Chapter 3.11 Resilience Element

Element Goal

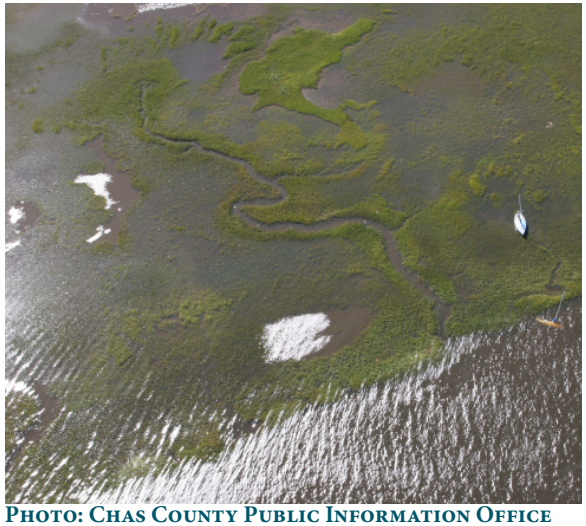
Charleston County will prioritize resilience in all County plans, policies, and regulations.

3.11.1: OVERVIEW

Resilience is the ability of a community to respond, adapt, and thrive under changing conditions, including, but not limited to, recurrent burdens and sudden disasters.

In light of flooding events over the past three years, along with annual hurricane threats, the existence of a major fault line, and unprecedented growth creating stresses on essential services, infrastructure, development, and the environment, it has become overwhelmingly apparent that Charleston County and surrounding areas need to plan and proactively approach resilience now to be prepared for changes in the future. By committing time, effort, and funding now we can research, assess, and implement projects to protect our citizens and community for future generations.

The need for a Resilience Element (Element) to be added to the Comprehensive Plan was identified after the 2015 flood event when Planning Commission saw the need for study and action, and wrote a letter to County Council about their concerns. This need was further demonstrated after flood events in 2016 and again in 2017. Planning Commission then determined that it would form a subcommittee containing different faces of the community so that several perspectives could sit at the same table. The end result is the formation of this Element, which contains goals and strategies to improve Charleston County's resilience, including, but not limited to, coordinated efforts with the jurisdictions within the County. The subcommittee worked for nine months to develop this Element, and then recommended it to the Planning Commission for approval. The Planning Commission reviewed it and recommended it to County Council for approval on October 14, 2019, and County Council adopted it as part of the Comprehensive Plan on March 10, 2020.



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Purpose and Intent

The primary purpose of the Resilience Element is to identify strategies to make the County more resilient. Although flooding is a major concern and addressed throughout the Element, other areas of concern are also discussed, and Charleston County is dedicated to taking an all-hazards approach to resilience planning. This means when planning for resilience, the County is not planning around specific events, but rather taking a big-picture approach towards risk mitigation. Another purpose of the Resilience Element is to clarify the roles that government, the private sector, and individuals hold in regards to improving resilience.

3.11.2: BACKGROUND AND INVENTORY OF EXISTING CONDITIONS

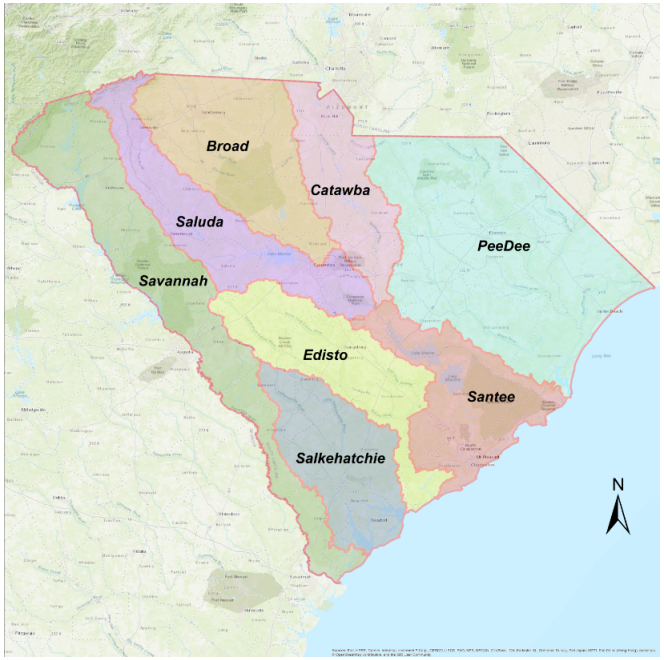
Topography and Geography

Charleston County's geography is first and foremost defined by water. Here, the Cooper River, Ashley River, Edisto River, Wadmalaw River, Stono River, and Wando River converge and meet the Atlantic Ocean.

In 1972, the United States Government began granting states funding to better manage its water quality. The Federal Water Pollution Control Act Amendments (US Public Law 92-500) prompted the state of South Carolina to launch its first watershed planning activities, and statewide planning activities were completed in the 1970s. Managed by the SC Department of Health and Environment Control (DHEC), the state created eight major regions, along hydrologic lines, known as river basins (Broad, Catawba, Edisto, Salkahatchie, Saluda, Santee, Savannah and Pee Dee). The majority

of Charleston County falls within the Santee River Basin; however, a portion of the southern/western County is located in the Edisto River Basin (see Map 3.11.1).

Map 3.11.1: South Carolina Watersheds (SCDNR)



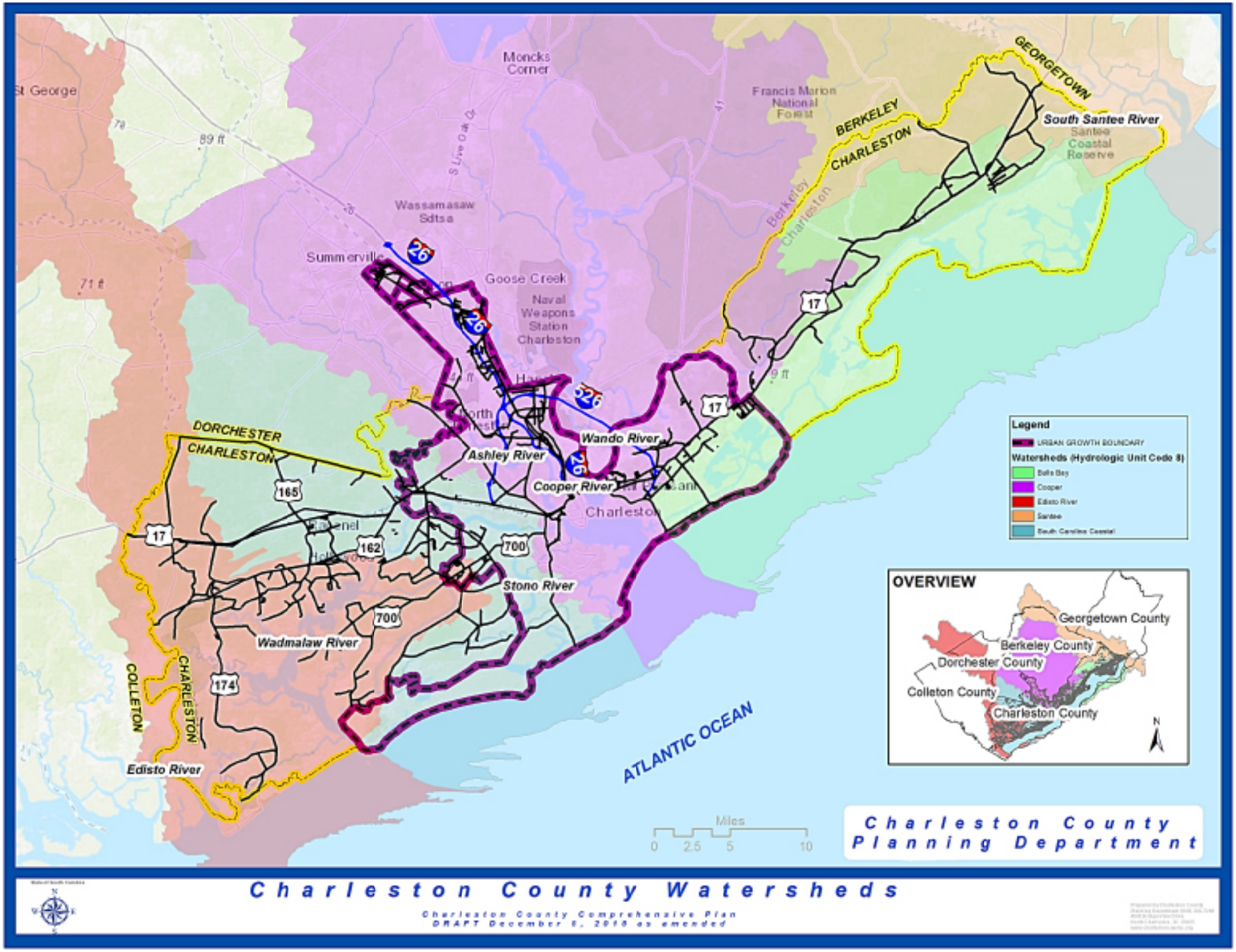
The Santee River Basin encompasses 11 watersheds and 1,280 square miles. The Santee River originates in the Upper Coastal Plain region, giving way to the Lower Coastal Plain and Coastal Zone regions. The Santee River Basin includes nearly one million acres. There are a total of 976 stream miles, 94,668 acres of lake waters, and 5,276 acres of estuarine areas in the Santee River Basin. The Santee River is formed from the confluence of the Congaree and Wateree Rivers and flows through Lake Marion. It is diverted in lower Lake Marion, and either flows out of the Santee Dam to eventually drain into the Atlantic Ocean via the South Santee River and the North Santee River, or is channeled along a 7.5-mile diversion canal to fill Lake Moultrie.

