BEAUFORT
HAZARD MITIGATION PLAN
2009 UPDATE

for

Unincorporated Beaufort County
The City of Beaufort
The Town of Bluffton
The Town of Hilton Head Island
The Town of Port Royal

Prepared by:
Lowcountry Council of Governments
Planning Department

December 2009

TABLE OF CONTENTS

1. Introduction 1-1
Background 1-1
Planning Process 1-2
Getting Organized 1-2
Committee 1-3
Assess Hazards and Vulnerabilities 1-4
Develop a Mitigation Plan 1-5
Other Agencies 1-6
Evaluate Your Work 1-7
Public Involvement 1-7
Federal Funding Sources for Mitigation 1-7
2. Hazard Identification and Profiles 2-1
Introduction 2-1
Hurricanes, Tropical Storms 2-1
Past Occurrences of Hurricanes 2-1
September 1804 2-4
August 1854 2-4
August 1893 2-4
October 1902 2-5
August 1940 2-5
October 1944 2-5
Hurricane Cindy – July 1959 2-5
Hurricane Gracie - September 1959 2-5
Hurricane Donna – September 1960 2-6
Hurricane David – September 1979 2-6
Hurricane Bob – July 1985 2-6
Hurricane Hugo – September 1989 2-6
Future Probabilities of Hurricanes 2-7
Past Occurrences of Nor'Easters 2-8
Flooding 2-9
Past Occurrences of Flooding 2-12
Future Probabilities of Flooding 2-12
Erosion 2-18
Past Occurrences and Future Probabilities of Erosion 2-16
Winter Storms 2-20
Past Occurrences of Winter Storms 2-20
Future Probabilities of Winter Storms 2-21
Dam Failure 2-33
Drought 2-21
Wind: Thunderstorms and Tornadoes 2-22
Past Occurrences of Thunderstorms 2-22
Future Probability of Thunderstorms 2-22
Tornadoes 2-22
Past Occurrences of Tornadoes 2-24
Future Probabilities of Tornadoes 2-26

Earthquakes 2-27
Past Occurrences of Earthquakes 2-28
Earthquakes near Beaufort County: potentially a major impact. 2-28
1886 Earthquake 2-29
Future Probabilities of Earthquakes 2-30
Fire 2-30
Past Occurrences of Fire 2-31
Future Probabilities of Fire Community/ Public Affairs Manager, Community/ 2-33
Hazards not Historically Prevalent 2-33
Landslides 2-33
Tsunamis 2-34
Volcanic Hazards 2-34
3. Vulnerability Assessment 3-36
Vulnerability Summary 3-36
Social Vulnerability 3-39
Inventory Information 3-40
Flooding 3-42
Floodplain 3-42
Flood Depths 3-42
City of Beaufort 3-42
Town of Bluffton 3-43
Town of Hilton Head 3-43
Town of Port Royal 3-43
Unincorporated County – Bluffton Township 3-43
Unincorporated County – Dafuskie 3-43
Unincorporated County – Fripp Island 3-43
Unincorporated County – St. Helena 3-44
Unincorporated County – Sheldon-Dale 3-44
Flood prone Structure Counts 3-44
Critical Facilities 3-48
Repetitive Loss Areas 3-50
Unincorporated County 3-50
Beaufort 3-51
Bluffton 3-51
Hilton Head 3-51
Port Royal 3-52
Access 3-52
Conclusions 3-55
Erosion 3-55
Development Trends 3-56
Beaufort County 3-56
City of Beaufort 3-56
Town of Bluffton 3-56
Town of Hilton Head Island 3-56
Town of Port Royal 3-57
Summary 3-57
HAZUS-MH Data for the 2009 Update 3-59
4. Community Mitigation Capability Assessment 4-1
Beaufort County: 4-3

Comprehensive Plan, 2007: 4-3
Zoning & Development Standards 4-5
Hurricane Response & Recovery Guide 4-5
Emergency Operations Plan 4-5
Other 4-6
City of Beaufort: 4-6
Comprehensive Plan, 2009 revision 4-6
Unified Development Ordinance, 2006 4-8
Town of Bluffton 4-10
Comprehensive Plan, 2007: 4-10
Zoning Ordinance 4-11
Stormwater BMP Manual, 2007. 4-11
Unified Development Ordinance 4-12
Town of Hilton Head Island: 4-12
Comprehensive Plan, 2009 4-12
Beaufort County Hazard Mitigation Plan 4-13
Island Wide Drainage Study, August 30, 1995 4-14
Floodplain Management and Land Management Ordinance 4-15
Town of Port Royal: 4-16
Comprehensive Plan (update nearly complete in 2009) 4-16
Building Regulations 4-17
Town Code 4-17
The Local Government Capability Matrix 4-18
State Plans and Regulations 4-22
Federal Regulations 4-24
5. Mitigation Goals and Objectives 5-1
Introduction 5-1
Goals and Objectives for the Mitigation Plan 5-1
Mitigation Action Plan (and update of previous actions) 6-1
Explanation of Tables 6-1
National Floodplain Insurance Program—prioritization and participation 6-2
Addressing Known Risks and Vulnerabilities 6-2
Benefit-to-Cost Review 6-4
Cost Benefit Review—Prioritization of Mitigation Actions 6-4
Multi-jurisdictional action items 6-5
Implementing the Actions 6-12
Actions Incorporated into the Mitigation Plan and Implementation 6-51
Implementation through Existing Plans and Programs 6-52
Continued Public Involvement 6-52
The Next Planning Cycles 6-53
Idealized schedule of implementation 6-53
Monitoring, Evaluating, and Updating the Plan 6-53
Plan Maintenance 6-53
Updating the Plan 6-54
Potential Funding Sources 6-54
6. References (includes original plans references and any updates) 7-1

Appendix A – Meeting Agendas and Notes
Appendix B – Hazard Mitigation Planning Committee Meeting Sign-In Sheet(s)
Appendix C—Planning Meeting Notes
Appendix C – Public Meeting Advertisements/Newspaper

LIST OF FIGURES

Figure 1-1. Beaufort County Locator Map 1-1
Figure 1-2 Beaufort County and Incorporated Areas 1-1
Figure 2-1. Storm Tracks Passing through Beaufort County, 1850-2008 2-2
Figure 2-2. Storm Tracks through and within 50 miles of Beaufort County, 1850-2006 2-3
Figure 2-3. Beaufort County Waterways 2-11
Figure 2-4. Floodplain Zones ..... **Error! Bookmark not defined.**
Figure 2-5. Northern Beaufort County Storm Surge Inundation 2-18
Figure 2-6. Southern Beaufort County Storm Surge Inundation 2-19
Figure 2-7. Tornado Events in Beaufort County, 1950 – 2006 2-26
Figure 2-8. shows these areas of concentrated, historical epicenter locations for the period of record from 1698 to 2008. 2-29
Figure 3.1 Social Vulnerability 3-40
Figure 3-2. Structures in Beaufort County 3-41
Figure 3-3. Planning Districts and Incorporated Areas 3-46
Figure 3-4. Repetitive Loss Areas in Hilton Head 3-52
Figure 3-5. Major Routes in the Floodplain in Beaufort County 3-54

LIST OF TABLES

Table 2-1. Saffir-Sampson Scale and Typical Damages.....2-1
Table 2-2. Storm Tracks Passing through Beaufort County 1850-2008.....2-2
Table 2-3. Storm Tracks Passing within 50 miles of Beaufort County 1850-2006 ..2-3
Table 2-4. Estimated Recurrence Intervals of Hurricanes and Tropical Storms within 50 miles of Beaufort County.....2-8
Table 2-5. Shoreline Characteristics.....2-17
Table 2-6. Time Spent in Drought Conditions, 1925-2000.....2-21
Table 2-7. Enhanced Fujita Tornado Scale.....2-23
Table 2-8. History of Known Tornadoes in Beaufort County, 1950 – 2006.....2-24
Table 2-9. Estimated Recurrence Intervals of Tornadoes (based on data from 1950 to 2006).....2-27
Table 2-10. Richter Scale Magnitude Classes.....2-28
Table 2-11. Estimated Recurrence Intervals of Earthquakes in Beaufort County .2-30
Table 2-12. Occurrences of Landfires in Beaufort County, 1988-2008.....2-32
Table 2-13, Overall Probability Table.....2-34
Table 3.1, Assessor Valuation Data.....3-36
Table 3.2, Loss information per hazard in Beaufort County based on historical data3-37
Table 3-3 Overall Vulnerability Summary.....3-38
Table 3.4 Multi-jurisdictional Risk Assessment, varied and unique risks.....3-39
Table 3-5. Critical Facilities.....3-41
Table 3-6. Number of Structures in Flood Zones.....3-45
Table 3-7. Structures in Flood Zones in Unincorporated Beaufort County by Planning District.....3-46
Table 3-8. Flood Insurance Policies as of May 2009.....3-47
Table 3-9. Structures in Storm Surge Zones in Beaufort County by Planning District3-47
Table 3-10. Structure Inundation Counts for the 100-year floodplain versus the Category 2 storm surge zone.....3-48
Table 3-11. Critical Facilities located in the 100-year floodplain of Incorporated Communities.....3-49
Table 3-12. Critical Facilities located in the 100-year floodplain of the Unincorporated County.....3-50
Table 3-13.....3-54
Table 3.14, Development Trends at a glance.....3-57
Table 3-15. Ranking of Perceived Risk due to Hazards by Community.....3-58
Table 3-16, Data with increases based on building permit data.....3-59
Table 3-17 Wind Scenarios based on building increases (damage sustained).....3-60

Table 3-18 Total Damage (building numbers) from earthquake of 6.9 Magnitude based on percent increase of building permit data 3-60
Table 3-19. Wind Damage Percentages for Structure Classifications based on the Level of Engineering Design 3-62
Table 3-20. Building Types Grouped by Level of Engineering Design 3-63
Table 3-23. Building Type (by Engineering Design Level) Distribution 3-64
Table 3-24. Replacement Values for Structures Based on the Degree of Engineering Design (dollars in thousands) 3-65
Table 3-25. Damage Assessments for a Category 1 Hurricane Wind Event (dollars in thousands) 3-65
Table 3-26. Damage Assessments for a Category 3 Hurricane Wind Event (dollars in thousands) 3-66
Table 3-27. HAZUS Moderate Structural Damage Descriptions 3-1
Table 3-28. Building Count by General Building Type 3-2
Table 3-29. Number of Structures Incurring at Least Moderate Damage for a ML = 6.9 Event 3-2
Table 3-30. Number of Structures Incurring at Least Moderate Damage for a ML = 5.9 Event 3-3
Table 4-1. Beaufort County Documents used for Capability Assessment 4-2
Table 4-2. Capability Matrix 4-19
Table 4-3. Regional Hurricane Shelters in Adjacent Counties 4-22
Table 6.1, Prioritization Scoring Table 6-3
Table 6.2, Previous Mitigation Actions and Status Report 6-6
Table 6.3, Beaufort County NEW Mitigation Actions 6-13
Table 6.4, Hilton Head NEW Mitigation Actions 6-20
Table 6.5, City of Beaufort NEW Mitigation Actions 6-26
Table 6.5, Port Royal NEW Mitigation Actions 6-35
Table 6.6, Bluffton NEW Mitigation Actions 6-44

1. Introduction

Beaufort County, South Carolina and its incorporated communities prepared this update to their Hazard Mitigation Plan to assess the communities' vulnerabilities to natural hazards and prepare a long term strategy to address these hazards and prevent future damage and loss of life. This plan was created through participation from county and municipality officials, residents, and business owners and represents the community's consensus.

