Horry County
South Carolina

Flood Resilience Master Plan

SUMMARY REPORT

SEPTEMBER 30, 2022

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EXECUTIVE SUMMARY

OVERVIEW

Horry County (the County) is situated within South Carolina's coastal plain and is bordered by North Carolina to the north and the Atlantic Ocean to the east. Water is a prominent natural feature throughout Horry County, encompassing approximately 9% percent of the County's 1,134 square miles. Horry County is low-lying and contains the major waterways of the Pee Dee River, the Waccamaw River, and the Atlantic Intracoastal Waterway, all of which flooded during Hurricane Florence. The County has experienced steady growth over the past decade and its population has swelled by more than 30% since 2010, to 351,029 residents (2020 U.S. Census). With a temperate climate, a relatively inexpensive cost of living, and the Grand Strand as a regional destination, by 2035 it is projected that Horry County's population will have grown to 603,675. This projection does not account for the seasonal and tourist population. As a result of rapid population growth, the County, which has been primarily rural, is quickly becoming suburban, with approximately 75% of the permanent population residing in unincorporated Horry County. This expansive growth, as well as the County's growth as a tourist destination, increases pressure on infrastructure and government services.

PLAN SCOPE AND FOCUS

Horry County has long recognized its vulnerability to storm events and flooding. The County's geological characteristics are conducive to flooding and its proximity to the Atlantic seaboard places it in the pathway of hurricane systems. The County sits at the base of several significant inland watersheds that stretch to North Carolina and neighboring counties. The County is continually evolving its level of preparedness as the threat of storm impacts and flooding increase.

Horry County recognizes the need to understand the impacts of flooding and to put measures in place that can increase resilience to future flood events. Development of the Horry County Flood Resilience Plan was funded under the FEMA HMGP Planning program (Project: 4346-0030) as an annex to the County's Multi-Jurisdictional Hazard Mitigation Plan. The plan focuses on the development of riverine flood mitigation strategies for the unincorporated areas of Horry County. The plan provides a roadmap for County government and the community to build a partnership to successfully adapt to future flood conditions. The plan includes a study of the movement of floodwater in selected pilot communities to describe how flooding caused by different types of storms may damage existing assets. Finally, the Plan includes a series of suggested physical interventions and interrelated policies and programs that can be piloted locally and enacted throughout the County to build the foundation for a long-term resilient future.

SUMMARY OF KEY CHALLENGES AND OPPORTUNITIES

Hurricane Florence exposed the magnitude of the County's vulnerability to flooding. Like Matthew and Joaquin before it, Florence impacted communities previously considered to be safe from flooding. As a result of Hurricane Florence, more than 2,000 buildings were damaged, more than 460 roads were closed, and more than 250 roads were damaged. Both established and more recently constructed communities were affected.

Key Risks and Vulnerabilities in Horry County:

- Low-lying and relatively flat topography.
- Historical development patterns impacted properties in the floodplains vulnerable to flooding.

• Reduction of water storage within floodplains and wetlands as a result of development.
• Evacuation routes and key roadways are compromised during flooding events, limiting access and emergency response.
• Hurricane storm surge hinders the ability of the riverine water system to discharge into the Atlantic Ocean

In the wake of Hurricane Florence, community meetings were held in the areas hardest hit by Hurricane Florence regarding causes and potential solutions for extreme flooding. The public input collected during these engagement sessions was critical to the development of the plan. The collective wisdom of the community was instrumental in identifying key issues that needed to be further explored during plan development.

Key issues included:

- The types of flooding Horry County experiences, and how to communicate that information
- The hydrologic and geologic characteristics that influence the unique impacts of flooding on individual communities, often in ways that are not reflected in the current FEMA flood zone designations assigned to properties.
- The role of development in flooding impact
- The potential for engineered solutions to address specific flooding challenges
- The need for a greater public understanding about the County's regulatory structure regarding low-impact development and stormwater management.

POLICY AND PROJECT CONSIDERATIONS
The report culminates in a general set of considerations in the areas of Policy Development, Resilient Design Strategies, and Community Engagement and Planning that may be considered for adoption alone or in combination in an effort to make Horry County more resilient in the face of future riverine floods.

Policies and recommendations made in this report include specific revisions to the flood ordinance. A comprehensive revision to the Horry County Flood Damage Prevention Ordinance was in process when this report was being drafted in early 2021. A number of recommendations within the report were included in the updated flood ordinance adopted by Horry County Council in Summer 2021.

A task order to the original FEMA planning grant was approved so that Horry County could undertake a mapping of the full extent of riverine flooding in the wake of Hurricane Florence. Within the study area, specific flood elevations using Florence data from stream gauges, USGS high water marks, and post-storm damage reports have been estimated. Based on these data, the Florence flood elevations within the study area range from 21 to 25 feet above NAVD88. An adjusted BFE can be established by comparing the FEMA BFE to Florence flood elevations and using the higher elevation value.

CHAPTER 1: OVERVIEW AND CONTEXT

1.1 Planning Area

Community Context

The significant influx of new residents is expanding neighborhoods across the County, not only in Myrtle Beach and the largely suburban zone that lies between Conway and Myrtle Beach, but also in the historically rural western sections of the County, an area largely composed of unincorporated communities. This growth will continue to add pressure on County resources with increased impacts to natural systems, and will require the construction and management of roads, sewers, and storm water management systems.

The relatively flat conditions and the confluence of multiple waterways can cause floodwaters to "back-up" in times of high flow. Although the County's stormwater ordinance requires reduced run-off rates from development, new development builds up and fills the land and creates additional impervious surfaces, increasing run-off and reducing the storage capacity of the floodplain and surrounding lands.

Target Communities

The unincorporated Horry County communities of Bucksport, Longs, Red Bluff, and Socastee were designated as the areas of focus for this report. The target communities are representative of flooding conditions that are experienced throughout the County. Therefore, solutions piloted in these communities can be evaluated for potential application in other parts of Horry County. Specific vulnerabilities and asset inventories for each community are included in Chapter 2.

The communities illustrate the diverse impacts flooding has on the communities throughout the County.

- Bucksport illustrates the regional basin relationships of the Waccamaw and Pee Dee Rivers.
- Socastee represents the Intracoastal Waterway impacts, including the relationship between flow patterns, elevations, and the Waccamaw and Pee Dee Rivers.
- Longs and Red Bluff exhibit the impact of flooding along the upstream tributaries of Simpson Creek and Buck Creek and their confluence with the Waccamaw River.

1.2 Nature and Categorization of Storm Impacts

The slow-moving nature of Hurricane Florence combined with the consistent volume of rainfall produced throughout its track across the region made the storm even more impactful than larger storms moving more quickly. Estimated monetary damages in South Carolina from Florence totaled $2 billion.

