fifteen (15) horse power. Any boat (and trailers where applicable) launched from the boat ramp must have affixed a decal obtained from the Security office. The boat ramp may be used only between sunrise and sun set. Parking in this area is strictly limited to parking spaces specifically designated for this use. Use of Creek Watch Villa amenities by users of the boat ramp is strictly prohibited.

d. To preserve the personal safety of all beach users, anyone digging a hole in the beach sand must restore the surface to its natural condition before vacating the beach.

e. Only motorized vehicles owned by the SIPOA or the Town, and used for maintenance, Security or official business, and vehicles approved by the Director of Safety and Security for special purposes, are permitted on the beach.

f. Any Person making a fire on the beach must have prior approval from Security. Littering, the use of glass containers, and the playing of loud music is prohibited on the beach. Construction debris may not be used in beach fires.

g. All Persons are to stay off the dunes. Persons walking dogs off-leash in areas permitted by the Town must keep their dogs off of the dunes.

h. Personal property such as chairs, tents, umbrellas and E-Z up structures are not to remain unattended on the beach overnight. Security may remove such personal property that it finds unattended. Generators are prohibited from use on the beach, except for SIPOA authorized events.

i. Property Owners, Tenants and their Guests may use boats, rafts and other watercraft on SIPOA lakes, creeks or rivers. The use of such facilities by Property Owners, Tenants and their Guests shall be at their own risk. Such bodies of water may contain alligators and other wildlife. Only electric motors are permitted in lakes except Contractor or service personnel performing algae or weed control maintenance or other services. Boats may not exceed 14 feet in length and, if motorized, 15 hp, and when not in use, must be stored in a garage or Club storage facility.

j. From May through September non-motorized boats and watercraft may be temporarily left on the beach in a specially designated area located adjacent to the beach end of the Oyster Catcher boardwalk. Boats and watercraft may not be left overnight on any other areas of Seabrook Island's beaches or creeks. Boats and watercraft must be kept off all sand dunes.

Section 7.6 Local and Comprehensive Beach Management Plan Requirements

The following is a section of the State of South Carolina Code Title 48 – "Environmental Protection and Conservation" that outlines the requirements for local government comprehensive beach management plans:

SECTION 48-39-350. Local comprehensive beach management plan.

(A) The local governments must prepare by July 1, 1991, in coordination with the department, a local comprehensive beach management plan which must be submitted for approval to the department. The local comprehensive beach management plan, at a minimum, must contain all of the following:

(1) an inventory of beach profile data and historic erosion rate data provided by the department for each standard erosion zone and inlet erosion zone under the local jurisdiction;

(2) an inventory of public beach access and attendant parking along with a plan for enhancing public access and parking;

(3) an inventory of all structures located in the area seaward of the setback line;

(4) an inventory of turtle nesting and important habitats of the beach/dune system and a protection and restoration plan if necessary;

(5) a conventional zoning and land use plan consistent with the purposes of this chapter for the area seaward of the setback line;

(6) an analysis of beach erosion control alternatives, including renourishment for the beach under the local government's jurisdiction;

(7) a drainage plan for the area seaward of the setback zone;

(8) a post disaster plan including plans for cleanup, maintaining essential services, protecting public health, emergency building ordinances, and the establishment of priorities, all of which must be consistent with this chapter;

(9) a detailed strategy for achieving the goals of this chapter by the end of the forty-year retreat period. Consideration must be given to relocating buildings, removal of erosion control structures, and relocation of utilities;

(10) a detailed strategy for achieving the goals of preservation of existing public access and the enhancement of public access to assure full enjoyment of the beach by all residents of this State. The plan must be updated at least every five years in coordination with the department following its approval. The local governments and the department must implement the plan by July 1, 1992.

(B) Notwithstanding the provisions of Section 48-39-340, if a local government fails to act in a timely manner to establish and enforce a local coastal beach management plan, the department must impose and implement the plan or the State Comprehensive Beach Management Plan for the local government. If a local government fails to establish and enforce a local coastal beach management plan, the government automatically loses its eligibility to receive available state-generated or shared revenues designated for beach/dune system protection, preservation, restoration, or enhancement, except as directly applied by the department in its administrative capacities.

HISTORY: 1988 Act No. 634, Section 3; 1990 Act No. 607, Section 3; 1993 Act No. 181, Section 1235.