Background

Beaufort County is situated along the southern portion of South Carolina's Atlantic coastline (as shown in Figure 1-1) and has an area of 587 square miles. It lies in the coastal plain and is comprised largely of tidal marshes and swamp areas; the county has little relief with a high elevation of approximately 50 ft National Geodetic Vertical Datum 1929 (NGVD 29). Beaufort County's climate is generally subtropical with hot summers and mild winters. The average annual rainfall is approximately 49 inches with most precipitation occurring from April to October.

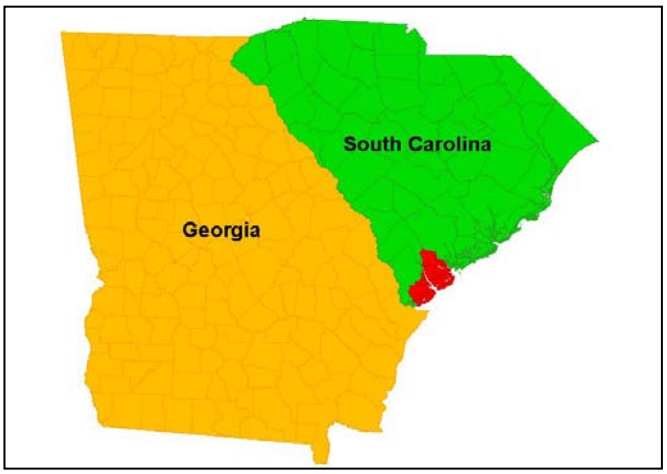


Figure 1-1. Beaufort County Locator Map

Beaufort County is one of the state's fastest growing counties (by population percentage increase) with a 2000 population of 120,937 (U.S. Census) which represented a 40% increase from the 1990 population. The 2008 population estimate was just over 150,000, representing 24.36 percent increase in eight years. Where there is population growth, there is usually also significant development; according to the U.S. Census, in 2000, over 2,600 building permits were issued for housing units in the county. While the recent economic climate has slowed the building industry, since 2004, there have been an average of about 2609 total building permits issued, with 4,053 being the largest number of permits. Obviously, growth continues to occur.

There are five incorporated municipalities within the county: the Town of Bluffton, the City of Beaufort, the Town of Hilton Head, the Town of Port Royal, and a portion of the Town of Yemassee. The majority of Yemassee lies within Hampton County to the northwest of Beaufort County, and therefore they chose to participate in Hampton County's Hazard

Mitigation Plan Process, which is also currently underway. The City of Beaufort is the County Seat. A map of the county showing the locations of the incorporated communities is provided as Figure 1-2.

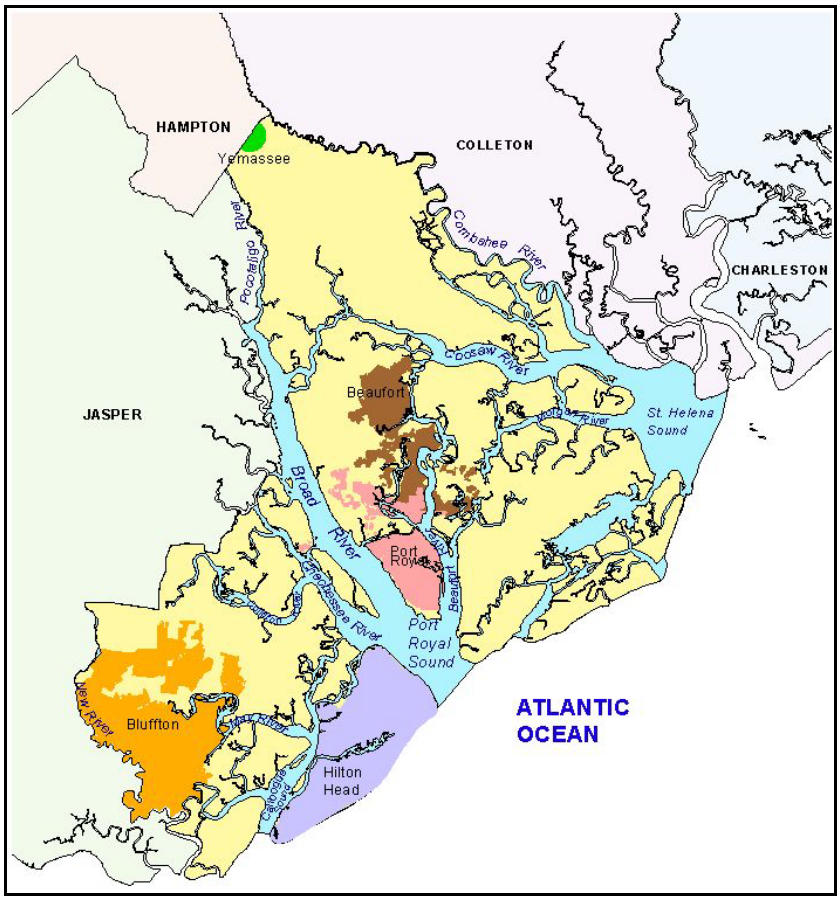


Figure 1-2 Beaufort County and Incorporated Areas

Beaufort County's coastal location makes it susceptible to flooding, erosion, and wind hazards associated with hurricanes, tropical storms and nor'easters. Furthermore, its proximity to the Charleston area, one of the most seismically active areas along the East Coast, makes it vulnerable to seismic hazards. The county's susceptibility to these and several other natural hazards were considered as part of this plan.

Planning Process

In order to conduct hazard mitigation planning, a committee was formed consisting of officials from the county and each of the participating communities. The formation of this committee was based on the members who participated in the original hazard mitigation plan. Participation by communities in the planning process was defined as attendance (at least once) of at least one representative from each jurisdiction and/or agency and one-on-one meetings with LCOG staff to both gather information and also to review suggested changes to such key components of the Plan as Mitigation capability Assessments and Action Plan items, thereby incorporating the review process. Through these meetings, this Hazard Mitigation Planning Committee developed a countywide Hazard Mitigation Plan.

It is important to note that the Town of Yemassee, an original participant in the plan, did not participate in this update. While they are partly in Beaufort County, they also have a large portion of their boundaries within Hampton County, SC. Representatives of the Town were contacted, but they have chosen to participate in the three-county mulit-hazard mitigation plan that will include Colleton, Hampton and Jasper Counties. LCOG is also the consultant for that project.

The committee reviewed the county's vulnerabilities to natural hazards and considered a wide variety of ways to reduce and prevent potential damage from these hazards. The committee then worked together to select the most appropriate and feasible mitigation measures.

To be effective, many of these measures, particularly floodproofing and emergency preparedness plans, require the cooperation of the floodplain residents. Because residents were involved in the hazard mitigation planning process through public meetings, and attempts to garner their input was made throughout the process. Following is a detailed description of the planning process and the committee's role.

Getting Organized

The first step of the hazard mitigation planning process was for the County to organize their resources by ensuring they had adequate technical assistance and expertise to conduct the planning process and to form a Hazard Mitigation Planning Committee to include representation from key county and municipal agencies such as planning departments, emergency management departments, and building code inspection.

Support for the update of this plan was provided by the planning department at the Lowcountry Council of Governments under contract to Beaufort County. Each jurisdictions reviewed all of the technical information in the plan, and provided pertinent GIS, valuation and other data as necessary for updates. Accordingly, existing planning documents were evaluated to examine which documents support mitigation, and were mitigation may be incorporated into existing plans.

Committee

A Hazard Mitigation Planning Committee (HMPC) was formed to work together to update the 2004 hazard mitigation plan and to conduct a hazard mitigation planning process compliant with Disaster Mitigation Act of 2000 (DMA), Flood Mitigation Assistance (FMA), and Community Rating System (CRS) planning requirements. A DMA Mitigation Plan Crosswalk is included as Appendix A. A steering committee was formed from a few highly involved individuals, who were contacted frequently throughout this process. For this plan, the steering committee was Trudie Johnson, Linda Bridges, Arthur Cummings, Libby Anderson, Ed Nelson, Matthew Brady and Ginnie Kozak. The HMPC consists of representatives from Beaufort County, the City of Beaufort, the Town of Hilton Head, and the Town of Port Royal. The HMPC is composed of the following members including county and municipality staff and representatives for the residents, military facilities and utilities:

Community Officials

Matthew Brady, Senior Planner, Lowcountry Council of Governments

Libby Anderson, Planning Director, City of Beaufort

Linda Bridges, Town of Port Royal Planning Administrator

Andy Corriveau, County Codes/Insurance

Arthur Cummings, Director, Beaufort County Building Codes

Ian Hill, Beaufort County Historic Preservationist

Frank Hodge, Town of Bluffton Building Official

Jay Hogan, Beaufort County Planner

Trudie Johnson, Town of Hilton Head Island, Floodplain Administrator.

Colin Kinton, Beaufort County

Ginnie Kozak, Low Country Council of Governments

Ed Nelson, Deputy Building Official, Beaufort County Building Codes

William Winn, Director, Beaufort County Emergency Management

John Webber, Disaster Recovery, Beaufort County.

Todd Ferguson, Beaufort County Emergency Management

Military Facility Representative

Marine Corps Recruit Depot - Parris Island, Operations Officer

Utility Representatives

Ken Jordan, BJWSA

Dick Deuel, BJWSA

Furthermore, each of the Counties in the Lowcountry Region (Hampton, Jasper, Colleton) were contacted and consulted at a June 30, 2009 meeting. They gave valuable input for inclusion into the Beaufort County Plan.