While Florence was a coastal storm, the severe impacts felt by Horry County were primarily from inland flooding that took place in the days and weeks after the hurricane made landfall.

The extensive and prolonged flooding in Horry County during Florence was due to a combination of widespread unprecedented rainfall across the entire Pee Dee drainage basin that was further exacerbated by the low elevation and relief of the landscape (flat land near sea level) and the fact that the outfall to the Atlantic Ocean is more than 30 miles further south (at Winyah Bay).

As a result, the stream channels were unable to accommodate and quickly drain the excessive rainfall.

1.3 Community Resilience

Some residents may have the means to build back following a storm, but not all are able to find the necessary resources, and even fewer are able to sustain recovery when repeatedly impacted. The succession of destructive storms that result in repetitive flooding events can erode residents' confidence in the safety of an area and its resilience to flooding, as well as residents' financial stability.

Whereas long-time residents who experienced previous flood events are familiar with emergency protocols and relative flood risk, newer residents are often unfamiliar with Horry County's vulnerability to flooding and the prevalence of hurricanes. This knowledge gap could lead to less-informed decisions regarding evacuation, property protection, and the flood risk of prospective properties.

In November 2018, in the wake of Hurricane Florence, the third major riverine flooding event in four years, Horry County applied to and received funding from FEMA's Hazard Mitigation Grant Program (HMGP). FEMA HMGP funding was awarded to develop a Flood Resilience Plan as an annex to the County's All-Hazards Mitigation Plan, approved by FEMA in January 2016. As a first step in the development of the plan, meetings with residents and local leaders were coordinated in order to hear concerns and generate ideas for improving resiliency in the area.

Conversations during these meetings revealed that informing community members about the characteristics of different flooding types can help balance the perceived role of development in causing all flooding. While development can certainly contribute to flash flooding issues, it is a much less significant factor in the riverine flooding and storm surge events in our area that are the focus of the current planning effort.

The collective wisdom of the community helped identify key issues that needed to be further explored during plan development. Key issues included:

- The types of flooding Horry County experiences, and how to communicate that information
- The hydrologic and geologic characteristics that influence how flooding strikes different communities in different ways and at different times, sometimes in ways which are not reflected in the current and proposed FEMA flood zone designations assigned to the properties
- The role of new development in affecting flooding impacts
- The potential for engineering solutions to address specific flooding challenges

• The need for a greater understanding about the County's regulatory structure regarding low-impact development and stormwater management
• The importance of tree preservation and forestry management to overall County resilience

CHAPTER 2: RISKS AND VULNERABILITIES

2.1 Flood Overview and Trends

The types of flooding created by Hurricanes Joaquin, Matthew, and Florence are known as riverine and flash flooding. Riverine flooding is typically characterized by widespread rainfall across a river basin resulting in stormwater that progressively accumulates in volume as it moves downstream. In addition to riverine flooding, there are three other types of flooding that have the potential to impact Horry County riverine communities.

Flash flooding occurs when rainfall volumes exceed what can be absorbed or retained on a development site, causing runoff that affects adjoining properties and streets. As its name implies, flash flooding is felt immediately during and shortly after a storm and is seldom a multi-day event.

Storm surge is flooding driven by high winds associated with tropical or subtropical storm systems like hurricanes and nor'easters. Storm surge primarily affects properties in the immediate coastal zone, but strong storm surge events can force floodwaters up rivers and into floodplains. Like flash flooding, storm surge is a short-term event.

Compound flooding happens when flash flooding, riverine flooding, or storm surge combine to raise the local water table and increase the extent of flooding beyond what would be expected from a single flooding type. Compound flooding will happen when the ground is saturated from prior rains or from a naturally high water table, and two or more additional flooding types occur. Rainfall from a thunderstorm that falls onto ground already saturated from prior storms can combine the effects of flash flooding and riverine flooding, for instance, resulting in a compound flooding event.

2.2 Key Risks and Vulnerabilities

When Hurricane Florence made landfall, many residents in Horry County were still recovering from the damaging effects of Matthew and Joaquin. The cumulative impact of these three successive storms within four years was particularly devastating and exposes the County's vulnerability to flooding.

The following key areas describe the primary challenges Horry County faces in achieving a flood resilient future.

Topography - The County sits at a low elevation relative to sea level and has broad, flat topography. Horry County is positioned at the lowest elevation of two expansive river systems, the Pee Dee and Waccamaw.

Storage Capacity - Tributaries, wetlands, swamps and other natural features serve as water storage during rain events and help to control the flow of water through Horry County. As a region develops, many of these natural flood management systems are re-purposed or converted into conveyance channels, and many of the sites are raised to support development and create detention ponds.

Storm Surge - Hurricanes Joaquin, Matthew, and Florence were characterized by extreme rainfall that led to destructive riverine flooding in inland areas. However, Horry County's coastal location also leaves it highly vulnerable to flooding due to storm surge, shallow coastal flooding that often occurs during extreme high tides, spring tides when combined with rainfall, and sea level rise.

Repetitive Flooding - Due to the repetitive nature of flooding events in the area, damage to property occurs continually, and often, communities have not repaired or rebuilt after one storm before another impacts the community.

Historic Development Patterns - Recent storm events were among the most damaging and extensive in the history of Horry County, reaching communities that had not previously experienced flooding.

Storm Damage to the Natural Flow of Local River Systems - Horry County has a vast system of larger and smaller rivers and tributaries. Despite continued maintenance of these systems, the number of storms and the extent of storm damage inevitably increases the amount of limbs, trees and other snags and blockages that reduce the flow rates within the system.

Egress and Evacuation Routes - Hurricane Florence resulted in the temporary closure of approximately 465 roads in the County. The closure of the less traveled neighborhood roads hindered residents' ability to travel or access necessities, like groceries. Additionally, some of the roads that were closed were major travel arteries that are primarily used for means of egress. The closure of these travel arteries resulted in the limitation of resident mobility, the impediment to the flow of goods and services throughout the County, and the constriction of residents' access to jobs and other necessities, such as grocery stores, schools, and hospitals.

Population Growth and Future Development Patterns - Development prompts the removal of forest and tree canopy, creates impervious areas, and requires new road infrastructure, culverts, and other conveyance structures. The compounding effects of these necessary actions reduce the capacity of the land to store water, thereby increasing the amount of water that cannot be infiltrated and needs to be drained during a rainfall event, exacerbating the naturally occurring flooding issues in the area.

2.3 Vulnerabilities in Target Communities

Three target communities that were the focus of this study all have a significant number of buildings, transportation, and infrastructure assets that are highly vulnerable to flooding.

