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Cover photo credit: Daniel Clay

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Maps created by: Alex Braud, College of Charleston
Executive Summary

With over 10,000 acres of the state’s roughly 350,000 acres of saltmarsh within its jurisdictional boundaries, the City of Folly Beach aims to preserve its marsh and protect the life and property of its citizens by encouraging responsible development along the marshfront. The city’s 2017 Sea Level Rise Adaptation Report recognized that despite the vulnerability of the marshfront, little investment has been made in planning, management, or protection along the vital marsh shorelines of the community. This Marshfront Management Plan (MMP) is the first of its kind in the state. It is an adaptive management effort that occurred in conjunction with a 2018 waterfront building moratorium and aimed to develop recommendations to guide planning efforts along the city’s marshfront.

Community engagement was the foundation of the MMP. Stakeholder concerns were communicated to the city planners, prioritized by stakeholders, and voted on by the public to finalize the plan’s recommendations. Marshfront management concerns were grouped into four categories: upland, regulatory, marsh-related, and education. The top concerns for each category were decreased flood protection value with increasing water levels (upland), the lack of a map of the critical line (regulatory), the marsh response to sea level rise (marsh-related), and the education of marshfront property owners and residents.

To address these concerns, the MMP recommends the short-term implementation of management actions that include numerous regulatory proposals, zoning proposals, a marshfront structural inventory, a historic marsh shoreline change analysis, planning restoration projects, a septic vulnerability assessment, and engagement and education. These short-term management actions directly address each of the stakeholders’ upland marsh management concerns. The regulatory and zoning proposals will also have a positive effect on the marsh and indirectly address some of the stakeholders’ marsh-related management concerns, such as marsh response to sea level rise (by establishing setbacks and marsh buffers). Partnerships with local community groups, as well as state and federal agencies, will facilitate implementation of the short-term recommendations.

The MMP also describes future marshfront management opportunities such as mapping of the marshfront critical line, a more detailed inventory of habitable marshfront structures and bulkheads including their distance from the critical line, a marsh mitigation bank fund, a detailed outline of how other communities handle marshfront management, and continued public education and engagement.

To ensure that the next generation of Folly Beach residents experiences the same quality of life that today’s residents enjoy, a long-term commitment to marshfront management and protection and restoration of the saltmarsh ecosystem is needed.
1. Introduction

1.1 Purpose
The City of Folly Beach is home to about 10,000 acres of saltwater marsh, tidal creeks, and marsh islands. These beautiful, important, and productive environments provide habitat for shrimp, crabs, fish, oysters and birds. The marsh provides recreational opportunities, absorbs wave energy, and filters pollutants. The City seeks to gain a better understanding of the uses, benefits, potential impacts, and management options along their marshfront shoreline. The purpose of this plan is to develop recommendations to guide planning for the protection, restoration, and management of the marsh and marsh islands within the jurisdiction of the City of Folly Beach. The spatial extent of the planning area is shown in Figure 1.

The South Carolina Department of Health and Environmental Control (DHEC) Office of Ocean and Coastal Resource Management (OCRM) is responsible for delineating exact boundaries of tidally influenced wetlands, which are known as critical areas per the State’s Coastal Zone Management Act. The state-delineated boundary between the upland and the coastal marsh is called the critical line.

Figure 1. Spatial extent of the marsh and marsh islands in the jurisdiction of the City of Folly Beach, SC.
This document is the first of its kind in the state of South Carolina. Few other marshfront management plans have been published globally (e.g., NYC Parks 2017; EA 2007). While individual efforts to protect and restore the marsh have occurred over the years on Folly Beach, this is the first comprehensive planning effort. The intent of this plan is to facilitate the planning process for the City of Folly Beach to better manage their marshfront and to have the most positive influence on the marshes within their jurisdiction over the next several decades. This plan anticipates the landward movement of the critical line and develops new regulations and plans to address such movement.

Due to physical and regulatory limitations on direct marsh restoration, this plan discusses mostly the indirect benefits to the marsh through the modification of upland behaviors and actions along the marshfront. Numerous marshfront management actions have been defined and prioritized through extensive community input. This plan develops a new zoning approach to the marshfront area along Folly Island and the marsh islands within Folly’s jurisdiction in the vicinity of and upland of the critical line.

1.2 Motivation for the Marshfront Management Plan (MMP)
The City of Folly Beach desires to preserve its marsh and protect the life and property of its citizens by encouraging responsible development along the marshfront. Some sources estimate that 50% of the original salt marsh habitat in the U.S. has been lost due to human influence over the last century (Kennish 2001). Globally, it is estimated that 85% of oyster reefs have been lost, with those remaining in poor condition (Beck et al. 2001).

City’s long-term planning documents including but not limited to the 2015 Beachfront Management Plan, the 2015 Comprehensive Plan, the 2017 Sea Level Rise Adaptation Plan, and the 2018 Strategic Plan, include recommendations that the City pursue the review and development of various regulations applicable to properties located adjacent to the marsh. The City has experienced chronic flooding due to high tides and storms leading to loss of property, and increased local, state, and federal disaster spending.

In particular, the 2017 Sea Level Rise Adaptation Report laid out the following implementation plan for an MMP, one of the top three recommendations of the Report.

Recommended Adaptation Action: Marshfront Management Plan

Near-term (1 year)

1. Initiate partnership with SCDHEC-OCRM to develop a pilot Marshfront Management Plan for a South Carolina beach community.
   a. Understand critical line permitting and building requirements
2. Participate in SCDHEC-OCRM’s Living Shorelines Working Group
3. Begin Plan development
4. Develop strategic education campaign of property owners and elected officials

Medium-term (3 years)
1. Complete and Adopt Plan, which will include a detailed inventory of all structures, property lines, habitat, erosion control devices, a vulnerability (historic and present) assessment of the marshside, as well as the consideration of management and adaptation options such as setbacks, ordinance/code modifications, and living shoreline incentives.

2. Continue strategic education campaign of property owners and elected officials

Long-term (5 years+)

1. Implement Plan
2. Assess modifications to setbacks, codes, and regs to determine effectiveness of plan implementation.
3. Adapt strategic education campaign of property owners and elected officials

1.2.1 2018 Waterfront building moratorium

Additionally, On May 30th, 2018 the Folly Beach City Council approved a building moratorium on the development of lots on either the beach or the marsh. During the moratorium, the Planning Commission is examining and recommending changes to the City’s requirements for setbacks, buffers, septic drainfields, marsh island development, dune protection, seawalls, construction elevations, and other regulations related to building in the affected areas. Final recommendations will be presented to City Council in December 2018 with review and adoption of proposals through March 2019.

During this time, the Folly Beach Planning Commission met twice monthly. Public involvement was encouraged through social media, newsletter articles, and information provided on the city website. The website included the meeting schedules and agendas, as well as resources such as city planning documents, and other links from the City of Folly Beach, SCDHEC OCRM, the Nature Conservancy, the S.C. Sea Grant Consortium, and other agencies and nonprofits. The information was provided as both education and a touchstone for conversations regarding current best practices.

1.2.2 Saltmarsh Overview

The salt marsh-tidal creek ecosystem within the City of Folly Beach is a highly productive coastal wetland between upland areas, such as the barrier or marsh islands, and the tidal rivers. The marsh is an intertidal habitat, meaning the surface of the salt marsh is under water at high tide and dry at low tide. A finger-like network of tidal creeks winds through the marsh and allows tidal water onto the marsh surface and back into the rivers.

Folly Beach contains about 10,000 of South Carolina’s 350,000 acres of salt marshes and tidal creeks. The marshes are dominated by smooth cordgrass (Spartina alterniflora). The extent of the marsh ecosystem is determined primarily by the elevation, which determines frequency, depth, and duration of salt water inundation and soil salinity (Figure 2).
Figure 2. Profile of a salt marsh, modified from Discover South Jersey Salt Marshes (2018). The red arrow represents the South Carolina state critical line and separates the marsh from the upland, which is subject to development on much of Folly Beach.

1.2.3 Marsh and Marshfront Uses and Values
Salt marshes provide essential habitat, wave attenuation, and water filtration. They provide essential refuge, breeding grounds and food for fish, birds and wildlife, as well as a unique open space in a dense urban environment. Within the City of Folly Beach, the marsh provides public and commercial fishing/oystering opportunities, as well as other recreational opportunities like boating and bird watching. In South Carolina, recreational fishing is a $686 million annual industry (USFWS 2014). In 2012, commercial fishermen in South Carolina landed 12.3 million pounds of finfish (2.4 million pounds) and shellfish (9.9 million pounds), earning $24 million in landing revenue (NMFS 2014).

Salt marshes also provide services for the City of Folly Beach by reducing wave energy, absorbing flooding, and filtering debris and pollutants from the water. Yet despite decades of regulatory protection, salt marshes continue to be threatened by poor water quality, rising sea levels, encroaching development, illicit dumping, and erosion. Folly’s marshes need to be managed in a sustainable manner to protect both long-term economic stability and the recreational amenities and natural resource benefits the marsh provides.

1.2.4 Summary of Marshfront Vulnerability to Future Sea Level Rise
The 2017 City of Folly Beach Sea Level Rise Adaptation Report included a vulnerability assessment to elevated water levels. It detailed historic and future sea level rise and the occurrence of King Tides or nuisance flooding as they relate to potential community flooding. Here, we discuss predicted timing of marsh impacts under different marsh accretion rate scenarios.

Long-term tide gauge data from nearby NOAA station 86655300 at Charleston, SC, located at the Cooper River Entrance, provides the data necessary for identifying sea level trends. Since the station’s establishment in 1921, relative mean sea level has risen an average of 0.126 inches (3.21 mm) per year (Figure 3). This translates to 1.05 feet/century.
The NOAA Sea Level Rise Viewer (NOAA, 2018) was useful in the Sea Level Rise Adaptation planning process. It allows a user to toggle water level scenarios to visualize potential impacts. Interestingly, little effect is obvious even at 3 feet of sea level rise on the beachfront, while the back side of the island and the causeways are significantly affected. This confirms the need to develop a MMP to protect critical habitat, private property and City infrastructure that are housed in, or service, these low-lying areas. The NOAA Sea Level Rise Viewer also includes an option to visualize marsh impacts, which is discussed later in this section.