Beaufort County contracted the Lowcountry Council of Governments (LCOG) to help the community perform hazard mitigation planning and develop the plan. The following is documentation of what happened at the meetings of the Hazard Mitigation Planning Committee. See Appendix A.

Development of the mitigation plan began with data collection. A kick-off meeting was held in March 2009 to begin the process of updating the plan. Community, county, state, and federal resources were identified and contacted to collect pertinent information about natural hazards including past occurrences, projected frequencies of future occurrence/the anticipated risk where available, and asset (structure, utility, and transportation systems) inventory information. Here, the planning team also began to take a more definite form in terms of make up of the HMPC.

On **May 13, 2009** another meeting was held. Here policy and regulatory information from each of the communities and the county was reviewed. This included comprehensive plans, zoning ordinances, development ordinances, and building code requirements. The LCOG compiled a report on these documents in regards to their compatibility with the Hazard Mitigation Plan and the HMPC was presented with this information. This list was also sent out electronically, and all participants were allowed to comment at the meeting and via e-mail. Also, the group present confirmed the members of the HMPC.

Information was collected from the Beaufort County Building Code Department, Planning Department, GIS Department, and Emergency Management Department. Several state agencies were contacted including the South Carolina Emergency Management Division, the Department of Natural Resources, and The University of South Carolina Hazards Research Lab. Information was collected from agencies such as The Department of Health and Environmental Control – Office of Ocean and Coastal Resource Management, the Forestry Commission, and the Geologic Survey.

Also, at the May 13 meeting, goals, objectives and mitigation actions were distributed to the HMPC for their review (see APPENDIX A, Handouts). The HMPC was directly involved in deciding what goals and actions were needed in order to further hazard mitigation within the County. They reviewed each of the previous goals for completion and established new goals. These goals, objectives and actions were collected at the HMPC meetings, through personal visits and through electronic mail. Through review of the identified hazards was discussed in order to make sure no possible mitigation action was “left out” of the plan. Finally, the staff was informed about the requirements of the updates, and a review of all sections of the plan was performed.

Assess Hazards and Vulnerabilities

The next job of the HMPC was to perform a hazard identification, vulnerability assessment and risk assessment for the entire county. This process allowed the committee to analyze the county’s greatest hazard threats and to determine its most significant vulnerabilities. Originally, GIS data from County, Hilton Head Island, and state sources. The State of South Carolina, at the time of this update, had contracted with the University of South Carolina geography department in order to collect the latest information on hazard assessment. That information has been used in this plan. At the first HMPC Meeting held on May 2009, an overview of the planning process was presented to the committee and the committee reviewed the first draft of the Hazard Identification and Vulnerability Assessment. The final

assessment was later updated by LCOG staff using the date from the SC Hazard Research Lab. This assessment was reviewed, in turn, by a subcommittee of HMPC members with relevant technical expertise.

Develop a Mitigation Plan

Next, a Capability Assessment Update was performed whereby the existing programs and policies addressing natural hazards were reviewed. A thorough analysis of the adequacy of existing measures was performed and potential changes and improvements were identified. The HMPC reviewed the Capability Assessment at the June 2009 meeting, but each jurisdiction review their capability portion individually and responded by electronic confirmation or by confirming in individual meetings.

As part of the first (May 2009) meeting, the HMPC worked to identify goals and objectives for countywide mitigation efforts. These goals represent the county and communities' vision for disaster resistance. The HMPC also reviewed the previous action items, with each community representative being assigned to update his/her portion of previous action list. They were also charged with defining new actions and goals.

Communication was made frequently through electronic means throughout this process. LCOG staff received many of their action list updates through e-mails, but the primary source of updates to the actions and goals was through individual staff meetings and meetings of the entire Planning Committee. They also received updates to other items, and the staff was frequently in contact with community representatives to ensure accuracy.

At the June 19, 2009 meeting, the HMPC reported on the status of mitigation actions for implementation. The results were recorded to be reflected in this plan. Furthermore, new mitigation actions were suggested. Everything that could affect hazard event-related damage in the county was considered by the HMPC, with special consideration of the National Floodplain Insurance Program (NFIP). The role of LCOG advisors was to ensure not only that relevant activities were considered, but also that the process was not limited to just a few alternatives. LCOG staff informed the HMPC members that they would visit each of them to go over individual considerations in the Hazard Mitigation Plan Update. The HMPC also considered the previous goals and objectives of the original plan, and amended them as appropriate at this meeting to create a final list of goals. Status of some sections of the plan (such as the Vulnerability and Capability assessments) was discussed.

At the August 27, 2009 meeting, the HMPC finalized the goals and actions of the plan, as well as participated in the discussion of prioritization methods for the actions and goals. Here, standards were set (which are reflected in this plan) for the ranking of hazards, goals, and actions based on NFIP standards and a feasibility review of the actions. The HMPC drafted an "action plan" that specifies recommended projects, who is responsible for implementing them, and when they are to be completed. Also, the hazards and their particular ranking was discussed, with the original plan serving as their guide for ranking. Draft elements of the plan were presented to the HMPC for review and comment with particular emphasis on project development and prioritization. LCOG staff also ensured that

the HMPC was aware of the need for public meetings, and they were assigned the task of scheduling public meetings.

In order to get as much information as possible from the participants, LCOG staff met with the designated representative from each of the jurisdictions:

- Ed Nelson, Assistant Building Codes Director, Beaufort County, 08/06/2009,
- Libby Anderson, Planning Director, City of Beaufort, 08/06/2009;
- Trudie Johnson, Floodplain Administrator, Town of Hilton Head Island, 06/30/2209;
- Linda Bridges, Planning Administrator, Town of Port Royal, 06/26/2009,
- Dick Deuel, Program Manager, Beaufort Jasper Water and Sewer Authority, 09/08/2009.
- John Webber, Disaster Recovery Manager, Beaufort County Disaster Recovery, 09/28/2009

In these meetings, updates to the "action plan" were further discussed. Also an assessment of any updates to the jurisdictions' capability assessment that had not been covered in the HMPC meetings was confirmed. Also, these meetings gave the committee members opportunity to discuss and other concerns that they had with the plan, as well as an opportunity to finalize their prioritization scores.

HMPC meeting Number 4 was held on November 19, 2009. Comments were compiled and a Final Draft plan was given to committee members.

It should be noted that this plan recommends mitigation measures that should be pursued. Implementation of these recommendations depends on adoption of this plan by the County Council and each of the municipalities and the cooperation and support of the offices and contacts designated as being responsible for each action item.

Drafts were sent in November to all members of the HMPC. The final meeting was held by the steering committee on December 13, 2009. Here, the members made final comments before the plan was to be sent to SCEMD for review. After the review, the LCOG staff made final revisions and sent it in to FEMA.

Documentation for the HPMC meetings can be found in the form of agendas, sign in sheets and meeting notes in the Appendix.

Other Agencies

During the planning process, contacts were made with the following agencies to determine how their programs affect or could support Beaufort County's hazard mitigation efforts:

- Federal Emergency Management Agency (FEMA), Region IV
- South Carolina Department of Natural Resources (SCDNR)
- South Carolina Emergency Management Division (SCEMD)
- University of South Carolina. Hazard Research Lab (SCHRL)

- US Army Corps of Engineers

Each of the agencies will receive a draft of the plan for their review and comment.

Evaluate Your Work

The County will continue to implement the plan and perform periodic reviews and revisions of the plan through on-going HMPC reviews. The HMPC will meet annually to review the plan and will also hold public meetings to garner citizen comment. Specific language on the HMPC's future endeavors to continue to evaluate the plan is included in the Action Plan.

Public Involvement

The public involvement elements of the planning process were addressed through several sets of public meetings.

The first set of public meetings was held on July 23, 2009 at Hilton Head Town Hall (one in the morning and one in the evening). At this meeting, the public was given a general overview of Hazard Mitigation and the Hazard Mitigation Plan. Staff explained that there was a need to update the plan, and fielded questions from the public, as well as comments. Furthermore, the public was given the option to contribute to the plan by distribution of a survey. The comments at the meetings and the input from the survey were accepted by Hilton Head planning staff, and the input from the public was used in writing this Plan. The survey was also available online at http://www.surveymonkey.com/s/CWR879H. Response was not overwhelming, but some of the reactions were positive to the survey, as the public seemed willing to help the HMPC understand their personal concerns

The second set of meetings began on October 29, 2009. At this meeting, the public was given a brief rundown of where the plan stood near completion. Comments from the public were taken into consideration in order to make any last minute adjustments to the plan. Documentation in the form of public notice can be found appended to this plan.

In order to have a continued commitment to public involvement, a meeting is scheduled for January 2010 at the Beaufort County Planning Commission meeting. Staff will explain the updates and take any suggestions for changes to the plan. This will also begin the process of formal adoption by Beaufort County. Also, a version of the plan was placed on the LCOG website on December 10, 2009. Notice of the draft was placed in the Regional Planning agency announcement board, and comments were taken until December 18, 2009.

Federal Funding Sources for Mitigation

In preparing the hazard mitigation plan and identifying potential mitigation measures, the committee also had to consider potential funding sources for the specified projects. An overview of several federal and state funding sources that can be used for hazard mitigation projects is provided below. Preparations are being made to apply for grants once FEMA approves this update.

FEMA's Hazard Mitigation Grant Program (HMGP) assists states and local communities in implementing long-term hazard mitigation measures following a major disaster declaration. As of November 1, 2004, all communities must have an approved hazard mitigation plan in place to remain eligible for HMGP funding. HMGP grants can be used to fund projects that provide protection to either public or private property. HMGP eligible projects include structural hazard control such as debris basins, floodwalls, or stream restoration, and retrofitting measures such as flood proofing, acquisition, or relocation of structures.

FEMA can fund up to 75 percent of the eligible costs of each project. The State or local match does not have to be cash; in-kind services or materials may be used. Federal funding under the HMGP is based on 7.5 percent of the Federal funds spent on the Public and Individual Assistance programs (minus administrative expenses) for each disaster. Eligible applicants must apply for the HMGP through the South Carolina Emergency Management Division – Recovery and Mitigation Group.

FEMA's Pre Disaster Mitigation (PDM) **Funds** provide both planning and project funding to eligible communities. PDM project funding is nationally competitive; there is no 'base' amount guaranteed to each state. A national priority is placed on projects that address NFIP repetitive loss properties and a benefit cost analysis is required for each proposed project. Projects are awarded priority based on the state's analysis and resulting ranking, and on factors such as cost effectiveness, addressing critical facilities, and the percent of the population that benefits from the project.

