



2023

Folly 2050: Planning for Water



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6-Year Update to the 2017 City of Folly Beach Sea Level Rise Adaptation Report,

Prepared for:

The City of Folly Beach, SC

P.O. Box 48, Folly Beach, SC 29439

Prepared by:

Elko Coastal Consulting, Inc.

P.O. Box 1451, Folly Beach, SC 29439

(843) 371-782

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Initial Sea Level Rise Adaptation Report, Adopted in 2017

This Version (6-Year Update) Adopted by the City of Folly Beach on November 28, 2023

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Overview

Folly 2050: Planning for Water is a 2023 update of the 2017 City of Folly Beach Sea Level Rise Adaptation Plan. It includes recent climate data, as well as new infrastructure and drainage projects and policy updates. The 2023 update highlights the valuable work that the city has completed; the important work that is underway; and the essential work ahead.

The National Oceanic and Atmospheric Administration's (NOAA) 2022 Sea Level Rise Technical Report projects that by the year 2050, water levels will be about 1 foot higher than today and that today's flood will happen 10 times more often. The city also collects local water level data to plan for and respond to flood events in the community.

The S.C. Sea Grant Consortium and the College of Charleston's Lowcountry Hazards Center conducted a sophisticated, local flood mapping analysis to visualize future water level scenarios on Folly Beach in order to and to assess current and future vulnerability.

Over 150 stakeholders provided input to this plan to improve the city's resilience to flooding and sea level rise. Significant progress was noted since 2017 on drainage and marshfront management, but implementation was lacking in transportation and septic adaptation, as well as education educational outreach, such as flood and stormwater adaptation options. Despite progress, drainage and transportation remain the top concerns of property owners - in particular, the effect of flooding on access and livability (getting around the island, having to move vehicles when a King Tide is predicted, etc.). This plan serves as a framework to address these concerns.



Based on community input and key stakeholder feedback, initiatives are grouped under six **Adaptation Action Categories** to plan for Sea Level Rise (SLR):

- Building Codes/Zoning
- Transportation
- Land Management
- Drainage
- Septic
- Engagement

To ensure the plan is used to mitigate flooding on the ground, an Initiatives Chart is provided in the section on Adaptation Actions, along with an implementation timeline and more detail about each initiative.

Introduction

The City of Folly Beach is located on a barrier island and the adjacent lands on the Atlantic Ocean in Charleston County, SC. Known to Charleston locals as "the Edge of America," the city's vulnerability to coastal hazards is clear. In addition, the city's economy is entirely dependent on the water and ecosystems that surround it. Thus, managing these waters is critical for the community's future.

The city has invested significantly in its beachfront through a 50-year Local Cooperation Agreement (LCA) with the U.S. Army Corps of Engineers (USACE), which will be renewed for an additional 50 years in the near future. 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](#) (LCBMPⁱ).

Long-term management plans for other important city infrastructure projects were lacking. However, in 2015, high-tide flooding became a major concern for the city, and in an important act of foresight, the Comprehensive Plan was updated at this time (five years before mandated by the state) to add resilience elements. The initial [Sea Level Rise Adaptation Plan](#)ⁱⁱ was adopted in 2017 ("the 2017 plan"). It was envisioned to be a living document, revisited regularly to assess implementation, and adapted as needed for improved flood mitigation.

The city immediately began implementing recommendations from the 2017 plan. An Island Drainage Study and Stormwater System Assessment ("drainage study") was completed in 2018. During the development of [dune and marsh management plans](#)ⁱⁱⁱ in 2018, City Council approved an unprecedented 9-month coastal building moratorium on the development of properties on either the beachfront or the marshfront. This proactive planning process resulted in the adoption of twenty-five new land use regulations including ordinances for setbacks, buffers, septic tanks, marsh-island development, dune protection, seawalls, increased freeboard and other regulations related to increasing resilience.

Adaptation actions that were identified and prioritized in the 2017 plan are listed in Appendix A. This document is an update of the 2017 plan. Note that flood mitigation provided by the beach and dune system was intentionally not a major focus of this document as recommended by the 2017 plan due to significant prior planning and investment in that area. New guidance based on recent observations and the latest science provided by federal and state agencies and South Carolina universities, is used to inform the revised initiatives. In this update, the city partnered with the S.C. Sea Grant Consortium, the College of Charleston's Lowcountry Hazards Center, and Elko Coastal Consulting (the "project team") to develop strategies for the city to adapt, or increase its capacity to adapt, to future SLR impacts. The project team utilized existing information, collected new data and input, and developed new products to inform and prioritize recommendations.

Motivation

The 2017 plan was informed by the U.S. National Climate Assessment^{iv}. In 2023, the plan update was, in part, inspired by the publication of the federal interagency report, “*Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines*” (2022 Sea Level Rise Technical Report^v) and its accompanying *Application Guide for the 2022 Sea Level Rise Technical Report*^{vi}.

Two of the Application Guide’s key takeaways strongly influenced this planning effort (Figure 1):

- 1) Sea level along the U.S. coastline is projected to rise 1 foot by 2050, and
- 2) Today’s moderate floods are expected to occur 10 times as often by 2050.

Based on this updated science, the city adopted a revised planning horizon to anticipate **1 foot of increased water level by 2050**.

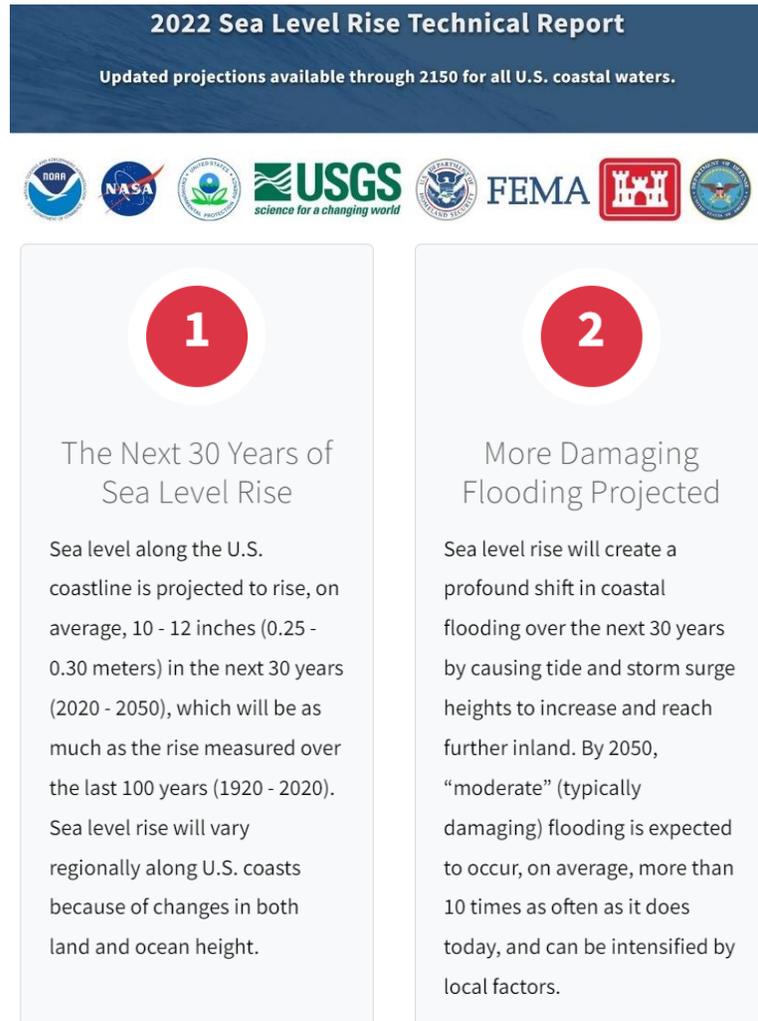


Figure 1. Top two key takeaways from the NOAA 2022 Sea Level Rise Technical Report.

The 2017 plan utilized data from a nearby tide gauge (NOAA station 86655300) in Charleston, SC, located at the Cooper River Entrance.

This gauge remains an excellent indicator of long-term SLR as it has been operational since 1921. In 2023, relative sea level was rising 0.135 inches (3.44 mm) per year (Figure 2), an increase in the rate of SLR of 0.23 mm per year since the 2017 report.

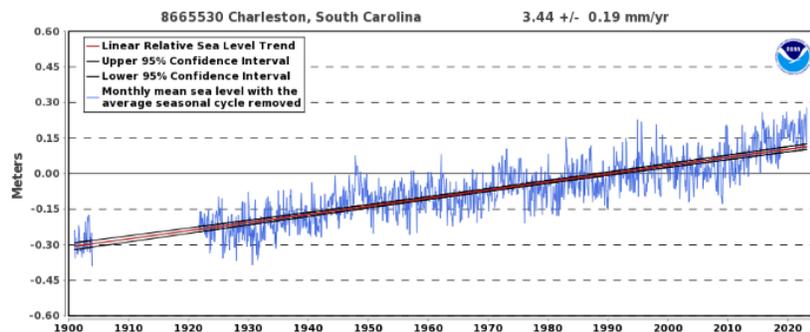


Figure 2. Observed monthly mean sea level in Charleston, SC from 2023 showing a rate of 0.135 inches (3.44 mm) per year. From NOAA Tides & Currents.

Local Water Level Data

The city installed a local water level sensor (a closer, low-cost tide gauge) on the Folly River bridge in March 2021. Today, real-time water level data helps inform decisions related to flooding and SLR adaptation. For example, the city set a flood threshold elevation at 7.8 feet above mean lower low water (MLLW), which corresponds to King Tide related impacts on Folly Beach (Figure 3). Appendix B defines the tidal datums used in this plan.

During the fall of 2022, the custom flood threshold was exceeded three times in 90 days, or about once per month. The Technical Report suggests that Folly Beach should expect this flood threshold to be exceeded at least **10 times per month by 2050**.

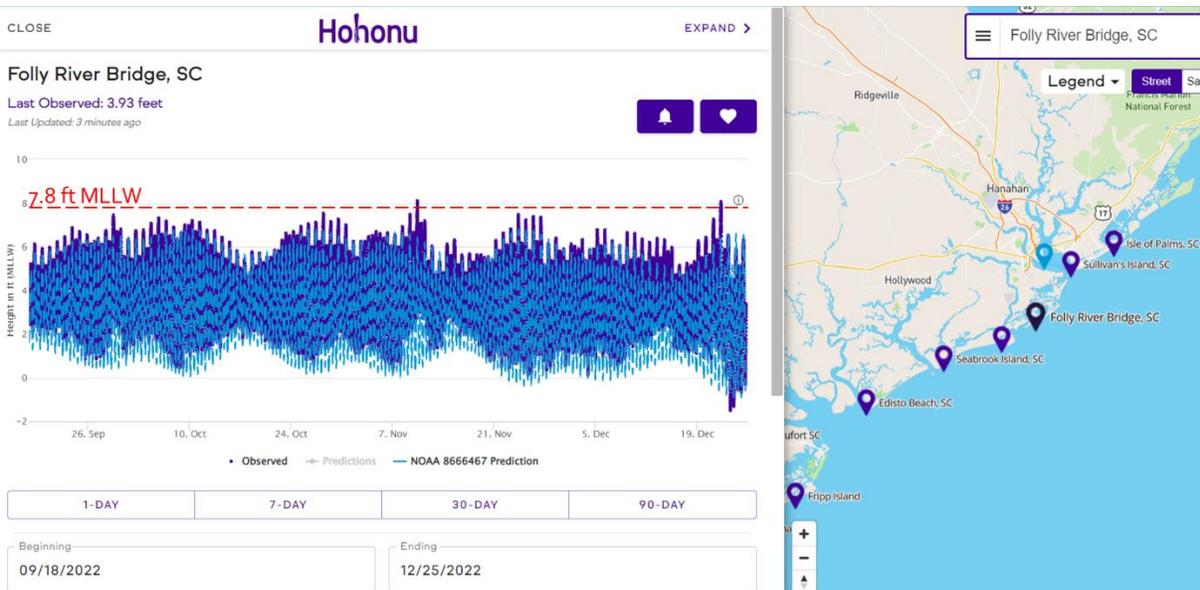
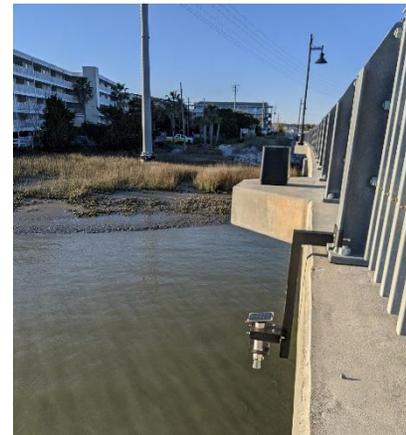


Figure 3. Water level data collected at the Folly River bridge during the fall of 2022, illustrating three flood events that met or nearly met the city's self-determined flood threshold of 7.8 ft MLLW. <https://dashboard.hohonu.io/map-page>

This observed King Tide water level elevation is roughly 2 feet above today's average high tide (mean higher high water [MHHW]) and was used to develop an estimate for a 2050 King Tide of about 9.5 feet MLLW (Appendix B).

Flood Mapping

In the 2017 plan, output from the NOAA Sea Level Rise viewer depicting 3 feet of base SLR was used to help stakeholders understand potential water level scenarios. In 2023, the College of Charleston's Lowcountry Hazards Center and the South Carolina Sea Grant Consortium conducted a sophisticated, local flood mapping analysis to develop an interactive online tool. The [mapping analysis](#)^{vii} used elevation data, geospatial locations of roads, parcels, buildings, and businesses, and tidal flood heights modeled at half foot increments above MHHW (5.76 feet MLLW) (Figure 4). This mapping tool played a critical planning role in the community engagement process and was utilized during each step of plan development, including monthly team meetings.