Due to increased storminess and frequent nuisance flooding, the Folly Beach Sea Level Rise Adaptation Report recommended the City prepare for 3 feet of sea level rise over the next 50 years, or by 2066. This corresponds with the high sea level rise scenario of the U.S. National Climate Assessment (NCA, 2014). Marsh impacts under this scenario, as depicted by NOAA (2018), are compared in Figure 4. The timing for the marsh reaching this condition will depend on the rate of sediment accumulation on the marsh (i.e., accretion, restoration), among other factors. Unfortunately, little is known about sedimentation rates in the Folly Beach marsh system and future marsh restoration efforts are not included. Table 1 shows different accretion rates and the resulting change in the year that the NOAA Sea Level Rise Viewer predicts this scenario. The marsh will reach the condition depicted in Figure 4 in 2060 provided the accumulation rate is 4mm/yr. Marsh restoration projects can help increase elevations (i.e., increase the accretion rate) if deemed necessary.

Figure 3. Graph of observed monthly mean sea level in Charleston, SC resulting in a linear rise in sea level of 0.126 in/yr. From NOAA Tides & Currents.
Figure 4. NOAA’s Sea Level Rise Viewer Marsh Migration visualization depicting (top) present day sea level and (bottom) 3 feet of sea level rise for Folly Beach, SC
To ensure future marsh habitats through conservation, the likely pathways of marsh migration need to be identified. Salt marsh will migrate onto former upland areas where not blocked by development. It is difficult to accurately predict future habitat change, but this tool, particularly at lower sea level rise scenarios, can help plan for marsh restoration.

Table 1. NOAA Sea Level Rise Viewer prediction of year Folly marsh will reach the scenario depicted in Figure 4 under the National Climate Assessment’s High SLR Scenario as selected by the City’s Sea Level Rise Adaptation Report.

<table>
<thead>
<tr>
<th>Accretion Rate</th>
<th>Year will reach 3ft scenario</th>
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</thead>
<tbody>
<tr>
<td>None</td>
<td>2053</td>
</tr>
<tr>
<td>Low (2mm/yr)</td>
<td>2056</td>
</tr>
<tr>
<td>Mid (4mm/yr)</td>
<td>2060</td>
</tr>
<tr>
<td>High (6mm/yr)</td>
<td>2064</td>
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1.3 Overview of Municipality & History of Marsh Management Approaches

1.3.1 Overview of Municipality

The City of Folly Beach, SC, is located 4 miles south of the entrance to Charleston Harbor. The barrier island portion of the municipality is approximately 6 miles in length and runs in a general northeast/southwest direction. The municipal limits of the City extend up to 2 miles inland and encompass about 10,000 acres of marsh, tidal creeks, and developed and undeveloped marsh islands. Folly Road, with its span bridges and causeways, intersects the marsh to provide vehicular access to the City. The Folly River runs along the landward side of the barrier island and the Stono River runs along the western municipal limit as shown in Figure 1. The City is bordered on the northeast by Lighthouse Inlet. Known to Charleston locals as "the Edge of America," the City’s vulnerable position to coastal hazards is clear.

1.3.2 History of Marsh Management Approaches

There is a stark contrast between historical beach and marsh management approaches on Folly Beach. The federal government and the city have invested significantly in the beachfront through a 50-year Local Cooperation Agreement (LCA) between the U.S. Army Corps of Engineers (USACE) and the city which remain in effect from 1992 until 2042. The city has also planned for beach management alternatives in addition to the Federal project in its State-Approved Folly Beach Local Comprehensive Beachfront Management Plan (LCBMP1). The goal of this plan is to “develop a long-term beach preservation strategy such that the restored beach and dune system is not lost between periodic renourishments.”

Like the beachfront, most of the marshfront on the backside of Folly Island, as well as the marsh islands, is privately controlled. However, long-term management plans or strategies to manage development or restore habitat along the marsh side of the island have not yet been created. As mentioned previously, the Folly Beach Sea Level Rise Adaptation Plan recommended that the City develop this MMP.

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1 City of Folly Beach Local Comprehensive Beach Management Plan, 2015
Marshfront policies and regulations presently in effect include DHEC rules for septic systems, which require a 75-foot buffer from the critical line. In 2010, the City’s marsh setback was increased to 10 feet from the critical line for any impervious surface. The intent of this setback is to begin to reduce and control stormwater runoff into the marsh.

The majority of marsh parcels are zoned conservation. Seawalls upland of the critical line require building permits from the City; whereas, seawalls or any modifications beyond the critical line require permission from SCDHEC OCRM. DHEC is also responsible for permitting docks. The City prohibits signs in the marsh. River-based vendors pay sales tax and business license fees. DOT handles post-storm debris removal along the causeway.

In June 2018, the S.C. Department of Natural Resources (SCDNR) South Carolina Oyster Restoration and Enhancement (SCORE) Program partnered with Folly Beach to restore an oyster reef at the County operated Folly Beach boat ramp (Figure 5). This is a common living shoreline approach in the Lowcountry. Oyster reefs can protect marsh habitats and the upland behind them from erosion if the conditions are right. Oysters do best when placed in environments with low wave energy. SCDNR² and The Nature Conservancy³ each manage ongoing oyster restoration projects in South Carolina.

![Figure 5. Photograph of the oyster restoration project during construction in June 2018.](image)

1.3.3 General Land Use Patterns

The primary land use classification in the City of Folly Beach is low density residential. The largest zoning district is Residential Single Family (RSF) which covers approximately 85 percent of the island.

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² [http://score.dnr.sc.gov/](http://score.dnr.sc.gov/)
Although there are scattered properties containing more than one residential unit that have been grandfathered, there are no commercial or high density residential uses located in the RSF district. The standard lot size in this district is 10,500 square feet and the average density is 4 units per acre.

Folly Beach has taken several actions to limit the scale and impact of residential development in recent years. In 2013, the City codified regulations that require homes in the RSF district that are nonconforming to adhere to the 50% rule. This limits improvements to nonconforming structures over a 10 year period to 50% of the appraised value of the home. Any homeowner who wishes to exceed this limit must bring the property into conformity with current zoning. Since many of the parcels currently zoned RSF were developed as multiple unit properties, this would mean abandoning all but one of the units.

The City also changed the dimensional standards governing single family development. In 2010, the maximum size of a home allowed on a standard Folly Beach lot was reduced from 4,500 heated square feet to 3,600 heated square feet. Maximum lot coverage was reduced from 50% to 35% of the lot’s high ground. Also, the setback from the OCRM Baseline was increased from 0’ to a minimum of 5’ (maximum 10’) and the critical line setback was increased from 5’ to 10’. In 2014, the City increased side setbacks from 5’ to 10’ and required all new driveways to be constructed with pervious surfaces. Finally, the City passed an ordinance which requires that all new construction be built to V-Zone flood standards even if located in A-Zones.

Higher density residential uses are clustered in the center of the island and along the causeway leading from the mainland. Historically, each wave of multifamily housing led to greater restrictions on the allowable density of future projects. The first condominium project in the City was constructed in 1996 with an allowable density of 32 units per acre. The current maximum density is 12 units per acre. The area available for future multifamily construction has also been gradually reduced over time. Currently no future multifamily construction is allowed on Folly Island and is limited to properties on the causeway.

Residential Multi Family (RMF) is the highest intensity residential zone in Folly Beach. Growth in this zoning district in recent years has occurred primarily in the Preserve, a previously approved project at the intersection of Folly Road and Bowens Island Road. This project was approved for approximately 60 units in 2006. Properties zoned RMF are located along the causeway to the island with two exceptions. Little Oak Villas is located on Little Oak Island and is surrounded by an RSF district. Palmetto Pointe, which takes up the entirety of Peas Island, is also zoned RMF. Since the 2005 Comprehensive Plan, there have been no new developments approved in the RMF District and there are currently no vacant parcels in the City that have this designation.

The commercial core of the island is roughly 2 blocks wide and 6 blocks long. Commercial uses include retail, lodging, bars, and restaurants. The largest physical and most intense commercial use is the Tides Hotel which is located on the beach at the end of Center Street. Growth of the commercial district is extremely restricted. Steady reductions in lot coverage allowances combined with increased parking requirements and a commitment to prevent the expansion of commercial zoning districts have all served to limit actual and potential expansion of the business district.
1.3.4 Marshfront Land Use and Zoning

Like the majority of Folly Island, the dominant zoning along the marsh is also RSF. The RSF properties account for approximately 70% of the marshfront. The current maximum allowable square footage is 3,600 heated square feet. A handful of homes are built to the prior maximum allowable size of 4,500 square feet, but the majority of the houses on the marsh are 3,600 square feet or less. Setbacks are as low as zero 0’ and lot coverage as high as 50% (mostly in Sunset Point and beyond the Washout). Current regulations on lot coverage is 35% and the marsh setback is 10 feet.

Commercially zoned marshfront properties cluster in the middle of the island near the commercial district and cover about 10% of the marshfront shoreline of Folly Island. These include multifamily properties (Turtle Bay, Water’s Edge, the Sandbar Apartments, Back Bay), two Inns (Water’s Edge In, the Folly Lodge), the Folly Beach Boat Landing, the Folly Beach Baptist Church, and a commercial development at 81-83 Center Street. Sunset Cay Marina extends into the river at 9th Street West Extension. As built setbacks in this area are as low as 0’.

20% of the marshfront shoreline of Folly Island is zoned Conservation (CN) which allows very limited development intended to maintain property in a mostly undeveloped state. Lands at either end of the island as well as the Folly Beach Boat Landing at the causeway, are owned and operated by Charleston County Parks and Recreation. The Folly River Park, operated by the City, is also zoned CN.

On the causeway, the dominant use is Residential Multiple Family (Turn of River, Marshwinds, Marshview Villas/Mariners Cay, Little Oak Villas(?), The Palmettos at Folly, Waterfront Point Villas, The Clam Farm, Peas Island). Single family homes are located at Kings Flats, Little Oak Island, McDonough Road, and Oak Island, and Bowens Island. Commercial development is limited (Lolo’s, Bowen’s Island Restaurant, and Crosby’s Seafood).

The Marsh Islands to the East/North of Folly Beach including Long Island are currently undeveloped. They are zoned RSF.

SCDHEC OCRM’s Living Shorelines Working Group is developing a state permitting and regulatory plan for living shorelines. SCDNR is conducting research to investigate the effectiveness of different types of living shoreline materials along South Carolina marsh edges which include oyster reefs, modified crab traps, and natural fiber logs. Best management practices and industry standards do not yet exist for living shorelines projects. Most living shoreline projects to-date have been small-scale and mostly privately funded or installed for research purposes. Aside from the oyster restoration project depicted in Figure 5, no other living shoreline projects have been installed along the Folly Beach marshfront.