FEMA funds up to 75 percent of the cost of the project, or up to 90 percent for small, impoverished communities. There is a $3 million cap on the federal share of the cost per project. Eligible applicants must apply for the PDM through the South Carolina Emergency Management Division – Recovery and Mitigation Group.

FEMA's Flood Mitigation Assistance Program (FMA) provides grants to states and communities for planning assistance and mitigation projects that reduce the risk of flood damage to structures covered by flood insurance. The types of grants available include planning and project assistance. FMA monies are available to eligible applicants when a Flood Mitigation Plan has been developed and FEMA has approved it.

FEMA may contribute up to 75 percent of the total eligible costs. At least 25 percent of the total eligible costs must be provided by a nonfederal source. Of this 25 percent, no more than half can be provided as in-kind contributions from third parties. There are limits on the frequency of grants and the amount of funding that can be allocated to a State or community in any 5-year period. The South Carolina Department of Natural Resources (SCDNR) serves as the administrator of the planning and projects portions of the grant. The State's FMA Coordinator is within the Land, Water and Conservation Division of SCDNR. The agency's web page is www.dnr.state.sc.us.

Continuing Authorities Program (CAP) initiates a short reconnaissance effort to determine Federal interest in proceeding. If there is interest, a feasibility study is performed, and then

the project might move on to a plans and specifications phase. Finally, the project goes to its construction phase. A local sponsor must identify the flood-related problem and request USACE Assistance. Small flood control projects are also eligible.

The cost share for the CAP is 65% USACE and 35 % local. The federal project limit is $7,000,000. The USACE's Charleston District office would review the local sponsor's request for assistance and would request funds from the USACE's annual appropriations.

USACE's Floodplain Management Services Program aims to support comprehensive floodplain management planning to encourage and guide sponsors to prudent use of the Nations' floodplains for the benefit of the national economy and welfare. Some examples of the types of projects that would be funded include:

- flood warning and flood emergency preparedness
- floodproofing measures
- studies to improve methods and procedures for flood mitigating damages
- preparation of guides and brochures on flood-related topics

A local sponsor must identify a problem and request USACE assistance under the Floodplain Management Services Program. The USACE may provide up to 100% of funding at the request of the sponsor. The USACE's Charleston District's office would review the local sponsor's request for assistance and determine if it fits within the program.

Department of Housing and Urban Development's (HUD) Community Development Block Grant - Disaster Recovery Initiative (DRI) program provides flexible grants to help cities, counties, and States recover from Presidentially-declared disasters, especially in low-income areas. Since it can fund a broader range of recovery activities than most other programs, the DRI helps communities and neighborhoods that otherwise might not recover due to limited resources.

When disasters occur, Congress may appropriate additional funding for the Community Development Block Grant and as DRI grants to rebuild the affected areas and bring crucial seed money to start the recovery process. Grantees may use DRI funds for recovery efforts involving housing, economic development, infrastructure and prevention of further damage, if such use does not duplicate funding available from the Federal Emergency Management Agency, the Small Business Administration, and the U.S. Army Corps of Engineers. Examples of these activities include:

- buying damaged properties in a flood plain and relocating them to safer areas;
- relocation payments for people and businesses displaced by the disaster;
- debris removal;
- rehabilitation of homes and buildings damaged by the disaster;
- buying, constructing, or rehabilitating public facilities such as water and sewer systems, streets, neighborhood centers, and government buildings;
- code enforcement;

- planning and administration costs (limited to no more than 20 percent of the grant).

HUD notifies eligible governments, which must then develop and submit an Action Plan for Disaster Recovery before receiving DRI grants. The Action Plan must describe the needs, strategies, and projected uses of the Disaster Recovery funds.

Certified Local Government (CLG) **Grants** are available for historic preservation through the **State Historic Preservation Office** (SHPO) which is part of the **South Carolina Department of Archives and History** (SCDAH). Although the funding for this program is administered by state, the funding is allocated by the U.S. Department of the Interior. Ten percent of the total federal appropriation to the State Historic Preservation Office's is awarded annually to Certified Local Governments (CLGs). The City of Beaufort and the Town of Bluffton are both Certified Local Governments and are thus eligible for this funding source. The grants can be used for projects related to historic structures and preservation, and requires matching funds (50/50 share) with awards generally ranging from $1,500 to $25,000. Historic Preservation projects often overlap with hazard mitigation efforts and include Identifying, Recording and Recognizing Historic Properties; Planning for Historic Districts and Multiple Historic Properties; Building Stabilization Projects; Planning for Individual Historic Properties; Preservation Education; and Strengthening Local Government Historic Preservation Programs.

The **SHPO** also administers the **State Development ("Bricks and Mortar") Grants** which can be used for stabilizing historic buildings and structures, or protecting historic buildings and structures from the adverse effects of the weather. Eligible applicants include local governments, nonprofit organizations applying for the grants for buildings or structures that are listed in the National Register of Historic Places or eligible for the National Register and have a planned or current public use. The grants are reimbursable, have a 50/50 cost match requirement and generally range from t$5,000 to $20,000. The SHPO's website is located at www.state.sc.us/scdah/histrcpl.htm.

2. Hazard Identification and Profiles

Introduction

Beaufort County performed a Hazard Identification to determine the hazards the County faces. The hazard identification section describes each hazard, describes the extent of severity of each hazard, provides the previous occurrences of hazards and describes the probability of future occurrences of each hazard based on historical data. While each hazard is described in narrative form, with its corresponding probability also included, Table 2-13 (at the end of this section) serves a quick reference guide that shows the annual probability, the hazard and jurisdictions affected. The results were presented to the Committee members for review, and data and additional events were added.

To perform this process, existing sources of hazard frequency data were consulted including Flood Insurance Rate Maps (FIRMs), FEMA publications, Department of Agriculture Forest Service wildfire risk maps, USGS earthquake and landslide risk maps, storm surge mapping developed by the USACE, State of South Carolina erosion information, and wind and climatic data. Additionally, historical hazard events were researched through publications as well as state and federal agency information provided on the internet to determine their effects on the County and their probability of recurrence. Since it the most recent and deemed to be most reliable, the information the SC Hazard Research Labs (drawn from NCDC data) was the primary information source for profiling hazards in Beaufort County. NCDC data itself was also utilized. Unless otherwise noted, these are the authoritative information sources for this planning document.

Finally, flood insurance policy information was obtained from the state. The Hazard Identification process was used to identify those hazards that pose the greatest risk to the County and warrant further analysis through the vulnerability assessment. The hazard identification section describes each hazard, describes the extent of severity of each hazard, provides the previous occurrences of hazards and describes the probability of future occurrences of each hazard. Because of the County's geographical situation, it can be expected that the County is almost equally vulnerable to hazards throughout. However, areas nearer the coast, closer to water and described by the FIRM as being in a flood zone are more susceptible to flooding and hurricane hazards.

For purposes of this plan, when "Beaufort" or "Beaufort County" is used, that is generally used to refer to the County and all municipalities in the County. Over all, all municipalities are affected the same in terms of probability and vulnerability by each hazard. If there is a notable or meaningful difference between jurisdictions, it is noted specifically (such as Hilton Head and beach erosion).

Hurricanes, Tropical Storms

Hurricanes and tropical storms, as well as tropical depressions, are all tropical cyclones which are defined by the National Weather Service's National Hurricane Center (NHC) as *warm-core non-frontal synoptic-scale cyclones, originating over tropical or subtropical waters, with organized deep convection and a closed surface wind circulation about a well-defined center*. According to the NHC, once they have formed, tropical cyclones maintain

themselves by extracting heat energy from the ocean at high temperatures and releasing heat at the low temperatures of the upper troposphere. Hurricanes and tropical storms bring heavy rainfalls, storm surge, and high winds, all of which can cause significant damage. These storms can last for several days, and therefore have the potential to cause sustained flooding, high wind, and erosion conditions.

These types of storms are classified using the Saffir-Sampson Hurricane Scale which was developed by Herbert Saffir and then director of the National Hurricane Center, Robert Simpson. The scale rates the intensity of hurricanes based on wind speed and barometric pressure measurements and is used by the National Weather Service to predict potential property damage and flooding levels from imminent storms. Although the scale assigns a wind speed and surge level to each category of storm, in recent years, there has been more and more recognition of the fact that wind speed, storm surge and inland rainfall are not necessarily of the same intensity for a given storm. Therefore, there is some interest in classifying hurricanes by separate scales according to each of these risks. However, the Saffir-Sampson Scale is still the most widely used classification tool for hurricanes. The scale is presented in Table 2-1.

Table 2-1. Saffir-Sampson Scale and Typical Damages

CATEGORY	SUSTAINED WIND SPEEDS (MPH)	SURGE (FT)	PRESSURE (MB)	TYPICAL DAMAGE
Tropical Depression	<39	--	--	
Tropical Storm	39-73	--	--	
Hurricane 1	74-95	4-5	> 980	*Minimal* – Damage is done primarily to shrubbery and trees, unanchored manufactured homes are damaged, some signs are damaged, no real damage is done to structures on permanent foundations.
Hurricane 2	96-110	6-8	965-980	*Moderate* – Some trees are toppled, some roof coverings are damaged, major damage is done to manufactured homes.
Hurricane 3	111-130	9-12	945-965	*Extensive Damage* – Large trees are toppled, some structural damage is done to roofs, manufactured homes are destroyed, structural damage is done to small homes and utility buildings.
Hurricane 4	131-155	13-18	920-945	*Extreme Damage* – Extensive damage is done to roofs, windows, and doors; roof systems on small buildings completely fail' some curtain walls fail.
Hurricane 5	> 155	> 18	< 920	*Catastrophic Damage* – Roof damage is considerable and widespread, window and door damage is severe, there are extensive glass failures, some buildings fail completely.

Northeasters are extratropical storms occurring during the period from late fall to early spring that affect the east coast of the U.S. Low pressure systems develop off the east coast that lead to storms that bring strong northeast winds, heavy rains/precipitation and storm surge to coastal areas. Although northeasters' winds and storm surge might be less intense than that of hurricanes, northeasters can hover for several days over a given area. This kind of long duration storm allows larger accumulations of precipitation as well as more damage to structures as they are exposed to wind and flooding for long periods of time. Additionally, the long duration of northeasters typically leads to wide spread coastal change through erosion and accretion along the shoreline.