The Edisto River Basin originates in the South Carolina Sandhills region and flows through the Upper and Lower Coastal Plain Regions and into the Coastal Zone region. It encompasses 30 watersheds and some two million acres of the State. There are a total of 2,780 stream miles, 8,402 acres of lake waters, and 20,284 acres (31.7 square miles) of estuarine areas in the Edisto River Basin. The confluence of Chinquapin Creek and Lightwood Knot Creek form the North Fork Edisto River, which is joined downstream by Black Creek, Bull Swamp Creek, and Caw Caw Swamp. The South Fork Edisto River accepts drainage from Shaw Creek, Dean Swamp Creek, Goodland Creek, and Roberts Swamp before merging with the North Fork Edisto River to form the Edisto River. Downstream from the confluence, the Edisto River is joined by Cattle Creek, Indian Field Swamp, and Four Hole Swamp. Prior to joining the Edisto River, Four Hole Swamp accepts drainage from Cow Castle Creek, Providence Swamp, Horse Range Swamp, and Dean Swamp. Downstream from the Four Hole Swamp, the Dawho River enters the Edisto River, and their confluence forms the South Edisto River and the North Edisto River, which both drain to the Atlantic Ocean.

Each of these river basins are further subdivided into specific regional watersheds, which are geographic areas into which the surrounding waters, sediments, and dissolved materials drain, and whose boundaries extend along surrounding topographic ridges. Each watershed or "unit" has a unique hydrologic unit code (HUC). Hydrologic unit codes are a United States Geological Survey (USGS) cataloging system that arranges watersheds from the largest area or region (2 digits - 03) to the smallest (12 digits - 030502020101). Charleston County includes five HUC-8 watersheds: Edisto River, Santee River, Cooper River, Bulls Bay, and South Carolina Coastal as shown on Map 3.11.2. HUC-8 maps show us the sub-basin level, which corresponds to medium-sized river basins. These watersheds can be even further divided into HUC-10 watersheds, of which Charleston County has eight: Edisto River, North Edisto River, Rantowles Creek, Stono River, Ashley River, Cooper River, Wando River, and Bulls Bay. DHEC produces a Watershed Water Quality Assessment (WWQA) for each watershed every five years.

The Cooper River Basin spans 843 square miles and the Ashley River Basin covers 894 square miles. The Charleston Harbor Watershed, a combined area also known as the Ashley/Cooper River Basin, continues inland 45 miles, and incorporates three freshwater lakes: Lake Moultrie, Bushy Park Reservoir, and Goose Creek Reservoir. The watersheds in Charleston County have been greatly influenced by time and increasing human interaction. Rice cultivation changed the shape of tidal rivers as farmers learned to control the water. Later, the practice of filling in wetlands added more land area, and as industry grew, pollutants entered the watershed. In 1939, as population and industry grew, the Santee-Cooper Hydroelectric Project formed Lake Moultrie, by damming the headwaters of the Cooper River. Because Lake Moultrie is connected to Lake Marion, on the Santee River, drainage from the Santee River Basin combined with the Ashley/Cooper River Basin, which increased the size of the watershed to 15,600 square miles.

Map 3.11.2: Charleston County HUC-8 Watersheds



Hazards

Flooding

According to NOAA, flooding is an overflowing of water onto land that is normally dry. Flooding can be further classified, defined, and forecasted depending on several factors including cause, duration, and extent. Flooding is the most frequent and costly natural hazard in the United States. In Charleston County, the most common types of flooding are rain events, tidal flooding, and storm surges. Other issues that enhance the effects and extent of flooding are sea level rise and climate change. Because about 68% of the County lies within the floodplain, a proactive approach to flooding is necessary to protect the community and make it more resilient.

Sea Level Rise

Sea level rise is the result of two major causes: the thermal expansion caused by warming of the ocean and increased melting of land-based ice (NOAA). The current global rate of rise is about one-eighth of an inch per year, but could be measured at a rate higher or lower depending on other factors locally. Scientists are confident that the global mean sea level will rise 8 inches to 6.6 feet by the year 2100 (NOAA, Climate.gov). Global sea level trends and local sea level trends are different measurements. Just as the surface of the Earth is not flat, the surface of the ocean is also not flat—in other words, the sea level is not changing at the same rate globally. Sea level rise at specific locations may be more or less than the global average due to many local factors such as land subsidence from natural processes and withdrawal of groundwater and fossil fuels, upstream flood control, erosion, changes in regional ocean currents, variations in land height, and whether the land is still rebounding from the compressive weight of Ice Age glaciers.

There has been a more than one foot rise in sea level in the Charleston Harbor over the past 80 years. NOAA estimates the rate at which sea level is rising in South Carolina has been increasing, and is now around one inch of rise every two years. NOAA's predictions for sea level rise in Charleston can be seen in Figure 3.11.1, and includes six potential scenarios. The intermediate scenario suggests Charleston could see a four foot increase in sea level by 2100. The City of Charleston currently plans their Sea Level Rise Strategy around a 2 to 3-foot increase in sea level over the next fifty years.

In urban settings, rising seas threaten infrastructure necessary for local jobs and regional industries. Roads, bridges, subways, water supplies, oil and gas wells, power plants, sewage treatment plants, landfills—virtually all human infrastructure—is at risk from sea level rise.