The following sections describe each of the target communities, including general characteristics, past storm impacts, and major infrastructure vulnerabilities.

- Bucksport Target Area
- Longs/Red Bluff Target Area
- Socastee Target Area

Bucksport

During Florence, flooding came from both the Pee Dee and Waccamaw Rivers. The stream gauge on the Pee Dee River west of Bucksport recorded a peak stage on September 27 around 14 feet above normal.

Bucksport Road, the primary road in the community, was flooded for almost two weeks during Florence. Extended road closures limited the ability of residents to return home after the storm, check on flooded homes, and even travel to work.

Only a small area of Bucksport is included in a Special Flood Hazard Area in the effective (1999) FEMA maps. Most of the buildings flooded during Florence are instead in the X zone (minimal flood hazard). The preliminary FEMA maps show significant change in this area, with most of the Florence-flooded properties within the Special Flood Hazard Areas (100-year floodplain) once the maps are approved. This means when the new maps become effective, over 100 buildings in the Bucksport area will be non-conforming, which could severely impact property and resale values.

BUCKSPORT ASSET INVENTORY

Infrastructure or Asset	Florence Damage	FEMA Prelim. Flood Zone
Major Transportation		
Hwy 701		AE, 500-year, X
Bucksport Road	Yes	AE
Mosdell Drive	Yes	AE
Port Harrelson Road	Yes	AE
Big Bull Landing Road	Yes	AE
Mishoe Road	Yes	AE
Ole Bellamy Drive	Yes	AE
Bethune Drive	Yes	AE
Martin Luther Drive	Yes	AE
Mahalia Drive	Yes	AE
Magnum Drive	Yes	AE
Broadway Street	Yes	AE
Rutledge Street	Yes	AE
Railroad Drive	Yes	AE
Old Magnolia Lane	Yes	AE
Sherman Place	Yes	AE
Beth Drive	Yes	AE
Isabella Drive	Yes	AE
Still Meadow Drive	Yes	AE
Glover Road	Yes	AE
Ole Moore Drive	Yes	AE
Treatment Road		AE, 500-year, X
Bridge 1 (Cowford Swamp - HWY 701)		AE
Major Subdivisions		
Buck Forest		AE, 500-year

Infrastructure or Asset	Florence Damage	FEMA Prelim. Flood Zone
Major Subdivisions		
Bucksport Heights	Yes	AE, 500-year
Bucksport River		AE
DV Richardson		AE, 500-year
Earl Lewis		AE
Flossie S Morris	Yes	AE, 500-year
Klondyke		AE, 500-year
Sherman Place		AE, 500-year
Recreation		
Bucksport Landing	Yes	AE
Port Harrelson Landing	Yes	AE
Major Commercial & Public Structures		
Bethel Seventh Day Adventist Church		AE, 500-year
Bucksport Marina	Yes	AE
Car Wash		500-year
Glenda's		AE
GSWSA Bull Creek Water Treatment Plant		AE, 500-year
Horry Telephone Cooperative Inc		AE, 500-year
James R. Frazier Community Center		AE
Jerusalem Baptist Church		AE
Mt. Moriah Baptist Church		AE
Salem AME Church		AE
Store - Bucksport Road		AE
Store - Hwy 701		500-year
Victory Church	Yes	AE
Victoria Chapel Holiness Church	Yes	AE

Longs

During Florence, the Waccamaw River gauge near Longs recorded a peak stage on September 21, 2018, of approximately 18 feet above normal.

Much of the area that was flooded during Florence (and Matthew) is not located within FEMA's Special Flood Hazard Areas, commonly known as the 100-year floodplains. For instance, most of the buildings in Aberdeen that flooded during Hurricane Florence are not in the Special Flood Hazard Area or FEMA maps.

21, 2018, of approximately 18 feet above normal. Most of the buildings in Longs that are highly

LONGS ASSET INVENTORY

Infrastructure or Asset	Florence Damage	FEMA Prelim. Flood Zone
Major Transportation		
SC HWY 9	Yes	AE
SC HWY 905	Yes	AE
Bridge 1 (Buck Creek - SC HWY 905)	Yes	AE
Bridge 2 (Waccamaw - SC HWY 9)	Yes	AE
Bridge 3 (Waccamaw Swamp - SC HWY 9)	Yes	AE
Major Residential Subdivisions		
Aberdeen Country Club	Yes	AE, 500-year, X
Long Bay Golf Club		X
Pine Needle Estates		X
Arbor Glen		X
Sarvis Farms		X
Rolling Ridge	Yes	AE, 500-year, X
Oak Hollow	Yes	AE, 500-year, X
Rum Bluff	Yes	AE, 500-year, X
Long Acres Drive		X
Anchors Bend		X
Longs Station		X
Longview		X
Recreation		
Chris Anderson Landing	Yes	AE
Major Commercial and Public Structures		
A Plus Auto Sales		X
Big E's	Yes	500-year
Bottle Bungalow Liquor		X
Buck Creek Baptist Church		X
Canipes Candy Factory	Yes	AE, 500-year
Carefree Exterior	Yes	500-year
Claridy Funland Day Care		X
Clubhouse - Freemont Road		X
Coastal Sleep Lab		X

Infrastructure or Asset	Florence Damage	FEMA Prelim. Flood Zone
Cornell & Diehl - SMH Buildings LLC		X
Designed for Life LLC	Yes	X
Dollar General		X
Ebenezer School		X
Ebenezer UMC Church		X
Exxon Tiger Mart		X
EZ Storage of Horry County LLC		X
Food Lion		X
Freedom Deliverance Center		X
Freemont Baptist Church		X
Golden Paws		X
Horry's Restaurant	Yes	500-year
Horry Telephone Coop Inc.		X
Kevins Auto Repair	Yes	500-year
Laudisi Enterprises		X
Little River Alternators	Yes	X
Living Water Baptist Church		X
Longs Head Start		X
Longs Mini Storage		X
Minuteman - Marathon Gas & Little Caesars		X
Norris Property LLC		500-year
Rustically Refined - Designed for Life LLC	Yes	X
Sand Beachwear Inc	Yes	X
SC DOT		X
Shell Station		X
Southern Breeze Contracting LLC		X
Southern Breeze Car Wash		X
Strategic Business Concepts LLC	Yes	X
Sun Colony Plaza		X
Williams Arcade		X
Wynna Renea LLC	Yes	AE

Red Bluff

During Florence, a rapid-deployment gauge on the Waccamaw River near Red Bluff recorded a peak stage on September 23, 2018, of approximately 18 feet above normal. As in Longs, much of the Red Bluff area that was flooded during Florence is not classified in FEMA's highest risk zones.