Past Occurrences of Hurricanes

Hurricane track data gathered from the South Carolina State Hazard Assessment (performed by the South Carolina Emergency Management Division in conjunction with the University of South Carolina Hazards Research Lab) indicates that from 1850 to 2008, 20 storms passed directly through Beaufort County[1]. These included tropical storms, tropical depressions, subtropical storms, subtropical depressions and extratropical storms[2]. Figure 2-1 illustrates

[1] The data is from the SCHRL; older data was taken from NOAA Coast Services Center and reflected 24 storms.
[2] At some point, all of these storms were tropical cyclone storms of at least tropical depression grade.

the storm paths within the County; hurricane tracks are shown in pink, and all other storm tracks are shown in blue.

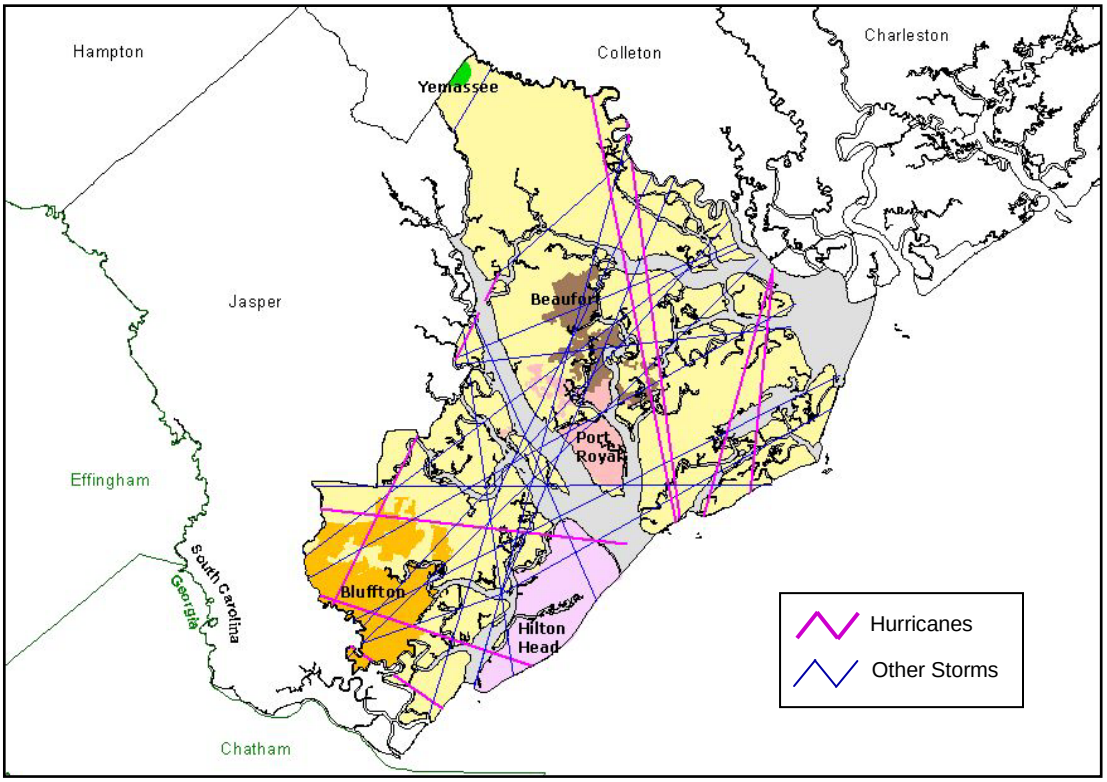


Figure 2-1. Storm Tracks Passing through Beaufort County, 1850-2008

A summary of the types and numbers of hurricanes and other storms is provided in Table 2-2. The data included in that table represents that data from the coastal services center of the original plan. Because of the disparity in this data, it is evident that there are some limitations on its meaning. However, it is evident that hurricanes and tropical storms represent a major threat to Beaufort County.

Table 2-2. Storm Tracks Passing through Beaufort County 1850-2008

TYPE OF STORM	QUANTITY	NAMED[1]
Hurricane – Category 3	1	
Hurricane – Category 2	2	
Hurricane – Category 1	5	
Tropical Storm	10	
Tropical Depression	2	1 - occurred prior to naming convention 1 – Yes
Subtropical Storm	1	No
Subtropical Depression	1	Yes
Extratropical Storms	2	Both Named

[1] If storm with a grade of Tropical Depression or lower was named, at some point it was classified as a Tropical Storm and/or Hurricane.

Hurricanes that pass in relatively close proximity to Beaufort County can also have an impact upon Beaufort County. Therefore, an analysis of storms passing through or within 50 miles of the County was also performed. Results of this analysis are presented in Table 2-3.

Table 2-3. Storm Tracks Passing within 50 miles of Beaufort County 1850-2006

TYPE OF STORM	QUANTITY
Hurricane – Category 4	2
Hurricane – Category 3	3
Hurricane – Category 2	5
Hurricane – Category 1	15
Tropical Storm	39
Tropical Depression	7
Subtropical Storm	3
Subtropical Depression	2
Extratropical Storms	5

Figure 2-2 shows the locations of the storm tracks within 50 miles of the County. Hurricanes tracks are shown in red. Tropical, subtropical, and extratropical storm paths are shown in blue.

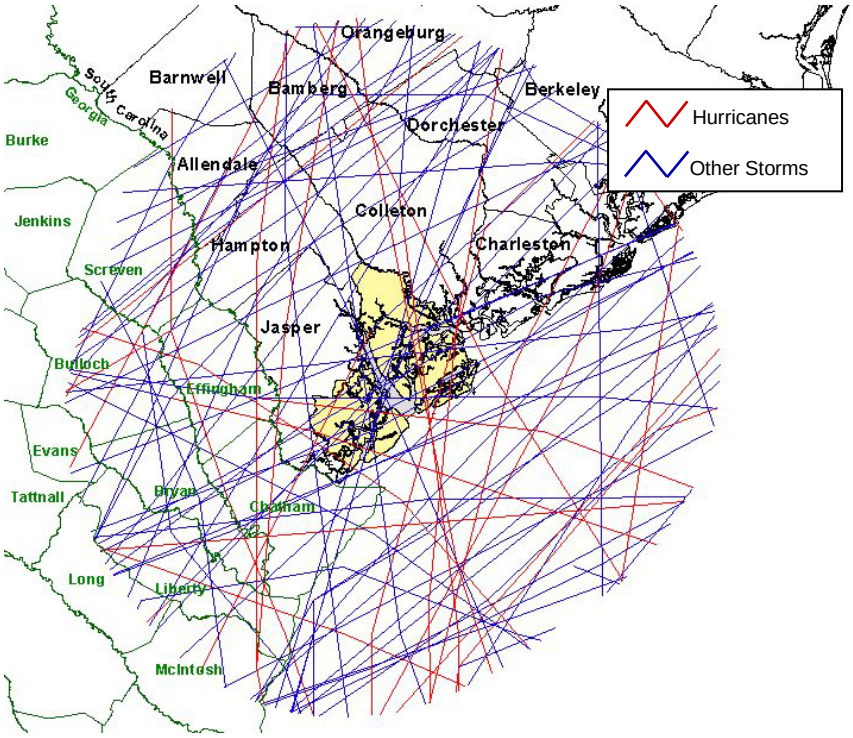


Figure 2-2. Storm Tracks through and within 50 miles of Beaufort County, 1850-2006

According to the County's Flood Insurance Study, the major storms that have effected or caused significant damage in Beaufort County include hurricanes that hit on September 7, 1804, August 7, 1854, and August 27, 1893. Additionally, on October 11, 1902 an extratropical storm hit Beaufort County; the storm had been a hurricane but was downgraded to an extratropical storm when it reached South Carolina. On August 11, 1940, a hurricane made landfall between Savannah and the City of Beaufort. On October 19-20, 1944 a Tropical Storm passed through Beaufort County bringing heavy rains. Hurricanes Cindy and Gracie hit South Carolina in 1959. Gracie made landfall in Beaufort County on September 29. Hurricane Donna moved off the South Carolina coast 50 to 70 miles from the Beaufort shore in September 1960. In 1979, Hurricane David hit the south coast of South Carolina, and in 1985, Hurricane Bob's center made landfall on Fripp Island. In addition to these storms, another noteworthy storm that affected the state of South Carolina in September 1989 was Hurricane Hugo. While northeaster storms also present a significant threat to the Beaufort County and particularly to its coastline, there is not as much documented information about these storms suggesting that historically hurricanes have caused more damage in the county.

The following past storms have been documented to help predict the occurrences of future storms:

September 1804

A hurricane moved inland between Savannah, Georgia and Charleston, South Carolina on September 7 and caused severe damage along the coastline of both states. The center of the storm stayed along the inland side of the coastline and passed over the City of Beaufort. Records indicated that this storm caused over 500 persons to drown in South Carolina and severely impacted the state's economy.

August 1854

The center of this hurricane passed about 20-25 miles southeast of Beaufort County changing from a Category 3 storm to a Category 1 storm as it made its way over land. It approached the coastline from a south-southeasterly direction bringing winds that caused significant storm surge as they drove waters inland from the ocean into the tidal estuaries and over the tidal lowlands of Beaufort County.

August 1893

This hurricane went from a Category 3 to a Category 2 hurricane as its center approached the north Georgia coastline. The center of the hurricane passed 10-15 miles west of southern Beaufort County. The hurricane approached the coastline from the southeast and thus caused extensive storm surge along the coast. Surge levels on the North Georgia and lower South Carolina coasts reached up to 19.5 ft NGVD at Savannah Beach in Georgia, and 8.9 ft NGVD in Charleston. It is estimated that over 1,000 people along the coastal islands and lowlands from northern Georgia to Charleston, South Carolina died as a result of this storm.

October 1902

A hurricane moving from the Gulf of Mexico became an extratropical storm as it passed over Beaufort County bringing 3.4 inches of rain to the County during a 12 hour period on October 10 and 11, 1902.

August 1940

This Category 1 hurricane came from the southeast and made landfall in Beaufort County on August 11, 1940. Winds from the hurricane created surge in Beaufort's tidal estuaries and caused the Beaufort River to leave its banks and reach a height of 14.2 ft NGVD. In the Broad River on Lemon Island, a surge level of 16 ft NGVD was recorded. On outlying islands including St. Helena, Hilton Head, Daufuskie and Pinckney, flood levels reached 10 ft NGVD.

In Beaufort City, every wharf along the Beaufort River was damaged or destroyed and the business district was flooded to depths of 2 to 3 feet. On Ladies Island, flooding caused the deaths of 8 people. Severe damage was also reported on the outlying islands of St. Helena, Hilton Head, Daufuskie, and Pinckney where numerous homes were damaged or destroyed, several hundred people were left homeless, and 25 people lost their lives. At Hunting Island, severe beach erosion was reported causing the beach line to recede up to 100 feet. This hurricane caused the deaths of 34 people in all and damage estimated at $6.6 million (1940 costs).