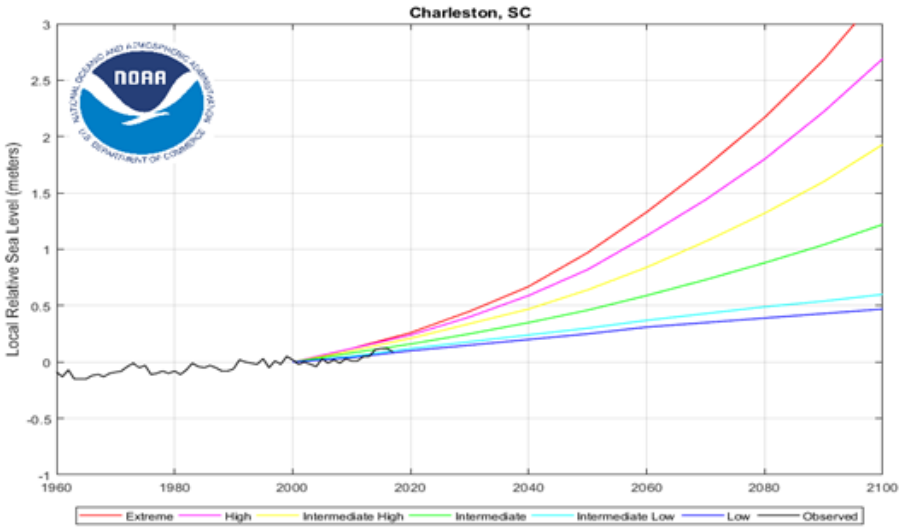


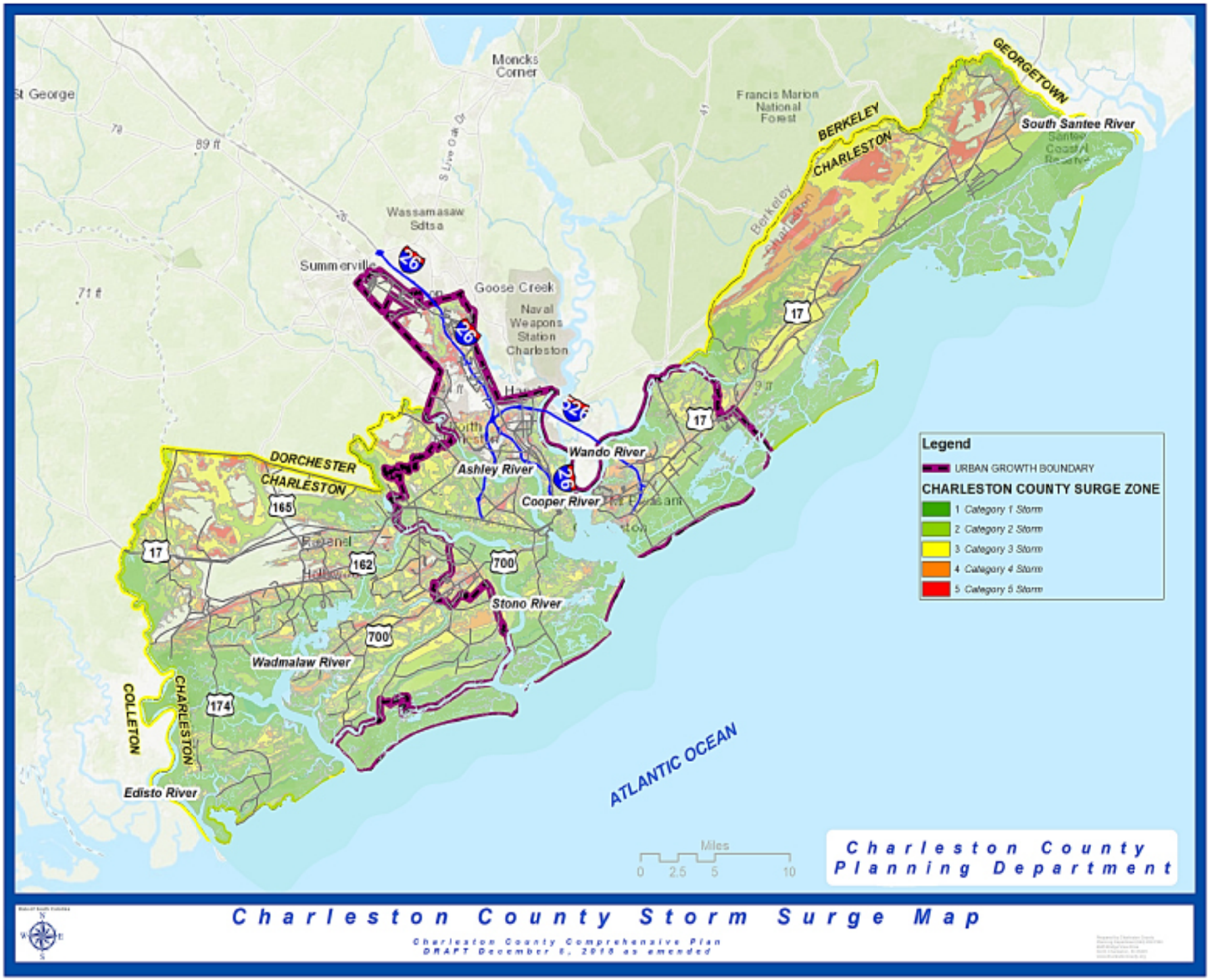
Figure 3.11.1 NOAA Sea Level Rise Predictions

Rain Event Flooding

Rain event flooding can be classified by severe rain events, whether associated with tropical weather or not, that cause major flooding in areas that may not have experienced flooding in prior years. Like tidal flooding, these big rain events are exacerbated by a combination of several factors that result in widespread flooding, including king tides, sea level rise, drainage issues and storm surges. Charleston County experienced flooding as a result of continual rain lasting several days in 2015 that caused extensive damage and shut down the County for days. The storm drainage systems could not handle the amount of rain that fell in the area during those days, and because there was no break in the rain, the drainage systems had no time to recover. In addition, high tides peaked which added more struggle to the already aggravated system.

In 2016, the area was hit by Hurricane Matthew which made landfall near McClellanville, SC as a Category 1 Hurricane. The storm dumped nearly a foot of rain on parts of the County, and the combination of a six-foot storm surge and strong winds led to extensive damage along the coast, despite hitting the area during a relatively low tide. Matthew resulted in water levels three to five feet higher than normal astronomical tides. In 2017, Charleston County felt the effects of Hurricane Irma, which had weakened to a tropical storm before Charleston felt its effects. Tropical Storm Irma swept through Charleston during an extremely high tide, resulting in a peak storm tide recorded at almost 10 feet, the third highest on record in Charleston County. The greatest storm surge during Tropical Storm Irma was recorded at just under five feet. Additionally, four tornados were confirmed in Charleston County in association with this storm.

Map 3.11.3 Charleston County Storm Surge Map



Overall, rain events that have impacted the Charleston area since 2015 have brought the issue of flooding to the forefront. The purpose of this Element is to address these issues and pave the way for future planning to combat the problem.

Hurricanes

Records dating back to the 1600s indicate there were about 43 tropical cyclones before official records were kept in 1851. Since then, there have been an additional 41 tropical systems (25 hurricanes, 10 tropical storms and six tropical depressions) that have hit or affected the Charleston region (NOAA). The region will remain vulnerable to hurricanes and tropical weather and this threat may increase with climate change and warming seas. Hurricanes pose many threats to the area, including wind, rainfall, and storm surge. In addition, tides can also have a major effect on the extent of hurricane-related flooding.

Storm Surge

Storm surge is the rise of water level that occurs as a result of high winds pushing onto the coast due to tropical conditions. In combination with regular tides, storm surge can cause significant flooding in coastal areas, and is exasperated depending on the intensity of the storm. Some problems that storm surges cause include inland flooding, flooding in advance of a storm, dangerous debris carried by waves, severe beach erosion, and significant property damage.