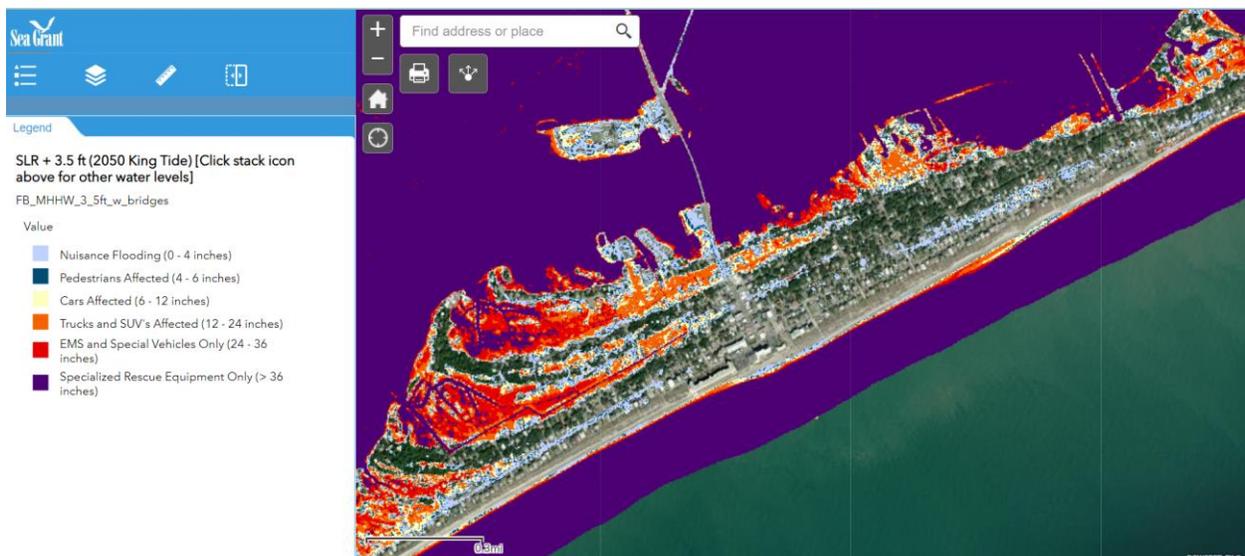


Figure 4. Tidal Inundation & Asset Vulnerability Application developed by the Lowcountry Hazards Center at the College of Charleston and S.C. Sea Grant Consortium to assist this plan.

Community Engagement

Municipal leaders, residents, business owners, property owners, external technical experts, and other key stakeholders developed the vision for this plan. The engagement process, outlined in this section, was designed to provide multiple opportunities and methods of responding to ideas and indicating preferences. Community input was the cornerstone of this project, and included a website, emails, and social media posts; an online survey for Folly property owners and residents; a [Flood Reporter](#) website to allow sharing of photos and public input; interviews with key stakeholders; an in-person planning charette (Figure 5); and a public engagement station held in conjunction with a community event at the Folly Beach River Park.



Figure 5. Key stakeholders met in April to review implementation of 2017 actions and co-develop new recommendations for the plan update.

First, a website and communication campaign (emails and social media blasts) were developed to share information. A public survey was released to understand residents’ concerns, specific locations, timing, and depth of flooding, and opinions on how well the city was doing with plan implementation. A [Flood Reporter](#) website was also developed by the College of Charleston and South Carolina Sea Grant Consortium to allow residents and visitors on Folly Beach to report flooding photos and information.

Internal Self-Assessment

This 2023 update began with the project team reviewing adaptation actions from the 2017 plan to assess implementation progress (Figure 6). Results from the assessment reveal significant implementation progress on drainage management and drinking water delivery improvement for which the city has received substantial funding and constructed several projects (Appendix). City staff scored other actions such as a septic vulnerability assessment and outreach to property owners and elected officials lower because these have not been notably implemented since 2017 (Figure 6, green and white numbers).

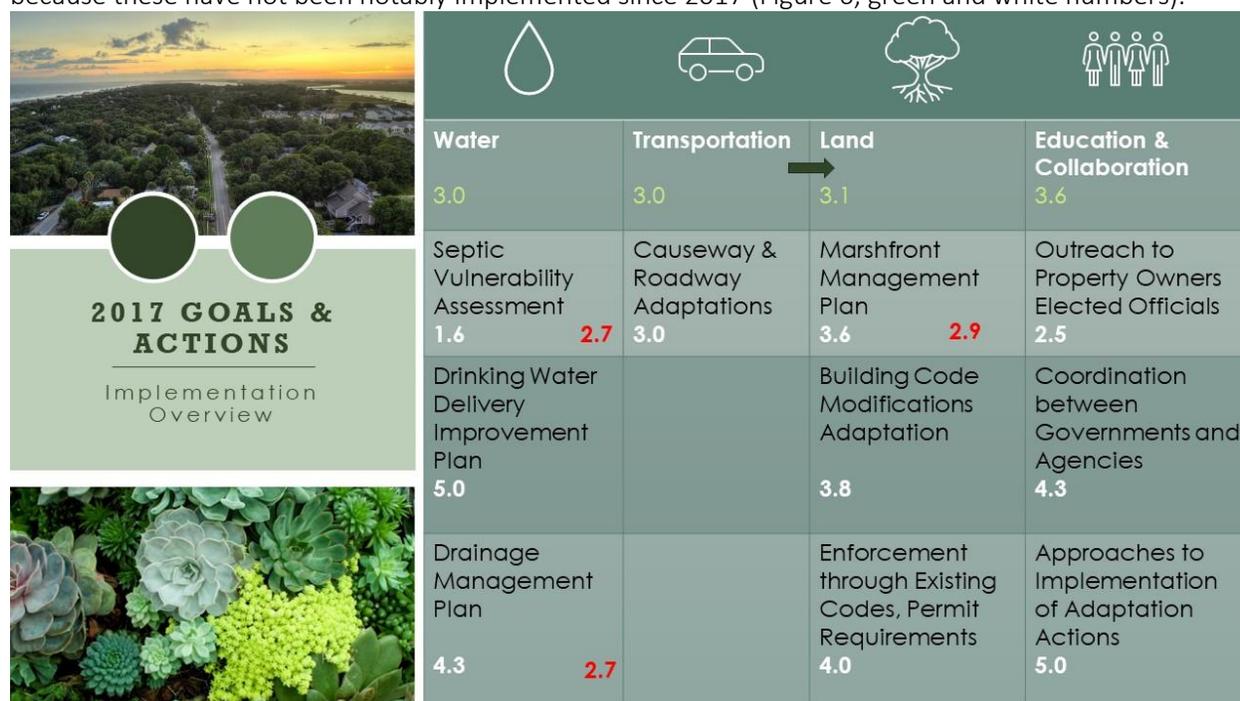


Figure 6. Assessment of implementation of 2017 adaptation actions by city staff (white numbers scaled 1-5; increasing with positive perception) and public survey respondents (red numbers). An example survey question was, “How satisfied are you with how the city is addressing marshfront management? For example, setbacks, bulkhead management, inventory/mapping, etc.”

Public responses from a survey (see Community Concerns) reveal lower implementation scores as compared to the city staff assessment for septic, drainage, and marshfront management alike (Figure 6, red numbers). Results from the self-assessment suggest that informed content of the subsequent interviews with key stakeholders, the residents’ online survey, and the planning charette.

Interviews with Key Stakeholders

In early 2023, the consultant conducted interviews with key stakeholders to understand present flood concerns, progress on 2017 plan recommendations, and remaining or new needs and gaps. Interview outcomes and preliminary public survey results were used to inform a collaborative, in-person, planning charette. Internal and external stakeholders were interviewed and ultimately invited to a planning charette (Appendix D). Internal stakeholders included elected/appointed officials, staff, and residents of

Folly Beach. External stakeholders included experts from county and state agencies, non-profit organizations, and neighboring communities. Interview questions are listed in Appendix D.

Internal stakeholders

Ten internal stakeholders including property owners, city staff, and commission/board members were interviewed. Their greatest concerns were transportation (4), septic (3), marsh management/bulkheads (2), land management (2), and environmental and human health (pollution) (2). These interviews revealed that while concern about flooding and SLR is significant, residents are not well informed about the city's SLR implementation efforts. Additionally, interviewees expressed a willingness to pay or help fund SLR projects, as long as benefits are perceived and communicated.

External stakeholders

Fourteen external stakeholders from 12 different organizations were interviewed. Most stated that the city is a resilience leader in the region, on par with the City of Charleston, they are aware of the city's SLR planning efforts, and they perceive that implementation is going well. The exception was a wastewater management expert who stated that planning and implementation are severely lacking.

In general, the city was commended for selecting a 3-foot planning scenario in 2017 and for its implementation progress on drainage and marshfront management. Limitations were noted in septic adaptation by seven interviewees (7), on-site stormwater management (3), education (3), groundwater monitoring (2), and roadway adaptation (2).

Community Concerns

An online survey for property owners and residents was open from April to June 2023 for the project team to better understand stakeholder concerns over the problems higher water levels are causing. Almost all the 140 Folly Beach property owners that responded to the survey are concerned about flooding (Figure 7).

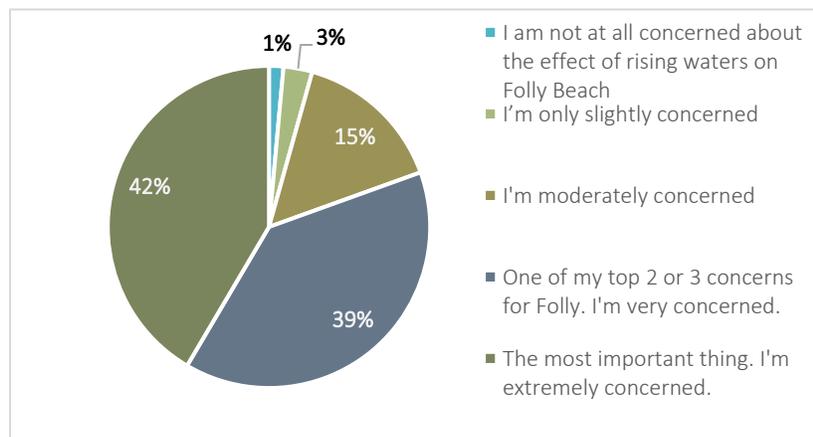


Figure 7. Survey responses to the question, "How would you rank these relative to other Folly concerns (like traffic, Short Term Rentals, etc.)?" n = 140

In Figure 8, survey respondents ranked their top concern as drainage, with a score of 4.1 out of 6, (with environmental and human health concerns a close second at 4.0 out of 6). The lowest ranked concern was wastewater management, with a score of 2.7 out of 6.

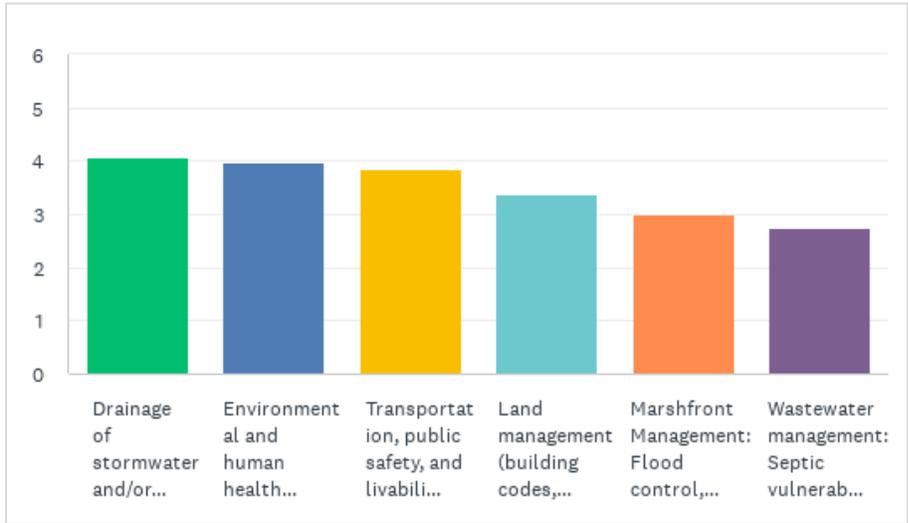


Figure 8. Survey responses to question, "Please rank your greatest non-beachfront concerns related to increasing water levels?"

About 60% of survey respondents also indicated that water backs up through storm drains and/or floods the road or their property during King tides or moderate storm events. Road flooding was reported to be between a few inches and up to 36 inches in some areas. The most significant flooding reported in the survey was flagged and included in the Priority Flood Areas section. Most survey respondents indicated that they drive through flood water on the city's roads at least once or twice a year, if not more (e.g., Figure 9).



Figure 9. Photo of vehicles driving through flooded roadways on Folly Beach. Most residents report having to drive through floodwaters at least once or twice a year, if not more.

Planning Charette

A full-day planning charette with key stakeholders was held on April 19, 2023 at the Folly Beach Community Center (Appendix). The goal of the charette was to co-develop adaptation actions, recommendations, and educational strategies based on concepts introduced during the meeting (informed by the interviews) and modified on-the-fly with the participants. Participants were challenged to envision:

- How will Folly have adapted to sea level rise by 2050?**
- What Land Management, Water Management, Education/Coordination actions are needed?**



The charette began with lightning talks about flood mapping conducted by the College of Charleston Lowcountry Hazards Center, the James Island Creek Watershed Management Plan (septic), and the Kiawah Conservancy’s Nature-Based Solutions Manual. The remainder of the day was spent interacting with stations in small groups to share ideas, amend concerns voiced in 2017, and amplify priorities for the 2023 plan update. The charette concluded with a facilitated group discussion to refine initiatives for each of the adaptation actions.