October 1944

This storm passed through Beaufort County as a tropical storm on October 19-20, 1944 and brought heavy rains to the area. The storm center's track shows the storm entered southern Beaufort County at Daufuskie Island and traveled northwest tracing a long path through the County and entering into Colleton County north of the Williman Islands (St. Helena Sound Heritage Preserve). Damage estimates from the storm were fairly low with a property damage of approximately $200,000 and crop damage estimated at approximately $150,000 (1944 costs).

Hurricane Cindy – July 1959

Hurricane Cindy came ashore from the southeast into Charleston County as a Category 1 storm with winds of 75 mph. The eye of the storm was located near McClellanville, about 50 miles northeast of Beaufort County, when it made landfall. Cindy caused one death, high tides and considerable flash flooding.

Hurricane Gracie - September 1959

Hurricane Gracie came from the southeast and caused storm surge to reach between 7.3 and 11.9 ft NGVD at Edisto Beach (just north of Beaufort County at the border of coastal Colleton and Charleston Counties). The hurricane's center track went through St. Helena Sound and made landfall just northeast of Beaufort County in Colleton County. The hurricane was downgraded from a Category 4 to a Category 3 storm as it made landfall. Severe damage was reported from the City of Beaufort northward to Charleston including damage caused by fallen trees and crop damage. Considerable precipitation as well as several

tornadoes resulted from the storm. The total storm damage was estimated at $14 million (1959 costs).

Hurricane Donna – September 1960

Hurricane Donna was a Category 2 storm that passed offshore of Beaufort County moving parallel to the coastline. The hurricane was reportedly 50-70 miles from the coastline, but resulted in squalls and gale force winds along the coast. No significant damage or casualties were reported for this storm.

Hurricane David – September 1979

David made landfall as a Category 1 storm well south of Beaufort in McIntosh County, Georgia after causing severe destruction in the Caribbean. The storm had winds of up to 85 mph and its center passed within 6-7 miles of southern Beaufort County on September 4 causing minor to moderate damage and significant beach erosion.

Hurricane Bob – July 1985

The center of Hurricane Bob made landfall on Fripp Island in Beaufort County as a Category 1 Storm on July 25 and moved northwestward through the county. There was minimal damage associated with the storm and no deaths as a direct result.

Hurricane Hugo – September 1989

While Hurricane Hugo, which made landfall on the South Carolina coast on September 22, 1989, was the first major hurricane to hit the South Carolina coast since Hurricane Gracie, and the strongest hurricane to ever make landfall in the state (It was a Category 4 storm when it made landfall in Charleston County with sustained winds of 135 mph.), it did not cause significant damage in Beaufort County. However, a hurricane evacuation warning was issued in the county leading to a loss of revenue for many businesses particularly in resort areas including Hilton Head Island. Twenty-four (24) counties in South Carolina, including both Colleton and Charleston Counties located just north and northeast of Beaufort County, were Presidentially-declared disaster areas, and damage estimates for the state as a result of the storm were estimated at approximately $5.9 billion (1989 costs) (source: USACE – Charleston District).

Hurricane Bertha – July 1996

Hurricane Bertha came close to the south coastal counties of South Carolina, but did not cause any significant damage. The maximum sustained winds (36kts) and peak gust (50kts) both occurred at the Charleston City Office on 7/12/96. Bertha's most significant impact was on tourism where the estimated loss revenue approached $20,000,000. Near eleven (11) million dollars of that was in Beaufort/Hilton Head area. A few places along the Charleston coast experienced moderate beach erosion.

Hurricane Floyd – September 1999

Hurricane Floyd weakened to a category three hurricane as it approached the southeast Georgia and southern South Carolina coasts on the morning of September 15th.The storm brushed the area

during the late afternoon and evening as it took a more north and northeast course toward North Carolina. Sustained winds of tropical storm force were reported from Savannah on the southeast Georgia coast to Charleston on the South Carolina coast with wind gusts to hurricane force in the Charleston area. The highest sustained wind speed was 58 mph at the downtown Charleston office, which also had the highest gust (85 mph). In general, 3 to 5 inches of rainfall was reported across the area. Tides were 3.5 feet above normal with a maximum tide height 10.66 ft. ASL (7.71MLLW) at downtown Charleston. Minor to moderate beach erosion occurred along the South Carolina coast. Many businesses and homes suffered major damage with thousands of homes suffering at least minor damage in Charleston county, where 10.5 million dollars in damage was reported. Beaufort county reported 750,000 dollars damage with Berkeley and Dorchester counties reporting 500,000 dollars each. Well over a thousand trees were down, which contributed to over 200,000 people across south coastal South Carolina being without power at times on the night of September 15. There were sporadic reports of roofs being torn from homes or businesses across the area.

Past Occurrences of Tropical Storms

Recorded data show only 55 tropical storms passing in or near Beaufort County between 1850 and 2006, but that number is likely to be unrepresentative of the true number of events, as a result of limited record-keeping in the earlier years. During the period from 2000 to 2008, the NCDC recorded 11 tropical storms that impacted Beaufort County. However, they caused only minor property damage, the largest amount being the erosion at Hunting Island in August 2008.

Future Probabilities of Hurricanes

Based on the frequency of past events, the occurrence of future events can be predicted. From Table 2-2, the center of eight hurricanes, one of which was a Class 3 hurricane, have passed directly through Beaufort County since 1850. Table 2-3 shows that the centers of an additional 17 hurricanes that have passed within 50 miles of Beaufort County. This includes two Category 3 and two Category 4 storms. That data reflects the NOAA Coastal Services Center data from the original plan.

In order to estimate the frequency of occurrence, the number of hurricanes is compared to the length of the period of record which is from 1850-2008 and is 158 years. The recurrence interval is defined from this information and is a rough estimate of the amount of time, on average, during which one occurrence of a given storm will take place. It is important to note that in reality, a storm can occur multiple times during one recurrence interval, and that the recurrence interval is only an estimated average time period. Recurrence intervals for hurricanes and tropical storms within and in the vicinity of Beaufort County are presented in **Table 2-4**, which is included as a reference.

The SC Hazard Research Lab reports 20 such events in the same period of time. Using this data as the authoritative source for this planning document, an annual percent chance of a hurricane of 12.66 percent is calculated for hurricanes for Beaufort. Taking into account both the updated data and that data from the original plan, hurricanes are still considered a significant hazard—especially considering Beaufort's proximity to the Atlantic Ocean.

Table 2-4. Estimated Recurrence Intervals of Hurricanes and Tropical Storms within 50 miles of Beaufort County

Storm Type	Number of Occurrences With Center of Storm Track Within 50 miles of Beaufort County	Recurrence Interval (years)	Number of Occurrences With Center of Storm Track In Beaufort County	Recurrence Interval (years)
Tropical Storm	39	4	10	15
Category 1	15	10	5	30
Category 2	5	30	2	76
Category 3	3	50	1	151
Category 4	2	76	no record	----------
Category 5	no record	----------	no record	----------
Tropical Storms and All Hurricanes	64	2	18	8

Another source of hurricane frequency prediction is the Forecast of Atlantic Seasonal Hurricane Activity which is performed annually by the members of the Colorado State University Hurricane Forecast Team, including Dr. William Gray. The forecasts include individual monthly predictions activity and seasonal and monthly U.S. hurricane landfall probabilities. The prediction varies annually based on several atmospheric and oceanic factors and is available through the team's website at typhoon.atmos.colostate.edu/forecasts.

Past Occurrences of Nor'Easters

Major nor'easters that affected much of the East Coast occurred during March 1962 (the Ash Wednesday Storm), October 1991 (Halloween Storm), December 1992, March 1993, and January 1998. Records indicate that these storms generally had more of an effect on storm surge and flooding further north in the mid-Atlantic and northeast United States. The Ash Wednesday storm affected the coast from North Carolina to New England, just missing South Carolina. The effects of the Halloween Storm were felt along the mid-Atlantic and northeast coast as well as the north Atlantic Ocean.

The January 1998 Nor'Easter did have a direct effect on the county. It brought heavy rainfall to the County causing significant roadway flooding. There were also reports of standing water in yards more than a foot in height.

The March 1993 storm caused high winds along the southeastern coast of the United States resulting in damage along beachfront and coastal properties. In Beaufort County, wind and storm surge destroyed the downtown Beaufort Marina and damaged or destroyed approximately 2 dozen boats in the marina. Throughout the county, drainage ditches filled with debris carried by wind and floodwater which led to more severe flooding. On Fripp and Harbour Island, residents lost electricity for a week when salt water flooding led to damage of transformers.

Additionally, two storms occurred in October 1994 causing serious flooding as the slow-moving storms dropped several inches of rain on the county. A storm that occurred on October 3, 1994 dumped approximately 11.5 inches of rain on the county in a 24-hour period resulting in flash and coastal flooding. Many structures were damaged by floodwaters including an estimated 147 homes. Approximately 37 roads were washed out. Hilton Head Island was reportedly the hardest hit. A storm on October 13, 1994 led to flash and coastal flooding along the South Carolina coast with the southern counties being particularly hard hit. Runoff volumes were high and flooding was especially bad due to antecedent conditions; previous rainfall in the area had left the ground saturated. Beach erosion was reported at several locations along the coast as a result of this storm including a loss of an estimated 200,000 cubic feet of sand along Hilton Head Island. Conservative estimates for Beaufort County indicate that 218 residences and 15 businesses were damaged as well as wastewater treatment plants. Roadway flooding was also reported and the State Highway 21 Bridge over Whale Branch was closed. There is no data specifically for Nor'easters, but these storms are considered a serious threat to the entire County, along with hurricanes and other storms.

Flooding

Beaufort County is located along the Atlantic coast in southern South Carolina and is bordered by Jasper County to the west; Colleton County to the north, and Chatham County to the south. Beaufort, along with the three surrounding counties Colleton, Hampton and Jasper, is part of the *Low Country* of South Carolina; the highest elevation in Beaufort County is approximately 50 feet NGVD 29 (National Geoditic Vertical Datum of 1929) above sea level in its northern, inland area. The County is located on the low coastal plain and is comprised partially of tidal marshes and swamps. Several waterways flow through the County and ultimately into the Atlantic Ocean along Beaufort's coast. Figure 2-3 shows Beaufort County and its waterways. Beaufort County is highly susceptible to storm surge and coastal erosion along the Atlantic Ocean shoreline due to the relentless wave action along the coastline and the coastal currents. Storm surge is a large dome of water formed by winds driving large, open bodies of water and are also affected by low pressure systems that add to the storm surge effect by pulling on the surface of the water. Storm surge threatens coastal areas as winds drive it towards the shoreline and can reach heights of 20 feet and be 50–100 miles wide. The county's flood vulnerability is also heightened by the fact that the county consists of low-lying land areas, including marsh areas adjacent to many of its waterways, and wide, relatively flat outlets where its streams and rivers meet the ocean.