Section 7.7 Storm Drainage Report

The following document is the last available Seabrook Island Property Owners Association Storm Drainage Report:

Seabrook Island Property Owners Association

Storm Drainage Report

September, 2013

Prepared by:	Josh Hoke & Brett Sexton, GIS Interns
Supervisors:	John Wells
Phone: (843) 768-0061	

Section 7.7 Storm Drainage Report (continued)

1.0 Executive Summary

This Storm Drainage Report details: (1) the inspection and maintenance work accomplished this year, (2) the maintenance and funding plans for coming years, and (3) the status of the storm drainage system. This document is also submitted to the Town of Seabrook Island as part of FEMA's Flood Insurance Community Rating System annual recertification program.

The Seabrook Island Property Owners Association (SIPOA) accomplishments in 2013 toward maintaining the Seabrook Island storm water system include:

We continue to maintain our storm water system proactively. This year we have a contract to rehabilitate 39 Corrugated Metal Pipes (CMP), 2871 feet, with Cured-In-Place-Pipe (CIPP) fiberglass liners. These pipes include 21 load bearing pipes, 945 feet. When this contract is completed, we will have rehabilitated 172 pipes, 11,436 feet. A total of 319 CMP pipes remain, 35,922 feet. Two significantly damaged sections of pipe were replaced in 2013.

Two projects were completed in 2013 which greatly improve drainage for over 300 acres of the southwestern and western portion of the island. We installed a variable frequency drive (VFD) motor and controller at Pump Station #2 in 2013. This VFD system can ramp up the pump speed from approximately 50% to 100% of capacity based on the detected water level changes in Dune Crest Pond, where storm water from the area collects. Second, the Pump Station #2 diversion project was completed and tested. This diversion project provides a second outlet for Pump Station #2 and provides access to additional pond storage for storm water.

Over last two years our summer interns inspected 568 pipes using an ultra-zoom video camera. This summer our interns inspected 102 pipes. The remaining 88 pipes have a high water surcharge which prevents inspection. Similar to last year, a number of damaged and deteriorated pipes were identified which need to be repaired. We will continue video inspections in the future, re-inspecting pipes which had shown deterioration in the first inspection.

We propose to carry forward our work plans and budget requests with a priority to rehabilitate load bearing CMP pipes. We also will continue rehabilitating or replacing non-load bearing pipes to maintain the drainage system. We also anticipate making some spot repairs of damaged or failing CMP. However, spot repairs are considered a short term fix because the remaining CMP is left in service and will require additional work to prevent failure at some point in the future.

Our progress to date indicate, if funding remains at 2013 levels, that we may be able to complete rehabilitation or replacement of load bearing CMP in approximately 5 years and rehabilitation or replacement of all remaining CMP in approximately 13 year. Budget plan

include our best judgment of the highest priority repairs at this time. Adjustments to the planned work will be made as ongoing inspections reveal major structural problems.

The Seabrook Island Club (SIC) hired our two summer GIS interns for two weeks again in 2013 to complete the mapping and assessment of their portion of the Seabrook Island storm water systems. The SIC has also retained an engineering firm to conduct hydraulic modeling and drainage studies to integrate the SIPOA and SIC drainage system into the overall hydraulic model for the island. We now have a much more complete map of the entire drainage system, an assessment of the condition of major pipes, and the opportunity to find synergies to improve overall drainage.

2.0 2013 Storm Water Expenditures

Table 1.0 provides the expenditures of Reserve Capital and Operating Expense funds used to accomplish the work highlighted above. Some contracts have not been completed as of this time are scheduled later this year.

Table 1.0 – 2013 STORM WATER SYSTEM EXPENDITURES

	Reserve Capital	**Operating Expense**
CIPP Rehabilitation of CMP - 2871 ft for 2013	$523,334	-
Complete PS#2 Diversion Project	$238,657	-
PS#2 VFR controller/motor upgrade	$28,256	-
Replace collapsed pipes	$7,500	$7,200
Ditch Cleaning/Maintenance	-	$17,468
Pipe cleaning, and inspecting	-	$36,738
Misc. Materials	-	$3200
Total	**$797,747**	**$64,606**
Total Storm Water Expenditures	**$862,353**	

3.0 Recommendations for 2014 Budget

The recommended Storm Drainage Reserve Capital Budget for 2014 includes $620,000 and the Maintenance Operating budget includes $92,600 for FY 2014. Table 1.1 provides the budget and summarizes the work planned.