Public Engagement Event

The final public engagement activity was held in conjunction with a community event at the Folly Beach River Park on July 18, 2023. The project team hosted an engagement session for residents to interact with the flood maps, discuss concerns, and learn how they could get involved.



Vulnerability Analysis

The [mapping analysis](#) was introduced in the section on Flood Mapping (Figure 4). First, the impact of flooding on public and private assets, such as buildings, parcels, and septic systems, was considered in a 2023 SLR vulnerability analysis. The assets analysis revealed that 20% of septic systems, 35% of parcels, and 46% of building footprints will be impacted by a 2050 King tide event (i.e., 3.5 feet of added water level about MHHW; Figure 10). Note that parcels are counted as impacted when any level of water reaches the center point (not just a corner) and building footprints can refer to the slab under an elevated home.

Next, a preliminary streets and stormwater vulnerability assessment was conducted. The streets analysis included all roadways shown in the highlighted areas of Figure 4, whether within the jurisdictional limits of the City of Folly Beach or outside of that area, but critical for access, in Charleston County (Appendix). Stormwater infrastructure analysis was for Folly Beach only. In this analysis, a linear foot of roadway or stormwater system is counted as impacted when water reaches or touches the infrastructure. Results show that 37% of roads and 70% of stormwater infrastructure will be inundated by a 2050 King tide event (Figure 11). It is important to note that stormwater systems are typically beneath the ground surface and therefore should be interpreted with caution when considering this above-ground flooding.

This analysis offers a glimpse of possible impacts from future flood events. A more detailed analysis is recommended in the Transportation section to better quantify flood water depths and impacts on livability, transportation, and public safety. For example, one foot of water on a roadway generally affects access by cars and trucks, whereas two feet or more of flooding limits transportation to EMS and special vehicles only. By incorporating transportation networks into the analysis, we will gain better information on, for example, the number of homes made inaccessible by different water level scenarios. Public education should follow such a detailed analysis to help residents understand that just because their road or parcel isn't flooded, that doesn't necessarily mean they can safely access their property.

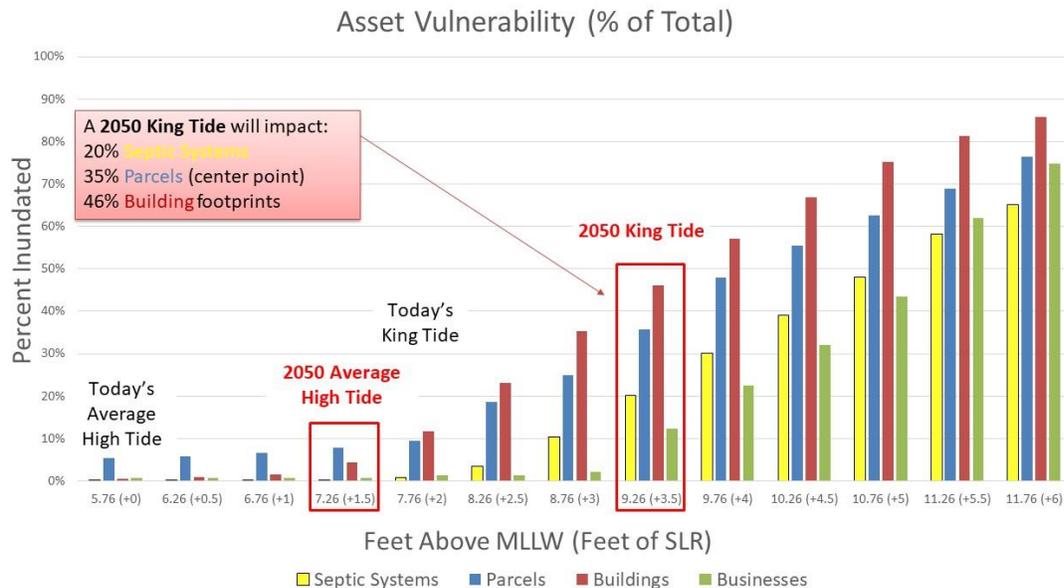


Figure 10. Vulnerability analysis developed from flood mapping showing the percentage of assets (septic systems, parcels, buildings, businesses) that will be impacted with increasing water levels.

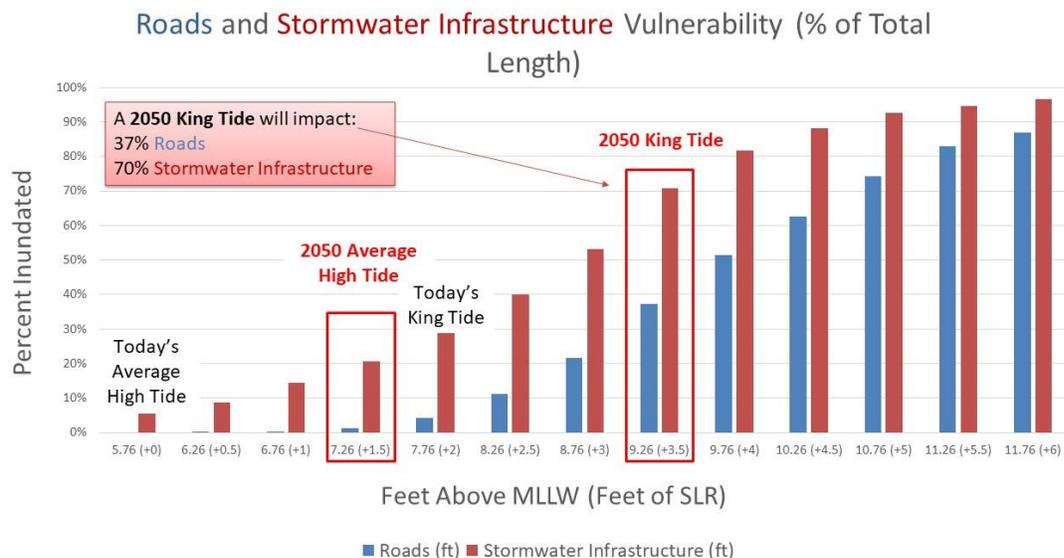


Figure 11. Vulnerability analysis developed from flood mapping showing the percentage of the length of roadways and stormwater infrastructure that will be impacted with increasing water levels.

Priority Flood Areas

The flood mapping vulnerability assessment, community survey responses, and flooding photos (from the Flood Reporter) were combined onto one GIS map to better highlight areas of immediate concern. Locations where all three of these mapped metrics coincided were then compared to previously identified drainage priority locations to develop priority flood areas for this plan.

Priority flood areas are listed in (Table 1 and Appendix , Table 10). As an example, the top priority flood area at East Ashley, Cooper, Erie & Seacrest between 9-12th Street East was identified as the 3rd priority by the drainage study but no scoping or improvements have been initiated to date. This area is selected as a high priority flood area in this plan because in addition:

- 1) Mapping revealed substantial road flooding during a 2050 King Tide (2-3 feet of water),
- 2) Photos of flooding were submitted for this area, and
- 3) Survey responses indicated parcels with high flood severity (Figure 12).

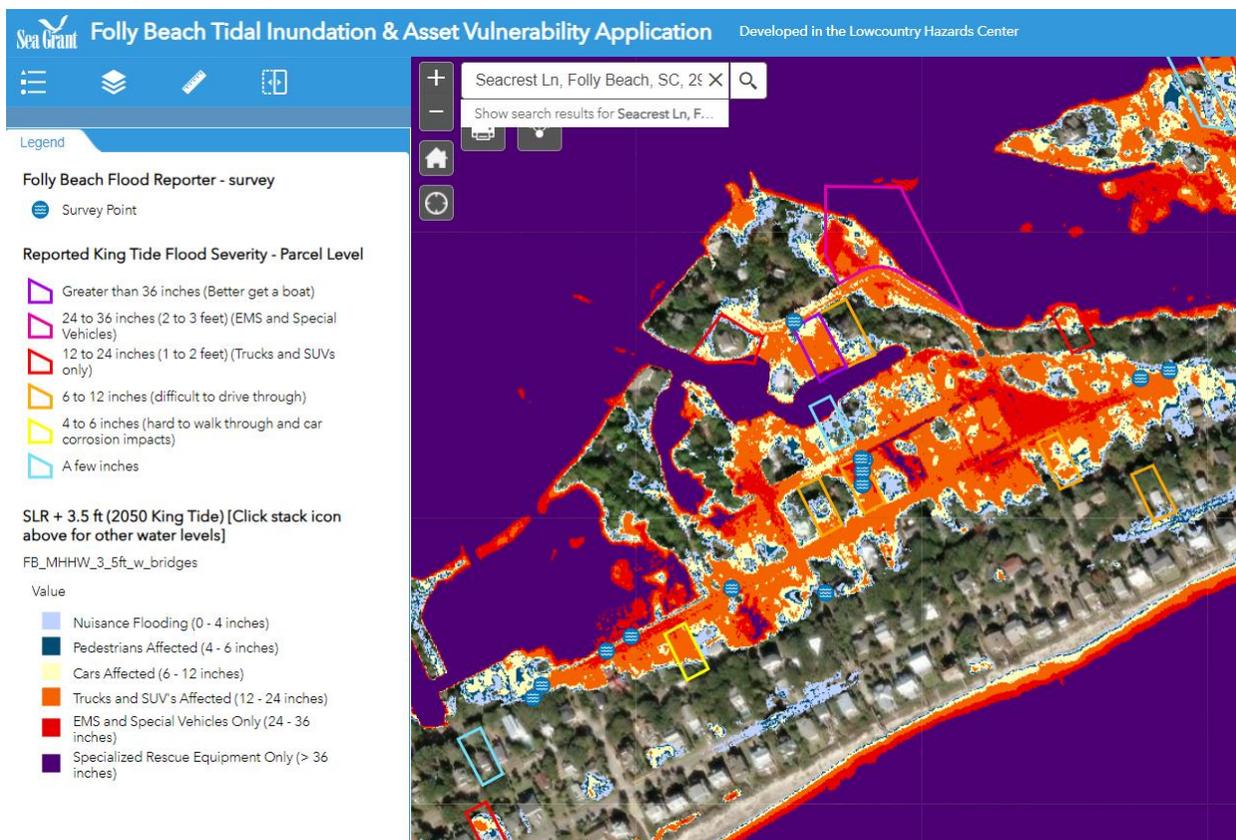


Figure 12. GIS map of this plan's top priority flood area in the vicinity of Seacrest Dr and 11th St East illustrating 2-3 feet of flooding at a 2050 King Tide, locations where photos were submitted to the Folly Flood Reporter (blue circles), and survey responses from residents of flooding at specific parcels (colored parcel outlines).

Priority flood areas identified in this plan update are ranked in Table 1. Locations labeled as having high SLR flood risk are projected to experience 2 to 3 feet of flooding during a 2050 King Tide; whereas, those with moderate risk are projected for 1 to 2 feet. Areas with projects and funding in place are also listed to ensure internal tracking. Finally, several private property areas from the East End, beyond the Washout, are included. High flood risk to public infrastructure is not projected beyond the Washout but several low-lying areas with frequent private property flooding should be monitored. Private property

flood challenges across the rest of the island are not listed because they are generally adjacent to impacted public infrastructure and would be/are being considered as part of city improvement projects.

Table 1. Priority flood areas ranked based on level of investment, flood severity, and stakeholder input. See Appendix for details.

| Rank | Priority Flood Area | Notes |
|-------------|--|--|
| 1 | E Ashley, Cooper, Erie & Seacrest (at 9-12th St. East) | No project; high SLR/drainage flood risk |
| 2 | Little Oak Island Drive | No project; moderate (mod.) SLR flood risk |
| 3 | 8th & 9th St. West & Red Sunset Lane | Drainage/roadway improvements; high SLR/drainage flood risk; add'l elevation increase needed |
| 3 | Tabby Drive (13th St. East) | Improvements ongoing; high SLR/drainage flood risk |
| 3 | Erie & 8th St. East | Improvements ongoing; high SLR/drainage flood risk |
| 3 | 1st & 2nd West Indian & Michigan | Improvements ongoing; high SLR/drainage flood risk |
| 7 | 4th and 5th East Indian | Improvements ongoing; mod. SLR/drainage flood risk |
| 8 | 9th & 10th St. East at Arctic | Dune infiltration pilot site; drainage flood risk |
| 9 | 1507 Forrest Ave. | Private properties; high SLR flood risk |
| 9 | 1722 East Ashley Ave. to Summer Place Lane | Private properties; mod. SLR flood risk |
| 9 | 1630-1670 East Ashley | Private properties; mod. SLR flood risk |

Adaptation Actions

This section provides an update on 2017 adaptation actions, informed by the Community Engagement activities. The city cannot implement these actions alone. They require community buy in and participation, as well as partnerships at the regional, state, and federal levels with supporting partners such as: similar communities, funding agencies, consultants, contractors, S.C. Office of Resilience, SCDHEC-OCRM, and other state agencies; NOAA, the Federal Emergency Management Agency (FEMA), and other federal agencies; and S.C. Sea Grant Consortium, Clemson Extension, and other educational partners.

Initiatives Chart

For the plan to fulfill its purpose, it must be supported by initiatives that implement the plan adaptation actions. Figure 13 illustrates the initiatives for each of the following Adaptation Actions prioritized in order of an implementation timeline: Building Codes/Zoning, Transportation, Land Management, Drainage, Septic, and Engagement. The next sections of the plan detail the initiatives for implementation.