RED BLUFF ASSET INVENTORY

Infrastructure or Asset	Florence Damage	FEMA Prelim. Flood Zone
Major Transportation		
SC HWY 22	Yes	AE
SC HWY 905	Yes	AE
SC HWY 554	Yes	AE
Waccamaw Lane	Yes	AE
Loop Circle	Yes	AE
Bridge 1 (Waccamaw River - SC HWY 22)	Yes	AE
Bridge 2 (Jones Big Swamp - SC HWY 22)	Yes	AE
Bridge 3 (Jones Big Swamp 2 - SC HWY 22)	Yes	AE
Bridge 4 (Todd Swamp - Red Bluff Road)	Yes	AE
Bridge 5 (Todd Swamp - SC HWY 554)	Yes	X
Bridge 6 (Waccamaw River - SC HWY 31)	Yes	AE
Bridge 7 (Waccamaw River Swamp - HWY 31)	Yes	AE
Bridge 8 (Todd Creek - McNeil Chapel)		AE
Bridge 9 (Todd Creek - SC HWY 905)	Yes	AE
Bridge 10 (Simpson Creek - Hardee Road)	Yes	AE
Bridge 11 (Simpson Creek - SC HWY 905)	Yes	AE
Bridge 12 (Chestnut Branch - Loop Circle)	Yes	X
Major Subdivisions		
Stalvey - Mobile Home Park		AE, X
Red Bluff Village		AE, X
Roman Road		X
Inland Sands		X
MB Hardee Airport		X

Infrastructure or Asset	Florence Damage	FEMA Prelim. Flood Zone
Major Subdivisions		
RL Wiggins Jr Lots	Yes	AE
Polo Farms	Yes	AE, 500-year, X
Richardson/Mesa Raven Estates		X
Chesnut Estates at Mesa Raven		X
Mary Williams Wilson Lots		X
Sarah Vereen LD		X
Recreation		
Simpson Creek Park		X
Danny Knight Landing	Yes	AE
Major Commercial & Public Structures		
Atlantic Coast Medical Transport		X
Consignment Corner		X
Dollar General		X
Galaxy Food Center		X
Hardwick's Restaurant Supplies		X
Horry County Fire Rescue Station 34		X
King's Super Market		X
McNeil Chapel Missionary Baptist Church		X
Mt. Leon Baptist Church		X
One Stop Convenience		X
Piedmont Coca-Cola Bottling		X
Pleasant Hill Baptist Church		X
St John AME Church		X

Socastee

During Florence, the river gauge along the Intracoastal Waterway in Socastee recorded a peak stage on September 27, 2018, of approximately nine feet above normal. Of all the target communities, Socastee has the highest number of properties identified as repetitive loss. Repetitive loss properties are defined as having two or more claims of more than $1,000 paid by the National Flood Insurance Program (NFIP) in a ten-year period.

In much of Socastee, only a narrow strip of land that is less than several hundred feet wide along the Intracoastal Waterway is included in a Special Flood Hazard Area in the effective (1999) FEMA maps. Less than 20 percent of the buildings damaged by flooding during Florence (96 of 565 total) were within the effective FEMA SFHA.

SOCASTEE ASSET INVENTORY

Infrastructure or Asset	Florence Damage	FEMA Prelim. Flood Zone
Major Transportation		
SC HWY 17 BYP		AE, X
Socastee Boulevard		AE, X
Dick Pond Road	Yes	AE
River Road	Yes	AE
Rosewood Drive	Yes	AE
White Pine Drive	Yes	AE
Cottonwood Drive	Yes	AE
Shem Creek Circle	Yes	AE
Smith Blvd	Yes	AE
Folly Road	Yes	AE
Riverside Drive	Yes	AE
Teague Road	Yes	AE
Brandy Mill Boulevard	Yes	AE
Palmetto Point Boulevard		AE, X
Ed Smith Avenue	Yes	AE
Roberta Lane	Yes	AE
Bridge 1 (ICW & SC HWY 544)		AE
Bridge 2 (ICW & Dick Pond Road)	Yes	AE
Bridge 3 (NF Swamp & Socastee Boulevard)	Yes	AE
Bridge 4 (S NF Swamp & SC HWY 17 BYP)		AE
Major Subdivisions		
Rosewood Estates	Yes	AE, 500-year, X
Bridge Creek	Yes	AE, 500-year, X
Silver Creek		AE, 500-year, X
Lawsons Landing	Yes	AE, 500-year, X
Watsons Riverside	Yes	AE, 500-year, X
Inland Reef	Yes	AE, 500-year, X
Bellamy Estates & MHP	Yes	AE, 500-year, X
Lauderdale Bay HPR		AE, 500-year, X
Harbour Towne	Yes	AE, 500-year, X
Wildwood Ranchette		AE, 500-year, X
Worthington Estates		X
Stonebridge		AE, 500-year, X
Brandy Mill		AE, 500-year, X
Ivystone LLC Apts		X

Infrastructure or Asset	Florence Damage	FEMA Prelim. Flood Zone
Major Subdivisions		
Cimmeron Plantation		X
Woodbury		X
Palmetto Glen		X
Cascades at Azalea Lakes		X
Recreation		
Rosewood Landing	Yes	AE
Socastee Yacht Basin & Park		AE, 500-year, X
Major Public Structures		
Azalea Lakes Medical Center		X
BB&T (Coastal Federal Saving Bank)		X
Beach Family Worship		X
Calvary Baptist Church		X
Calvary Chapel		X
Coastal Carolina Allergy & Asthma		X
CresCom Bank (First South)		X
Grand Strand Health Care		X
Grand Strand Water & Sewer Station		X
Horry Co. Board of Education		X
Horry County Fire Rescue Station 1		X
Horry Electric Coop Inc		X
Horry Telephone Cooperative		X
Lakewood Pentecostal Holiness Church		X
Palmetto Pointe Church of God		X
Sand Hills Bank		X
SC Department of Education - Maintenance		X
Socastee Baptist Church		X
Socastee Elementary School		AE, X
Socastee High School		AE
Socastee Pentecostal Holiness Church		X
Socatsee Library		X
South Strand Medical Center		X
Tidelands Health		X
US Postal Service		X
WBTW News 13		X
Wellspring Fellowship Church		X

CHAPTER 3: POLICY AND PROJECT CONSIDERATIONS

The policy and project considerations for flood resilience are summarized into the following categories:

- **Policy Development**- Implement and strengthen regulations and policies to create more resilient communities.
- **Neighborhood Design** - Develop design strategies to assist future development and mitigate flood risks.
- **Infrastructure Improvements**- Identify infrastructure projects that could assist in flood mitigation strategies.
- **Recovery** –Strengthen policies and procedures for post storm recovery efforts.
- **Education and Community Planning** – Develop communication efforts to inform residents of the flood risk and neighborhood plans for repetitive loss properties.
- **Buyouts** – Implement buyouts for selected areas that have experienced severe repetitive loss due to flooding.