Table 1.1 – 2014 Budget Recommendations

	Reserve Capital	**Operating Expense**
Rehabilitate ~3,000 feet of high priority CMP with CIPP liners. *	$510,000	
Upgrade two pump/motor/controllers for VFD Pump Station #3	$50,000	
Replace collapsed pipes	$20,000	
Video Inspection and Cleaning of CMP		$40,000
Spot Repair Pipes/Structures		$40,000
Rebuild two Storm Water Pumps		$10,000
Pump Station Remote Services		$2,600
Total	**$620,000**	**$92,600**
Total Storm Water Expense	**$712,600**	

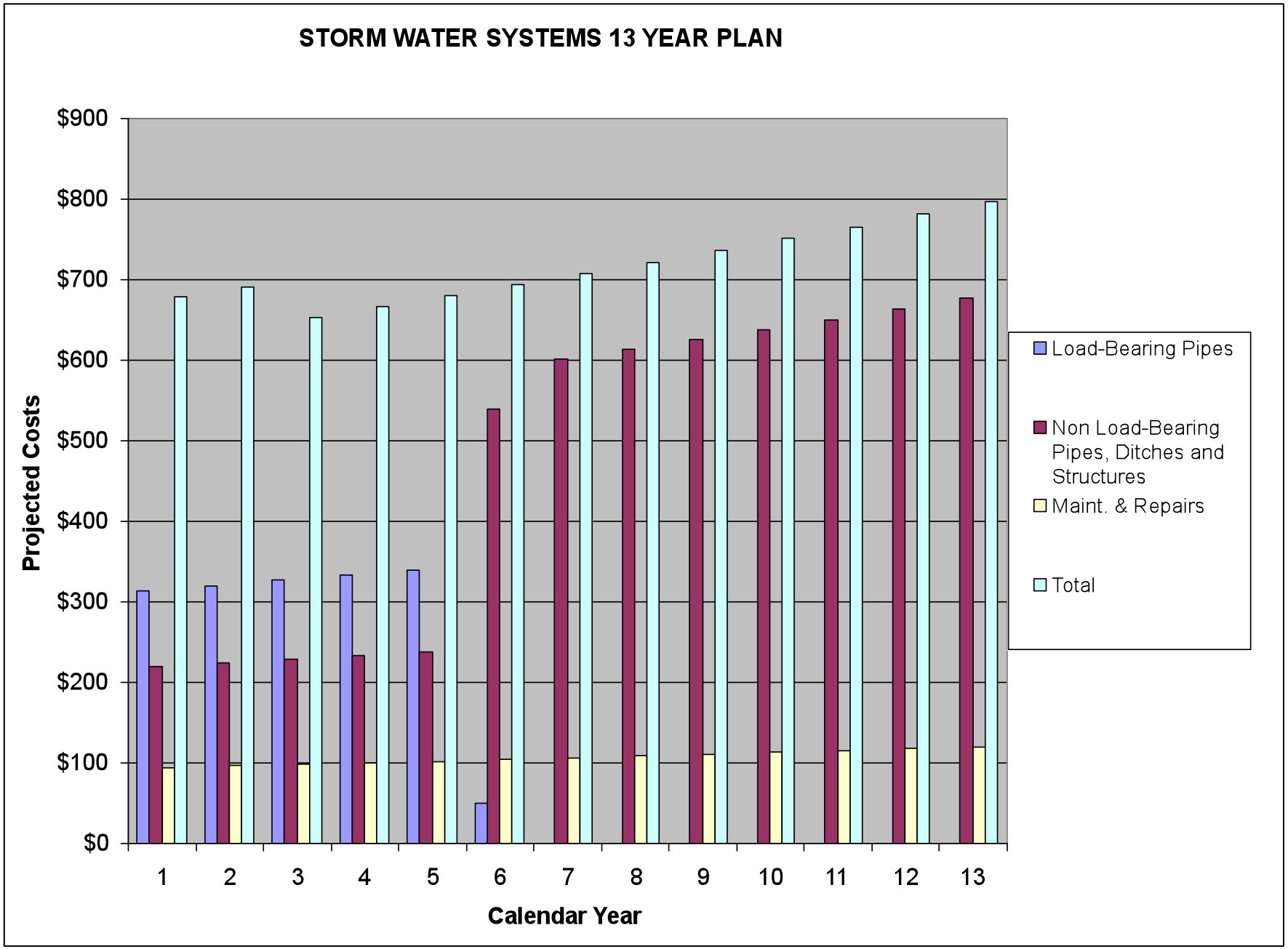
***Some Pipe linings involve both SIPOA and Seabrook Island Club pipe segments and depends on partial funding by the Club.**