A series of sea islands including both barrier islands and erosion remnant islands are within Beaufort County. Barrier islands are located in the ocean and are the first areas of the county to be affected by seaborne storms. The origin of their existence is debated but is generally believed to be due to sand accretion along sand bars, or possibly due to the retreat of the ocean during the Ice Age combined with the effects of glacier meltdown. Barrier islands generally are prone to erosion along their northern ends, and accretion along their southern portions. Fripp and Hunting Islands are both barrier islands.

Erosion remnant islands are believed to be remnants of land that was once above sea level before Ice Age glaciers melted and raised the sea level. St. Helena and Port Royal Islands are erosion remnant islands. Hilton Head Island is actually a combination of the two types of

islands. Broad Creek divides the northern erosion remnant island from the southern barrier island which have been fused together.

While a few of the County's numerous waterways are rivers with sizeable watershed drainage areas, most of them are tidal estuaries. The Combahee and Pocotaligo Rivers both have significant drainage areas. The Combahee River forms the northern border of Beaufort County. The Pocotaligo forms part of the border between Beaufort and Jasper Counties and empties into the tidally influenced Broad River. Some of the major tidally influenced water bodies within the County include: the Broad River which divides the northern portion of the County from the southern portion; Beaufort River which flows along the eastern edge of the City of Beaufort and the Town of Port Royal; the Coosaw River which flows in an easterly direction and empties into St. Helena Sound; the Chechessee and Colleton Rivers in the southern portion of the County; Calibogue Sound and Skull Creek which separate Hilton Head Island from the mainland of the County; and May, Cooper, and New River in the southwestern Beaufort County.

The County's Flood Insurance Rate Maps (FIRMs) show that an estimated two-thirds (approximately 400 square miles) of the County's land mass lies within the 100-year floodplain, or Special Flood Hazard Area (SFHA). Within Beaufort County, the SFHA consists of A zones and V zones. The National Flood Insurance Program (NFIP) uses these general labels to mark areas subject to riverine and inland flooding (A zones) and coastal flooding (V zones) where flood hazards include velocity flows, wave action and erosion.

Most of the SFHA is designated as AE zone; the NFIP uses this label for riverine/inland areas of the SFHA where base flood elevations (BFEs), the elevations of the 100-year floodplain, are determined. In Beaufort County, within much of this AE zone, floodwater levels are controlled by tidal influences and storm surge levels. Beaufort County also has areas designated as VE zones, or Coastal High Hazard Areas. VE zones are parts of the SFHA that are prone to velocity/wave action at least 3 feet in height during a 100-year flood. The wave action that occurs during flooding in these zones generally causes more severe damage to structures, as well as erosion, than what is experienced in nearby A zones and riverine flooding areas. Several VE zone areas are found along the coast within the County. **Error! Reference source not found.** shows the Floodplain Zones within Beaufort County. Flood elevations within the County range from 22 ft NGVD within VE zones on Hilton Head Island to 8 ft NGVD in inland areas of the northern county.

Some coastal areas of the County are designated Coastal Barrier Resources Protection Act (CoBRA) zones. CoBRA was passed by Congress in 1982 to protect undeveloped, environmentally-sensitive coastal lands thus protecting natural resources and minimizing the loss of life and property damage caused by development in high risk areas. Designated CoBRA zones are undeveloped coastal barrier systems. Within CoBRA zones, no federal financing is available. Thus, federally backed flood insurance is not available if the structures are new or substantially improved (built or improved after October 1, 1983).

Although there is not a specific NFIP designation for them, areas called Coastal A zones exist in coastal communities like Beaufort County. They appear as A or AE zones on the

community's FIRMs, and are located adjacent to V zones. These areas are subject to some of the same flood hazards as V zones, including the effects of waves and velocity flow, but the magnitude of these effects is less. This is noteworthy because structures located in A zones adjacent to V zones often experience more extensive damage as a result of these effects than those in non-coastal A zones (FEMA, *Coastal Construction Manual*, 2000, Ch. 3). Generally, coastal A zones are defined as areas that are prone to velocity/wave action of 1 ½ - 3 feet in height during a 100-year flood.

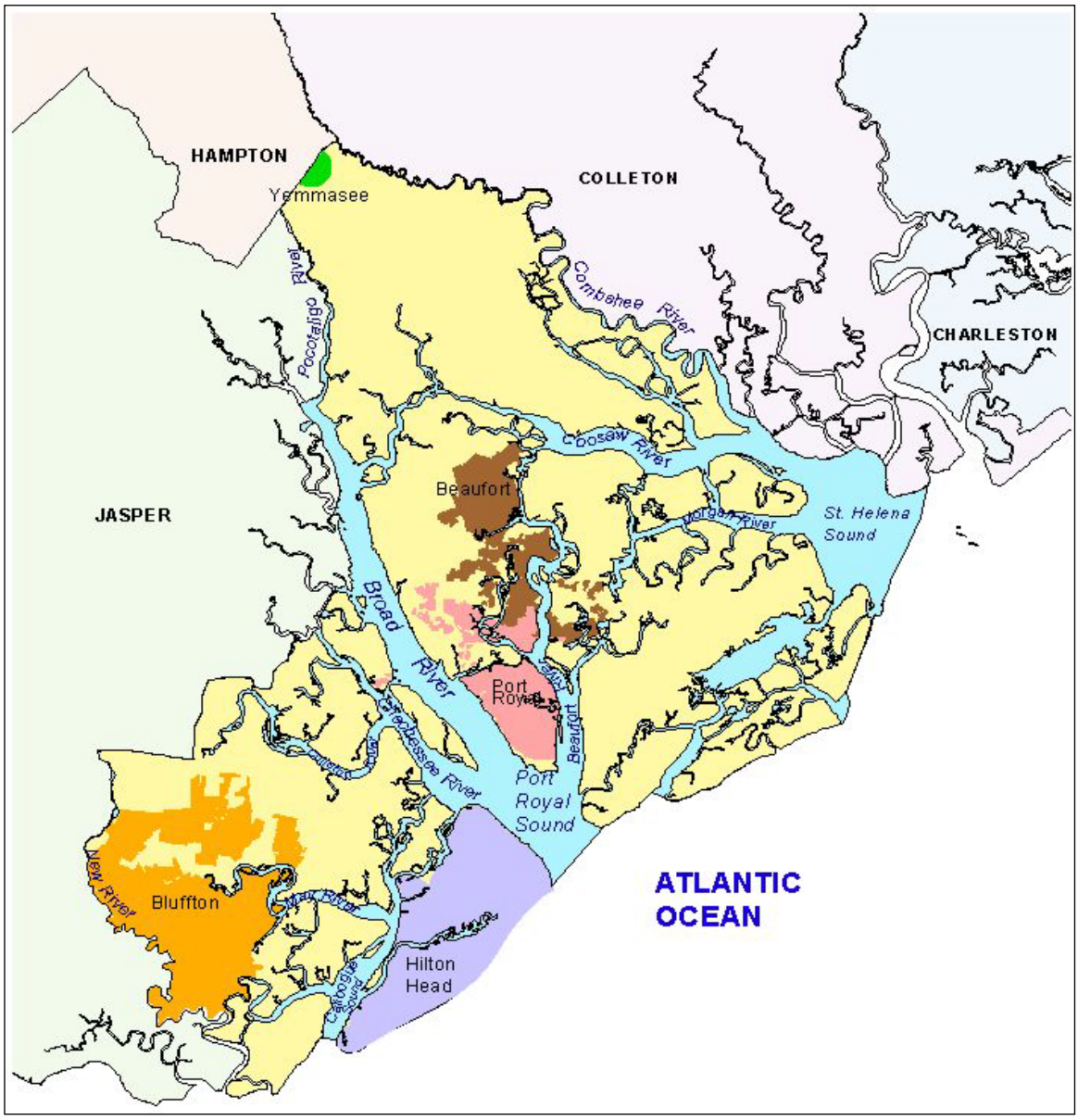


Figure 2-3. Beaufort County Waterways

Past Occurrences of Flooding

Data used to perform the State's risk assessment, which was processed by the University of South Carolina's Hazards Research Lab (HRL) and gathered from the National Climatic Data Center (NCDC) indicates that between 1950 and 2008, 25 floods occurred in Beaufort County. Combined, the 25 floods caused a total of $26 million in property damage and $50,000 in crop damage. No fatalities or injuries were reported as a result of the floods.

Beaufort County is susceptible to flooding caused by hurricanes, tropical storms and coastal storms such as northeasters (nor'easters). According to the community's Flood Insurance Study, major storms and hurricanes caused severe flooding in 1787, 1804, 1893, 1940, and 1959. The highest storm surge recorded was for the August 11, 1940 hurricane event for which flood heights reached 14 ft NGVD 29.