1.3.5 Threatened and Endangered Species

Endangered species that utilize the salt marshes within the jurisdiction of Folly Beach may include the Bald eagle, the West Indian manatee, and the Shortnose and Atlantic sturgeon. Any future marsh restoration project would require consultation with NOAA National Marine Fisheries Service as required by the National Environmental Policy Act (NEPA).
2. Community Input Process

The MMP was informed through significant stakeholder input at the beginning, middle, and end of the planning process. This iterative format allowed stakeholders to voice their concerns about marshfront management and to share ideas and opportunities for improved management. Stakeholders were informed of the MMP process, educated about marsh management challenges, consulted with during public meetings, and involved through direct polling and expert presentations. This ensured that public concerns were understood and considered throughout the planning process.

During the early stakeholder meetings, the MMP process was also determined to be an *adaptive* management effort. Adaptive management is a structured, iterative process of decision making in the face of uncertainty with an aim at reducing uncertainty over time through monitoring. The MMP is envisioned to be a living document that should be revisited once every five years to assess the effectiveness of implemented recommendations, and adapt as needed for improved management.

The MMP process began on May 30, 2018 with a kick-off meeting with city staff, DHEC OCRM, South Carolina Sea Grant, The Nature Conservancy, and Elko Coastal Consulting to discuss the planning process. A public City Planning Commission Meeting was held on July 9, 2018 to introduce MMP concept, which was followed by a public listening session on August 15, 2018 and another Planning Commission meeting on September 10, 2018. S.C. Sea Grant staff presented at the August meeting and staff met with SCDNR prior to the September meeting. These initial meetings served to educate stakeholders and formulate a list of concerns about marshfront management in the City of Folly Beach.

Once the list of concerns was developed, an online survey of city staff, planning commissioners, and elected officials was conducted during October 2018 to prioritize the concerns and develop action items. Eighteen (18) City staff and officials participated in the survey. These action items were incorporated into a draft MMP which was posted on the City’s website. A final public meeting was advertised online, in the City’s newsletter, and on social media. This meeting, held on November 20, 2018 provided an opportunity for stakeholders to further prioritize the action items.

The following list of concerns was developed during the first phase of the public input process. An initial prioritization of these concerns occurred through an online survey of City staff, elected officials, and planning commissioners. The final prioritization occurred during a public meeting in November 2018. A discussion of each concern and the existing regulations and any relevant ongoing actions follows the prioritized lists. The survey also included questions about proposed regulatory changes and future opportunities.
## Stakeholders’ Prioritized Marshfront Management Concerns

### Upland

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<td>1</td>
<td>Decreased flood/storm protection due to nuisance flooding/sea level rise</td>
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<td>2</td>
<td>Septic systems (Outdated/leaky/too close to marsh)</td>
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<td>3</td>
<td>Stormwater (polluting marsh)</td>
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<td>4</td>
<td>Bulkheads on private marshfront land and the impacts on existing marsh and adjacent shorelines</td>
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<td>5</td>
<td>Scenic views</td>
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<td>6</td>
<td>Causeway impacts on marsh health</td>
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<td>Public access</td>
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### Regulatory

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### Marsh/River-based

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<td>Marsh response to sea level rise (Coastal squeeze, can it keep up?)</td>
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### Education

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<td>3</td>
<td>Visualizing parcel scale impacts</td>
</tr>
</tbody>
</table>

### 2.1 Prioritized Marshfront Management Concerns: Upland

The following items are related to the upland portion of the marshfront, defined as the area landward of the critical line - the high ground of marshfront properties. Each concern is followed by a brief description of the relevant existing conditions and regulations, as well as any ongoing City actions.
Survey respondents were asked to select their #1 and #2 upland marshfront management concerns. Top priority responses received two points and #2 priority responses received one point. The total points each concern received is depicted in Figure 6.

![Prioritized Upland Marshfront Management Concerns](image)

**Figure 6. Survey Results: Prioritized Upland Marshfront Management Concerns**

2.1.1 Decreased flood/storm protection value due to increased nuisance flooding/sea level rise
The #1 priority of surveyed participants was the loss of protection as flooding increases. Here, the concerns are about flooding of upland public and private infrastructure along and adjacent to the marshfront. The City of Folly Beach Sea Level Rise Adaptation report addressed this concern through the recommendation of an MMP. A summary of marshfront vulnerability has been provided in Section 1.2.4.

2.1.2 Septic
The #2 priority of surveyed participants was septic systems along the marshfront, whether they might be leaky, outdated, or too close to the marsh. The existing sewage system on Folly Island extends from commercial district to Berts along Ashley and Sunset Point. Marsh islands are also on public sewage. Most of Folly Beach Island’s residential properties have septic tanks and the water table is only 3.5 feet deep on average. DHEC regulates septic systems by requiring a 75-foot buffer from the critical line.

When a septic tank is compromised (e.g., eroded off beachfront) and the City is made aware of it, the home is ruled unfit for occupancy until septic tank is fixed or relocated. City Ordinance 55.09 requires that when a residential property is sold, a septic inspection is required and enforced. City
Ordinance 55.07 requires a baseline septic inspection when the property becomes a short-term rental, then every 5 years thereafter.

Septic systems contribute to marsh pollution when septic tanks and drainfields are over-topped as a result of King tides, heavy precipitation events, storm surge inundation, erosion, and higher water tables due to sea level rise. Contaminants of concern include pathogenic organisms like fecal bacteria that cause illness in humans from ingestion or contact with contaminated water (EPA 2012).

2.1.3 Stormwater runoff (Drainage)
The #3 priority of surveyed participants was the potential for stormwater runoff to pollute the marsh. Roughly half of the roads and marshfront on Folly Beach have drainage infrastructure to collect stormwater runoff. About 10 underground drainage systems take runoff to the marsh through 24 or 30” diameter pipes with tide check valves that discourage saltwater from entering the drainage system at high tide. Other drainage mechanisms include wetland-type ditches that aim to direct stormwater to the marsh.

Inevitably, some pollutants are draining to lower elevations including the marsh and upland soils. Stormwater runoff is rain mixed with pollutants on impervious surfaces (rooftops, driveways) like oil, grease, and coolants from vehicles; fertilizers and pesticides from gardens and homes; bacteria from pet wastes and leaky septic systems; sediment from construction sites, etc. Stormwater runoff entering the marsh can have negative impacts like over sedimentation which may increase elevations out of the narrow marsh elevation window, destroying existing marsh; algae blooms that remove oxygen from the water; human health hazards from bacteria and pathogens; death or injury to marine organisms from for example debris and plastics, etc.

Controlling stormwater with vegetative buffers is one of the most effective ways to protect salt marsh habitat (see Appendix 6.2). According to Morganello and Rose (2013), vegetative buffers provide the following benefits:
1. Reduce pollution in stormwater runoff,
2. Reduce shoreline erosion and property damage caused by flooding,
3. Provide increased privacy to the homeowner while still maintaining a view corridor,
4. Serve as wildlife habitat, and
5. Save the homeowner money, especially when native plant species are dominant, as little to no water, fertilizers or pesticides are needed to maintain this area of the yard.

Through Charleston County, the City of Folly Beach has been contracting with Clemson Extension in the Ashley Cooper Stormwater Education Consortium for several years. The Consortium provides stormwater related outreach and education directly to Folly Beach. Recent efforts have included metal disks marking storm drains along Center Street indicating that the water drains to the river. The consortium also hosts an annual rain barrel sale in early summer which offers rain barrels to

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5 [https://www.clemson.edu/extension/carolinaclear/regional-consortiums/acsec/index.html](https://www.clemson.edu/extension/carolinaclear/regional-consortiums/acsec/index.html)
Folly property owners at 50% off. The consortium’s 2018 strategic plan focuses on three types of pollutants: bacteria (e.g., from septic systems and pet waste), nutrients, and microplastics.

The City contracted with a consultant to conduct a City-wide drainage study as a result of the recommendations of the Sea Level Rise Adaptation report. The study held its kick-off meeting in August 2018. The drainage study will assess the city’s drainage infrastructure which includes drainage outfalls that cross the critical line and flow into the marsh. Stakeholder input from this and the Sea Level Rise adaptation reports will be incorporated. Completion is expected by fall of 2019.

According to the project manager, the objectives of the study are to 1) collect supporting data including potential field survey information and inspection of all components of the drainage system; 2) organize the data (catalog) including creating a comprehensive inventory and map; 3) create a drainage study (2 Dimensional) of existing and future conditions; and 4) provide drainage recommendations that can be incorporated into a Capital Improvement Plan and where grant applications can be developed.

Other coastal municipalities are investing in major drainage and infrastructure improvements to improve flood protection. For example, the City of Charleston has made a $235 million capital investment in drainage improvements (tunnels, pumps) and transportation improvements (roads, seawalls) between 1990 and 20206.

2.1.4 Bulkheads
The #4 priority of surveyed participants was the use of bulkheads on private marshfront land and the impacts on the existing marsh and adjacent shorelines. To obtain City permission to install a bulkhead on private marshfront property, a permit application is submitted that includes a site plan showing property lines, setback lines, and the OCRM critical line, as well as a scope of work that includes a description of the bulkhead construction materials. The permit application goes through both a building and zoning review to ensure compliance with the City’s seawall ordinance 151.23. There is presently no setback for bulkheads from the critical line.

During the passage of Hurricane Irene in the outer banks of North Carolina, marshes with and without sills protected estuarine shorelines from erosion better than bulkheads (Gittman et al. 2014). No damage was observed at marsh or marsh sill shorelines as a result of Irene; whereas, 76% of bulkheads were damaged. The study suggests that marsh vegetation and sills may provide better erosion protection than bulkheads. Another study suggests that property owners with bulkheads reported quadruple the annual maintenance costs as compared to those with natural shorelines and that despite increased use, hardened shorelines are not living up to homeowner expectations (Smith et al. 2017).

Additionally, bulkheads have the potential to exacerbate flooding by trapping water that emerges from the subsurface on the landward side of the shoreline. These subsurface waters may be contaminated or overloaded with nutrients from human sewage in septic drain fields.

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Concerns 2.1.1 through 2.1.4 were very important to surveyed participants (Figure 6), whereas the following concerns ranked lower in terms of prioritized concerns.

2.1.5 Scenic Views
Ordinance 166.10 prohibit exterior lights shining directly on the Folly River, but this is vague and difficult to enforce. New park sites for marsh viewing are primarily envisioned as pocket parks located in unopened right-of-ways with visual access to the marsh. For example, benches have been installed along the Erie Canal and a pocket park with a bench constructed in the right-of-way at 1585 East Ashley. The City has applied for state funding to aid in the development of this site.