Advancements in mapping have provided flood inundation maps to inform citizens of potential flood impacts during different categories of storm events where a citizen can simply type in their address on a web page and have a visual reference of where flooding can occur around them (NOAA). These tools are very helpful when planning and preparing for an event and determining the amount of storm preparation that would be required in advance.

Map 3.11.3 shows storm surge projections for Charleston County. The Sea, Lake, and Overland Surges from Hurricanes (SLOSH) Model was used to generate Map 3.11.3 and estimates storm surge heights, considering atmospheric pressure, size, forward speed, and track data to model the wind field, which generates storm surge. The model was developed by the National Weather Service and is a computerized numerical model that can be applied to a specific region's coastline. The SLOSH Model can be used to predict storm surge heights resulting from historical, hypothetical, or forecasted hurricanes. The SLOSH model does not include breaking waves/wave run-up, astronomical tide, or normal river flow and rain. However, the model does consider coastal reflection; overtopping of barrier systems, levees, and roads; inland inundation; deep passes between bodies of water; and flow through barriers, gaps, and passes. The SLOSH Model, like most storm surge models, is heavily reliant on the accuracy of meteorological input. Additionally, it is important to note that storm surge is merely one element of total water level rise, with tides, waves, and freshwater flow making up the other components.

Tidal Flooding

The beauty and character of Charleston County lies in its breadth of winding tidal creeks and hidden reaches of waterfront property. With this beauty comes the risks associated with tidal flooding, also called nuisance flooding, because of the inconveniences caused during unusually high tides. Many factors contribute to this "perfect storm" of problems that can shutdown areas of Charleston County for hours or days.

Sea level rise is one contributing problem to tidal flooding in many areas within the County. Rising seas means higher tides, and more frequent king tides, which are now an issue to formerly non-flood-prone areas. In areas like Downtown Charleston that were built centuries ago on fill dirt, the land has subsided over time and is simply not high enough to avoid this flooding. Also because it was built on fill dirt, areas have further settled over time, leaving some parts of the City lower, and more affected than others.

Frequent road closures, property damage, loss of business, and potentially hazardous conditions leave areas affected by tidal flooding in a state of uncertainty. Sea level rise will continue to be a more frequent issue for all coastal areas within the County. Time is of the essence to study and make modifications to alleviate some of the effects that sea level rise will have on communities in the County. This not only affects area residents from being able to get to and from their homes, but also has a large impact on continuity of services for business operations, safety services, including access to area hospitals, and the general functioning of the area and its residents on a normal day-to-day level.

A recent example of how king tides can majorly affect Charleston occurred in November 2018 when the County was affected by the sixth highest record tide. This resulted in several road closures and flooding on a perfectly sunny day. Instances like these are becoming more and more common, and the County needs to plan for ways to protect and prepare the community.

Impacts to Groundwater

Groundwater aquifers are sponge-like, interconnected layers saturated slowly over time with water that comes from the surface water supply. Groundwater resources are of concern when considering resilience because when aquifers are depleted of groundwater, surface water sinks to replace it. The surface water supply is where most residents obtain drinking water, thus the depletion of this resource is of great concern. Additionally, due to its very dynamic nature beneath the earth's surface,

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groundwater resources are not easily quantified, making it difficult to determine exactly how much groundwater exists and where it is located. The Charleston Aquifer runs under most of the South Carolina Coastal Plain, beginning at the boundary of the Piedmont and Coastal Plains (the Fall Line) and deepening and thickening as it gets closer to the ocean. As a result of groundwater being pumped from the Charleston Aquifer since the late 1800s to fuel development and industry, Charleston County now experiences regional declines in groundwater levels. Because of these declines, Charleston, Berkeley, and Dorchester Counties were designated as the Trident Capacity Use Area (CUA) in August of 2002. There are currently four CUAs in South Carolina, each within the Coastal Plain. In these areas, groundwater withdrawals in excess of three million gallons per month must be permitted by SCDHEC. During the year 2016, Charleston County reported a total of approximately 2.44 billion gallons of water withdrawn from groundwater. In the County, the number one use for this water is for the public water supply, followed by golf course irrigation, and then industrial use.

Drought

Drought, the lack of precipitation over an extended period of time, is another stressor that Charleston County may face. South Carolina experiences significant variability in rainfall and this makes it hard to pinpoint the start or end of a drought. The Coastal Plain of South Carolina receives around 48 to 56 inches of precipitation annually, although there is some variation. Charleston County is at risk for a drought during any season, and it can be brought about by factors such as changes in pressure, storm tracks, and the jet stream, as well as extreme heat, wind, and evapotranspiration rates. In the 2018 Charleston County Emergency Operations Plan, drought was listed as a moderate probability threat for the area, and is considered a serious economic threat to the County because of how severely it can adversely affect agricultural industries.

Earthquakes

Earthquakes regularly occur in South Carolina. An earthquake hit the City of Charleston with an estimated magnitude of 7.0 on August 31, 1886, and it changed the face of the City killing approximately 60 people.

The entire County of Charleston lies within a "high potential for liquefaction" area (South Carolina Department of Natural Resources). This issue needs additional study and evaluation as it is definitely an issue of concern. The County needs to address ways to protect against additional damage in the event of an earthquake beyond what is regulated through building codes.

Liquefaction is the transformation of loosely packed sediment or cohesionless soil to a liquid state as a result of increased porefluid pressure and reduced effective stress. Liquefaction is caused by the ground shaking during an earthquake. Soil-liquefaction potential is based on the interpretation of thick, cohesionless material (mostly sand) combined with a high water table (SCDNR).

Although no major damaging earthquake occurred in the County since 1886, there have been several small scale earthquakes, mainly clustered around the Summerville area. Charleston County should prepare for the impacts of an earthquake now so that it can be ready. Because we have regularly occurring issues like flooding, earthquake resilience is often overlooked or set aside in order to address more regularly occurring issues, but the threat is imminent on a day-to-day basis.

Winter Weather

Although a rare occurrence, Charleston County can be affected by winter weather. In January 2018, Charleston County experienced a variety of wintry precipitation including snow, sleet and freezing rain. The Charleston Airport measured 5.3 inches of snow, the third greatest snowfall on record. Due to the continued cold air in place after the storm, the snow and ice remained on the ground for many days, causing significant disruptions to day-to-day life throughout the County.

Just four years earlier in February 2014, Charleston experienced a winter storm event leaving about one quarter of an inch of ice throughout Charleston County. Most of Charleston County escaped the amount of accumulation to cause serious damage, but the surrounding counties of Berkeley, Dorchester and Colleton had significant damage to trees and power lines caused by ice. Although not as crippling as the 2018 storm, Charleston was not able to bounce back from this event quickly, having roads and business closures County-wide.

Because of the irregularity of winter weather in Charleston County, the area is not

typically prepared to handle such events. There are few, if any, salt trucks and snow plows available. The County must rely on outside resources to assist or just wait out the weather and shut down for several days creating disruptions in essential services, safety concerns, and financial hardships. Building resilience and planning for winter weather is definitely necessary for future events to limit the economic impact.

OTHER RESILIENCE ISSUES

Transportation Infrastructure

Transportation is essential for a community to function. Flooding can interrupt or detrimentally affect transportation. According to the Centers for Disease Control and Prevention, over half of all flood-related deaths occur when a vehicle is driven into hazardous flood water. The next highest percentage of flood related deaths is due to walking into or near flood waters. People continue to drive or walk through flood waters to get to work and school, and if they are not able to, this indicates a need to increase the County's economic resilience, as laid out later in this Element. Critical infrastructure, such as bridges, roads, ports, clinics and hospitals are the foundation upon which the County functions, and are essential elements in getting the community back up and running after an event.