3.1 Thirteen Year Budget Plan

The budget plan through 2028 is provided in Table 1.2. This budget plan is based upon actual experience from 2007 to the present combined with our judgment that rehabilitation of load bearing and critical CMP should be accelerated in the future. The projected budget for future years is escalated at 2% per year.

STORM WATER SYSTEMS 13 YEAR PLAN (2% per year increase)

		Reserve Capital Improvements				Operating Expense Maintenance & Repairs		All Storm Drainage Projects	
		Load-Bearing Pipes		Non Load-Bearing Pipes, Ditches and Structures				Total	
Year	**Projects**	**Recommended**	**Approved**	**Recommended**	**Approved**	**Recommended**	**Approved**	**Recommended**	**Approved**
2007		**$262,500**	**$262,500**			**$40,500**	**$40,500**	**$303,000**	**$303,000**
2008		**$260,000**	**$260,000**			**$48,600**	**$52,800**	**$308,600**	**$312,800**
2009		**$282,000**	**$200,000**			**$60,000**	**$33,595**	**$342,000**	**$233,595**
2010		**$383,500**	**$283,500**			**$64,780**	**$45,776**	**$448,280**	**$329,276**
2011		**$395,000**	**$415,000**			**$77,700**	**$41,643**	**$472,700**	**$456,643**
2012	**$115,000**	**$545,000**	**$304,600**	**$45,000**	**$45,000**	**$83,300**	**$75,300**	**$788,300**	**$539,900**
2013	**$274,400**	**$307,700**	**$307,700**	**$215,600**	**$215,600**	**$92,600**	**$64,600**	**$883,400**	**$855,400**
2014		$314		$220		$94		$678	
2015		$320		$224		$96		$691	
2016		$327		$229		$98		$654	
2017		$333		$233		$100		$667	
2018		$340		$238		$102		$680	
2019		$50		$539		$104		$694	
2020		$0		$601		$106		$707	
2021		$0		$613		$108		$722	
2022		$0		$625		$111		$736	
2023		$0		$638		$113		$751	
2024		$0		$651		$115		$766	
2025		$0		$664		$117		$781	
2026		$0		$677		$120		$797	
13 Year Total		$1,683		$6,153		$1,387		$9,322	


STORM WATER SYSTEMS 13 YEAR PLAN
Projected Costs
$900
$800
$700
$600
$500
$400
$300
$200
$100
$0
1
2
3
4
5
6
7
8
9
10
11
12
13
Calendar Year
Load-Bearing Pipes
Non Load-Bearing Pipes, Ditches and Structures
Maint. & Repairs
Total

4.0 Seabrook Island Storm Water System

Seabrook Island storm drainage is provided by a system of collection structures, detention ponds, and approximately 122,000 feet of pipes, and ditches which collect and conduct storm water to the surrounding tidal marshes and creeks. The system includes three pump stations and a number of backflow check valves at marsh outfalls.

The storm drainage system operates as a unit: however, ownership and maintenance responsibilities for the system are divided between the SIPOA, the SIC and 33 Villa Regimes (VR). The SIPOA is responsible for the pump stations, most of the check valves, and approximately 63% of total length of the pipes and ditches. The SIC is responsible for most of the remaining significant parts of the drainage system. These include the ponds, connecting pipes, and ditches on the SIC property and golf courses, approximately 31% of the total length. Individual VR's are each responsible for only a few pipes and structures. Combined, the VR's are responsible for a small percentage of the system.

Major maintenance challenges are:

(1) Aging of the bituminous coated, steel CMP, installed from approximately 1975 through 1985. These pipes are approaching and/or have reached the end of their service life. Most are not easily accessible for servicing.
(2) The unstable, sandy soil in which pipes and collection structures are buried. Drainage system leaks rapidly erode the soil surrounding structures and lead to sinkholes and road damage.
(3) The large amount of leaf litter, sediment, and aquatic vegetation which can clog drainage structures and require frequent cleaning.