2.1.6 Causeway impacts
Stakeholders are also concerned how the causeways might be affecting marsh health, perhaps by limiting circulation and perhaps exacerbating marsh dieback along the edges of the causeway. Large areas of marsh have been converted to mud flats over time. It is hypothesized that the causeway may be trapping sediment and causing excessive marsh accretion (i.e., elevation increase) which has resulted in this marsh dieback.

2.1.7 Public access
Public access was the lowest priority marshfront management concern of surveyed participants. For some people, marshes are considered dangerous and inhospitable places which are typically appreciated for their open space and aesthetic value from afar. Recreational values attached to marshes are for commercial and recreational fishing, or for ecosystem and wildlife viewing. Access by small watercraft is in demand.

There is limited physical access over or across the marsh beyond the County operated boat ramp on the west side of the Folly River Bridge on Folly Island and the public dock at the City of Folly Beach River Park on the northeast side of the bridge on the island. The 2014 Five Year Plan completed by the Folly Beach Parks and Recreation Committee calls for increasing both physical and visual access to the rear of the island. The first step includes small pocket parks located in City owned rights of way. Future plans also include two canoe/kayak launches in the footprint of the old bridges. One would be located northeast of the County boat ramp near the new bridge and the other across from Crosby’s on the north side of Folly Creek near the Clam Farm docks.

2.2 Prioritized Marshfront Management Concerns: Regulatory
The following prioritized concerns relate to the City’s ability to regulate marshfront activities in order to preserve and manage the marsh (Figure 7). Each concern includes a description of existing regulations.
No critical line map

The primary regulatory concern of surveyed respondents was the lack of a map of the critical line along the marshfront. SCDHEC OCRM does not maintain a map of critical lines for wetland areas. Each line is delineated on a lot-by-lot basis, but is not retained by the agency following permit processing. Due to this limitation, a significant survey effort would be required to determine how far existing development is located from the critical line. OCRM commissioned a statewide mapping study to inventory structures that cross the critical line (Jackson 2017) which was used in the marshfront inventory and shoreline analysis for this report.

Lack of regulations to manage

Upland of the critical line, coastal development regulation is the responsibility of the City; however, as mentioned previously, little marshfront management planning has occurred to this point. Aside from a 10’ setback from the critical line for impervious surfaces, few other regulations exist. Stakeholders are concerned that the city does not have adequate regulatory tools available to properly manage the marsh.

Mixed jurisdiction on marsh islands

The numerous marsh islands located between Folly Beach and James Island present a unique challenge for management. Only Long Island, the largest of the islands, is technically within the Folly Beach limits. The other islands scattered in the marsh are within in the jurisdiction of Charleston County. This mixed jurisdiction is the result of the annexation of the area which was written to only include the areas below the critical line. All the high ground of the islands (and also parcels along Sol Legare Road) were excluded. This means that these parcels are all currently split between the jurisdictions. Folly Beach has no authority over the use and dimensional standards on the high ground.
2.3 Prioritized Marshfront Management Concerns: Marsh

The following items are related to the submerged portion of the marshfront, defined as things that happen below the critical line, in the marsh itself, not on the upland private property. The main threats to salt marsh longevity include limited area for migration, failure to build up in elevation at the same pace as sea level rise, and marsh bank erosion (NYC Parks 2017). These items were prioritized within the top four concerns below (Figure 8).

Survey respondents were asked to select their #1 and #2 marsh-related management concerns. Top priority responses received two points and #2 priority responses received one point. The total points each concern received is depicted in Figure 8. Marsh response to sea level rise and planning marsh restoration are clearly of highest priority to stakeholders.

![Prioritized Marsh-related Management Concerns](image)

**Figure 8. Survey Results: Prioritized Marsh-related Management Concerns**

Here, it is important to keep in mind that although 10,000 acres of saltmarsh lie within the jurisdictional boundaries of the City of Folly Beach, the marsh (coastal tidelands) is owned and regulated by the state in most cases.

2.3.1 Marsh Response to Sea Level Rise

The Folly Beach salt marsh will be subjected to continued sea level rise over the next century. The rate of sea level rise will likely be faster than it was over the last century, when salt marshes were able to “keep up” with sea level rise. Preliminary findings from an ongoing study by the National Centers for Coastal Ocean Science in North Carolina (NCCOS, 2018) has measured salt marsh accretion rates between 2.3 and 9 mm/yr since 2004. This suggests that marshes will keep up with present rates of sea level rise (3.2 mm/yr, see Figure 3); however, if the rate of sea level rise accelerates, salt marshes will likely begin to decline.
Even if salt marshes are able to keep up with rising sea level, the accommodation space available for their migration is limited by coastal development. Natural salt marshes keep up with sea level rise by slowly migrating landward as sea level rises (Figure 9). Folly Beach stakeholders are concerned that coastal development has rendered the salt marsh unable to migrate and keep up with sea level rise. This restriction on natural habitat migration is known as coastal squeeze (ESCP, 2018). Marsh habitats become squeezed up against coastal development, such as bulkheads and buildings along the marshfront, as sea levels rise. This means the extent and function of the marsh will decrease over time, as well as the habitats and species that it supports.

Figure 9. Graphic depicting the difference between natural marsh migration and coastal squeeze from ESCP (2018).
A recommended action of NYC Parks (2017) is to protect and create pathways for marsh migration. This type of recommendation is more difficult to implement when the pathways for migration are privately owned, as opposed to publicly owned park property; however, the concept of regulating to allow the maximum amount of space for marsh migration is sound.

2.3.2 Planning marsh restoration

Folly Beach stakeholders are interested in learning more about options for marsh restoration, such as living shorelines. They are concerned about marsh degradation in general and specifically, a perceived over-oystering along the banks of tidal creeks within Folly Beach. Over oystering can reduce marsh bank stability. Oysters are efficient filter feeders that help maintain water quality. Oyster beds along the marsh provide shelter for other species and help keep marsh edges from eroding. Additional SCORE projects could be installed along the Folly Beach marsh edge, but determining the ideal location is a challenge.

SCDNR mapped boundaries of intertidal oyster reefs using aerial photography in 2003-2006, and updated in 2016, to create the SC Intertidal Oyster Reefs Map Application (http://www.dnr.sc.gov/GIS/descoysterbed.html). Figure 10 illustrates most of the oyster reef coverage within the City of Folly Beach jurisdictional limits. The map scale is an artifact of the online tool’s zoom function.

Figure 10. SCDNR 2015 Intertidal Oyster Reefs Map, vicinity Folly Beach (from http://www.dnr.sc.gov/GIS/descoysterbed.html)

The National Estuarine Research Reserve System (NOAA NERRS 2018) has established two marsh monitoring sites in South Carolina in the Ace Basin and at North Inlet-Winyah Bay. A variety of ecological and geological measurements are collected, which include sediment accretion or elevation change. No similar monitoring site exists in the marshes of Folly Beach. It is unclear whether results
from these sites would be applicable to Folly marshes. Folly Beach stakeholders hope to better understand the health of the marsh to inform the location for future restoration efforts.

Stakeholders have asked the following questions about future marsh restoration efforts:

▪ How to identify areas with poor marsh health for future restoration opportunities
  ▪ What are the appropriate metrics? Marsh bank erosion, over oystering, vegetative cover, elevation?
▪ How to fund?
▪ What is a good community-scale marsh restoration project?
  ▪ Living shorelines projects not yet practical on community scale, most happening at property scale

2.3.3 River-based vendors
Numerous vendors operate in the Folly River and therefore provide access to the marshes. River-based vendors include boating and fishing charters, kayak and standup paddle board tours and rentals, ecotours such as dolphin watching and salt marsh adventures, etc. Vendors that operate in the Folly River must obtain a Folly Beach business license, but are not required to pay a franchise fee. This is different from beach vendors, which are required to do both.

2.3.4 Bank erosion from boat wakes
Ongoing erosion along the water’s edge due to boat wakes is a threat to salt marsh longevity. Recreational boat traffic appears to be on the rise in the Folly River. Stakeholders have shown some concern that slow speed zones are limited, poorly marked, and not enforced along the Folly River.

2.3.5 Regular debris removal program needed
One survey respondent recommended that the city implement a regular marine debris removal effort along the marshfront and Folly River. Marine debris is any man-made, solid material that enters waterways through littering or indirectly via rivers, streams, and storm drains. Beach cleanups have become popular and can perhaps serve as a proxy for a similar program for the marsh and river.

2.3.6 Private and commercial docks
The construction of private recreational docks is one of the most popular ways for citizens to gain access to the creeks and waterways. SCDHEC OCRM is responsible for the permitting of docks within the critical area. State requirements include:

▪ Docks should not be located on or near sensitive natural resources, such as oyster beds.
▪ Docks typically must end at the first navigable creek.
▪ Dock length is limited to no more than 1000 feet.
▪ Docks typically cannot cross side extended property lines or dock corridor lines.
▪ Docks cannot restrict public access to and in state waterways.

A dock permit application can be obtained at local DHEC OCRM offices or online at: https://www.scdhec.gov/ocrm.
2.4 Prioritized Marshfront Management Concerns: Education

The following prioritized concerns relate to the need for educational programs related to marshfront management (Figure 11).

![Prioritized Educational Marshfront Management Concerns](image)

**Figure 11. Survey results - Prioritized educational marshfront management concerns**

### 2.4.1 Education of property owners and residents

Section 3.7 includes suggestions on individual actions that property owners can adopt to better manage the marshfront. This information could be incorporated into educational materials and included on the city website.

In addition, the South Carolina Sea Grant Consortium, on behalf of the Charleston Resilience Network, has received a Regional Coastal Resilience Grant from the National Oceanic and Atmospheric Administration (NOAA) to understand the capacity of the Charleston, SC, region’s infrastructure to handle nuisance and severe flooding. This information will allow the region to respond now to immediate needs and enhance adaptive capacity for future issues. Partners on the project include the S.C. Sea Grant Consortium, College of Charleston, The Citadel, and University of South Carolina.

The project includes several objectives, one which is engagement and educational awareness. Outreach events are conducted in representative communities and sectors in the Charleston region on vulnerability and actions to address these issues. The first engagement event occurred on July 10, 2018 in North Charleston. While this effort is not focused specifically on marshfront management, a similar outreach event on Folly Beach may be useful in educating the community about several of the priorities listed in this Section 2 that are related to flooding and sea level rise.