While a separate section is dedicated to engagement, it is an essential element to the implementation of all the adaptation actions. To flag the importance of engagement, the chart includes an overarching action to communicate (virtually and on-site) how new projects will help residents as soon as possible.

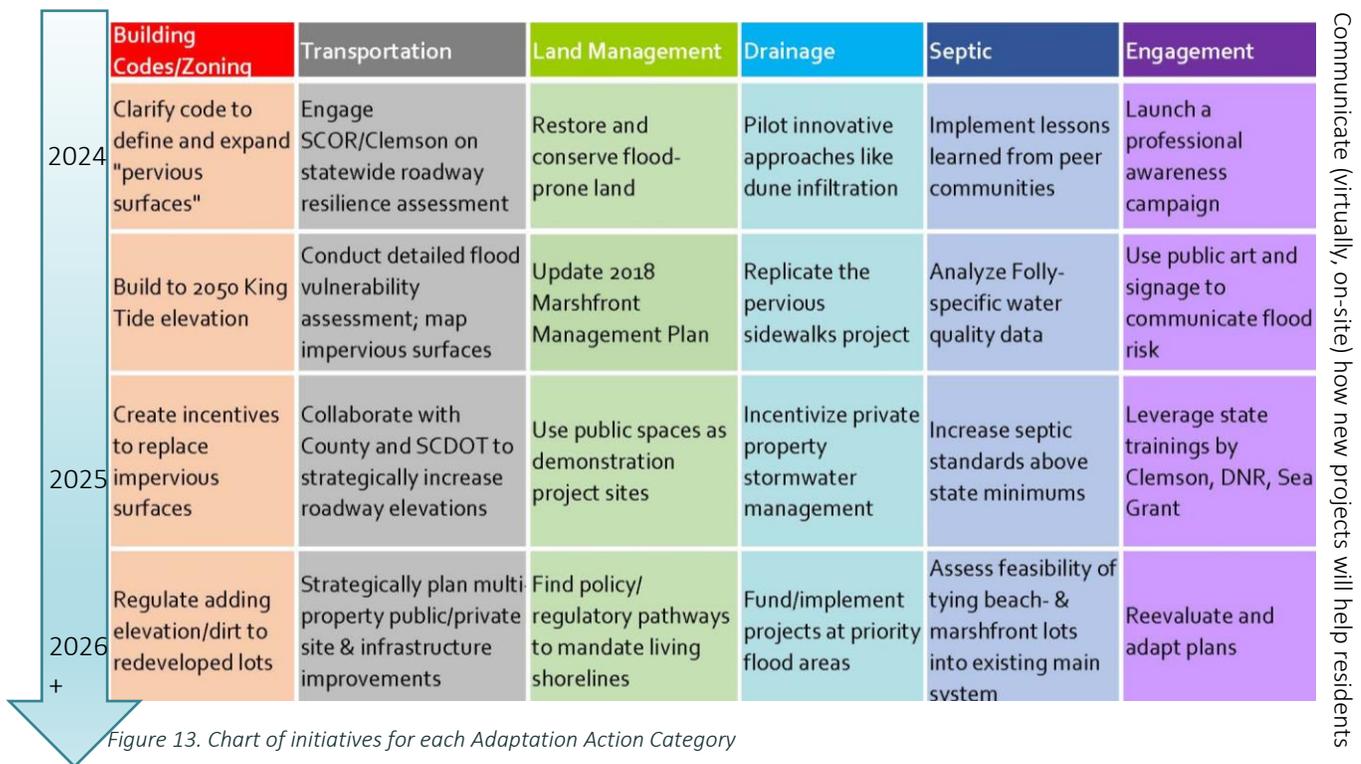


Figure 13. Chart of initiatives for each Adaptation Action Category

Building Codes/Zoning

In the 2017 plan, *building code modifications (where possible to incentivize better design)* were an adaptation action in the Land Management category. Due to the importance and cross-action application of building codes and zoning, it is called out in this plan update as a separate category.

As described in the Introduction, the city has revised building codes to build in resilience elements. In 2010, the maximum allowable size of a home on a standard lot was reduced from 4,500 to 3,600 heated square feet. Maximum lot coverage was reduced from 50% to 35% of the lot's high ground. In 2014, the city increased side-yard setbacks from 5' to 10' and required all new driveways to be pervious. Following adoption of the 2017 plan, the city increased freeboard to 4' and required island-wide V-Zone flood standards for new construction. To maintain momentum of resilient building and zoning codes, this plan recommends the following actions.

Clarify code to define and expand "pervious surfaces"

City code 166.06-11 requires all residential driveways and parking areas to be pervious but does not include a definition of pervious surfaces or specifications for installation. This section could also be expanded to extend the pervious requirement to walkways and pool decks.

Build public and private flood reduction projects at 2050 King Tide elevation

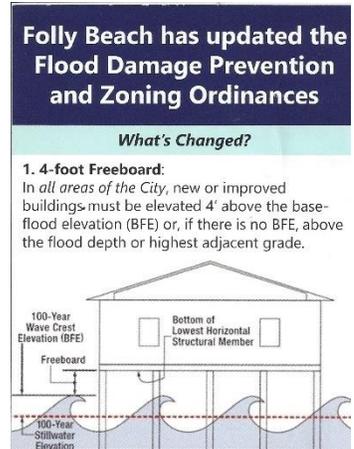
As a result of the 2018 Marshfront Management Plan recommendation to address the use of bulkheads, city code section 151.23 was amended (through Ordinance 09-19), which enacted new seawall and bulkhead regulations. They include requirements that all new bulkheads must be constructed flush with adjacent grade/elevation, and any disturbed land must be backfilled and planted with appropriate vegetation. All bulkhead construction requires a city permit with proof of location behind the critical line with a depiction of the certified critical line. The city should require future infrastructure projects to accommodate the elevation of a 2050 King Tide at 9.5 feet MLLW (6.5 feet NAVD88).

Create incentives to replace impervious surfaces

The city could address the remaining nonconforming driveways and parking areas by incentivizing green protection techniques (e.g., natural and nature-based features) on private properties. In addition to incentive programs like lot coverage tradeoffs, the city could adopt on-site stormwater management, erosion control, and flood mitigation project permitting regulations.

Regulate adding elevation/dirt to redeveloped lots

As sea level rises, communities can adapt by increasing their overall elevation through various approaches. This initiative addresses the stakeholder concern that nearby properties' elevation improvements can divert flooding to neighboring lots. Public infrastructure improvements should be strategically planned on a large-scale and consider many properties (e.g., a city block) to avoid diverting drainage or floodwaters which could cause a new flooding problem adjacent to the improvements.



Clarify "pervious surfaces" definition

Build to 2050 King Tide elevation

Create incentives to replace impervious surfaces

Regulate adding elevation/dirt to redeveloped lots

Transportation

The 2017 plan noted the vulnerability of roadways and causeways serving Folly Beach. Internal city stakeholders cited transportation as their number one priority concern - in particular, the effect of flooding on access and livability (getting around the island, moving vehicles before a predicted King Tide, etc.).

Engage SCOR/Clemson on statewide roadway resilience assessment

The 2023 South Carolina Office of Resilience (SCOR) Statewide Resilience Plan included a recommendation to create a roadway elevations inventory to improve understanding of the State's roadways' vulnerability to flooding. The state Emergency Management Division, in conjunction with Clemson University, is developing a statewide road elevation dataset to conduct a vulnerability analysis. The city should coordinate with these entities to provide input to the study and utilize the results for future planning efforts.

Conduct detailed flood vulnerability assessment; Map impervious surfaces

As discussed in the Vulnerability Analysis section, a more detailed study is required to better quantify flood water depths and impacts on livability, transportation, and public

safety. Additionally, the city does not presently have an inventory of impervious surfaces. The city should utilize [NOAA's Coastal Change Analysis Program's](#) 1-m resolution dataset of impervious surface for coastal South Carolina to determine percent cover of impervious surfaces and analyze areas where significant impervious surfaces coincide with areas of high flood risk.

Engage SCOR/Clemson on statewide roadway assessment

Conduct detailed flood vulnerability assessment; Map impervious surfaces

Collaborate with County/SCDOT to increase elevations

Strategically plan multi-property public/private improvements

Collaborate with Charleston County and SCDOT to strategically increase roadway elevations

When state roads are repaved, SCDOT can mill the old road and resurface at the same elevation, or not mill, and rather, repave on top of the old road thereby slightly increasing elevation through multiple layers over time. The city should use data on known flooding areas to support future requests that roadway improvements avoid milling.

Strategically plan multi-property public/private site & infrastructure improvements

Roadway elevation projects are one piece of a larger solution that involves increasing island-wide elevations and beyond. Often when one element of a neighborhood is elevated, other locations become more flood prone as water is diverted to different areas. Thus, an ideal improvement project would consider private property elevation increases coincident with roadway raising and drainage improvements. The city should aim to coordinate these improvements on multi-property, city block, or neighborhood scales when possible.

Land Management

Restore and conserve flood-prone land

Repetitive flood properties can be ideal candidates for land acquisition. Funding opportunities exist, for example, for projects that eliminate the risk of repetitive flood damage. Acquired lands could be converted to open space areas and incorporate public flood mitigation projects. Significant federal funding opportunities exist through FEMA, NOAA, National Fish and Wildlife Foundation, and others. If properties in flood prone areas go up for sale, the city should prioritize land acquisition when possible.

Update 2018 Marshfront Management Plan

As noted in the Introduction, City Council approved the state’s first Marshfront Management Plan in 2018^{viii}. The plan was 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. Many of the plan’s short-term action items, such as mapping of the marshfront critical

- Restore and conserve flood-prone land
- Update 2018 Marshfront Management Plan
- Use public spaces as demonstration project sites
- Find policy/regulatory pathways to mandate living shorelines

line, a detailed inventory of habitable marshfront structures, bulkheads, and their distance from the



critical line, have been implemented. Long-term opportunities such as a marsh mitigation bank fund for future large-scale public marsh restoration have not yet been initiated. The plan should explore local mechanisms for funding, such as SLR impact fees (required mitigation contributions when marshfront regulations are violated or an exemption is issued).

Use public spaces as demonstration project sites

Private stormwater management projects are described in the Drainage section. The city can continue to lead by example by installing bioswales, [rain gardens](#)^{ix}, cisterns, and permeable pavers, as well as maintaining a robust tree canopy, on publicly owned lands. This initiative can help incentivize similar actions on private property (see Drainage section).

Find policy/regulatory pathways to mandate living shorelines and other applications of green infrastructure

Living shorelines help stabilize shorelines by combining plants and other natural materials (like oyster beds) to reduce erosion and mitigate flooding. Rather than creating a barrier between the bank and water, as with conventional bulkheads, a living shoreline allows for a natural transition. The shoreline can then provide erosion protection while still performing valuable ecosystem services thereby enhancing resilience (Figure 10). Living shorelines are constructed at and/or below the critical line. SCDHEC OCRM has recently streamlined the living shorelines permitting process.

The #2 priority of stakeholders during development of the 2018 Marshfront Management Plan was reducing the use of bulkheads on private marshfront land and their impacts on the existing marsh and adjacent shorelines. Research indicates marsh vegetation and sills may provide better erosion protection than bulkheads. Additionally, bulkheads have the potential to exacerbate flooding by trapping water that overtops the bulkhead or emerges from the subsurface on the landward side of the shoreline. These waters may be contaminated or overloaded with nutrients from human sewage in septic drain fields. While a new ordinance limits the elevation and location of new bulkheads in the marsh setback, there is no prohibition of bulkheads, setback from the critical line, or policy preference for green infrastructure.

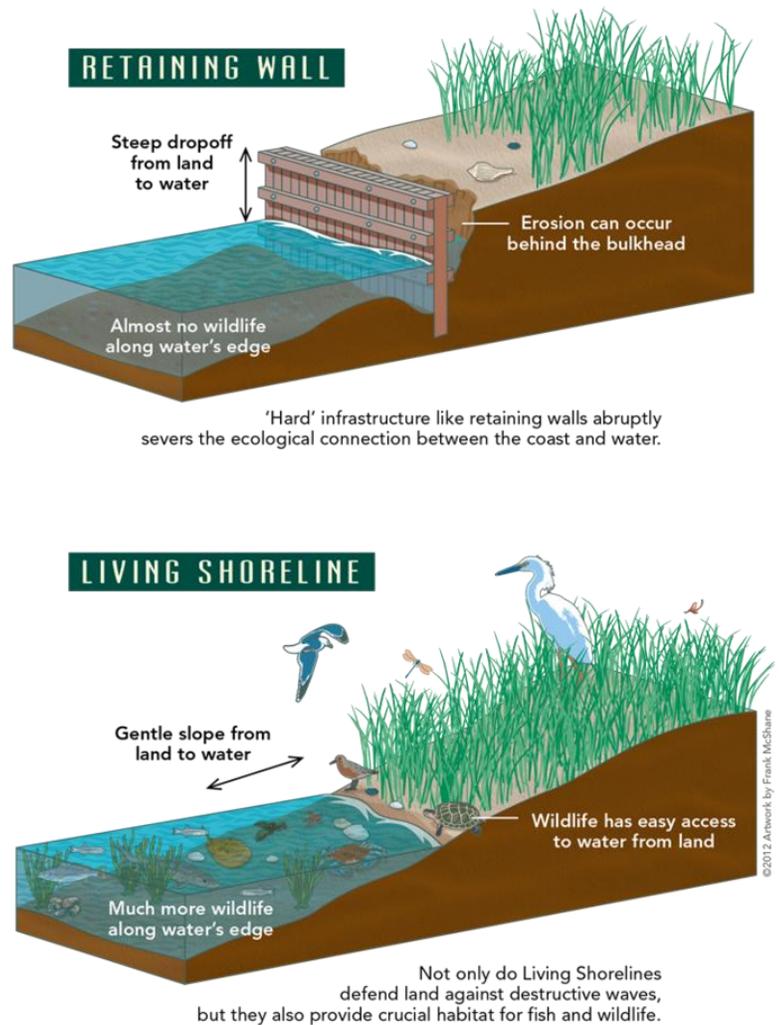


Figure 14. Living shoreline and bulkhead comparison for marsh edge shore protection.