Each of these categories will be described in greater detail in the following sections.

3.1 POLICY DEVELOPMENT

3.1.1 Flood Ordinance Policy Revisions

The County has drafted a comprehensive revision to the Flood Ordinance, entitled Horry County Flood Damage Prevention Ordinance (Flood Ordinance). The proposed Flood Ordinance includes a higher level of regulatory standards than the prior ordinance, including:

- Prohibiting critical facilities from being located within the FEMA 100-year floodplain AND the 500-year floodplain.
- Modifying requirements to ensure that construction in Coastal AE Zones (High risk areas associated with wave actions greater than one foot six inches and less than three feet.) must meet the same requirements as construction in coastal V Zones (coastal high hazard areas).
- Increasing the freeboard requirement from one foot to three feet. Freeboard is elevating a building's lowest floor above predicted flood elevations by an additional height in order to decrease chances of flooding.
- Modifying the definitions for *Substantial Damage* and *Substantial Improvement* to establish a 50 percent of market value threshold.

Preservation of the Floodplain

Limiting fill in the flood hazard zone within the floodplain would balance the need to reduce flood vulnerabilities with the need for growth in the County. In order to preserve the floodplain in the County, the Flood Prevention Ordinance could consider provisions to limit or prohibit the raising of homes through the use of fill in areas that are deemed to be within the special flood hazard area.

The County may wish to study appropriate areas to adopt more stringent floodplain boundaries to preserve the flood plain. This may include establishing a future floodplain, identifying undeveloped properties subject to future flooding, and providing opportunities to institute flood resilient developmental development approaches for future developments.

These additional recommendations are consistent with and support the establishment of a new, expanded regulatory flood zone, beyond which FEMA regulates. The early adoption of a supplemental flood zone would minimize development delays while the County awaits the new map adoption by FEMA.

Compensatory Storage
It is recommended that compensatory storage be provided and utilized when fill is used for development within the Special Flood Hazard Area Zone. Compensatory storage is an area outside the area of immediate development set aside for floodwater storage lost as a result of the development.

Project Benefits

Flood Prevention Ordinance revisions enable Horry County to coordinate policies with resilient strategies that are being proposed through this Flood Resilience Plan.

3.1.2 Supplemental Flood Zone Designation and Adjusted Base Flood Elevation (BFE)

Many of the structures damaged during Florence sit outside the existing FEMA floodplains and may not fall within the proposed updates to the FEMA floodplains. In order to better identify which buildings may be at risk, the County performed a study to adjust the base flood elevations (BFEs) to include data from Hurricane Florence.

The County has developed a methodology based upon scientific evidence to create a supplemental flood zone and adjusted BFE designation for the unincorporated areas of the County, using flooding and damage data from Hurricane Florence.

Analysis and mapping has been conducted in order to:

1. Identify an adjusted BFE for buildings in the existing preliminary FEMA zones
2. Develop a supplemental flood zone with adjusted BFEs outside FEMA zones, based on Florence flood elevations.

An adjusted-BFE can be established by comparing the FEMA BFE to Florence flood elevations and using the higher elevation value. These elevation values are then mapped to establish the supplemental flood zone. This supplemental flood zone has been seamlessly appended to the existing preliminary FEMA Special Flood Hazard Area (AE zone or 100-year floodplain), allowing for the establishment of a flood zone that incorporates the latest flood data (post-Florence).

3.1.3 Comprehensive Buyout and Area Re-Use Strategy

PROJECT DESCRIPTION

Buyout programs support hazard mitigation, floodplain management goals, and resiliency by removing homeowners who have suffered repetitive loss or severe repetitive flood losses from the floodplain, thus reducing vulnerability to future flooding events.

The objectives of a buyout program include:

1. Acquiring properties that have been subjected to multiple floods and implementing a re-purposing strategy.
2. Assisting homeowners to move to an area with a reduced risk of flooding.
3. Returning properties in the floodplain to natural and beneficial functions, aiding in the storage of floodwaters.
4. Eliminating future flood damages and health and safety risks for owners and rescuers.
5. Reducing repetitive subsidized flood insurance payments and federal disaster assistance.

The County will implement a prioritization methodology that provides a clear process to identify eligible and high priority candidates.

There are multiple considerations that inform an effective prioritization structure which are highlighted below.

Preservation of neighborhood integrity and value – the relative proximity of buyout properties, the ability to connect contiguous sites, and the ability to connect contiguous sites to existing public land.

Storm mitigation value – ability for the site to contribute to flood management/flood storage.

Ongoing Maintenance Costs - the ability to identify a maintenance structure and maintenance partner to maintain properties as part of a reuse strategy.

Replicability / Scalability – how the reuse strategy for the site can be replicated or expanded upon in the same area in the future.

Buyout Property Reuse Strategies

Comprehensive and coordinated re-use strategies that aim to convert buyout lots to public amenities, flood mitigation and performative landscapes can help to alleviate deterioration of community value.

Horry County seeks to mitigate challenges to buyouts by focusing on these strategies with its buyout program. A significant focus on the development of property reuse strategies can provide for effective property reuse that does not diminish from the overall value of the community, creates opportunities for amenities and provides direct stormwater management value.

The following approach could become part of the County's buyout and reuse process:

- Maintain a database of interested property owners seeking buyouts to inform priority buyout areas in the short and long term as funding becomes available.
- Coordinate near-term buyout properties with available grant funding.
- Develop neighborhood master plans, when necessary, to repurpose large, contiguous buyout areas as recreational and stormwater assets.

PROJECT BENEFITS

A strategy for buyout reuse reverses the perception of blight, keeps sites from becoming dumping grounds and preserves the fabric of the community.

3.2 RESILIENT NEIGHBORHOOD DESIGN STRATEGIES

The modification of the natural topography, including the clearing of trees, filling of the floodplain, and the filling of riparian and wetland fringes, can alter the natural flood capacity of the landscape. The cumulative impacts of this type of development combined with new growth, the County's flat terrain, and increasing rainfall patterns could alter the size of the floodplain over time.

The creation of riparian and wetland buffers, expansion of tree preservation regulations, and the establishment of resilient subdivision design standards will all help preserve the landscape's natural flood storage capacity.