### 2.4.2 Visualizing parcel scale impacts

Most publicly available mapping tools (e.g., NOAA 2018) do not have the resolution to predict parcel scale flooding impacts from the combined effects of degrading salt marshes and future sea level rise. Site specific studies are typically required to provide property owners with detailed information.
Another element of the S.C. Sea Grant project described in Section 2.4.1 above is this type of localized modeling effort. Parcel level analysis is being conducted of flood impacts that incorporates tides, meteorological components, wind, surge, and infrastructure such as drains (Figure 12).

![Figure 12. Parcel-level analysis of flood impacts on the peninsula of Charleston (from http://www.charlestonresilience.net/projects/noaa-resilience-grant/)](image)

2.4.3 Educating public officials and staff
The survey of public officials and staff indicated that education of public officials and staff was not a high priority. The City of Folly Beach has done an excellent job providing information to elected officials during the ongoing moratorium, and their efforts have been applauded in the local press (Spees 2018).
3. Short-Term Marshfront Management Actions

This section translates the stakeholder concerns, prioritized by the survey and public workshops and discussed in detail in Section 2, into short-term actions. Each recommended action section describes the action and which prioritized marshfront management concern it addresses. Short-term marshfront management actions recommended by this plan include new local regulations, modifications to marshfront zoning, a marshfront structural inventory, a historical shoreline change analysis, and an engagement and education component. The short-term actions lay the foundation for future opportunities for marshfront management, which are discussed in the next section.

3.1 Regulatory Proposals

A number of proposed regulatory changes that relate to marsh management are under consideration during the waterfront building moratorium. The survey of city staff and elected officials prioritized an update of marsh island zoning as the highest priority (Figure 13) regulatory proposal. As described in this section, each of the proposed regulatory modifications addresses a specific concern that was voiced by stakeholders during the MMP process. The city is directly addressing every one of the upland marsh management concerns. As discussed previously, the city has direct authority to manage the upland. Management of the marsh areas below the critical line is out of the city’s jurisdiction. Some of the proposed regulatory updates will have a positive indirect effect on the marsh and indirectly address some of the prioritized marsh-related management concerns, such as marsh response to sea level rise (by creating a setback and marsh buffers).

![Figure 13. Survey results: Highest priority regulatory proposals of city staff and elected officials.](image)

The regulatory proposals address the upland marshfront management concerns, as discussed in Section 2.1 and the mixed jurisdiction of marsh islands, as discussed in Section 2.2.3. These new proposals also at least begin to address the concern discussed in Section 2.2.2, that the city had limited ability to manage the marshfront due to a lack of regulations.
3.1.1 Flood Protection
To address the concern of a loss of protection as flooding increases, as described in Section 2.1.1, the city is proposing to increase its freeboard requirement by one foot.

FEMA’s National Flood Insurance Rate Maps dictate the required minimum or base flood elevation (BFE) of new construction in a flood zone. Freeboard is any additional elevation above BFE that is added to the structure’s height as a safety factor against extreme flooding. The city’s new proposals increase the Folly Beach freeboard (elevation structures must be built above FEMA’s BFE) from 1’ to 2’. This also provides a benefit to the city’s FEMA Community Rating System (CRS) credits which result in a discount on residents’ flood insurance policies.

3.1.2 Septic
To address the concern of leaky, outdated and improperly located septic systems, as described in Section 2.1.2, the city is proposing that all new or substantially improved septic systems be located as far landward as possible on the site, regardless of DHEC septic allowances. The city is also proposing to adopt DHEC regulations for septic pump out schedules. In addition, any DHEC septic permit older than 2007 submitted as basis for new construction must also include a current survey establishing that original conditions of approval are met.

A new program is proposed to be administered by the water department. Each septic customer will be required to provide a certification by a licensed DHEC septic inspector for the tank size and occupancy. The standard short-term rental property with an average 1,000 tank (average occupancy of 8.7) would be subject to a once per year pump out or system inspection schedule, due to heavy use. This could be enforced during the annual business license reapplication.

3.1.3 Stormwater runoff (Drainage)
To address the concern of stormwater runoff and drainage of pollutants into the marsh, as described in Section 2.1.3, the marsh setback is proposed to be amended to prohibit pervious surfaces (to reduce the disturbance of the area) as well as impervious surfaces. The marsh setback may also be increased. The only construction allowed in the setback would be a bulkhead and associated riprap.

The new proposals also establish a natural buffer for all new construction and/or substantial improvement within the marshfront setback. The buffer can be undisturbed or natural, maintained with native vegetation. Appendix 6.2 provides educational materials about the types of native vegetation that are recommended, as well as best management practices. Property owners can also learn more about creating healthy, watershed-friendly landscapes through the Carolina Yards program.

3.1.4 Bulkheads
To address the concern of the use of bulkheads on private property, as described in Section 2.1.4, the new regulatory proposals require new bulkheads to be setback 10’ from the critical line to allow room for riprap. Any bulkhead/rip rap that is set back into the high ground must be covered and the setback planted with appropriate native vegetation.

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Clemson Extension, Carolina Yards: [https://www.clemson.edu/extension/carolinayards/](https://www.clemson.edu/extension/carolinayards/)
3.1.5 Scenic Views
To address the concern of preserving scenic views of the marsh, as described in Section 2.1.5, the new proposals require lights facing the river to shine downward and not out to the river. Safety lights on docks would also be required to be downward facing and hooded unless amber or green like standard river marking lights. In addition, a plan will be developed to address existing signs in the marsh.

3.2 Zoning Proposals
To address the mixed jurisdiction of marsh islands, as discussed in Section 2.2.3, the following zoning modifications are proposed.

1) Engage owners of Bowens Island and initiate rezoning to residential if warranted.
2) Rezone Long Island and other islands in Folly Marsh to match County’s zoning (in red bold) of Cole Island.
   a. Max Density: 4/3 units per acre.
   b. Minimum Lot Area: 10,500/14,500 square feet.
   c. Minimum Lot Width: 70/70 feet.
   e. Max Lot Coverage: 35/30 percent of high ground.
   f. Max Height: 35 feet above BFE.
   g. Allowable Uses: Single Family and associated Accessory Uses
3) Request a memorandum of agreement with Charleston County for coordination of any highland development on islands in their jurisdiction.
4) Amend CN zoning to allow private, non-commercial docks. Define commercial docks.
5) Add a requirement that any marsh island development require a letter or coordination with OCRM that the proposed development meets marsh island regulations.
6) Require platted access or deeded easements prior to issuance of building permit for new construction.

By matching County zoning on marsh islands, the critical line setback will increase to 35 feet on Long Island, Palm Island, and any other marsh islands that are developed in the future. In addition, number 4 above will address the marsh management concern, as described in Section 2.3.6, regarding private and commercial docks.

3.3 Marshfront Structural Inventory
Without a map of the marshfront critical line, it is difficult to inventory the habitable structures and bulkheads and their distance from the line. Based on a cursory analysis of the parcels that intersected a 2016 mean high water contour extracted from lidar data, this draft plan estimates that there are approximately 600 habitable properties on the marshfront within the jurisdiction of the City of Folly Beach. An inventory of the parcels and developed lots along the marshfront will be included in the final version of this MMP.

Jackson (2017) conducted a mapping study of the South Carolina coast that digitized all anthropogenic shoreline features (e.g. docks, seawalls, bulkheads) in the vicinity of the state critical line. Data from this study were used to create a map book depicting all marshfront structures...
located in the vicinity of the SC DHEC-OCRM critical line (Appendix 6.3). Figure 14 provides an example map for the area in the vicinity of the Folly River bridge. Twenty-seven maps depict the 393 marshfront structures that cross the critical line. These structures are dominated by private docks and bulkheads (Figure 15).

![Figure 14. Example of the marshfront structural inventory maps included in Appendix 6.3 for the highly developed area in the vicinity of the Folly River bridge.](image)
3.4 Marsh Shoreline Change Analysis: 1933-2014

SCDHEC, in partnership with the Governors' South Atlantic Alliance, is promoting the use of a spatial analysis tool that can be used by state and local coastal managers and scientists to improve comprehensive and hazard mitigation planning, post-disaster redevelopment, as well as determine areas best suited for restoration and mitigation efforts. **Hazard Vulnerability Assessment (HVA)** tool\(^8\). The HVA is an analysis tool that evaluates coastal hazard vulnerability from four hazards: storm surge, shoreline change rate (erosion or accretion), flooding, and social/economic vulnerability (SoVI\(^*\)). The final product is a vulnerability index on a scale of 1 to 5 (1 being the least risk, 5 being the most risk).

In addition to the shoreline structural inventory, Jackson (2017) also examined shoreline change rates along S.C. marsh shorelines. Data from Jackson (2017) were utilized in this study to produce Figure 16. After a detailed examination of the data, outliers that indicated very large shoreline change rates, for example near the mouth of Folly River, were removed. If one were to compare the HVA tool, which also utilizes data from Jackson (2017), and Figure 16, these data modifications would become obvious. In this example, the data were removed because a comparison of historic maps did not reveal that the shoreline change rates suggested by Jackson (2017) were realistic.

Changes affecting saltmarshes take place on variety of temporal and spatial scales, partly as a result of the dynamic nature of saltmarsh processes and partly due to changes in external forcing factors.

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\(^8\) [http://www.scdhec.gov/HomeAndEnvironment/Water/CoastalManagement/CoastalZoneManagement/CoastalHazards/](http://www.scdhec.gov/HomeAndEnvironment/Water/CoastalManagement/CoastalZoneManagement/CoastalHazards/)
such as sea level, tidal range, wave climate, sediment supply and human activities. It is important to identify the scale of natural fluctuation, as distinct from any net change, before intervention measures are considered and implemented. In the case of the dynamic shoreline changes near the Folly River mouth, it is important to recognize that these are natural shoreline dynamics that should be allowed to continue and do not require mitigation.

![Shoreline Change Map](image)

*Figure 16. Shoreline change rates along the marshfront within the City of Folly Beach between 1933 and 2014, modified from Jackson (2017).*

### 3.5 Planning Restoration Projects

The city can approach restoration efforts from both the upland and the marsh area below the critical line. Restoration efforts on upland city owned property are the most straightforward; whereas, marsh restoration projects require consultation with, and permits from, numerous state and federal agencies.