Considering the unique topographical nature of Charleston County, including islands, peninsulas, and inland property, the County is reliant on its infrastructure to tie transportation facilities together. Of large importance are bridges, which are something that nearly every citizen of Charleston County must cross on a daily basis. Since many areas of the County are only accessible via bridges, bridge closures can prevent many of our citizens from being able to get to and from their home, work, or school, potentially creating vast negative economic consequences. Bridge closures are not typically associated with flooding, but other influential impacts on the area such as ice storms and strong winds can completely shut down access to and from work, home, and school.

Accessibility is also key to the functionality of a community. If specific areas are not accessible due to flooding, the economics of that area and those working there can be affected, and also cause major issues in terms of safety. Recently during a rain event, the hospitals in Downtown Charleston were not accessible, creating a hazard for caregivers, patients, and visitors.

Health Resilience

Charleston's climate makes it susceptible to the transmission of vector-borne diseases, those spread by the bite of an insect such as a mosquito. The 2018 National Climate Assessment, a federally mandated report, asserts that climate change will modify the seasonality and prevalence of vector-borne diseases. Currently, Charleston's climate is suitable for the Aedes aegypti mosquito, that can spread several diseases including Zika, dengue fever, and chikungunya, from July through September. If temperatures were to increase in Charleston County, that active season could potentially lengthen, leading to increased disease risk. Additionally, the 2018 National Climate Assessment predicts an increase in labor hours lost from heat-related illnesses, as climate change contributes to higher temperatures. These stresses would be felt strongly in the labor-intensive agricultural, timber, and manufacturing sectors.

Economic Resilience

In Charleston County, we face frequent flooding and other events that impact our local economy by making it harder for employees to get to work, as well as affecting the County's ability to provide services to its citizens. In 2018, Charleston County offices were closed due to flooding, winter, and tropical storm events for several business days. Additionally, when there is a mandatory evacuation order for Charleston County, it adds to families' financial stresses, as they budget and plan for an extended stay away from home. Increasing our economic resilience, therefore, must include ways to reduce the number of down days due to such events.

The Charleston County Emergency Operations Plan (Operations Plan) includes the County's Continuity of Operations Program (COOP), the purpose of which is to ensure the continuity of mission essential emergency functions under all circumstances. The Operations Plan also encourages all County agencies to have a viable COOP in place. In Charleston County, several departments have a COOP which instructs departments on how to function in the event of an emergency. FEMA provides a course in Continuity of Operations, and also has templates and other resources available online for businesses and government entities to begin developing their own COOPs. Additionally, the Charleston County Emergency Management Department encourages local business owners to form disaster plans and COOPs of their own, and offers support for those looking to develop emergency operations plans. A collection of governmental and private sector business and industry leaders hold an annual workshop to assist businesses with the formation of these emergency operations plans.

Energy Resilience

The 2018 National Climate Assessment predicts that the southeast region will experience the highest costs in the United States associated with meeting increased electricity demands in a warmer world. Therefore, energy becomes an essential consideration when creating a resilient community. The Energy Element of the Comprehensive Plan already addresses some issues of energy resilience. It outlines planning and zoning techniques such as the establishment of an Urban Growth Boundary, Infill Development, and Transit-Oriented Development as tools for building sustainable

and resilient communities. Additionally, the Energy Element Strategies support goals for resilience including, but not limited to: promoting green building code standards and sustainable landscaping that aid in energy conservation; supporting tax incentives for properties that install/utilize alternative energy sources; and amending the Zoning and Land Development Regulations Ordinance to encourage local renewable energy generation and green building design, and providing standards for solar collectors and wind generators as accessory uses.

Food

The 2018 National Climate Assessment predicts climate change to have a negative impact on agricultural productivity, because changes in temperature can change the conditions for crops and livestock. All livestock are susceptible to heat stress, making it vital for Charleston County to consider new or enhanced adaptive care strategies. Additionally, climate change has the potential to impact local food sources, including regionally important crops. As the County experiences warmer temperatures during the winter months, the harvesting of corn, soybeans, rice, peaches, and many other crops are affected. However, for freeze-sensitive plants, including oranges, papayas, and mangoes, the increasing temperature has the potential to allow these crops to thrive in our region. An additional threat to food resilience is the impact of drought on crops and livestock. One of the most immediate effects of drought is a decrease in crop production. There are also other less obvious consequences of drought including poor soil quality and increased spending on feed and water for livestock, which impact our local food supply. These factors can all lead to higher food costs.

Tools and Existing Protective Measures

Charleston County Zoning and Land Development Regulations Ordinance

Strategic land use can bolster a county's resilience by shaping where, what, and how land can be developed. There are several regulations centered on the County's current Zoning and Land Development Regulations that contribute to resilience. One item that makes the County stand out is the required vegetated buffers from saltwater wetlands, waterways, and Ocean and Coastal Resource Management (OCRM) Critical Lines. These buffers provide a visual, spatial, and ecological transition zone between development and the County's saltwater wetlands and waterways, and to protect water quality and wildlife habitat. Additionally, Charleston County requires larger minimum lot sizes and widths for properties that contain or abut an OCRM Critical Line, in order to maintain a lower density along the waterfront. The Charleston County Zoning & Planning Department also works in close coordination with the County's Stormwater Management Division when property is being developed or redeveloped.

Charleston County Stormwater Manual

Charleston County developed both a manual and Charleston County Ordinance #1518 to protect, maintain, and enhance the water quality and the environment of the County, as well as to improve the short-term and long-term public health, safety, and general welfare of its citizens. This Manual is for stormwater management purposes only, and the requirements are specific to Charleston County.

The Charleston County Stormwater Permitting Standards and Procedures Manual (Manual) describes the policies and procedures used by the Public Works Department to implement the Ordinance and the County's Stormwater Management Plan (SWMP). These standards and procedures describe the requirements of construction activity applications and the approval process as it relates to stormwater management; convey the technical design standards to the engineering community, to include standards which address runoff flow rates, volumes, and pollutant load/concentration, as well as specific standards during construction, and post-construction for long-term performance; provide information on avenues to improve water quality, prevent illicit discharges, and minimize stormwater runoff impacts due to development and re-development; convey other protection provisions related to stormwater discharges such as wetlands and watercourse conservation.

Charleston Regional Hazard Mitigation Plan

In compliance with the Federal Emergency Management Agency's (FEMA) requirements to receive federal disaster funding, Charleston County, jurisdictions and community stakeholders and partners (i.e. Charleston County Parks & Recreation Commission, Roper St. Francis Hospital, Charleston County School District, individual water and sewer districts, etc.) have adopted a Hazard Mitigation Plan that is updated annually, with a full review every five years as required. The purpose of the Hazard Mitigation Plan is to continue guiding hazard mitigation efforts to better protect the people and property in the County from the effects of hazard events. This Hazard Mitigation Plan demonstrates the community's commitment to reducing risks from hazards, and serves as a tool to help decision makers direct mitigation activities and resources. This Hazard Mitigation Plan was also developed to ensure Charleston County and participating stakeholders and partners also earns points for the National Flood Insurance Program's Community Rating System (CRS), which provides for lower flood insurance premiums in CRS communities as described later in this Element.

Charleston County implores feedback from all jurisdictions within Charleston County and participation in planning the document is required. Public input is also obtained through surveys and open meetings. After updates, suggested edits and refocusing on the community's current hazard needs, the plan goes through a full adoption process

every five years. Adoption of the plan is required for all participating jurisdictions, stakeholders, and partners.

The Charleston Regional Hazard Mitigation Plan is incorporated into this Comprehensive Plan.