3.2.1 CREATION OF RIPARIAN AND WETLAND BUFFERS

PROJECT DESCRIPTION & RECOMMENDATIONS

An important first step in minimizing future flood damages is to preserve the flood storage capacity of the natural landscape. As additional development occurs to meet increasing demand, more pressure will exist to convert floodplains, wetlands, and their fringes into raised development plots for residential subdivisions.

Horry County may consider establishing riparian and wetland buffers to preserve the landscape's natural flood storage capacity and minimize future flood risks. Riparian and wetland buffers could be established as a requirement of all major residential developments, and even commercial sites, or could be required only within a designated riparian corridor, watershed, or defined area as an overlay.

The ability to manage and maintain ditches in proper working order is also critical to the County's overall stormwater management system. Ensuring fee-simple platted maintenance access to and around future stormwater ponds may also be considered to keep the area free of obstructions and alterations.

CONSIDERATIONS

Multiple measures would be required to establish riparian and wetland buffers in unincorporated Horry County. These could occur concurrently or in sequential order.

- Revise Horry County Land Development Regulations to prohibit the platting of wetlands and stormwater maintenance easements in the lots of major residential developments.
- Revise stormwater easement standards for ditches and ponds to allow for a 20' maintenance area from the finished top of bank outside of the property lines and within the common area or open

space for the development. Ditch easements could minimally run continuously on one side to ensure adequate maintenance equipment access.

- Map riparian corridors and potential wetlands utilizing County-collected, high resolution land cover data. This information may be used to map and evaluate different riparian and wetland buffer scenarios to determine appropriate buffer widths.
- Establish riparian and wetland buffer regulations for all new major residential developments. These regulations would prohibit fill and grading and limit tree removal within the buffer area. Establishing an overlay in which buffers are required is an alternative to creating county-wide riparian and wetland buffer regulations. An overlay could also allow for riparian and wetland setbacks for other types of land uses.
- Develop model covenants and restrictions for the management of wetlands and buffers in major residential developments.
- Revise Horry County Land Development Regulations to prohibit fill within the regulatory flood zone of all major and minor residential developments, including commercially reviewed multi-family developments. If these restrictions are included in the Land Development Regulations or Stormwater Ordinance, and not the Horry County Flood Prevention Ordinance, it could allow relief for developers and property owners through design modifications, onsite mitigation, or fees, as fill does not have to be prohibited in order for Horry County to be part of the National Flood Insurance Program.

3.2.2 EXPANDED TREE PRESERVATION STANDARDS

PROJECT DESCRIPTION & RECOMMENDATIONS

Preserving the mature tree canopy can effectively provide for flood storage and slow runoff rates, while also preserving the existing ecology.

The Landscape Buffer and Tree Preservation Ordinance is the County's primary tree preservation tool. Horry County has a number of other tools that could support the protection and preservation trees.

Multiple effective tree preservation programs in other jurisdictions take advantage of a combination of incentive-based structures, planning and design guidelines, and ordinances. For instance, many communities utilize what are called "tree save" standards for residential and commercial development, which require tree preservation as part of site development requirements. The County could consider an incentive designed specifically for the preservation of pine tree stands or other groves of trees.

CONSIDERATIONS

The following are a suite of options for the County to pursue in order to preserve and restore tree canopy:

- Require the preservation of 10 percent of the predevelopment tree canopy, including specimen trees, within the upland areas of all major residential subdivisions. This would require a predevelopment tree survey and calculation of the predevelopment diameter at breast height (DBH). Preferably, the trees would be protected within neighborhood open space to ensure they are maintained by the homeowners association and also protected through covenants and restrictions.

- Incorporate tree canopy preservation as a component of an existing overlay, and not necessarily as a standalone regulation for the entire County. Such requirements could follow the bounds of an existing community overlay or be combined with a Riparian and Wetland Buffer overlay. An overlay could specifically include tree canopy requirements for major residential subdivision, but it could also apply tree preservation requirements for minor and commercial development.
- Expand the list of specimen tree species beyond live oaks over 24" DBH or establish a minimum size, for instance 36" DBH, in which any protected tree would also be classified as a specimen tree.
- Amend the Landscape Buffer and Tree Preservation Ordinance to require the planting of a tree on every residential lot within a major subdivision prior to issuing the Certificate of Occupancy of a new home.

3.2.3 RESILIENT SUBDIVISION DESIGN STANDARDS

PROJECT DESCRIPTION & RECOMMENDATIONS

It is recommended that Horry County incorporate resilient subdivision design standards into its zoning ordinance. An overlay or specific zoning district could include resilient subdivision design standards for major residential developments. This approach would ensure that the desired interconnected network of open space, wetland, and floodplain protection, as described within *Imagine 2040* and the *Horry County Parks and Open Space Plan*, would be realized.

Establishing resilient subdivision design standards would transform the residential subdivisions in the County, resulting in more uniquely designed communities that avoid natural hazards and preserve open space for habitat, recreation, and flood attenuation.

Beyond cost savings and return to the developer, the protected open space would likely include streams, wetlands, woodlands, and even farmland that would serve as neighborhood amenities, improving the quality of life for the residents.

POLICY CONSIDERATIONS

In Horry County, it is recommended that resilient subdivision design standards be allowed in all residential zoning districts and be required within a geographically defined overlay including environmentally sensitive, flood prone areas.

Conditions of the resilient subdivision design typically include the following:

1. 100' riparian buffer adjacent to shoreline of waters of the United States
   i) 25' riparian stream buffer, including an easement for maintenance in closest to shoreline; and
   ii) 75' transitional buffer.
2. 75' buffer adjacent to properties under existing conservation managed by a Federal, State, or local government, or conservation entity.
3. 50' riparian wetland buffer (includes non-jurisdictional features) for wetlands 3 acres or larger.
4. 25' riparian wetland buffer (includes non-jurisdictional features) for wetlands less than 3 acres.
5. No modifications to elevation, slope, or vegetation is permitted in the riparian stream and wetland buffers except for rehabilitation to enhance ecology and hydrology, to provide access for the uses allowed herein, or stormwater conveyance.
6. All residential lots platted outside of the Special Flood Hazard Area (SFHA) and buffer areas.

7. No grading, fill or permanent structure within the SFHA (see exceptions below).
8. No grading, fill or permanent structure within the Florence adjusted BFE (see exceptions below).
9. No land disturbance in wetlands (includes non-jurisdictional features).
10. Minimum 35' setback from adjacent existing roadways.
11. No tree removal in applicable forestland (under brushing allowed).
12. 50% of the property to remain undeveloped and shall be identified as a Conservation Area.

There should be exceptions for the aforementioned conditions. Roads, utilities, active recreational open space, stormwater retention, and conveyances could still be allowed in the Special Flood Hazard Areas.