4.1 Storm Drainage System Management

The storm drainage pipes were repaired mainly on an as-needed basis until 2002. Then the SIPOA instituted a more proactive maintenance plan. The SIPOA used student interns to survey, inspect, and map the entire drainage system and to organize the data in a Geographic Information System. The SIPOA also engaged engineering consultants to analyze and design enhancements of the system. Finally a CMP rehabilitation program using Cured-In-Place–Pipe (CIPP) technology was started. CIPP does not require excavation, provides a glass-fiber reinforced plastic liner which maintains flow capacity, is corrosion resistant, and is as structurally strong or stronger as the original pipe.

The immediate goal of CIPP was to protect the road system by lining all the CMP pipes that lay under pavement and were subject to traffic loads (load bearing pipes). This goal was to be attained by 2016. As time went on and our knowledge of the deteriorating condition of CMP pipes grew, the goal expanded to rehabilitation of non-load bearing pipes also.

Two major improvements over the past two years have made it possible to revise the way we will manage the storm drainage system in the future.

Section 7.7 Storm Drainage Report (continued)

First, in 2010 we conducted a risk assessment to rank the likelihood of pipe failure and combined that with the significance of each individual pipe to the drainage network. In this way we identified the critical pipes which must be inspected more frequently and maintained in good condition. We have elevated these critical pipes to the same priority level as load bearing pipes for the purpose of planning future rehabilitation.

Second, in 2011 we purchased a pole-mounted video inspection camera and started screening inspections using summer interns. As of now we have screening inspections of over 600 pipes and have identified enough repair work to make detailed schedules for the future. These improvements have demonstrated that we will be able to make screening inspections of all critical pipes yearly and we have significantly reduced inspection costs by monitoring the condition of the majority of pipes in-house. Detailed inspections will still be made by contractors with mobile robotic inspection cameras as needed in cases where pipes are submerged in water.

Based on these improvements, we have developed a risk-based maintenance strategy based on extending the useful life of all pipes. To safely do this we must:

1. Inspect pipes frequently.
   Critical pipes and deteriorating pipes will be inspected annually. Inspect pipes in GOOD or FAIR condition every several years. In this way, the useful life of all pipes can be extended with little risk of unexpected failure. We will continue to install CIPP linings in load-bearing CMP pipes because of increased inspection. Failed pipes or critical pipes about to fail can be rehabilitated or replaced.

2. Continue to rehabilitate pipes under roads using CIPP but extend the schedule past 2016.

3. Make spot repairs to non load-bearing pipes found to have isolated defects such as root penetrations or leaking joints, but which are otherwise in good condition.

4. Rehabilitate or replace non-load bearing pipes. We anticipate that many of these remaining CMP pipes will also be lined with CIPP. Excavating to directly replace pipes causes collateral damage to roads, landscaping, and other utilities, usually making the CIPP process more cost effective and more reliable over the long term.

5. Continue the Engineering Study of the High Hammock basin area and conduct additional engineering studies to identify future drainage improvement projects for water retention and pump station upgrades.

5.0 Drainage System Analysis

Table 1.3 – 2013 SIPOA Storm Drain Pipe Statistics

		Number of Pipes	% of Pipes	Length (ft)	% of Length
ALL SIPOA PIPES	All SIPOA Pipes	758	100%	74,216	100%
	By Condition				
	Good	596	78.63%	56,523	76.16%
	Fair	81	10.69%	8,723	11.75%
	Poor	23	3.03%	2,887	3.89%
	Bad	20	2.64%	2,926	3.94%
	Unknown	38	5.01%	3,157	4.25%
	Total	758	100%	74,216	100%
	By Type				
	CAIP	8	1.06%	801	1.08%
	CMP	358	47.23%	38,793	52.27%
	Ditch	25	3.30%	7,946	10.71%
	GRP	133	17.55%	8,565	11.54%
	HDPE	31	4.09%	2,759	3.72%
	PVC	8	1.06%	308	0.42%
	RCP	166	21.90%	12,251	16.51%
	Unknown	29	3.83%	2793	3.76%
	Total	758	100%	74,216	100%
LOAD BEARING PIPES	Load Bearing Pipes	291	100%	17,388	100%
	By Condition				
	Good	244	83.85%	13,953	80.24%
	Fair	24	8.25%	1,473	8.47%
	Poor	9	3.09%	529	3.04%
	Bad	3	1.03%	619	3.56%
	Unknown	11	3.78%	814	4.68%
	Total	291	100%	17,388	100%
	By Type				
	CAIP	2	0.69%	377	2.17%
	CMP	92	31.62%	6,123	35.21%
	Ditch	0	0%	0	0%
	GRP	102	35.05%	5,161	29.68%
	HDPE	4	1.37%	230	1.32%
	Linear Drain	0	0%	0	0%
	OEP	0	0%	0	0%
	PVC	1	0.34%	38	0.22%