Community Rating System

Charleston County has participated in the Community Rating System (CRS) program since 1995. The purpose of the CRS is to support the National Flood Insurance Program (NFIP) by working to minimize flood losses nationwide. This can be accomplished by encouraging communities to reduce the exposure of existing building to flood damage, protect new buildings from known and future flood hazards, and encourage implementation of higher regulatory standards from the minimum NFIP requirements. It is a point-based system that once all efforts are tallied, CRS will issue a rating. This rating is associated with a discount that is assessed to all residents owning flood insurance policies within a participating jurisdiction. For those jurisdictions in Charleston County that have opted to allow the County to administer their floodplain management regulations, the rating they are currently assessed upon is a 30% discount in flood insurance premiums. This 30% means that Charleston County has accumulated enough points to be rated as a Class 4 community (ranging on a scale of 1-10 with Class 1 being the highest). Several County departments work with Building Inspection Services to either provide information for the required documentation or they work to implement higher regulatory standards. Although the County currently covers many of the sections in the CRS manual, there are a few sections that could be covered to implemented to make the community more resilient.

The Community Rating System program consists of nineteen creditable activities under four categories, including public information, mapping and regulations, flood damage reduction, and warning and response activities. The County participates in all four categories and most of the creditable activities contained within the categories. Some examples of the County activities include: raising the freeboard (the required height at which buildings must be built) from one foot above base flood elevation to two feet above; digitizing and providing complimentary review and public access to elevation certificates; providing a Public Information Plan characterized by the County's activities to provide flood protection information to the public; designating and mapping open space preservation areas; assessing and mapping repetitive loss properties; providing notification of special flood hazard area information; and participating in annual drills, among many others. Other activities that the County can potentially participate in to increase its CRS rating will be detailed in the Strategies section of this element.

Beachfront Management Plan

The State of South Carolina requires that ocean beachfront counties and municipalities prepare local comprehensive beach management plans in coordination with the Department of Health and Environmental Control, Office of Coastal Resource Management (DHEC-OCRM). The plan must include a minimum of ten elements, be adopted by the community, and then submitted to DHEC for review and state approval. These plans provide guidance to state and federal agencies on local policies, regulations, and procedures related to beachfront management plans. Similar to the County's Comprehensive Plan, the Beachfront Management Plan must be reviewed every five years and updated every ten years.

The required elements include the following:

1. Inventory of beach profile data and historic erosion rate data for each standard erosion zone and inlet erosion zone under the local jurisdiction;

2. Inventory of public beach accesses along with a plan for enhancing public access and parking;

3. Inventory of all structures located in the area seaward of the setback line;

4. Inventory of turtle nesting and important habitats of the beach/dune system and a protection and restoration plan if necessary;

5. A conventional zoning and land use plan consistent with the purposes of the Act for the area seaward of the setback line;

6. Analysis of beach erosion control alternatives, including re-nourishment of the beach under the local government's jurisdiction;

7. Drainage plan for the area seaward of the setback zone;

8. Post disaster plan, including plans for cleanup, maintaining essential services, protecting public health, emergency building ordinances, and the establishment of priorities, all of which must be consistent with the Act;

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

10. Detailed strategy for achieving the goals of preservation of existing public access and the enhancement of public access to assure full enjoyment of the beach by all residents of this state.

The Charleston County Beachfront Management Plan is prepared in coordination with several departments including the Deputy Administrator for General Services, Building Inspection Services, Zoning & Planning, GIS/Technology Services, Stormwater/Public Works, and Emergency Management. It has been adopted as a part of the Comprehensive Plan and is due for a ten-year update in 2020. Because the next update is in the near future, this is a great opportunity to collaborate and work on strategies to support this Beachfront Management Plan.

Emergency Management Accreditation Program (EMAP)

The Charleston County Emergency Management Department maintains extensive emergency management plans and strategies, accreditations and resources that can be utilized in planning for a resilient community. The Department's vision is "to be recognized as an accomplished and innovative leader in emergency management that is known as ready, relevant, resilient and responsible." The County is recognized as being the only EMAP accredited community in the state of South Carolina. EMAP, the voluntary standards, assessment, and accreditation process for disaster preparedness programs throughout the country, fosters excellence and accountability in emergency management and homeland security programs, by establishing credible standards applied in a peer-review accreditation process. EMAP was created by a group of national organizations to foster continuous improvement in emergency management capabilities. It provides emergency management programs the opportunity to be recognized for compliance with industry standards, to demonstrate accountability, and to focus attention on areas and issues where resources are needed.

Strategic Plan

Charleston County's Emergency Management Department utilizes strategic planning in an effort to maximize team members' ability to provide measurable projects and programs through preparedness, prevention, response, recovery, and mitigation. During the strategic planning process, goals and objectives are determined based on community need and the on-going changes in the field of emergency management. This Plan serves as the Strategic Plan for the entire Charleston County Emergency Management Program to include all municipalities and public services districts. As a result, the Emergency Management Department developed a comprehensive three-year plan to enhance the way Charleston County manages major events.

In collaboration with public, private, faith-based, and non-profit organizations; goals and objectives were developed that enhance the "whole community" approach to emergency management. The development of goals and objectives derives from strengths, opportunities for improvement, lessons learned, and best practices gathered from disaster events across the world. The 2016-2019 Strategic Plan aims to facilitate accountability of necessary goals and objectives by assigning action items and completion dates to measure achievements for the team throughout the planning process. The Emergency Management Department helps to coordinate the response among public, private, non-profit, and community organizations in order for Charleston County to remain resilient during major events.

The Emergency Management Department looks for opportunities to curb the trends of dwindling budgets, staffing shortages, availability of grants, and the overall decreasing volunteerism in order to build a resilient emergency management program. The team members seek new ways to better utilize existing resources and enhance their capability to respond and recover from large-scale events. The Emergency Management Department focuses on building community partnerships to help leverage the gaps analyzed as a result of the strategic plan. In doing so, organizations engage in exercises, trainings, and community meetings that promote a culture of preparedness. Research has shown that communities that train together, across all disciplines and jurisdictions, will ultimately build the resiliency needed to recover quickly from even the worst disaster to impact the community. These vital partnerships within our community allow Charleston County to maximize the utility of resources available to citizens after a major event.

The Emergency Management Department has several additional resources including the Redbook, the Emergency Operations Plan, and the Lowcountry CERT Program, among other training opportunities to keep County staff and volunteers current on training and documentation to prepare for most situations.

International Building Code Series

The State of South Carolina requires governing local entities to adopt, by ordinance, the state-approved versions of the International Building Code series. Currently the State approved Building Code in South Carolina is the 2015 International Building Code (IBC), and the 2009 Energy Code. The 2018 International Building Code is currently under review by the State, and will be required to be adopted by the local governing entities within six months after receiving notification of the approval.

The International Building Code series provides best practices to protect the public health, safety, and general welfare by regulating and controlling the design, construction, quality of materials, use and occupancy, location and maintenance of all buildings, structures, and certain equipment. In Charleston County, a series

of processes are in place that require a building plan review in order to check for compliance with the applicable building codes in effect. In addition, during this review, plans are also reviewed for compliance with FEMA standards for buildings located within the Special Flood Hazard Area, such as freeboard requirements, venting requirements and systems, wet or dry floodproofing, among others.