To encourage implementation of resiliently designed subdivisions, the following incentives should be considered:

1. Remove minimum setbacks; minimum lot size; minimum street frontage; and minimum lot width;
2. Allow for required parking to be partially or wholly met through common parking and/or reduce parking requirements;
3. Perimeter landscape buffers may be waived except along Collector or Arterial roads;
4. Private roads (access and alley only) may be held in common;
5. Alley ways may serve as primary access to 3 lots/units with 1 point of ingress/egress with an 18' pavement width. An alley cannot originate from another alley;
6. Conservation areas shall count towards the required open space;
7. Maximum density shall be capped at 25% above the number of lots/units allowed in a Yield Plan developed for the underlying zoning.

3.3 Resilient Infrastructure Recommendations

To determine improvements for drainage to reduce flooding, the system must first be analyzed.

3.3.1 Watershed Hydrology Modeling

PROJECT DESCRIPTION & RECOMMENDATIONS

To determine specific infrastructure improvements, watersheds need to be analyzed using Hydrology and Hydraulics (H&H) studies to determine greatest impact on localized flooding. H&H studies can provide a comprehensive understanding of flooding dynamics, to more effectively target locations for critical drainage infrastructure improvements.

PROJECT BENEFITS

There are multiple benefits to the development of comprehensive models for watersheds within the County. The information enables scenario testing and detailed flood risk analyses. The model would incorporate wetlands and floodplains in the area which would be used to determine the effect of any impacts to these critical natural features. Drainage patterns and conveyances would be analyzed, critical pinch points would be identified, establishing flow paths and run-off volume potential. Identified deficiencies would be used to as an opportunity to model improvements.

3.3.2 Resilient Infrastructure Design Strategies

PROJECT DESCRIPTION & RECOMMENDATIONS

Determining the appropriate infrastructure improvements for floodprone areas requires the development and analysis of a detailed hydraulic model. An example of software that fits the needs of this analysis is the U.S Army Corps of Engineers' HEC-RAS program, paired with the hydrologic analysis program HEC-HMS from the same agency. This program can determine which hydraulic structures would fail in different storms under various conditions.

Incorporation of the plan would address improvements to SC HWY 90, SC HWY 905, SC HWY 9, SC HWY 501 Bypass, SC HWY 701 North of Conway and SC HWY 22 as well as other major arteries of to address future flooding and protect the health, safety, and welfare of residents and visitors.

One project identified would raise Big Bull Landing Road, making the flooding less likely by creating a levee/dam at the existing crossline. During a flooding event, the culvert would be blocked to prevent water from the Pee Dee River backing up into the community.

PROJECT BENEFITS

A systematic approach to create infrastructure projects along roadways within the County would serve to improve access and maintain major arteries of egress or alleviate flooding in critical areas.

3.3.3 Watershed Management and Regional Storage Improvements

If less water can be introduced into the river system through increased upstream storage and detention within the reaches and tributaries, stress on capacity to exceed flow rate will be reduced, slowing the rise of water. For instance, the Longs and Red Bluff communities that were impacted by Florence flooding radiated from two tributaries that feed the Waccamaw River, Simpson Creek and Buck Creek. These man-made canals are characteristic of the infrastructure in the region and are appropriate candidates for regional creek storage improvements, such as large, regional detention basins or creating wider benching within the canals themselves.

CONSIDERATIONS

The goal should be to systematically create additional storage, where possible, within the reaches and to consider all of the creeks as contributors to the larger network of streams and rivers. Buck Creek and Simpson Creek storage improvements can serve as pilots for similar creek storage improvements throughout the County.

To optimize the efficiency of this plan, it is recommended that the County create a mechanism for developers to contribute into a stormwater system that is designed by the County. Another option would be to determine specific areas that could be developed, requiring any new development to provide additional storage above the current Stormwater regulations. Strategic placements of storage areas and additional storage requirements could be identified with a hydraulic model (e.g. HEC-RAS), to understand where pinch points occur.

In addition to the construction of detention basins, it is recommended that the larger stormwater system optimize the use of existing storage areas, such as ponds and lakes. This approach would provide additional storage to slow down rising stage elevations in a riverine flood event.

PROJECT BENEFITS

A combination of larger-scale public storage devices and smaller-scale private resources could be implemented over time as funding becomes available and new development is envisioned within the areas of watershed within each reach.

3.3.4 Improved Drainage for Localized and Riverine Flooding

PROJECT DESCRIPTION & RECOMMENDATIONS

A two-stage flood relief strategy is proposed in Bucksport, solving for localized flooding through improvements to the local ditch system and providing "smart" relief to drain water in the opposite direction of flood waters during larger flood events.

An extensive drainage study to include survey data for the Bucksport area is necessary to determine the flow paths and areas that need to be upgraded or maintained.

To allow the system to move water and maintain drainage from the wetland system, a relief channel/culvert system to the Waccamaw River should be studied.

The County should conduct a further technical analysis of Socastee area also include survey data to determine flow paths and areas that would need to be upgraded, improved or maintained.

3.4 Community Engagement and Planning

3.4.1 Flood Education Plan and Communication Strategy

DESCRIPTION

Effective management of flood risks is a community-wide endeavor that requires support of citizens, businesses, government agencies, and other organizations. As such, a top priority is to develop a Flood Education Plan to enhance safety and reduce vulnerability to flood damage by improving the efficacy of public information programs.

Horry County wants everyone in the County to know their flood risk and understand the FEMA flood zone designations and their importance. A better understanding of flood insurance programs and their availability is needed as well.

Expanding Awareness of Risk through Mapping

Many people who move to Horry County are not aware that their property may be near a flood zone or in an area that has the potential to be flooded, particularly if they are not located directly on the coast. As the County examines the proposed FEMA FIRM designations in comparison to the areas that experienced flooding from Hurricane Florence, information relating to risk of flooding beyond the FEMA flood zone can be made publicly available. The County intends to use this information as part of an information campaign entitled "Map My Move," which can show anyone looking to move into or within the County where flood waters have impacted properties.

Developing a Network for Communication and Education

The County is looking to construct a campaign to educate the community about flood risk. The focus will be on identifying the types of flooding to which the County is susceptible, where flooding is most likely to happen and why and the measures being undertaken to reduce flood risk and to move people out of harm's way. Horry County's communication goals include the following:

- Develop a Flood Education Plan for Horry County that focuses on public messaging of risks and vulnerabilities
- Establish a multi-media platform to disseminate flood risk information
- Use mapping as a visual tool to illustrate risk
- Prioritize educating residents about funding resources that are aimed at assisting individuals and households

PROJECT BENEFITS

The dissemination of information will increase engagement, increase understanding, and help towards building consensus amongst community and government on needed actions. The community will thereby better understand their level of risk as well as be prepared for future storm events.