	RCP	80	27.49%	4,873	28.03%
	Unknown	10	3%	586	3%
	Total	291	100%	17,388	100%
LOAD BEARING CMP PIPES	Load Bearing CMP Pipes	92	100%	6,123	1000%
	Good	75	81.52%	5,001	81.68%
	Fair	15	16.30%	781	12.76%
	Poor	0	0%	0	0%
	Bad	0	0%	0	0%
	Unknown	2	2.17%	341	5.57%
	Total	92	100%	6,123	100%

6.0 Data for Storm Water Pipes Not Owned by SIPOA

Table 1.4 – 2013 Non-SIPOA Storm Drain Statistics

All Non-SIPOA Pipes		Number of Pipes	% of Pipes	Length (ft)	% of Length
	All Non-SIPOA Pipes	404	100%	48236	100%
	By Condition				
	Good	180	44.55%	21,590	44.76%
	Fair	34	8.42%	3,436	7.12%
	Poor	2	0.50%	73	0.15%
	Bad	7	1.73%	638	1.32%
	Unknown	181	44.80%	22,499	46.64%
	Total	404	100.00%	48,236	100%
	By Type				
	CAIP	0	0%	0	0%
	CMP	123	30.45%	12,928	26.80%
	Ditch	27	6.68%	9,013	18.69%
	GRP	4	0.99%	171	0.35%
	HDPE	164	40.59%	19,203	39.81%
	Linear Drain	1	0.25%	140	0.29%
	PVC	9	2.23%	846	1.75%
	RCP	75	18.56%	5,820	12.07%
	Unknown	1	0.25%	115	0.24%
	Total	404	100%	48,236	100.00%

7.0 Limitations of Storm Drainage Data

- Data with ditches in particular is prone to error because the maintainable feature is difficult to distinguish from natural hydraulic morphology.

- Pipe lengths are determined by a scaled measurement of features after they are drawn in ArcView. The error in length is determined by the accuracy of the drawn feature.

- Data for storm drainage pipes not owned by the SIPOA is dated and is only meant to give a general picture of the condition of all the pipes on the island not owned by the SIPOA.

- Accuracy of data can vary depending on the type of material used. For example, HDPE pipes are more flexible than other materials, making it capable to twist and turn them abruptly. This can cause a discrepancy between the length of the actual pipe and the length between each structure, in addition to making it difficult to determine their location without original documentation.

8.0 Glossary of Terms

- **ArcView:** A mapping program functioning as the numerical and drawn database from which all Storm Drainage data is compiled and stored

- **ArcGIS Online:** A website that allows a user or organization to post maps that can then be viewed online, whether on a computer or a mobile device

- **Pipe:** Any linear conduit that carries water and must be maintained

- **Structure:** The point at which water enters or exits a pipe; they are often indicated by a grate inlet or manhole cover above ground

Table 1.5 – Glossary of Terms Used in Report

Glossary of Terms	
Condition of Pipe	Definition
Good	Pipe shows little sign of wear
Fair	Pipe shows signs of wear
Poor	No apparent threat to safety but appears to be insufficient
Bad	In need of immediate replacement or rehabilitation
Unknown	The condition of the pipe is not determined
Type of Pipe	Definition
CAIP	Corrugated Metal Pipe – Aluminum
CMP	Corrugated Metal Pipe – Steel
Ditch	Graded Channel
GRP (or CIPP)	Fiberglass Lining for CMP
HDPE	High Density Polyethylene
Linear Drain	
Open End Pipe	Pipe that outlets in either water or a ditch
PVC	Polyvinyl Chloride
RCP	Reinforced Concrete Pipe
Unknown	Type is undetermined

Section 7.8 Definitions

The definitions included in this Section 7.9 are intended to assist the reader in understanding some of the terms used repeatedly throughout this Beach Management Plan.

Association means the Seabrook Island Property Owners Association.