FEMA Flood Insurance Rate Maps (FIRM)

The Federal Government requires the adoption and maintenance of Flood Insurance Rate Maps (FIRM) by communities in order to participate in the National Flood Insurance Program (NFIP). These maps are tools for communities to not only identify the area's flood zones, but also provide information to citizens in evaluating their risks. These maps are updated periodically by either the introduction of new technology or due to the needs of a community. The process of updating these maps can be very costly, and for a community the size of Charleston, it is a lengthy process. After a private consultant prepares new map updates, the community is provided with a period of time to review the maps and submit any comments or appeals. The appeals can come from citizens or jurisdictions. If appeals are submitted, they are reviewed and will be further processed if the claim is based on quantifiable data. It is the responsibility of the property owner to either provide a survey or an engineering analysis if the claim is stating that the new data is inaccurate. After FEMA completes its review, the jurisdiction will receive a Letter of Final Determination, and is then required to adopt the new maps within six months to maintain the community's NFIP status. Charleston County has been in the process of updating the maps since September 2016. FEMA received comments and appeals, and has since been reviewing the data and working with the engineer that produced the maps. The County will likely adopt the new maps sometime in 2019.

Map 3.11.4 illustrates the County's flood zones according to the currently adopted 2004 maps. Most of the County lies within a flood zone, or about 68% of the land area. It is imperative that Charleston County as a whole works with other departments and jurisdictions to make floodplain management a collaborative effort so that systems and strategies compliment and support one another. Flood zones know no boundaries and by joining forces, the County can best serve its citizens. In addition, because a property is located in an X Flood Zone does not mean that the property does not have a risk of flooding because the flood zone designation is only associated with a potential for an annual chance of a flood. For example, properties located within the AE Flood Zone are identified as having a one-percent annual chance of flooding. X Zones are still considered to be areas of "moderate" risks as opposed to "high risk," therefore still have the potential to flood, just not as high of a chance as those zones within the Special Flood Hazard Areas. Public education is essential to inform citizens about what flood zones mean and how they can be affected by varying factors.

The Special Flood Hazard Area (SFHA) is the area that will be inundated by the flood event having a one-percent chance of being equaled or exceeded in any given year. This is also referred to as the "base flood" or "100-year flood." SFHA's are labeled as Zone A, AO, AH, A1-A30, AE, A99, AR, AR/AE, AR/AO, AR/A1-A30, AR/A, V, VE, and V2-V30. These are considered to be high hazard areas, and have additional building code and flood requirements. Moderate flood hazard areas are labeled B or Shaded X, and have a 0.2 percent annual chance of flood or also known as the 500-year flood. The area of minimal flood hazard, called Zone X, or C, are outside the SFHA and have a higher elevation than the 0.2 percent annual chance flood area.

Charleston County Building Ordinance

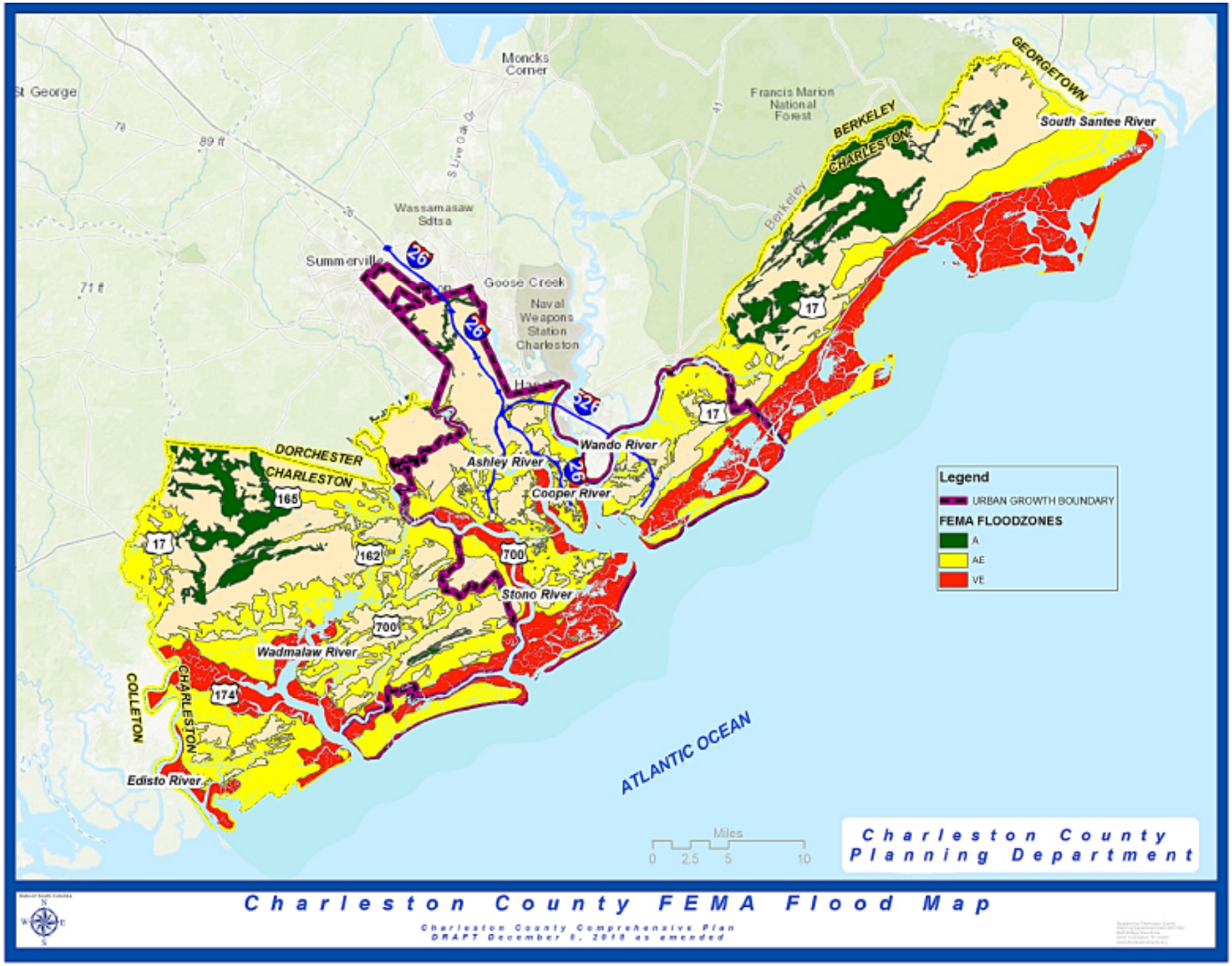
The Charleston County Building Inspection Services Department administers the County's Building Ordinance, which adopts the International Building Code (as required by the State of South Carolina), and sets out any additional standards above the minimum building code requirements that must be met to, and in the interest of, public health, safety, and welfare. There are several flood-related standards identified in the International Building Code, but the Code points to the FEMA regulatory standards when referencing requirements. The Charleston County Building Ordinance addresses all concerns regarding buildings, except flood requirements, which are found in the Charleston County Flood Damage and Prevention Ordinance.

Charleston County Flood Damage and Prevention Ordinance

One major step in ensuring compliance with FEMA flood regulations is in the adoption of a flood ordinance by local jurisdictions. It is required for communities to participate in the National Flood Insurance Program. The purposes of this Ordinance, also called the "Flood" Ordinance, is to promote the public health, safety and general welfare, and to minimize public and private losses due to flood conditions in specific areas. These provisions are designed to restrict or prohibit uses which are potentially in danger and vulnerable to water or erosion hazards, or which result in damaging increases in erosion or in flood heights and velocities. This ordinance also requires that structures vulnerable to flooding be protected against flood damage. Some examples of how the Ordinance can accomplish this is by implementing a minimum freeboard at which a building must be elevated or protected above the base flood elevation; requiring hydrostatic venting systems, dry or wet floodproofing techniques on commercial building, among several others.

Some ways that the Flood Ordinance ensures building protection against flood damage is by requiring building plans be reviewed for compliance with the Flood Ordinance prior to building permits being issued. During this review, the Department is looking for things such as breakaway wall certification from a design professional, elevation of mechanical systems, and reviewing the height at which the lowest floor is designed.