Drainage

The 2017 recommendation to develop a drainage master plan was implemented with the adoption of the 2018 Island Drainage Study and Stormwater System Assessment (“Drainage Study”). Numerous recommendations of the Drainage Study have been implemented since 2018 as detailed in Appendix E.

Pilot innovative approaches like dune infiltration

The 2017 plan recommended that the city, “study stormwater/pump station feasibility.” Dune infiltration systems accept and infiltrate stormwater runoff that ponds on adjacent roadways. Pumps, installed at low points along the beachfront road, deliver stormwater to a series of sprinklers attached to the underside of a public dune walkover. The system is optimized to reduce street flooding to a level safe for vehicular traffic in two to four hours.

Pilot innovative approaches like dune infiltration

Replicate the pervious sidewalks project

Incentivize private stormwater management

Fund/implement projects at priority flood areas

Replicate the pervious sidewalks project

The successful Central Island Drainage

Improvement project included stormwater pipes and storage located underground, beneath pervious pedestrian paths in the vicinity of Center Street to 2nd Street in both directions (see also Table 4). As new pedestrian paths are developed, this model should be replicated.

Incentivize private property stormwater management

Property owners can help with overall island water management by installing bioswales, [rain gardens^x](#), cisterns, and permeable pavers, as well as maintaining a robust tree canopy. These practices absorb flood water as close to its source as possible and can reduce the volume of stormwater in the public drainage system. They offer the added benefits of aesthetics, [improved water quality^{xi}](#), and often, the use of stormwater as a water source for irrigation. Bioswales and rain gardens require sufficient space which isn’t always available in flood prone areas. Generally, the techniques aim to manage the first inch of rainwater. When rainfall exceeds 1-inch or occurs during high-water events that saturate the groundwater system, these methods alone are insufficient to alleviate flooding. Stakeholders suggested the [Naturally Kiawah Recognition Program](#) as a model for incentivizing these green techniques.

Fund/implement projects at priority flood areas

The Priority Flood Areas section recommends projects to be implemented at E Ashley, Cooper, Erie & Seacrest (at 9-12th St E), Little Oak Island Drive, and 8th & 9th St West & Red Sunset Ln (Table 1). The city should scope improvements in these areas, apply for funding, and implement drainage projects. Continued collaboration with Charleston County is also recommended to leverage resources, for example, installing back flow preventers on drainage pipes.

Septic

The 2017 recommendation to conduct a septic vulnerability assessment was not implemented; however, Ordinance 11-19 was adopted to require new septic systems be sited as far upland as possible. When septic systems are not properly sited, designed, installed, and maintained, bacteria can be transmitted to the marsh and shellfish beds. In addition, floodwaters can carry contaminants from private drain fields into the public stormwater system. Internal city stakeholders cited septic as their number two priority concern, second to transportation.

Implement lessons learned from peer communities

Because it is difficult to assess how well septic tanks are functioning, North Carolina Sea Grant invested in a [study](#) to gain a better understanding of how on-site and centralized wastewater treatment methods impact water quality^{xii}. The study included case studies from the Town of Nags Head and the City of Folly Beach and offers several recommendations. It suggests, for example, installing groundwater monitoring wells and utilizing the data to help prioritize action in areas where groundwater levels are expected to impact septic system functions.

Additionally, the Town of Nags Head, NC has a [Septic Health Division](#) of the Planning and Development Department with a separate budget to promote water quality and education

to maintain the Town's wastewater infrastructure and improve private septic system performance^{xiii}. A portion of the division's budget is earmarked for incentives. For example, property owners can receive a \$150 credit on their water account for pumping their system every three years. The Edisto Open Land Trust has also recently implemented a [septic system assistance program](#) to incentivize maintenance^{xiv}.

Implement lessons learned from peer communities

Analyze Folly-specific water quality data

Increase septic standards above state minimums

Assess feasibility of tying into existing main system

Analyze Folly-specific data collected by water quality programs

Numerous water quality monitoring programs collect data in the waters surrounding Folly Beach. SC-[DHEC beach water quality monitoring](#) rarely results in swim advisories for Folly Beach^{xv}. Due to frequent tidal flushing, monitoring sites in the Folly River (e.g., Charleston Waterkeeper site at the boat ramp) are also generally clean. It would be useful to combine all monitoring data to analyze trends that may suggest contamination, such as deteriorated water quality that does not coincide with a rain event. The S.C. Sea Grant Consortium's [Water Quality Monitoring Portal](#) can help assess water quality.

Increase septic standards above state minimums

Dry soil is necessary to process contaminants from wastewater. As sea level rises, both surface floodwaters and elevated groundwaters will encounter untreated wastewater more frequently. For new and redeveloped lots, the city could require 18 inches of soil cover for conventional systems or if site conditions are not ideal, require engineered septic systems.

Assess feasibility of tying beach- & marshfront lots into existing main system

Recent federal requirements for local communities to address impaired waterways, such as [James Island Creek](#)^{xvi}, [Beaufort County](#)^{xvii}, Edisto Beach, and the Grand Strand, have increased scrutiny on septic systems. In these areas, improperly maintained, poorly designed, and failing septic tanks have contributed to bacterial contamination into coastal waters. Stakeholders encouraged the city to assess the feasibility, and calculate costs, of tying some neighborhoods into the existing main sewer system.

Engagement

Engagement with residents, visitors, property owners, and city officials was identified as the most important element of this effort during the planning process. Stakeholders felt that the objective from the 2017 plan to, “increase local awareness about risk to inspire individuals and organizations to act,” had not been implemented. The Flood Reporter launched during 2023 plan development addressed the 2017 engagement recommendation for a citizen science program for reporting of flooding issues in real-time. To further increase engagement, the following adaptation actions are recommended.

Launch a professional awareness campaign

The city should prioritize adding a staff person or contractor to devote to this topic. Stakeholders agreed that dedicating a position to engagement and tasking that person with the responsibility to develop and implement a public awareness campaign would be effective. Elements of the campaign may include virtual and printed educational materials, social media posts, podcasts, in-person activities and trainings, leveraging local events & publications, etc. Materials should be developed for target audiences such as property owners, landlords, renters, elected and appointed officials, business owners, and the general public. Maintaining an up-to-date project website is a vital component of this action item.

Launch a professional awareness campaign

Use public art and signage to communicate flood risk

Leverage state trainings by Clemson, DNR, Sea Grant

Reevaluate and adapt plans

Use public art and signage to communicate flood risk

Myriad opportunities for education exist in the community. One stakeholder’s suggestion was to “leverage the power of the pilot,” by using small city-owned projects as powerful education experiences. For example, educational signage should be installed at the County boat ramp, to highlight the living shoreline project and include photos of oyster sills and vegetation before and after. Signage and art can also help the public visualize water levels in 2050. A partnership with the S.C. Aquarium is recommended to install Sea Rise signs^{xviii} at flooding hotspots. Finally, the city should incorporate educational art (funky Folly) into infrastructure like cross-walks as also recommended by Rethink Folly Road^{xix}.



Leverage state trainings by Clemson, DNR, Sea Grant

External stakeholders offered multiple resources for education and outreach. For example, the Clemson Cooperative Extension offers trainings and other educational opportunities like [Be septic safe](#) and techniques described in the Land Management section^{xx}.

Reevaluate and adapt plans

The city should evaluate implementation success annually and adapt work plans as needed. Updates to the Sea Level Rise Adaptation Plan are recommended every five years.

Appendix A

The 2017 plan prioritized three of many adaptation actions: Septic Vulnerability Assessment, Drainage Management Plan, and Marshfront Management Plan. This section documents the city's progress toward implementation of these action items from 2017 to June 2023.

2017 Sea Level Rise Adaptation Action List

The following adaptation actions were identified and prioritized in the 2017 plan.

1. Water Infrastructure Management
 - a. Drainage Management Plan
 - b. Septic Vulnerability Assessment
 - c. Drinking Water Delivery Improvement Plan
2. Land Management
 - a. Marshfront Management Plan
 - b. Building Code Modifications
 - c. Adaptation Enforcement through Existing Codes, Permit Requirements
 - d. Monitor Ownership of Marsh Islands near Causeway
3. Education
 - a. Outreach to Property Owners and Elected Officials
4. Transportation Adaptation
 - a. Causeway & Roadway Adaptations
5. Coordination, Collaboration, and Cooperation
 - a. Coordination between Governments and Agencies
 - b. Approaches to Implementation of Adaptation Action Items

Appendix C provides a progress update for each of these items.

Appendix B

The tidal datums utilized in this plan were derived from the long-term NOAA tide gauge in Charleston, SC (Figure 15). According to NOAA^{xxi}, a datum is a base elevation used as a reference from which to reckon heights or depths. A tidal datum is a standard elevation defined by a certain phase of the tide. Tidal datums are used as references to measure local water levels. Table 2 provides definitions of the tidal datums used in this plan, as maintained by NOAA’s Center for Operational Oceanographic Products and Services.

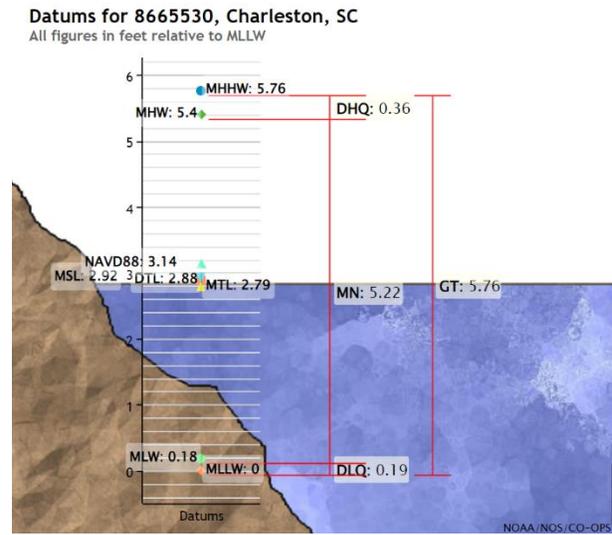


Figure 15. NOAA established tidal datums for [Charleston, SC](#).

Table 2. Definitions of tidal datums maintained by NOAA and used in this plan.

| | |
|---|---|
| MHHW Mean Higher High Water | The average of the higher high water height of each tidal day observed over the National Tidal Datum Epoch. For stations with shorter series, comparison of simultaneous observations with a control tide station is made in order to derive the equivalent datum of the National Tidal Datum Epoch. |
| MHW Mean High Water | The average of all the high water heights observed over the National Tidal Datum Epoch. For stations with shorter series, comparison of simultaneous observations with a control tide station is made in order to derive the equivalent datum of the National Tidal Datum Epoch. |
| MLLW Mean Lower Low Water | The average of the lower low water height of each tidal day observed over the National Tidal Datum Epoch. For stations with shorter series, comparison of simultaneous observations with a control tide station is made in order to derive the equivalent datum of the National Tidal Datum Epoch. |
| National Tidal Datum Epoch | The specific 19-year period adopted by the National Ocean Service as the official time segment over which tide observations are taken and reduced to obtain mean values (e.g., mean lower low water, etc.) for tidal datums. It is necessary for standardization because of periodic and apparent secular trends in sea level. The present NTDE is 1983 through 2001 and is actively considered for revision every 20-25 years. |

The [Interagency Sea Level Rise Scenario Tool](#)^{xxii} provides guidance for the Charleston area with an observation extrapolation rate of 1.65 feet by 2050 *relative to sea level in 2000* (Figure 16). The rate is generated from observations at the Charleston tide gauge from 1970-2020, and represent future water level that would result if sea level continues to follow the same trend and acceleration as it has shown over the last five decades.

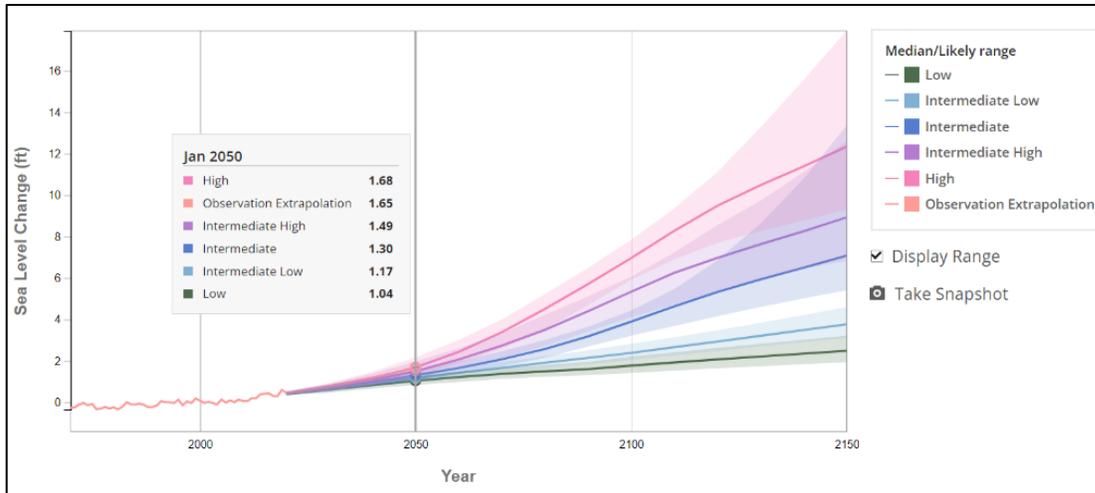


Figure 16. Charleston area projections for 2050 relative to sea level in 2000, from the Interagency Sea Level Rise Scenario Tool used to decide on appropriate planning horizons and scenarios

While the generalization of 1 ft of sea level rise by 2050 (see Motivation section) is a useful visualization tool, this effort also developed a quantitative water level estimate for 2050. Table 3 provides the values for average high tide and the observed King Tide elevation relative to today’s tidal datum, along with estimates of water levels for these scenarios in 2050. To estimate 2050 values, we first apply today’s MHHW at the mid-point year over the last tidal epoch (1983-2001): 1992. This is the baseline (zero) MHHW elevation in the flood mapping viewer introduced in the Flood Mapping section. As noted above, sea level rise predictions in Figure 16 are relative to sea level in 2000. To bring the 1992 MHHW level up to 2000 levels, an increase of 3 cm (0.10 ft) is applied for a 2000 MHHW level of 5.86 ft MLLW (Table 3). The 2050 estimates include the above observation extrapolation of 1.65 feet of SLR added to 2000 water levels for a 2050 MHHW level of 7.51 ft MLLW. These elevations were used for Flood Mapping and to develop a quantitative vulnerability analysis.