3.4.2 Community-Based Mitigation Plans

PROJECT DESCRIPTION

Impacts have been felt differently in the many Horry County communities that have been impacted by flooding. As the County looks to implement a series of initiatives to increase resilience, in some locations, infrastructure solutions alone are not going to be able to remove or significantly reduce flood risk. Future solutions in some communities may involve elevation of structures, property buyouts or some combination of interventions that have the potential to significantly impact community cohesion. In some communities, solutions could gravitate to discussions about communitywide relocation strategies.

Establishing a sense of trust with the community sets the foundation for neighborhood led decision making. The effort begins with community discussions regarding available options, the extent of risk, the challenges faced, and the possible avenues for resolution.

PROJECT BENEFITS

These efforts can provide solutions that are place-based and appropriate for specific circumstances.

Appendix A: Glossary of Critical Terms

AE zone - Areas subject to inundation by the 1-percent-annual-chance flood event (often known as the 100-year flood zone or floodplain) determined by detailed methods by FEMA. Base Flood Elevations (BFEs) are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply. (FEMA)

B or Shaded X Zone - FEMA's area of moderate flood hazard, usually the area between the limits of the 100- year and 500-year floods. B Zones are also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile. In this report, this zone is referred to simply as the 500-year flood zone or floodplain. (FEMA)

Base Flood – A flood having a one percent chance of being equaled or exceeded in any given year, often referred to as the 100-year flood. The base flood is the national standard used by the National Flood Insurance Program (NFIP) and all Federal agencies for the purposes of requiring the purchase of flood insurance and regulating new development. Base Flood Elevations (BFEs) are typically shown on Flood Insurance Rate Maps. (FEMA)

Base Flood Elevation (BFE) – The elevation to which floodwater is anticipated to rise during the base flood. The BFE is the regulatory requirement for the elevation or flood proofing of structures. (FEMA)

Digital Elevation Model - A computer representation of the earth's terrain/topography, created from elevation data. (WCU)

Ditch - A narrow channel dug in the ground, typically used for drainage alongside a road or the edge of a field. (Oxford Languages Dictionary)

Federal Emergency Management Agency (FEMA) - FEMA is an agency of the U.S. Department of Homeland Security. Its mission is to ensure that the nation works to build, sustain, and improve capability to prepare for and respond to all hazards. FEMA was created in 1978 and implemented in 1979. (FEMA)

Flood elevation - Water height during a particular storm, most commonly referenced to NAVD88. Most often measured by stream gages, rapid deployment gauges, or post-storm collected high water marks (e.g., mud lines on a building left by water). (WCU)

Flood Insurance Rate Maps (FIRMs) - The official map of a community on which FEMA has delineated both the special hazard areas and the risk premium zones applicable to the community, commonly called "flood maps." (FEMA)

Floodplain - A tract of land bordering a river, mainly in its lower reaches, and consisting of alluvium deposited by the river. It is formed by the sweeping of the meander belts downstream, thus widening the valley. During floods, when the river overflows its banks, sediment is deposited along the valley banks and plains. (USACE)

Freeboard - The vertical distance between the water level and the bottom of a structure. For regulatory and design purposes, this is the additional height of a structure above the base flood elevation to prevent flooding. (USACE and NOAA)

Letter of Map Revision (LOMR) - An official amendment to the currently effective FEMA map. It is issued by FEMA and changes flood zones, delineations, and elevations.

Levee - Earthen structure (also referred to as a dike or embankment) built to contain periodical floodwater from river systems within a specified area of the floodplain. (USACE)

Mean Higher High Water (MHHW) - The elevation of the highest predicted astronomical tide expected to occur at a specific tide station over the National Tidal Datum Epoch. (NOAA)

NAVD88 - North American Vertical Datum of 1988. The official vertical datum in the National Spatial Reference System (NSRS) for the Conterminous United States and Alaska (definition from NOAA). A datum is a surface of zero elevation to which heights of various points are referenced. Elevation data, including flood heights, are often referenced to this datum. In Horry County, NAVD88 is within 0.5 feet of local mean sea level. (FEMA)

National Flood Insurance Program (NFIP) - NFIP is a program created by the U.S. Congress in 1968 through the National Flood Insurance Act of 1968. The program is administered by the federal government and enables property owners in participating communities to purchase insurance protection against losses from flooding. (FEMA)

National Oceanic and Atmospheric Administration (NOAA) - NOAA is an American scientific agency within the U.S. Department of Commerce that focuses on the conditions of the oceans and atmosphere. NOAA tracks dangerous weather patterns, charts seas, guides the use and protection of oceanic and coastal resources, and conducts research to improve stewardship and increase public understanding and awareness of the environment. (NOAA)

Outlet Control Structure – Hydraulic structures that are placed at the end of drainage lines that control the outflow of water through the use of orifices or weirs. (Sherwood Design Engineers)

Sea level rise - An increase in the volume of water in the world's oceans, resulting in an increase in global mean sea level. Sea level rise is attributed to thermal expansion caused by the warming of the water in oceans and increased melting of land-based ice including glaciers. (NOAA)

Special Flood Hazard Areas (SFHA) - The land area covered by the floodwaters of the base flood. The SFHA is the area where the National Flood Insurance Program's (NFIP's) floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies. The SFHA includes Zones A, AO, AH, A1-30, AE, A99, AR, AR/A1-30, AR/AE, AR/AO, AR/AH, AR/A, VO, V1-30, VE, and V. These areas are often referred to as a "flood zone." (FEMA)

Tailwater - Waters located immediately downstream from a hydraulic structure, such as a dam, bridge or culvert. (Sherwood Design Engineers)

Topography - The measurements of the heights of the earth's terrain and relief surface above sea level. (NOAA)

U.S. Army Corps of Engineers (USACE) - USACE is a federal agency under the jurisdiction of the Department of Defense and one of the world's largest public engineering, design, and construction

management agencies. Missions include civil engineering of locks, dams, maintenance dredging, and flood control as well as environmental regulation and ecosystem restoration. (USACE)

U.S. Geological Survey (USGS) - The USGS is a federal scientific agency under the jurisdiction of the U.S. Department of the Interior. The agency studies the nation's natural resources, natural hazards, ecosystems, and environmental health as well as the impacts of climate and land use change. (USGS)

Watershed - An area of land that drains all the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel. (USGS)

Wetland - Land characterized by saturation with water, determining the nature of soil development and the types of plant and animal ecosystems that inhabit the soil and surface. In hydrologic terms, an area that is regularly wet or flooded and has a water table that stands at or above the land surface for at least part of the year. (USACE and NOAA)