Map 3.11.4 Charleston County FEMA Flood Map (Adopted 2004)



After a permit is issued and construction has begun, building inspectors will inspect the building to ensure that the requirements approved on the plans are also actually implemented during construction. All of the requirements must be met or corrected before a Certificate of Occupancy is issued.

Additional objectives of the ordinance help to minimize the expenditure of public money for costly flood control projects, minimize the need for rescue and relief efforts associated with flooding, minimize prolonged business interruptions, and to help maintain a stable tax base by providing for the sound use and development of flood prone areas in such manner as to minimize flood blight areas. And finally, to ensure that potential homebuyers are notified that property is in a flood zone.

Just as the Building Ordinance requires some additional standards above those outlined in the International Building Code, the Flood Ordinance provides an avenue for the County to legally require flood protection measures above and beyond minimum standards as set forth by FEMA regulations. The County's Flood Ordinance is where any existing higher regulatory standards can be found, as well as where any additional regulations can be implemented; such as requiring an increased minimum freeboard, requiring minimum flood standards for properties located in the X Flood Zone, requiring additional site plan review, etc. The Flood Ordinance is expected to be updated next when the new FEMA flood maps go into effect sometime within the next year.

Repetitive Loss Properties

Repetitive loss properties are classified by FEMA as any insurable building for which two or more flood insurance claims of more than $1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year time period, since 1978. The property may or may not be currently insured by the NFIP. Structures that flood frequently strain the National Flood Insurance Fund, draining the funds needed to prepare for catastrophic events. The primary objective of the Repetitive Loss identification program is to eliminate or reduce the damage to property and the disruption to life caused by repeated flooding of the same properties. There have been a number of efforts aimed at reducing the risks, one of which is providing the FEMA post-disaster Hazard Mitigation Grant Program (HMGP) projects, which has funded the mitigation of nearly 3,000 properties nationwide. Also the Flood Mitigation Assistance (FMA) Program offers monetary assistance to homeowners that mitigate their properties to reduce the impacts of flooding. Once mitigation efforts have been completed, the property owner may request for the property to be removed from the list.

Severe repetitive loss properties are classified as properties having four or more claims of more than $5,000 each or two or more separate claims where the total dollar amount of the payments exceeds the current value of the property. Both situations must have occurred within a ten-year period. Similar to the grants mentioned above, there are additional funding options for property owners to alleviate some of the mitigation costs.

Due to privacy restrictions, these lists are not available to the public and there are currently no requirements regarding disclosure when such properties are for sale to inform potential buyers of the known risks.

As of May 2018, there were 152 properties on the Repetitive Loss list in Unincorporated Charleston County and the following jurisdictions: Town of Awendaw, Town of Hollywood, Town of James Island, Town of Lincolnville, Town of Meggett, Town of Ravenel and Town of Seabrook Island. These jurisdictions are currently served by the County's floodplain management program through intergovernmental agreements.

Conclusion

The scope of resilience goes far beyond the topics covered in this Element, and the County will work to introduce additional areas of concern, causes, and potential solutions over time to help create a more resilient Charleston County. The topic of resilience is covered in other Elements of this Comprehensive Plan, and during the next scheduled review of the Comprehensive Plan in its entirety, these topics will be consolidated and evaluated.

Photo: Charleston County Public Information Office

3.11.3: RESILIENCE ELEMENT GOAL

Charleston County will prioritize resilience in all County plans, policies, and regulations.

Resilience Element Needs

Resilience Element needs include, but are not limited to, the following:

- Improving the County's ability to handle and recover from sudden emergencies, as well as more persistent issues.
- Determining areas that are of the highest risk, evaluating development intensity regulations for these areas, and prioritizing projects in these areas.
- Strengthening partnerships with surrounding jurisdictions to combat issues that cross jurisdictional boundaries.
- Educating the public about their role in building resilience and how to recover.
- Review and consolidate resilience-related efforts detailed in other Elements of this Plan during the next five-year update, which may include, but not be limited to, advanced study and audit of existing facilities and programs.

PHOTO: CHARLESTON COUNTY PUBLIC INFORMATION OFFICE

3.11.4: RESILIENCE ELEMENT STRATEGIES, ACTION ITEMS AND TIME FRAMES

The County should undertake the following strategic actions in support of the Vision and Goals of this Plan. These implementation strategies and action items will be reviewed a minimum of every five years and updated every ten years from the date of adoption of this Plan.

RE.1 Coordinate resilience-related efforts within the County and across jurisdictional boundaries.

ACTION ITEM: Identify a Resilience Officer and resources to implement strategies, administer programs, pursue funding opportunities, and provide standards to coordinate resilience-related efforts of County Departments, municipalities and adjacent jurisdictions, applicable regulatory agencies, and regional partners.

ACTION ITEM: Identify and pursue amendments to existing County policies and regulations including, but not limited to, the Floodplain Management Program, Hazard Mitigation Plan, Stormwater Ordinance, Building Ordinance, and Zoning and Land Development Regulations Ordinance, to improve the County's resilience towards long-term stresses and acute disasters, using the best data available to inform decisions.

ACTION ITEM: Amend applicable County ordinances to address the Community Rating System (CRS) standards not currently addressed by the County, including, but not limited to:

- Requiring low-impact development design Best Management Practices such as non-structural flood protection techniques that can mimic natural hydrologic runoff characteristics and minimize the impact of land development on water resources in applicable areas;
- Increasing the freeboard in Special Flood Hazard Areas;
- Implementing freeboard requirements in X Zones;
- Increasing minimum lot size requirements in low density zoning districts (in the Rural Area);
- Prohibiting filling of land where determined to create or exacerbate flooding, whether the land is in a flood zone or not;
- Increasing OCRM Critical Line buffer requirements;
- Requiring additional review of flood hazards during the Site Plan Review process;
- Enacting transfer and/or purchase of development rights programs through Intergovernmental Agreements with other jurisdictions to provide incentives for low levels of development within the Special Flood Hazard Areas; and
- Requiring compensatory storage of stormwater in new development/redevelopment, where applicable.

ACTION ITEM: Work with adjacent jurisdictions to secure funding to perform a regional vulnerability, risk, and resilience assessment and watershed assessment, both of which should include implementation strategies.

ACTION ITEM: Amend County regulations and policies to implement the strategies of the regional vulnerability and watershed assessments.

ACTION ITEM: Create, implement, maintain and assist in public information programs in order to educate citizens about resilience practices including, but not limited to, assisting business owners with developing Continuity of Operations Plans; educating the public, including children, about contributing factors related to flood risks, sea level rise, and ways to reduce environmental impacts; creating targeted messaging that is understood at all educational levels, ages and nationalities, so that the public can be better informed; and incorporating K-12 educational efforts to promote resilience, mitigation and disaster preparedness at the school-aged level.

ACTION ITEM: Continually monitor local, state, federal, and private initiatives and recommendations regarding resilience.

ACTION ITEM: Coordinate with municipalities to reduce waste and duplication of efforts, and investigate diversion strategies in order to limit impacts on the environment.

RE.2 Develop, adopt, and implement a Drainage Master Plan and sea level rise strategies that are coordinated with adjacent jurisdictions.

ACTION ITEM: Create an asset management plan to identify existing drainage easements and structures, including ownership, and ensure their maintenance and longevity.

ACTION ITEM: Identify additional Best Management Practices to be utilized in areas as specified by the Drainage Master Plan.

ACTION ITEM: Identify where drainage easements and/or structures are needed and coordinate with property owners and/or jurisdictions to obtain the easements, construct the improvements, and maintain the improvements.

ACTION ITEM: Develop, adopt, and implement resilience strategies for capital expenditures for existing and new infrastructure.

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