Table 3. Average high tide and King Tide elevations at the Charleston, SC gauge relative to the tidal datum in use today and in 2050 (estimated at 1.65 ft of SLR relative to 2000 water levels).

| | 1992 mid-point of tidal epoch | 2000 3 cm of SLR | 2050 observation extrapolation |
|--------------------------|-------------------------------------|---------------------|--------------------------------------|
| | (feet MLLW) | | |
| MHHW (Average High Tide) | 5.76 | 5.86 | 7.51 |
| King Tide (2 ft > MHHW) | | 7.86 | 9.51 |

Appendix C

Progress on 2017 adaptation initiatives is presented here, along with some new information.

2017 Top Priority: Drainage Management Plan

Significant progress on drainage initiatives was made immediately following approval of the 2017 plan with an *Island Drainage Study and Stormwater System Assessment*, completed in 2018. This assessment ranked drainage improvements based on each project’s estimated budget. Table 4 includes the projects in order of prioritization rank from that report. It also includes new information, developed during this plan update, indicating whether flooding in each area is controlled by drainage issues (e.g., insufficient capacity) or sea level rise (SLR) (e.g., low elevation). Improvements and how they were funded are listed along with new recommendations based on the findings of this plan. Projects with little implementation since 2017 and significant flooding impacts from either SLR or both drainage and SLR are flagged as new recommendations.

Table 4. Implementation tracking of improvements recommended by the *Island Drainage Study and Stormwater System Assessment* and new recommendations.

| Drainage Study Project Ranking (budget based) | Cause: Drainage/ SLR/Both | Improvements Implemented since 2017 | Funding | New Recommendations/ Findings | |
|--|----------------------------------|--|---|---|---|
| 1 | Tabby Drive (13th St. East) | Both | BRIC-funded concept development for drainage improvement; Installed two roadside drainage pumps; Collaborating with SCDOT on roadside shoulder improvements | FEMA 2020 Building Resilient Infrastructure & Communities (BRIC) grant; Applied for 2022 and 2023 Transportation Sales Tax (TST) funding for design and engineering | 2050 King Tide floods 80% of Tabby, 2-3 feet of water |
| 1 | Erie & 8th East | Both | Installed approximately 250 feet of new roadside ditches | SC Rural Infrastructure Authority (RIA), SC Infrastructure Investment Program (SCIIP) | 2050 King Tide floods this intersection, 2-3 feet of water |
| 1 | 1st & 2nd West Indian & Michigan | Both | Scope development to mitigate nuisance flooding | FEMA BRIC grant; SCIP and RIA | 2050 King Tide floods 58% of W Indian & 100% of W Michigan, 1-2 feet of water |
| 2 | 3rd to 6th St., West Ashley | Drainage | n/a | | Less than 6 inches flooding on 2050 King Tide. |

| | | | | | |
|---|---|----------|--|--|---|
| 3 | East Ashley, Cooper, Erie & Seacrest (9-12th St. East) | Both | n/a | | 2050 King Tide floods 100% of Seacrest with 2-3 feet of water. Prioritize |
| 4 | Center Street, 2nd & 3rd St. East Ashley, also from E. Arctic to E. Cooper Ave. | Drainage | Collaboration with County: stormwater (SW) pipe relocations, size increases, new tide valve at 2nd E outfall, pervious ped paths with buried drainage improvements for E and W sides of Ashley Ave | County Transportation: CTC and TST funds | Not significantly impacted by 2050 King Tide. Drainage issue |
| 4 | Center Street | Drainage | 115 SW grate inlets, 1,400 feet of new roadside ditches, and 9,600 linear feet of new SW pipe | RIA SCIIP | Not significantly impacted by 2050 King Tide. Drainage issue |
| 5 | 4th to 8th E. Ashley Ave. | Drainage | n/a | | Less than 6 inches flooding on 2050 King Tide. |
| - | 8th & 9th St. West & Red Sunset Lane | Both | Roadway resurfacing in collaboration with County (roadbed elevation, drainage improvements and SW ditches and piping | County Transportation: CTC and TST funds | 2050 King Tide floods 100% of 8th & 9th St W & Red Sunset Ln with ~2 feet of water; Prioritize roadway elevation (breaching and commercial use). |

2017 Top Priority: Septic Vulnerability Assessment

A new ordinance adopted during the building moratorium (11-9) requires the septic tank must be as landward as possible, defines failed septic system, details how to correct it, requires rentals to pump out annually, and defines leaks as failed system actions (Table 6). No sewer feasibility study or septic vulnerability assessment has occurred.

Drinking Water Delivery Improvement Plan

In 2023, the city received a grant of nearly \$9 million for both drainage and drinking water delivery improvements from RIA SCIIP. Drainage improvements recommended by the Island Drainage Study for Center Street and 8th East/East Erie will be implemented with this funding, along with drinking water delivery infrastructure.

Table 5. Drinking water delivery improvements implemented since 2017.

| Improvements Implemented since 2017 | Funding |
|---|-----------|
| East Arctic and Hudson & 12 th St. and East Cooper Water Main Replacements: 4,400 linear feet (lf) from Center St. to 7th East, 3,800 lf from Center St. to 5th St. E, and 180 lf along 12th St. East and a new water main onto the island as a back up (redundant) supply | RIA SCIIP |

2017 Top Priority: Marshfront Management Plan

The city adopted a Marshfront Management Plan (MMP) in 2018:

https://cityoffollybeach.com/corecode/uploads/document6/uploaded_pdfs/corecode/Marshfront-Management-Plan-July-19-FINAL_90.pdf. This plan was the first of its kind in South Carolina and expanded on numerous adaptation actions introduced in the 2017 plan, including some non-structural solutions to coastal flooding related to septic and drainage. It will be updated in 2024.

During MMP development, City Council approved an unprecedented 9-month coastal building moratorium on the development of properties on either the beach- or the marshfront. This proactive planning process resulted in the adoption of **twenty-five** new land use regulations including ordinances for setbacks, buffers, septic tanks, marsh-island development, dune protection, seawalls, increased freeboard and other regulations related to increasing resilience along the beach- and marshfront (e.g., Table 6).

Table 6. Some of the ordinances adopted to address staff and resident concerns revealed during development of the 2018 Marshfront Management Plan.

| Concern Topic | Ordinance No. | Ordinance Description |
|--|---------------|---|
| Septic: Leaky, outdated, too close to marsh | 11-19 | New septic systems must be as far upland as possible; annual septic inspections for short-term rentals |
| Use of bulkheads on private marshfront/impacts on existing marsh & adjacent shorelines | 09-19 | New bulkheads in marsh setback must not exceed upland elevation & must be upland of critical line |
| Stormwater runoff/drainage into the marsh | 05-19 | Setback increased from 10 to 15 feet & includes native buffer |
| Loss of protection as flooding increases | 08-19 | Freeboard increased to 2 feet above base flood elevation |
| Preserving scenic views of the marsh | 06-19 | Marsh lighting must shine downward; sign removal plan |
| Mixed jurisdiction of marsh islands | 02-19 | New marsh island residential zoning district with stricter lot size and setbacks (35') to match county zoning |
| | 12-19 | Letters of coordination from county and DHEC required for new marsh island development |

| | | |
|--------------------------------------|-------|---|
| Lack of regulations to protect marsh | 04-19 | Intent of zoning codes includes the prevention of encroachments adjacent to environmentally sensitive areas |
|--------------------------------------|-------|---|

Little to no progress was made on the 2017 plan recommendations to 1) use living shorelines as primary erosion management tool, or 2) encourage restoration/maintenance for natural areas not yet armored.

Building Code Modifications

As detailed above, the city adopted new ordinances to 1) increase freeboard requirement from 2 to 4 feet, 2) require V-Zone design certificates/building standards island wide, and 3) limit lot coverage to 35%, all driveway and parking surfaces must be pervious (Table 6).

Transportation Adaptation

As directed by the 2017 plan, the city has collaborated with SCDOT and the County to coordinate roadway and drainage improvements (e.g., Center Street improvements) and leveraged County funding opportunities (Table 4). The concern identified in the 2017 plan remains valid today:

Raising the surface of a road may pose challenges. For some roads to be raised, their shoulders must be widened. If the road runs along a causeway, this could mean that the road base needs to be extended into the wetlands. Depending on specific drainage conditions, road construction may also cause flooding on adjacent properties. An engineering assessment can provide more information about the opportunities to raise specific roadway segments.

Education

City staff and residents both agree that little to no progress was made on 2017 recommendations related to education.

Coordination, Collaboration, & Cooperation

City coordination with collaborating agencies has increased significantly since 2017 (e.g., DHEC, SCDOT, Charleston County, FEMA’s National Flood Insurance Program’s (NFIP) Community Ratings System (CRS), and other communities).

Appendix D

Community input was the cornerstone of this project and included numerous engagement activities including interviews with key stakeholders (Table 7) and an in-person planning charette (see agenda and boards below), in which most of these stakeholders participated.

Table 7. List of key stakeholders (internal and external) that were pivotal in development of this 2023 plan update.

| Name | Affiliation | Title |
|--|---|---|
| Aaron Pope | City of Folly Beach (COFB) | Administrator |
| Eric Lutz | COFB | Public Works Director |
| Jenna Stephens | COFB | Zoning Administrator |
| Matthew Gorstein | SC Sea Grant Consortium | Assistant Director for Dev. & Extension |
| Amanda Guthrie | SC Sea Grant Consortium | Coastal Climate & Resilience Specialist |
| Landon Knapp | SC Sea Grant Consortium | Coastal Resilience Program Manager |
| Emmi Palenbaum | SC Sea Grant Consortium | Coastal Public Information Coordinator |
| Cheyenne Cunningham | College of Charleston | Envir & Sustainability Grad Student |
| Duncan Williamson | College of Charleston | Lowcountry Hazards Center Intern |
| Joe Wilson | COFB | City Attorney, Property owner |
| Billy Grooms | COFB | City Council rep, Property owner |
| Paula Stubblefield, Jamie Mitchum | COFB | Planning Commission reps, Property owners |
| Jennifer Kline | COFB | Parks and Rec Board rep, resident |
| Dave Miller | COFB | Turtle Team rep, Property owner |
| Toni Catoe* | COFB | BZA rep, Property owner |
| Allen Kinter* | COFB | Design Review Board rep, Property owner |
| Andrew Gilreath* | COFB | Chief, Public Safety/Emergency Ops |
| Tim Goodwin* | COFB | Mayor, Property owner |
| Kyle Sullivan* | COFB | Utilities Director |
| John Rosen | Sweetgrass Realtors | Attorney, realtor, property owner |
| Douglas Kerr | City of Isle of Palms | Deputy City Administrator |
| Kim Morganello | Clemson extension | Water Resources Associate |
| Rachel Hawes, Riley Egger | Coastal Conservation League | Land, Water & Wildlife Project Manager |
| Patty Newschutz | Charleston County Parks & Recreation Commission | Director of Planning & Development |
| Chris Wannamaker | Charleston County Stormwater | Stormwater Utility Manager |
| Dale Morris | City of Charleston | Chief Resilience Officer |
| Tamara White | James Island Public Service District (PSD) | Assistant District Manager |
| Joe Marcinkus | James Island PSD | Director of Wastewater Services |
| David Schaeffer* | James Island PSD | District Manager |
| Lee Bundrick | Kiawah Conservancy | Sr. Ecological Health & Conserv. Coord. |
| Michael Black, Ray Molinaroli | SC Dept. of Transportation | District Maintenance Engineers |

| | | |
|-------------------------|-------------------------------|--------------------------------|
| Denise Sanger | SC Dept. of Natural Resources | Marine Scientist |
| Matt Slagel | SC DHEC OCRM | Manager, Beachfront Management |
| Adam Bode | SC DHEC OCRM | Coastal Planner |
| Bradley Craig | SC Office of Resilience | Hydrologist |
| Andrew Wunderly* | Charleston Waterkeeper | Executive Director |

*Did not attend charette, interview only

Key Stakeholder Interview Questions

Internal stakeholders:

- 1) What are your greatest concerns related to sea level rise (SLR)?
- 2) What SLR impacts have you witnessed?
- 3) Are you aware of anything the city has done to address these concerns?
- 4) How is the city doing with education; are others aware?
- 5) How would you rank your concerns regarding SLR impacts against other Folly concerns?
- 6) Would Folly property owners be willing to pay?
- 7) Please share any additional ideas, concerns, or suggestions.