An example of a short-term upland restoration project could be a vegetative buffer and/or a rain garden at the City’s River Park. Marsh restoration efforts through existing state programs might include additional oyster reef builds with SCORE (Figure 5) or a youth wetland restoration project,
Seeds to Shorelines (S2S). S2S involves students in harvesting, cultivating, and transplanting young seedlings of salt marsh grass to restore an area of salt marsh. By collaborating with local groups, S.C. Sea Grant Consortium, Clemson Extension, and SCDNR, these types of restoration projects could be initiated in the next year.

The city should also partner with SCDNR and NERRS to gain a better long-term understanding of marsh health in order to most effectively plan, permit, and construct future marsh restoration projects. An analysis of marsh health could be determined by combining new monitoring data with various products that have been developed and compiled through this MMP, such as shoreline change (Figure 16) and oyster reef coverage (Figure 10).

An example of particular concern to stakeholders is the health of the marsh along the causeway where dieback and mud flats appear to be most prevalent. Further research is required to determine whether this observation is factual and if so, whether or not human intervention is needed. In many cases of marsh dieback, restoration is not immediately recommended because the root system often lies dormant and regrowth may occur naturally.

3.6 Septic Vulnerability Assessment

Short-term actions to address the effect of septic systems on the marsh, as described in Section 2.1.2, include the regulatory proposals discussed in Section 3.1.2 as well as the initiation of a septic vulnerability assessment. The 2017 Sea Level Rise Adaptation Report recommended the following implementation plan for a Septic Vulnerability Assessment, one of the top three recommendations of that report.

Recommended Adaptation Action: Septic Vulnerability Assessment

Near-term (1 year)

1. Enforce septic limitations on rental applications
2. Learn from other beach communities with septic challenges (Edisto, Sullivan’s, Isle of Palms, Nags Head NC, etc.)
3. Approach SCDHEC about possibly hosting a workshop to educate stakeholders and for communities to share lessons learned
4. Initiate a strategic education campaign of property owners and elected officials
5. Map and inventory septic tanks

Medium-term (3 years)

1. Hire an engineering firm to conduct a vulnerability assessment of septic at elevated water level scenarios, ID priority areas (Marshfront Management Plan may help), and provide estimates of cost per linear foot.
2. Consider a septic inspection incentive program

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9 S.C. Sea Grant, Seeds to Shoreline Program: http://www.scseagrant.org/Content/?cid=921
3. Continue strategic education campaign of property owners and elected officials

Long-term (5 years+)

1. Expand sewer to prioritized areas (high risk + enough customers)
2. Adapt strategic education campaign of property owners and elected officials

In addition to the new regulations on septic system testing, SCDHEC staff has presented to the Planning Commission during the MMP process. It has become clear that Folly Beach is not alone in their aversion to the wide-spread use of central sewer systems. Other communities appear to share the same concerns about the cost to design, construct and maintain the systems. They are also undesirable for communities who wish to limit development pressures. A majority, 85 percent, of properties in Nags Head, NC rely on private septic systems to collect, treat, and dispose of sewage.

The next step in implementation of the septic vulnerability assessment is a joint grant application with the North and South Carolina Sea Grant Consortiums to investigate septic tipping points for Folly Beach, SC and Nags Head, NC. This proposed study will study the benefits of alternative wastewater technologies and relocation of septic systems. The study will show how to maximize pollution reduction under various climate scenarios. Results of the study may modify the city’s long-term approach to wastewater management.

3.7 Engagement and Education

This MMP initiated a community engagement plan to better manage the marshfront within the jurisdictional limits of the City of Folly Beach. This planned two-way process engages stakeholders and gives them the opportunity to provide input that enhances the decision-making process on issues that may impact the stakeholders well-being and interests. The MMP process has informed and educated stakeholders about marshfront management challenges. This has happened through public information sessions and the city website. The city has also consulted with stakeholders during the MMP process by obtaining feedback on the regulatory proposals and other decisions during public meetings. In fact, a third level of community engagement has been achieved by the involvement of stakeholders, meaning the planners worked directly with the public throughout the process to ensure that public concerns are understood and considered. This has been done through workshops, deliberative polling, and expert panels.

The city should continue these community education and engagement efforts through partnerships with agencies such as SCDNR, South Carolina Sea Grant Consortium, and Clemson Extension. These agencies can continue to provide expert panels and help with the development of additional educational materials tailored to city residents and property owners. For example, Clemson Extension may be able to provide a Vegetative Buffer Workshop for interested marshfront property owners in 2019.

Steps to improve vegetative buffers to protect the saltmarsh are outlined in Appendix 6.2, and include how to maintain existing vegetation and a list of native plants to improve an upland buffer. Marshfront property owners should be encouraged to manage as much of their upland as possible.

11 International Association for Public Participation: https://www.iap2.org/
and/or desired, and not be limited to the regulatory setback. Morganello and Rose (2013) suggest a buffer maintenance zone up to 50 feet inland from the critical area. Property owners can also learn more about creating healthy, watershed-friendly landscapes through the Carolina Yards program\textsuperscript{12}.

The following information related to \textit{stormwater management} could be included in educational materials for property owners and residents. This information was obtained from the City of Charleston\textsuperscript{13}, S.C. Sea Grant Consortium, Clemson Extension\textsuperscript{14}, and Penn State Extension\textsuperscript{15}.

- Plant trees. Trees can reduce a city’s stormwater runoff by 2-7%. During a rainfall event of 1 inch, 1 acre of forest will release 750 gallons of runoff, while a parking lot will release 27,000 gallons.
- Capture Water via Rain Barrels. During a rainfall event of 1 inch, a 1,000 square foot roof can capture over 600 gallons of water.
- Install a Rain Garden. A planted depression that allows rainwater runoff from impervious urban areas, like roofs, driveways, walkways, parking lots and compacted lawn areas, the opportunity to be absorbed.
- Consider downspout planter boxes. A cross between a rain barrel and a rain garden. Downspout planter boxes intercept water from a downspout, allow it to slowly soak through the planted media, and then slowly re-enter the downspout after the initial flush of rainwater has passed. Diverting water away from the storm drain during a rainfall event reduces demand on the sewer system, and also cleans and filters water as it is absorbed by plants, or as it soaks through the layers of the downspout planter box.
- Green Roofs. Will intercept between 50 and 60% of rooftop runoff first ½ + inch rainfall

Educational materials could also encourage marshfront property owners and residents to minimize fertilizer use and impervious surfaces. They should also be made aware of the option to donate land to the Folly Beach Nature Conservancy, a land-holding 501c(3) created in 2001 to acquire vulnerable coastal properties. Many of the properties that have been donated to the conservancy are partially submerged.

River or marsh sweeps or clean ups could also be organized by local groups, such as Folly Green Team, Surfrider Foundation, and Adopt-a-Highway. Litter is not only an eyesore; it can also harm marine life. Deteriorating plastics create harmful and nearly invisible microplastics within 8 weeks of entering the marine environment\textsuperscript{16}.

\textsuperscript{12} Clemson Extension, Carolina Yards: \url{https://www.clemson.edu/extension/carolinayards/}
\textsuperscript{13} \url{https://www.charleston-sc.gov/DocumentCenter/View/12347}
\textsuperscript{14} \url{https://www.clemson.edu/extension/carolinaclear/}
\textsuperscript{15} \url{https://agsci.psu.edu/aec/research-extension/research-centers/center-for-green-infrastructure-and-stormwater}
\textsuperscript{16} \url{http://www.saltmarshguide.org/}
4. Marshfront Management Opportunities

The completion and implementation of the short-term marshfront management action items, discussed in Section 3, will lay the groundwork for future marshfront management opportunities for the city. These opportunities include mapping of the marshfront critical line, a more detailed inventory of habitable marshfront structures and bulkheads including their distance from the critical line, a marsh mitigation bank fund, a detailed outline of how other communities handle marshfront management, and continued public education and engagement.

As mentioned previously, SCDHEC OCRM is responsible for delineating exact boundaries of tidally influenced wetlands, which are known as critical areas per the State’s Coastal Zone Management Act. However, the state does not maintain a map of the critical line for South Carolina marsh shorelines. A map (i.e., GIS layer) of the critical line along the marshfront would be useful for future management and regulation of marshfront development. Presently, it is not possible to determine, without extensive field checking, the relation of the mapped bulkheads and other erosion control structures to the critical line. The city will require a continuous digitized critical line along the marsh for regulatory and planning purposes.

Once the marshfront critical line is mapped, a more complete inventory of development along the critical line can occur. The inventory will map and discuss all marshfront structures located in the vicinity of the critical line. The discussion should provide summary statistics on type and number of habitable structures along the marshfront. Provide a table (appendix) of structures which includes distances to critical line from any existing building, pool, dock, or erosion control structure(s).

To identify funding for implementation of the opportunities listed above, and for future marsh restoration efforts, the city could establish a Marsh Mitigation Bank fund which could be funded through dedicated annual revenues from the City’s General Fund, similar to the beach preservation fund, and required mitigation contributions when new marshfront proposals are violated. The fund could cover the City’s share of future restoration efforts, which may be cost shared with SCDNR, FEMA, or other state and/or federal agencies.

A detailed outline of how other local communities handle marshfront management and the elements of greatest concern to stakeholders (septic, drainage, bulkheads, setbacks, buffers, etc.) would provide a useful comparison for future planning and regulatory efforts. Comparing innovative marsh management concepts from coastal counties and municipalities along the U.S. East Coast can provide ideas for future adaptive management of this plan.

Continued public education and engagement is recommended to ensure the two-way feedback loop described in Section 3.7 is closed. Stakeholders will be advised of key findings and outcomes of the planning process, as well as adaptive actions in the future.

As mentioned previously, the MMP process is an adaptive management effort. Adaptive management is a structured, iterative process of decision making in the face of uncertainty with an aim at reducing uncertainty over time through monitoring. For purposes of this adaptive plan, the city should revisit this document following the implementation of the action items and opportunities.
to determine how effective the new policies and regulations have been. Based on knowledge gained from this review, future management can be improved. The MMP and its associated policies and regulations can be agile and adapt as the city moves into an era of increasing coastal challenges due to rising seas.
5. Prior Studies/References


NCA, 2014. U.S. National Climate Assessment, U.S. Global Change Research Program, www.nca2014.globalchange.gov (included more than 300 experts guided by a 60-member Federal Advisory Committee, and the assessment was reviewed by the public, federal agencies, and a panel of the National Academy of Sciences)


6. Appendices

6.1 Federal, State, County, and other Local Marsh Management and Authorities

The 10,000 acres of marsh within the jurisdictional limits of the City of Folly Beach are not owned by the city. Instead, much of the marsh has been divided up into private parcels and is owned by land trusts, homeowners associations, or LLCs. Regardless of ownership, the marsh is undevelopable and SCDHEC OCRM and the U.S. Army Corps of Engineers (USACE) have jurisdiction over them and any activities on them.