Beach Club means the Seabrook Island Club facilities along the ocean fronting beach at its intersection with the Edisto River.

Beachfront Management Act means the South Carolina Code Ann. § 48-39-250 et seq that establishes a requirement that ocean beachfront counties and municipalities prepare local comprehensive beach management plans in coordination with DHEC-OCRM.

Beach Management Plan means the Town of Seabrook Island Comprehensive Beach Management Plan.

Club means the Seabrook Island Club.

Coastal Sciences Engineering means the engineering firm that has provided beach replenishment engineering support to the Town and Property Owners Association.

Comprehensive Beach Management Plan means the Town of Seabrook Island's Plan developed in accordance with Sections 48-39-320 and 350 of the South Carolina Coastal Zone Management Act as directed by the Department of Health and Environmental Control's Office of Ocean and Coastal Resource Management.

CSE means Coastal Sciences Engineering.

Department of Natural Resources means the State of South Carolina's department that is the principal advocate for and steward of the State's natural resources.

Department of Transportation means the State department responsible for planning, constructing and maintaining State roads and bridges, and provision of mass transit services.

DHEC OCRM means the State Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management.

DHEC means the Department of Health and Environmental Control.

DNR means the Department of Natural Resources.

DOT means the South Carolina Department of Transportation.

DTMs means digital terrain models of beach topography and channel bathymetry.

EMD means the State of South Carolina Emergency Management Division that provides major disaster preparation, response, and recovery assistance.

Emergency Management Division means the South Carolina organization providing major disaster preparation, response, and recovery assistance.

GPS means differential geographic positioning system.

Island means Seabrook Island.

National Marine Fisheries Service means the federal organization responsible for the management, conservation, and protection of living marine resources within about 200 miles of the U.S. coast.

National Oceanic and Atmospheric Administration means the federal agency responsible for protecting federal trust resources, provide mapping of navigation channels, monitoring and forecasting weather, monitoring coastal dynamics and conditions, and managing the nation's coast.

NAVD means North American Vertical Datum, the starting point for measuring vertical elevation used by surveyors to relate elevations to sea level.

NGVD means National Geodetic Vertical Datum, an earlier system used by surveyors as the starting point for measuring vertical elevations.

NMFS means the National Marine Fisheries Service.

NOAA means the National Oceanic and Atmospheric Administration.

North Beach means the beach area around the seaward end of Boardwalk #1.

OCRM means Office of Ocean and Coastal Resource Management.

Office of Ocean and Coastal Resource Management means the State's coastal management agency.

Plan means the Comprehensive Beach Management Plan.

Property Owners Association means the Seabrook Island Property Owners Association.

Renken Point means the area along the Seabrook Island beachfront between Boardwalk #5 and Boardwalk #6 where the beach turns down the coast to the Seabrook Island Club facilities on the Edisto River Inlet.

RPI means Research Planning Institute Inc, a science-technology consulting organization.

SCDNR means South Carolina Department of Natural Resources.

Seabrook Island Club means the member owned club on Seabrook Island.

Seabrook Island Property Owners Association means the jointly owned organization used by the property owners to manage and maintain their common property and supporting staff.

SIC means the Seabrook Island Club.

SIPOA means the Seabrook Island Property Owners Association.

SLR means sea level rise.

South Beach means the section of Seabrook Island's beach from Renken Point to the Edisto River.

South Carolina Department of Natural Resources means the State of South Carolina department that is the principal advocate for and steward of the State's natural resources.

State means the State of South Carolina.

St. Christopher Camp and Conference Center means the conference center located along the Edisto River front of Seabrook Island that provides a year-round conference facility and a summer camp.

St. Christopher Camp means St. Christopher Camp and Conference Center.

Town Council means the Town of Seabrook Island legislative body.

Town Hall means the Town's administrative office building at 2001 Seabrook Island Road.

Town means the Town of Seabrook Island.

Town of Seabrook Island means the town of that name located in Charleston County, South Carolina.

USACE means the US Army Corps of Engineers.

US Army Corps of Engineers means the US Federal agency responsible for providing engineering services to the United States.

US Fish and Wildlife Service means the federal agency responsible for the protection of federal fish and wildlife species and their habitats.

USFWS means US Fish and Wildlife Service.

Utility Commission means the Town of Seabrook Island's commission responsible for the Town's domestic water supply and the waste treatment plant.