External stakeholders:

- 1) Are you aware of anything the City of Folly Beach has done to address sea level rise (SLR)?
- 2) How do you perceive that Folly is doing on 1) planning and 2) implementation of their SLR actions?
- 3) I'll explain a few elements of the plan, then we'll discuss how you think the Folly plan compares with others you are familiar with, and what your community/agency or communities you are working with are doing.
 - a. What was successful?
 - b. What were your top three goals?
 - c. What are we missing; for example, did you/they use different classifications?
 - d. How are you/they funding implementation?
 - e. How successful has implementation been?
- 4) What resources does your agency offer to assist with SLR planning and implementation?
- 5) Please share any additional ideas, concerns, or suggestions.

Charette Agenda - Sea Level Rise Adaptation Plan, 5-Year Update

Wednesday, April 19, 2023

What is a Charette? A "Charette" combines creative, intense working sessions with public workshops or open houses. A Charette is a collaborative planning process that harnesses the talents and energies of all interested parties to create and support a master plan that represents transformative community change. Outcomes of this Charette will directly inform the strategies and recommendation incorporated into the 5-Year Update of the City of Folly Beach Sea Level Rise Adaptation Plan.

Attendees: Key Stakeholders - City staff and officials, property owners, and outside experts

Goal: Co-develop adaptation actions, recommendations, and educational strategies based on concepts introduced during the meeting (informed by previous stakeholder input) and modified on-the-fly with the participants.

What is your vision for how Folly will have adapted to sea level rise by 2050? What Land Management, Water Management, Education/Coordination actions are needed?

- 10:00 AM Welcome and Introductions
- Purpose & Objectives; Agenda overview
- 5-minute Lightning Talks
- 10:45 AM **Sea level rise concerns**
- Activity: Interact with stations in small groups
- Detailed concerns, see pages 3-5
- 11:30 AM Station Report Outs
- LUNCH**
- 12:15 **Conceptual actions to address concerns**
- Activity: Roundtable refinement of concepts for Water Infrastructure & Land Management (pre-assigned)
- Table report outs
- Facilitated group discussion
- Activity: Roundtable refinement of concepts for Education and Coordination
- Table report outs
- Facilitated group discussion
- 1:15 PM **Consensus on preliminary recommendations**
- Activity: Large group discussion
- Review recommendations
- 1:45 PM Wrap up, next steps, adjourn

Charette Boards

During the in-person Charette, small groups of participants interacted with these large poster boards at various stations around the room. The boards helped participants learn about progress the city had made on the 2017 adaptation initiatives (row #1) and to amend or amplify/vote (using sticker dots) on which actions remain a high priority (row #2). The boards also summarized 2023 interview responses and suggestions (row #3). Finally, the boards provided ideas to fuel a conversation on revised recommendations to include in the 2023 plan update.

| FOLLY 2050 WATER INFRASTRUCTURE MANAGEMENT | | | |
|--|---|--|--|
| <p>Review Progress (vote on priorities)</p> | <p>SEPTIC VULNERABILITY ASSESSMENT</p> <ul style="list-style-type: none"> × Map and inventory × Conduct vulnerability assessment of septic × Study sewer expansion zones in high risk and priority areas. + Enforce monitoring not only at time of house sale but also on a regular basis. + NOTE: Sea Grant study of Nags Head, NC & Folly Beach completed | <p>DRAINAGE MANAGEMENT PLAN</p> <ul style="list-style-type: none"> + Map and inventory + Collaborate with County × Study stormwater/pump station feasibility + NOTE: Drinking Water Delivery Improvements addressed with redundant water main | <p>OVERALL</p>  |
| <p>Amend Concerns (amplify with dots)</p> | <ul style="list-style-type: none"> • "How will septic tanks will function with higher water levels?" • The City is not doing well on septic • If we can't manage wastewater, tax base will decrease • Act before mandated by federal agencies • Keep septic, (caps density and is cleaner). | <ul style="list-style-type: none"> • King tides, compound flooding, stormwater drainage, street flooding, repetitive property loss • More extensive drainage improvements are needed • Environmental/human health: pollution consequences from flooding of developed areas • How much of our King Tide flooding is due to groundwater? | <ul style="list-style-type: none"> • "Sea level is rising faster" • Safety: Fires start when flood waters reach electrical outlets • Need water infrastructure utility upgrades |
| <p>Offer New Recommendations and Action Concepts</p> | <ul style="list-style-type: none"> • Educate about engineered septic systems, see top right • Educate about new ordinance • "At least do the study," to tie into existing main system • Adopt stricter zoning on development along new sewer corridors • Apply for funds for additional staff to track septic tank maintenance • Collaborate with Charleston Waterkeeper • <u>Example:</u> James Island Creek Watershed Management Plan • <u>Data:</u> Water quality monitoring | <ul style="list-style-type: none"> • Educate pervious surface maintenance • Coordinate with County • Incentivize on-site Stormwater management • Demonstrations at public properties • <u>Example:</u> City of Charleston Rainproof • <u>Data:</u> Groundwater monitoring | <ul style="list-style-type: none"> • Educate renters to reduce waste • <u>Data:</u> Water levels; Sophisticated flood mapping |

LAND MANAGEMENT & TRANSPORTATION ADAPTATION



| | MARSHFRONT MANAGEMENT PLAN | BUILDING CODES, PERMIT REQUIREMENTS | CAUSEWAY/ROADWAY ADAPTATIONS |
|---|--|--|--|
| Review Progress (vote on priorities) | <ul style="list-style-type: none"> + Map and Inventory + Parcel level inundation analysis + Historic shoreline change assessment + Economic valuation + Scientific review of spectrum of erosion management options × Use living shorelines as primary erosion management tool × Restore/maintain natural areas not yet armored × Monitor ownership of marsh islands | <ul style="list-style-type: none"> + Incentivize building code compliance × Consider LEED certification incentives and/or rebates on stormwater fee/permitting + Encourage smaller building footprints and fewer impervious surfaces + Clearly identify regulatory authorities, especially for private property permitting + Test permit requirements, codes that encourage adaptation measures, such as septic inspections, with rental properties | <ul style="list-style-type: none"> / Determine risk-based prioritization areas / Collaborate with SCDOT to resurface to higher elevation  |
| Amend Concerns (amplify with dots) | <ul style="list-style-type: none"> • Marshfront flood control/mitigation • Environmental impacts • Retreat and land acquisition; how to fund • Too many bulkheads • No progress on living shorelines nor on conservation of non-armored areas | <ul style="list-style-type: none"> • Freeboard increase, island-wide V-Zone too restrictive • Building Codes/Development enforcement challenges • Control density with zoning, not septic | <ul style="list-style-type: none"> • Ability to respond, reach emergency scene • East and West Ashley and the causeway are critical access points and primary revenue sources • Livability challenges • City does not own roads |
| Offer Recommendations and Action Concepts | <ul style="list-style-type: none"> • Educate about MMP: Distribute plan summary • Learn about Sea Level Rise impact fees • Promote land donations to Nature Conservancy • Visualize the future of Folly's marsh edge | <ul style="list-style-type: none"> • Educate about new ordinances. • Increase island elevation through building codes, permit requirements, concurrent with city infrastructure improvements like road raising. | <ul style="list-style-type: none"> • Educate about ongoing projects/funding requests • Collaborate with SCDOT for short- and long-term road raising • Engage with state officials • Example: NCDOT Resilience Strategy, annual update, above |

EDUCATION & COORDINATION



| | | | |
|--|--|--|--|
| <p>Review Progress (vote on priorities)</p> | <p>OUTREACH TO PROPERTY OWNERS & ELECTED OFFICIALS</p> <ul style="list-style-type: none"> + Educate with scenario-based water level maps ✓ Track implementation, status, time frames on webpage + Promote and educate about plan implementation × Encourage real estate disclosures for high-risk property × Distribute report summary: Explain the need, city projects, and implementation challenges. × Make it hit home: Title correspondences "How it will affect your..." tax bill, utility bill, septic tank, quality of life, etc. | <p>COORDINATION BETWEEN GOVERNMENTS & AGENCIES</p> <ul style="list-style-type: none"> + Identify a POC at each collaborating agency + Learn from other communities + Prioritize adaptation strategies that also improve the National Flood Insurance Program's (NFIP) Community Ratings System (CRS) score | <p>APPROACHES TO IMPLEMENTATION</p> <ul style="list-style-type: none"> + Prioritize high risk areas, and implement several action items in that area first rather than island-wide right away + Learn from other communities  <p>Morganello 2022</p> |
| <p>Amend Concerns (amplify with dots)</p> | <ul style="list-style-type: none"> • Residents need to be better informed and armed with tools to do their part • Overall: Farther away from City Hall, less is known (staff is highly informed; commissioners/board members – somewhat; residents – little to no knowledge) <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <p><i>How are we doing with education, are residents aware?</i></p> <p>1.6 out of 5</p> </div> | <ul style="list-style-type: none"> • Need partnerships with agencies and with residents • Local collaborations needed within Charleston County |  |
| <p>Offer Recommendations and Action Concepts</p> | <ul style="list-style-type: none"> • Form an education committee – leverage local events & publications • "Leverage the power of the pilot," Install educational signage, bottom right • Visualize 2050 • Incorporate educational art (funky Folly) into City infrastructure, top right • Launch a professional awareness campaign • Example: City of Charleston Champions and Initiatives Chart | <ul style="list-style-type: none"> • Convene Charette Team quarterly | <ul style="list-style-type: none"> • Encourage residents to share in responsibility, take ownership • Visualize redevelopment after major storm • Get buy in from state elected officials |

Appendix E

City streets vulnerability assessment on a 2050 King tide with 3.5 feet of SLR (9.25 feet MLLW)

Tables in this Appendix rank the vulnerability of city streets to a 2050 King Tide based on two different metrics. Table 8 prioritizes streets with the highest **percent** flood coverage. For example, a street may not be very long (i.e., small value of linear footage/street length) but the percent of that street length that is flooded is high. The top ranked most vulnerable street according to the percent flood coverage metric is Seacrest Lane, which is a rather short street at 975.8 feet long, but the entire length is flooded by a 2050 King Tide. Other streets that are 100% flooded on a 2050 King Tide are shorter than Seacrest. All of the 100% flooded streets are also located in one of the top priority flood areas in this plan.

Table 8. City streets ranked by the percent of flood coverage by a 2050 King Tide.

| Street Name | Street Type | Street Length (feet) | Flood Coverage (feet) | Flood Coverage (%) |
|----------------------|-------------|----------------------|-----------------------|--------------------|
| SEACREST LN | Paved | 975.7 | 975.7 | 100.0 |
| MICHIGAN AV | Paved | 682.0 | 682.0 | 100.0 |
| RED SUNSET LN | Paved | 593.8 | 593.8 | 100.0 |
| W 8TH ST | Paved | 209.0 | 209.0 | 100.0 |
| W 9TH ST | Paved | 499.0 | 499.0 | 100.0 |
| CUSABO ISLAND RD | Paved | 478.2 | 471.8 | 98.7 |
| W HURON AV | Paved | 770.0 | 751.6 | 97.6 |
| TUCKER LN | Non-Paved | 342.2 | 320.5 | 93.7 |
| SANDBAR LN | Paved | 1320.2 | 1230.5 | 93.2 |
| NO NAME 3 | Non-Paved | 335.7 | 303.0 | 90.3 |
| FORREST AV | Non-Paved | 451.2 | 406.9 | 90.2 |
| E INDIAN AV | Paved | 1634.6 | 1429.1 | 87.4 |
| W ERIE AV | Paved | 765.0 | 646.6 | 84.5 |
| W 9TH ST EXT | Paved | 1152.2 | 960.8 | 83.4 |
| E 13TH ST | Paved | 554.9 | 462.2 | 83.3 |
| TABBY DR | Paved | 1435.4 | 1152.1 | 80.3 |
| E 12TH ST | Paved | 393.6 | 313.2 | 79.6 |
| W 7TH ST | Non-Paved | 1528.9 | 1164.1 | 76.1 |
| MCDONOUGH RD | Paved | 416.8 | 306.7 | 73.6 |
| E 10TH ST | Paved | 798.6 | 520.8 | 65.2 |
| E HURON AV | Paved | 3272.2 | 2099.8 | 64.2 |
| W 2ND ST | Paved | 2290.3 | 1403.9 | 61.3 |
| WEATHERS LN | Non-Paved | 183.3 | 110.9 | 60.5 |
| SHADOW RACE LN | Paved | 2086.0 | 1258.8 | 60.3 |
| W ASHLEY AV | Paved | 9769.3 | 5868.5 | 60.1 |
| LITTLE OAK ISLAND DR | Paved | 5072.6 | 3010.9 | 59.4 |
| W INDIAN AV | Paved | 3585.7 | 2089.4 | 58.3 |
| W MARINERS CAY DR | Paved | 2481.5 | 1424.7 | 57.4 |
| E 11TH ST | Paved | 408.6 | 206.2 | 50.5 |

| | | | | |
|--------------|-----------|---------|--------|------|
| WOODY LN | Non-Paved | 1398.1 | 677.7 | 48.5 |
| W HUDSON AV | Paved | 3272.6 | 1539.8 | 47.1 |
| W 6TH ST | Paved | 398.6 | 158.3 | 39.7 |
| W BEACH CT | Paved | 1283.0 | 391.1 | 30.5 |
| E COOPER AV | Paved | 8370.6 | 2284.2 | 27.3 |
| E 5TH ST | Paved | 1286.3 | 340.5 | 26.5 |
| 3RD ST W | Paved | 789.9 | 195.7 | 24.8 |
| E ERIE AV | Paved | 6084.2 | 1482.9 | 24.4 |
| E 2ND ST | Paved | 1198.8 | 282.7 | 23.6 |
| LEMPESIS LN | Paved | 395.3 | 86.9 | 22.0 |
| W 5TH ST | Paved | 194.1 | 40.0 | 20.6 |
| W 4TH ST | Paved | 204.4 | 37.4 | 18.3 |
| CENTER ST | Paved | 1785.8 | 274.8 | 15.4 |
| E 4TH ST | Paved | 1286.3 | 193.5 | 15.0 |
| E 9TH ST | Paved | 396.5 | 54.7 | 13.8 |
| E 6TH ST | Paved | 945.1 | 125.2 | 13.2 |
| E ARCTIC AV | Paved | 8865.8 | 916.3 | 10.3 |
| E 8TH ST | Paved | 598.0 | 55.8 | 9.3 |
| W COOPER AV | Paved | 3357.2 | 275.1 | 8.2 |
| E ASHLEY AV | Paved | 19730.9 | 984.1 | 5.0 |
| LIMEHOUSE DR | Non-Paved | 388.4 | 18.6 | 4.8 |
| E HUDSON AV | Paved | 4084.3 | 164.2 | 4.0 |
| FOLLY RD | Paved | 13612.5 | 191.7 | 1.4 |
| E 3RD ST | Paved | 1001.5 | 6.6 | 0.7 |

Table 9 prioritizes streets with the highest **length** flood coverage caused by a 2050 King Tide. For example, West Ashley is one of the longer streets at 9,769.3 feet, and 5,868.5 feet of it will be flooded by a 2050 King Tide, making it the top ranked most vulnerable street according to the length of flood coverage metric.