According to the Charleston District, the USACE has been involved in regulating activities by others in navigable waterways through the granting of permits since passage of the Rivers & Harbors Act (Section 10) of 1899. At first, this program was meant to prevent obstructions to navigation, although an early 20th century law gave USACE regulatory authority over the dumping of trash and sewage. Passage of the Clean Water Act (Section 404) in 1972 greatly broadened this role by giving the USACE authority over dredging and filling in the "waters of the United States," including many wetlands.

6.1.1 State Authorities

The State’s Office of Ocean and Coastal Resource Management (OCRM) is responsible for delineating exact boundaries of tidally influenced wetlands, which are known as critical areas per the State’s Coastal Zone Management Act.

A dock application can be obtained from a local OCRM office or downloaded at http://www.scdhec.gov/ocrm. A non-refundable permit application fee is required with an application. The fees are outlined in the application packet.

SCDHEC-OCRM established a Living Shorelines Working Group in 2017 to assess data from a Science Collaborative project from SCDNR and NOAA’s National Estuarine Research Reserves. From this assessment, OCRM will aim to develop a regulatory definition for "Living Shoreline", along with success criteria and installation guidance. Once regulations are promulgated, individual permits for living shoreline projects will be more easily obtained by individual property owners, ideally making such projects a more, or at least equally, attractive alternative to armoring.

In South Carolina, oysters may be harvested recreationally from State Shellfish grounds (labeled with an S and green polygon in Figure 17) and Public Shellfish grounds (labeled with an R and red polygon in Figure 17) with a Saltwater Recreational Fishing License. License must be in possession while harvesting. Most Public (recreational-only) and State shellfish grounds are marked with signs.
6.1.2 Local Government and Authorities

6.1.2.1 Municipality’s Comprehensive Plan

The following excerpts from the City of Folly Beach 2015 Comprehensive Plan relate to the marsh.

In general, the Folly Beach Comprehensive Plan seeks to eliminate existing encroachments on sensitive water fronts, marshes, wetlands, and riparian areas while encouraging environmentally sensitive development; “Engage more fully with...other sensitive areas to balance access with protection; Create buffer zones on top of setbacks to require planting vegetation during development and redevelopment.”

1) **Protecting Natural Resources.** In the next decade Folly Beach must be prepared to adapt to the effects of sea level rise, decreasing federal and state funding, and increased tourism. The Plan recognizes the need for proactively managing the beach, the river and marsh areas, and wildlife habitat within the City.

**Needs**

1) Property in Folly Beach includes beach front, marsh and wetland environments, and historically important lands and structures which must be protected through sensitive development. **(Land Use)**
Goal: Eliminate existing encroachments on sensitive water fronts, marshes, wetlands, and riparian areas while encouraging environmentally sensitive development to protect the environments that define the beauty of Folly Beach.

Implementation: Vigorous enforcement of ordinances such as setbacks, sand dune disturbance, and impervious surfaces. Incorporate recognized Green Building Practices into the Folly Beach Building Code.

10) Undeveloped, environmentally sensitive lands in the marsh behind Folly Island are not protected from intense development. (Natural Resources)

Goal: Protect marsh islands from inappropriately intense development.

Implementation: Create a new lower density zoning classification for Long Island. Work with Charleston County to ensure that marsh islands out of Folly’s jurisdiction are regulated.

6.1.2.2 Municipality’s Sea Level Rise Adaptation Plan
The City of Folly Beach 2017 Sea Level Rise Adaptation report utilized a participatory approach to explore adaptation actions for making the City more resilient over time. Long-term data from the National Oceanographic and Atmospheric Administration (NOAA) tide gauge at Charleston, SC document 12 inches (1 foot) of sea level rise since its installation in 1921. Folly Beach is already being impacted by rising seas, particularly during “King” tide events when stormwater drainage systems backup and flood low-lying roads and yards.

This report highlights several adaptation options and recommends that the City plan for 3 feet of sea level rise over the next 50 years, or by 2066, and that City Council should consider the top Sea Level Rise Adaptation Actions, prioritized by stakeholders and the public as follows: a) Drainage Management Plan, b) Septic Vulnerability Assessment, and c) Marshfront Management Plan.

The Marshfront Management plan is envisioned to be similar to the Local Comprehensive Beach Management Plan (LCBMP) most recently updated by the City in 2015 but with a focus on the marshfront shore of Folly Beach. The marshfront management plan would include a detailed inventory of all structures, property lines, habitat, erosion control devices, etc. as in the LCBMP. Management and adaptation options such as living shorelines would be considered.

6.1.2.3 Municipality’s’ Marshfront Development Regulations
This section provides a listing of all the Folly Beach ordinances that are relevant to marshfront management. This section will be completed in the final MMP.

City Ordinance 151.23 regulates seawalls

City Ordinance 166.05-03(4) limits impervious surfaces in residential zones to a maximum of 35% of lot high ground coverage.

City Ordinance 166.06-11(d) requires that all driveways and parking areas in residential zones shall be constructed of pervious material.

A 10-ft marshfront buffer, excluding erosion control devices (bulkheads), is included in City Ordinance 161.04-03.
6.2. Educational Materials
6.2.1 Spartina Alternflora Poster
The most common salt marsh plant species in the Southeast provides us with a wealth of benefits!

Habitat
- Salt marsh is the second-most productive ecosystem on the planet. Its productivity is fueled by the recycling of nutrients, largely from Spartina alterniflora. The plant dies in the fall, forms wrack, and breaks down (decomposes) to release its nutrients back into the system.
- Over 75% of the commercially important species in the Southeast use the salt marsh during their life cycle.
- A number of animals such as shrimp, crabs, fish, and birds use the marsh as nursery habitat, feeding grounds, and nesting areas.

Erosion control
- Spartina rhizomes (underground stems) and root mats stabilize the marsh mud, protecting against erosion.
- Spartina stalls break up wave energy before it reaches the land, lessening the impacts of storms.
- Spartina stalls also trap sediment which helps protect against sea level rise.

Clean water
- Salt marshes filter pollutants from the water column that enter our estuaries from non-point sources such as houses and roads.
- Spartina helps remove pollutants from the water, such as pesticides, heavy metals, and nutrients.
- Marsh sediment can act as a sponge, burying and absorbing pollutants, thus minimizing the toxic effects.

Spartina alterniflora
A salt marsh is a coastal wetland that serves as the transition zone between land and salt water. The dominant salt marsh plant in southeastern estuaries is Spartina alterniflora. This amazing plant can tolerate being covered by salt water twice a day.

Salt marsh distribution
Spartina alterniflora is found throughout the Atlantic and Gulf of Mexico coasts. It is a dominant coastal habitat with about 1,000,000 acres in North Carolina, South Carolina, and Georgia.

Leaf surface
Spartina can excrete salt from glands on its leaves which allows it to survive in salt water. Algae on the leaf’s surface provides food for grazers, such as the periwinkle snail.

Seasons in the salt marsh
Being a perennial plant, Spartina in the salt marsh is an excellent indicator of the changing seasons. In the spring, new Spartina plants grow from seeds and rhizomes. In the summer, the marsh takes on its distinct bright green color.

By fall, small white flowers will have developed along the upper stems, becoming a seed head. Leaves then turn a golden brown color and the seeds disperse. By mid-winter, dead Spartina breaks off and accumulates as mats of detritus ("wrack") on the surface of the mud.
6.2.2 Life Along the Salt Marsh: Protecting Tidal Creeks with Vegetative Buffers
The salt marsh is the transitional area where the rivers meet the sea, comprised of intertidal water bodies in which salinity can range from near ocean strength (30 parts per thousand) to brackish water (greater than .5 and less than 30 parts per thousand). The salt marsh is ranked as one of the most biologically productive ecosystems on earth, providing nursery grounds for many species of birds and fish, as well as vital wildlife habitat (SCDNR, 2010). Additionally, the salt marsh provides many services to humans, including flood control during major storm events, nursery grounds for many commercially and recreationally important fish and shellfish species, and serves as a filter for removal of sediments and pollution from the water.

Vegetative buffers are one of the most effective ways to protect salt marsh habitat (SC DHEC OCRM, 2002). Vegetative buffers provide the following benefits:

1. Reduce pollution in stormwater runoff
2. Reduce shoreline erosion and property damage caused by flooding
3. Provide increased privacy to the homeowner while still maintaining a view corridor (Figure 1)
4. Serve as wildlife habitat (Figure 2)
5. Save the homeowner money, especially when native plant species are dominant, as little to no water, fertilizers or pesticides are needed to maintain this area of the yard (SC DHEC OCRM, 2002).
Minimizing Impacts to the Salt Marsh, …Naturally!

After European arrival in the “New World,” salt marshes and other wetland areas were diked, drained, and filed for human use; by 1954, these activities contributed to the destruction of nearly 50% of the nation’s wetlands (Kusler and Opheim, 1996). Though salt marsh is now protected under federal and state and some local laws, human threats still exist largely in the form of stormwater runoff and shoreline hardening. As coastal counties become increasingly popular and more people move to and visit these areas, additional infrastructure such as roads, rooftops and parking lots are needed. This increase in impervious area can significantly impact pre-existing hydrology and result in a larger volume of stormwater runoff to nearby waterways. Additionally, more people also means more contributors of nonpoint source pollution caused by seemingly harmless daily activities such as bacteria and pathogens from pet waste, sediment from construction activities, excess nutrients from improper fertilizer application and gasoline and oil from vehicles. See HGIC 1850 Illicit Discharge Detection.

Steps to Successfully Improving your Vegetative Buffer to Protect the Salt Marsh

1. Before Planting

Due to regulations in place to protect the salt marsh, understanding local, state or federal authority is a first and necessary step. The South Carolina Department of Health and Environmental Control-Office of Ocean and Coastal Resource Management (SC DHEC-OCRM) has direct permitting authority over “critical areas,” defined as coastal waters, tidelands, beaches and dune systems. Any land disturbance planned within the critical area may require a permit from SC DHEC-OCRM, in addition to any necessary authorizations from the local and federal governments. In most cases, establishing a vegetative buffer occurs on the adjacent upland and does not require disturbance in the salt marsh defined as a critical area; therefore, a special permit may not be necessary. For the purpose of this factsheet, the recommended buffer establishment and maintenance actions take place in the upland area above the high water mark, thus inland from the critical area.
Trees and shrubs may be shaped and “limbed up” to frame a view rather than blocking it. Silhouettes of branches and moss can make the salt marsh viewscape even more dramatic and aesthetically pleasing.

Before planting, consider the existing topography, vegetation, and soil present at the site. Whenever possible, use the natural contours and keep existing vegetation in place. The underground structure of existing plants helps to prevent erosion by holding soil in place with their fibrous roots system. Avoid unnecessary erosion by minimizing disturbance to the soil when planting or grading the shoreline bank. As with any new planting, having your soil tested will take the guesswork out of the pH and fertility of the site. See HGIC-1652 Soil Testing.

2. Right Plant, Right Place

Using the “right plant” will increase the effectiveness and chances that the vegetative buffer will survive. Plant selection is narrowed by the dynamic conditions that exist adjacent to a salt marsh, including the ever-present elements of wind, salt, and exposure. There are few appropriate plants for such sites, and most of these will be the native plants that have adapted to the pressures of living near the salt marsh. Once established, native plants typically require less maintenance time and cost, while also supporting local wildlife such as birds and beneficial insects including butterflies and other pollinators.

3. Maintaining Your Vegetative Buffer Adjacent to the Salt Marsh

Maintaining your vegetative buffer is important in ensuring the continued success, function and aesthetic appeal of the buffer zone. For the purpose of this factsheet, the following recommended actions occur in the “buffer maintenance zone,” described as the area up to 50 feet inland from the critical area. Additional local buffer requirements may apply.

- Turf grass in the buffer zone: If turf grass exists within your buffer maintenance zone, the lawn should be kept at the maximum recommended height for the specific turf, which will allow for a more extensive root system, help stabilize soil, and afford a larger leaf area, which can work to slow runoff, and capture sediment. See HGIC-1205 Mowing Lawns.

- Irrigation considerations: Irrigating within the buffer maintenance zone should be minimized to ensure that excess fresh water does not run off into salt marsh or tidal creeks. Stormwater occurs through irrigation efforts as well as rainfall events and can transport harmful pollutants to area waterways.

- Chemical controls: Consistent with management recommendations for areas adjacent to freshwater shorelines, pesticides and fertilizers should be avoided in the buffer maintenance zone. Weed control is best done by hand pulling. Mulch can help to unify the landscaped area and will also protect plants by conserving soil moisture and moderating temperature; however, mulch should only be spread in the upper portions of the buffer area to avoid being carried away during high tides. To reduce the potential for weed growth in the buffer area, consider spacing plants closely together.

- Maintenance: Any cut or mowed plant material within the buffer maintenance zone should be removed so that excess plant material does not wash away, potentially leading to water quality issues and water navigation challenges.

Zones of a Vegetated Salt Marsh Shoreline
The Salt Marsh – The salt marsh is designated as a critical area; any activity-taking place in the salt marsh will require a special permit from a regulatory authority. The salt marsh should be left untouched by maintenance or home gardening efforts.

Salt marsh vegetation is constantly inundated with varying water levels dependent on the twice-daily influence of the high and low tides. Soil in the salt marsh remains permanently saturated, forming a substrate affectionately known in the Lowcountry as “pluff mud.” Each year, the salt marsh vegetation, predominantly *Spartina alterniflora*, (commonly referred to as Smooth cordgrass) goes dormant in the winter months and grows back in the spring. This is obvious to the naked eye as the salt marsh appears brown and drab in the winter, vibrant green in the summer months, and near golden in the fall. As the Smooth cordgrass dies, it decays to form the base of a complex food web supporting not only next year’s salt marsh growth, but also a diverse array of animal life. In areas located upriver thus further away from the ocean, the water is less salty; the dominant plant in the salt marsh is *Juncus romarieanus* (commonly referred to as Black needlerush).

The Intertidal Zone – The intertidal zone is part of the designated critical area; any activity-taking place in the intertidal zone will require a special permit from a regulatory authority. A vegetative buffer is created in the intertidal zone best by leaving the area untouched; for example, avoid the use of a lawn mower, weed eater or planting in areas reached by the high tide.

The intertidal zone is highly variable, parts of this zone may be inundated with water twice daily during high tide where as some portions of the zone may typically be above the high tide mark, thus rarely inundated by the tides. Regardless, this transitional area of land lies above water at low tide. Plants that occur naturally in this area and can potentially volunteer include the following:
Sweetgrass – *Muhlenbergia filipes* is a plant of cultural significance in the Lowcountry as the Gullah community utilizes this plant to make sweetgrass baskets. Sweetgrass has gained increasing popularity over the years as a landscape plant, and becomes the “queen of the garden” in the fall with a showy purple inflorescence. Sweetgrass grows naturally along the edge of the salt marsh and can tolerate full sun to part shade with some saltwater inundation.

**The Upland Zone** – The upland zone is the appropriate area to create a vegetative buffer where plants can be both aesthetically pleasing and help to protect water quality in the adjacent salt marsh.

The upland zone is the area of the bank slope that lies above the high tide line. Vegetation in the upland zone is not inundated with saltwater from high tides, but may be inundated with saltwater during major storm event such as hurricanes and tropical storms. Included below is a list of native grasses, perennials, and trees or shrubs that may be good plantings for your upland zone buffer.

Native Grasses:

- Sweetgrass *Muhlenbergia filipes*
- Bushy bluestem *Andropogon glomeratus*
- Sand cordgrass *Spartina bakeri*
- Saltmeadow cordgrass *Spartina patens*

Perennials:

- Seaside goldenrod *Solidago sempervirens*
- Firewheel *Gaillardia pulchella*

Trees and Shrubs:

- Live oak *Quercus virginiana*
- Yaupon holly *Ilex vomitoria*
- Groundsel tree *Baccharis halimifolia*
- Beautyberry *Callicarpa americana*
- Spanish dagger *Yucca filamentosa*
- Saw Palmetto *Sereno repens*
- Red buckeye *Aesculus pavia*

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*Sweetgrass – Muhlenbergia filipes* is a plant of cultural significance in the Lowcountry as the Gullah community utilizes this plant to make sweetgrass baskets. Sweetgrass has gained increasing popularity over the years as a landscape plant, and becomes the “queen of the garden” in the fall with a showy purple inflorescence. Sweetgrass grows naturally along the edge of the salt marsh and can tolerate full sun to part shade with some saltwater inundation.
Groundsel tree – *Baccharis halimifolia* is a member of the Aster family and is extremely salt tolerant. This shrub is very attractive in the fall when the female plants bloom and make white snowy clusters of airborne achenes. The flowers are also a very important nectar source to pollinators, especially honeybees and migrating Monarch Butterflies.

Sand Cordgrass – *Spartina bakeri* is related to the dominant plant in the salt marsh, *Spartina alterniflora*, yet *S. bakeri* thrives naturally in isolated freshwater wetlands. Sand cordgrass also does well in dryer conditions, but certainly does not thrive in consistent saltwater intrusion as Smooth cordgrass. For this reason, Sand cordgrass should be planted well above the high tide line. Sand cordgrass can take full sun and makes for an excellent buffer as it grows low and thick, thus allowing a view while also slowing stormwater runoff. Like Sweetgrass, Sand cordgrass is becoming increasingly popular in the landscape industry.

Beautyberry – *Callicarpa americana* is a deciduous shrub with opposite leaves and small light lavender sessile flowers which are fragrant and attractive to beneficial insects. In the fall, clusters of bright purple berries appear and are eaten by birds. Beautyberry can grow up to 8’ but it may be pruned in winter without sacrificing its glamour.

Live oak – *Quercus virginiana* is one of several important oak species found in the upland zone. The Live Oak is the most notable and grand with its low spreading branches and it produces acorns and habitat for many species of small mammals, reptiles, birds, and insects. Live oaks are frequently adorned with two epiphytic species Spanish moss (*Tillandsia usneoides*) and Resurrection fern (*Pleopeltis ploypodioides*). Laurel oak (*Quercus laurifolia*) and
Live oak – *Quercus virginiana*
Photo by Kim Counts, Clemson Extension

Saw palmetto is a low growing evergreen shrub that is both salt and drought tolerant. The Saw palmetto is one of four native palms found in South Carolina and its habitat includes maritime forests and coastal dunes. Saw palmetto can be planted in cluster form to create a ground cover or used as a stand-alone planting.

![Saw Palmetto](image)

*Saw palmetto – Serenoa repens*
Photo by Kim Counts, Clemson Extension

Saw palmetto – *Serenoa repens* is a low growing evergreen shrub that is both salt and drought tolerant. The Saw palmetto is one of four native palms found in South Carolina and its habitat includes maritime forests and coastal dunes. Saw palmetto can be planted in cluster form to create a ground cover or used as a stand-alone planting.

Yaupon holly – *Ilex vomitoria*

Yaupon holly – *Ilex vomitoria* is a coastal plain plant that has naturalized to more northern and western locations as it was thought to have been traded by early Americans for its use in ritual ceremonies. The leaves contain caffeine. Male and female flower on separate hollies; berries are produced on the female plants and utilized by songbirds for food. Yaupon holly is found in nature as an understory tree in the maritime forest. These attractive evergreen plants can be used as mass plantings and also single or multi-trunk small trees, limbed up as “see through” landscaping.

![Yaupon Holly](image)

*Yaupon holly – Ilex vomitoria*
Photo by Kim Counts, Clemson Extension

Red buckeye – *Aesculus pavia*

Red buckeye – *Aesculus pavia* is one of the first nectar sources for early migrating hummingbirds attracted to its clusters of red tubular flowers. It is found in maritime forests. Buckeye is a small deciduous shrub or tree and grows about 12 feet high. Deer do not eat them, and they grow well in wet or dry soils.

![Red Buckeye](image)

*Red buckeye – Aesculus pavia*
Photo by Kim Counts, Clemson Extension

Water oak (*Quercus nigra*) are also common and can tolerate some salt spray.
Wax myrtle – *Morella cerifera* is a favorite of birds who use them for nesting and cover as well as for food by foraging on the waxy berries found on the female plants. The leaves are mostly evergreen and are aromatic when crushed. Wax myrtle can grow to a 25 foot tree, but can also be maintained as a hedge, windbreak, or limbed up as a standard.

If this document didn’t answer your questions, please contact HGIC at hgic@clemson.edu or 1-888-656-9988.

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6.3 Structural Inventory Map Book