Table 9. City streets ranked by the length of flood coverage caused by a 2050 King Tide.

| Street Name | Street Type | Street Length (feet) | Flood Coverage (feet) | Flood Coverage (%) |
|----------------------|-------------|----------------------|-----------------------|--------------------|
| W ASHLEY AV | Paved | 9769.3 | 5868.5 | 60.1 |
| LITTLE OAK ISLAND DR | Paved | 5072.6 | 3010.9 | 59.4 |
| E COOPER AV | Paved | 8370.6 | 2284.2 | 27.3 |
| E HURON AV | Paved | 3272.2 | 2099.8 | 64.2 |
| W INDIAN AV | Paved | 3585.7 | 2089.4 | 58.3 |
| W HUDSON AV | Paved | 3272.6 | 1539.8 | 47.1 |
| E ERIE AV | Paved | 6084.2 | 1482.9 | 24.4 |
| E INDIAN AV | Paved | 1634.6 | 1429.1 | 87.4 |
| W MARINERS CAY DR | Paved | 2481.5 | 1424.7 | 57.4 |
| W 2ND ST | Paved | 2290.3 | 1403.9 | 61.3 |
| SHADOW RACE LN | Paved | 2086.0 | 1258.8 | 60.3 |

| | | | | |
|------------------|-----------|---------|--------|-------|
| SANDBAR LN | Paved | 1320.2 | 1230.5 | 93.2 |
| W 7TH ST | Non-Paved | 1528.9 | 1164.1 | 76.1 |
| TABBY DR | Paved | 1435.4 | 1152.1 | 80.3 |
| E ASHLEY AV | Paved | 19730.9 | 984.1 | 5.0 |
| SEACREST LN | Paved | 975.7 | 975.8 | 100.0 |
| W 9TH ST EXT | Paved | 1152.2 | 960.8 | 83.4 |
| E ARCTIC AV | Paved | 8865.8 | 916.3 | 10.3 |
| W HURON AV | Paved | 770.0 | 751.6 | 97.6 |
| MICHIGAN AV | Paved | 682.0 | 682.1 | 100.0 |
| WOODY LN | Non-Paved | 1398.1 | 677.7 | 48.5 |
| W ERIE AV | Paved | 765.0 | 646.6 | 84.5 |
| RED SUNSET LN | Paved | 593.8 | 593.8 | 100.0 |
| E 10TH ST | Paved | 798.6 | 520.8 | 65.2 |
| W 9TH ST | Paved | 499.0 | 499.0 | 100.0 |
| CUSABO ISLAND RD | Paved | 478.2 | 471.8 | 98.7 |
| E 13TH ST | Paved | 554.9 | 462.2 | 83.3 |
| FORREST AV | Non-Paved | 451.2 | 406.9 | 90.2 |
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| E 12TH ST | Paved | 393.6 | 313.2 | 79.6 |
| MCDONOUGH RD | Paved | 416.8 | 306.7 | 73.6 |
| NO NAME 3 | Non-Paved | 335.7 | 303.0 | 90.3 |
| E 2ND ST | Paved | 1198.8 | 282.7 | 23.6 |
| W COOPER AV | Paved | 3357.2 | 275.1 | 8.2 |
| CENTER ST | Paved | 1785.8 | 274.8 | 15.4 |
| W 8TH ST | Paved | 209.0 | 209.0 | 100.0 |
| E 11TH ST | Paved | 408.6 | 206.2 | 50.5 |
| 3RD ST W | Paved | 789.9 | 195.7 | 24.8 |
| E 4TH ST | Paved | 1286.3 | 193.5 | 15.0 |
| FOLLY RD | Paved | 13612.5 | 191.7 | 1.4 |
| E HUDSON AV | Paved | 4084.3 | 164.2 | 4.0 |
| W 6TH ST | Paved | 398.6 | 158.3 | 39.7 |
| E 6TH ST | Paved | 945.1 | 125.2 | 13.2 |
| WEATHERS LN | Non-Paved | 183.3 | 110.9 | 60.5 |
| LEMPESIS LN | Paved | 395.3 | 86.9 | 22.0 |
| E 8TH ST | Paved | 598.0 | 55.8 | 9.3 |
| E 9TH ST | Paved | 396.5 | 54.7 | 13.8 |
| W 5TH ST | Paved | 194.1 | 40.0 | 20.6 |
| W 4TH ST | Paved | 204.4 | 37.4 | 18.3 |
| LIMEHOUSE DR | Non-Paved | 388.4 | 18.6 | 4.8 |
| E 3RD ST | Paved | 1001.5 | 6.6 | 0.7 |

Appendix F

The flood mapping vulnerability assessment, community survey responses, and reported flooding photos were combined onto one GIS map to better highlight areas of immediate concern. Locations where all three of these mapped metrics coincided were then compared to previously identified drainage priority locations to develop the following priority flood areas for this plan.

Table 10. Priority flood areas identified by this plan update with detailed columns not included in report text.

| Rank | Priority Flood Area | Drainage/SLR/Both | Improvements Implemented since 2017 | Funding | New Recommendations/Findings |
|------|--|-------------------|--|--|--|
| 1 | East Ashley, Cooper, Erie & Seacrest (9-12th St E) | Both | n/a | | 2050 King Tide floods 100% of Seacrest with 2-3 feet of water. Move to top priority based on outcomes of this study and lack of projects. |
| 2 | Little Oak Island Drive | SLR | n/a | | 2050 King Tide floods 3,000 feet of Little Oak Island Dr with ~1 feet of water + private impacts |
| 3 | 8th & 9th St West & Red Sunset Ln | Both | Roadway resurfacing in collaboration with Charleston County. Improved resilience by increasing roadbed elevation and incorporating drainage improvements and new infrastructure (new ditches and piping) in that area. | County Transportation: CTC and TST funds | 2050 King Tide floods 100% of 8th & 9th St W & Red Sunset Ln with ~2 feet of water. Prioritize additional improvements like roadway elevation increase due to significant breaching and high risk with commercial use. |
| 3 | Tabby Drive (13th St E) | Both | Used BRIC funds for 2023 inventory, existing conditions modeling development & concept development for drainage improvements. Purchased and installed two roadside drainage pumps Collaborating with SCDOT on roadside shoulder improvements | FEMA 2020 Building Resilient Infrastructure & Communities (BRIC) grant Applied for 2022 and 2023 Transportation Sales Tax (TST) funding for design and engineering | 2050 King Tide floods 80% of Tabby with 2-3 feet of water |

| Rank | Priority Flood Area | Drainage/SLR/Both | Improvements Implemented since 2017 | Funding | New Recommendations/Findings |
|------|--------------------------------------|-------------------|--|---|--|
| 3 | Erie & 8th East | Both | Approximately 250 feet of new roadside ditches | SC Rural Infrastructure Authority (RIA), SC Infrastructure Investment Program (SCIIP) | 2050 King Tide floods this intersection with 2-3 feet of water |
| 3 | 1st & 2nd West Indian & Michigan | Both | Used BRIC funds for 2023 inventory & existing conditions modeling development to mitigate nuisance flooding. | FEMA BRIC grant; SCIP and RIA | 2050 King Tide floods 58% of W Indian & 100% of W Michigan with 1-2 feet of water |
| 7 | 4th and 5th E Indian | Both | Berming, new tidal backflow preventer valves; Land Acquisition: Purchased flood-prone 502 and 504 East Huron for conservation | Charleston County Greenbelt Grant | 2050 King Tide floods 87% of E Indian with 1-2 feet of water; 502 and 504 East Huron with 2-3 feet |
| 8 | 9th & 10th East, Arctic | Drainage | Infiltration analysis and planning for an innovative pump system (dune infiltration); may consider similar system(s) at 4th E and 10th W | | Less than 6 inches flooding on 2050 King Tide. Drainage issue |
| 9 | 1630-1670 E Ashley | SLR | | | 2050 King Tide floods private properties with 1-2 feet of water |
| 9 | 1722 E Ashley Ave to Summer Place Ln | | | | 2050 King Tide floods private properties with 1-2 feet of water |
| 9 | 1507 Forrest Ave | | | | 2050 King Tide floods private properties with 2-3 feet of water |

Endnotes

- ⁱ City of Folly Beach Local Comprehensive Beach Management Plan, 2015; https://cityoffollybeach.com/corecode/uploads/document6/uploaded_pdfs/corecode/2021%20Comp%20Beach%20Mgmt%20Plan%20Update_88.pdf
- ⁱⁱ City of Folly Beach Sea Level Rise Adaptation Plan, 2017, https://cityoffollybeach.com/corecode/uploads/document6/uploaded_pdfs/corecode/Folly-Beach-Sea-Level-Rise-Adaptation-Report_FINAL_93.pdf
- ⁱⁱⁱ City of Folly Beach Dune Management Plan, 2018, and Marshfront Management Plan, 2019; https://cityoffollybeach.com/corecode/uploads/document6/uploaded_pdfs/corecode/Dune-Management-Plan-2Jan19_92.pdf and https://cityoffollybeach.com/corecode/uploads/document6/uploaded_pdfs/corecode/Marshfront-Management-Plan-July-19-FINAL_90.pdf
- ^{iv} National Climate Assessment, 2014. U.S. Global Change Research Program, www.nca2014.globalchange.gov
- ^v 2022 Sea Level Rise Technical Report, <https://oceanservice.noaa.gov/hazards/sealevelrise/sealevelrise-tech-report.html>
- ^{vi} Application Guide for the 2022 Sea Level Rise Technical Report, <https://oceanservice.noaa.gov/news/jun22/sealevelrise-report-guide.html>
- ^{vii} S.C. Sea Grant Consortium, Folly Beach Tidal Inundation & Asset Vulnerability Application, <https://arccg.is/1WSrSi0>
- ^{viii} City of Folly Beach Marshfront Management Plan, see iii above
- ^{ix} Clemson Cooperative Extension, 2022. Master Rain Gardener, <https://www.clemson.edu/extension/raingarden/mrg/>
- ^x Clemson Cooperative Extension, 2022. Master Rain Gardener, <https://www.clemson.edu/extension/raingarden/mrg/>.
- ^{xi} Clemson Cooperative Extension, 2022. Carolina Yards, <https://www.clemson.edu/extension/carolinayards/>
- ^{xii} N.C. Sea Grant, <https://ncseagrants.ncsu.edu/coastwatch/current-issue/summer-2022/the-new-pioneers/>
- ^{xiii} Town of Nags Head, NC, <https://www.nagsheadnc.gov/DocumentCenter/View/2495/Septic-Health?bidId=>
- ^{xiv} Edisto Island Open Land Trust, <https://edisto.org/septic-system-assistance-program/>
- ^{xv} S.C. Beach Guide, DHEC, <https://gis.dhec.sc.gov/beachaccess/>
- ^{xvi} James Island Watershed Management Plan, <https://www.jamesislandsc.us/sites/default/files/uploads/pdf-files/james-island-creek-watershed-management-plan-final.pdf>
- ^{xvii} Beaufort County, S.C., <https://www.beaufortcountysc.gov/news/2022/03/beaufort-county-adapts-sea-level-impacts-beneath-our-feet-study-receives-300k-grant.html>
- ^{xviii} S.C. Aquarium Sea Rise Project, <https://www.anecdata.org/projects/view/182>
- ^{xix} Rethink Folly Road, <https://rethinkfollyroad.com/>
- ^{xx} Clemson Cooperative Extension, <https://www.clemson.edu/extension/water/resources/be-septic-safe.html>, Master Rain Gardener, <https://www.clemson.edu/extension/raingarden/mrg/>, Carolina Yards, <https://www.clemson.edu/extension/carolinayards/>, Living Shorelines, <https://www.clemson.edu/extension/living-shorelines/>.
- ^{xxi} NOAA Tides and Currents, Tidal Datums, https://tidesandcurrents.noaa.gov/datum_options.html.
- ^{xxii} Interagency Sea Level Rise Scenario Tool, <https://sealevel.nasa.gov/task-force-scenario-tool>