Future Probabilities of Flooding

Storm surge can be modeled by various techniques; one such technique is the use of the National Weather Service's (NWS) Sea, lake and overland surges from hurricanes (SLOSH) model. The model is used to predict storm surge heights based on hurricane category. 4 and

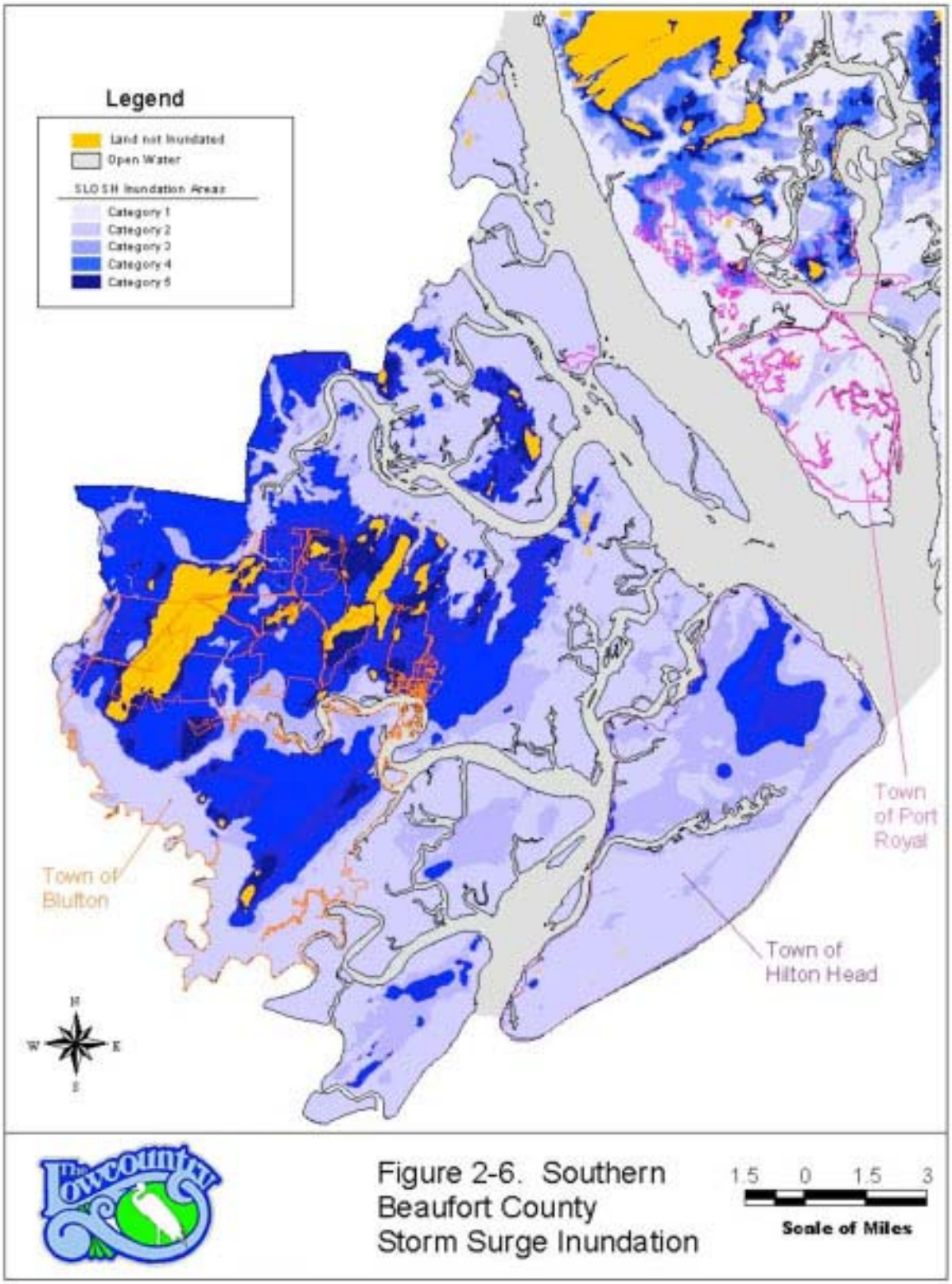


Figure 2-6. Southern Beaufort County Storm Surge Inundation

Figure 2-6 show results from the SLOSH model for the northern and southern parts of Beaufort County respectively. Surge inundation areas are classified based on the category of hurricane that would cause flooding.

The SLOSH maps indicate that for a Category 1 Hurricane, a significant portion of the County, including the majority of Hilton Head Island, much of Port Royal, and portions of the City of Beaufort and Bluffton, would be inundated. Unincorporated areas including Fripp Island and the eastern portion of the Sheldon area would also be inundated by a Category 1 storm. As the Category of the hurricane increases, more land area becomes inundated until in the case of a Category 5 storm, there are only pockets of land that are not inundated including some land within and adjacent to Bluffton, and an area located partially within the City of Beaufort and partially to its northwest (Gray's Hill). Storm surge is a major component of northeaster storms along the East Coast of the U.S. Because winds are moving from a north and/or eastward position, winds move across the ocean towards shore and form large waves.

According the data from the SC Hazard Research Laboratory, the percent chance per year of a flood (Hazard Frequency) is 42.37 percent.

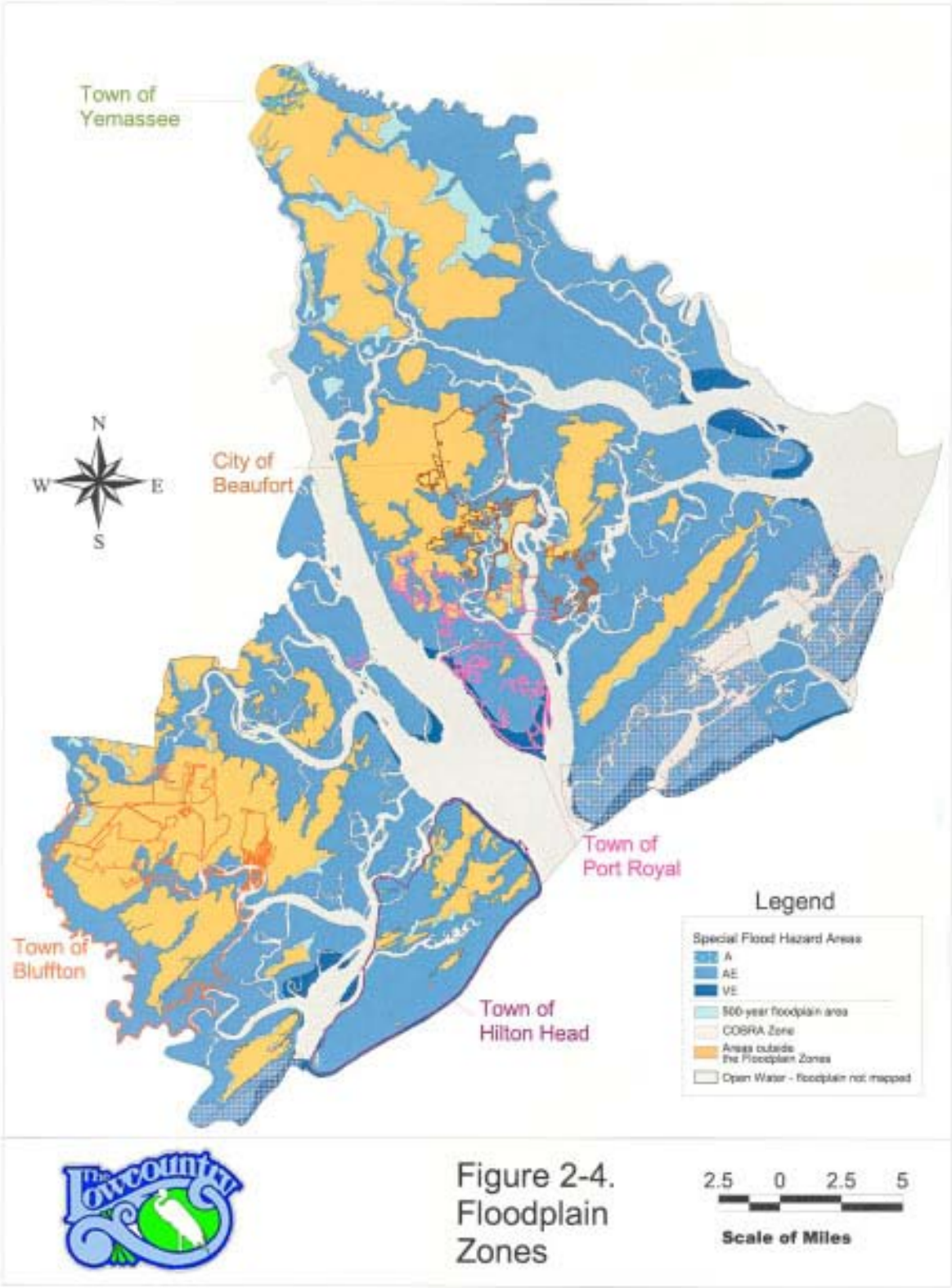


Figure 2-4. Floodplain Zones

Erosion

Erosion and accretion are long term, dynamic processes that occur along shorelines. Major erosion/accretion events are usually associated with coastal storms because floodwater forces have the ability to cause significant acts of erosion/accretion in a short time period.

Erosion is considered a serious hazard in coastal areas because it can threaten coastal development by eroding valuable beach areas including both the flat berm portion and protective dunes of a beach. This has a direct effect on residents and business owners as well as the economies of beach communities that depend on tourists and vacationers.

Past Occurrences and Future Probabilities of Erosion

The South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management (DHEC-OCRM) publishes the *Annual State of the Beaches Report* which summarizes changes that have occurred along the state's shoreline. Results of the 2009 report for Beaufort County areas are presented in Table 2-5. The table notes what, if any, type of shoreline change is occurring for the given area; what the average long term change rate is; whether or not the area is an unstablized inlet zone, which is the type of shoreline zone where the greatest amount of change is likely to occur; and the date of the last nourishment project in the area.

Table 2-5. Shoreline Characteristics

AREA	EROSION, ACCRETION, OR STABLE	AVERAGE ANNUAL LONG-TERM CHANGE RATE (FEET)	UNSTABILIZED INLET ZONE?	DATE OF LAST NOURISHMENT PROJECT
DAUFUSKIE ISLAND	Erosion	4 to 5	Yes	December 1998
FRIPP ISLAND				
Central to Northern island along Atlantic Coast	Strongly accretional	----------	No	
Southern island and NE island along Atlantic	Erosion	----------	No	
Fripp Inlet coastline	Erosion	----------	No	
HARBOR ISLAND			No	
Southern Island	Accretion		Yes	
Northern portions	Erosion		Yes	
HILTON HEAD ISLAND				
Sea Pines Plantation along Calibogue Sound	Light Accretion		Yes	Winter 1999
South Forest Beach	Stable	----------	No	2006-2007
North Forest Beaches and Palmetto Dunes	Erosion	----------	No	2006
Folly Beach-2200 ft stretch	Erosion	6	Yes	1997 (jetty built)
1.3 mile stretch beginning just north of Burke's Beach Road	Stable	----------	No	
Port Royal Plantation shoreline – Atlantic Coast	Accretion	----------	Yes	
Port Royal Plantation shoreline – Port Royal Sound	Erosion	2 to 5	Yes	
HUNTING ISLAND				
Southern End	Strongly erosional	7 to 15	Yes	2006
Northern End	Strongly erosional	7 to 15	No –inlet zone stabilized by terminal groin	2006
PRITCHARD ISLAND[1]	Highly erosional with accretion in some areas including north end	----------	----------	----------

Hunting Island State Park had previously been listed as the state's highest priority for beach renourishment/restoration in the State of the Beaches report. Hunting Island provides public access to the beach, but experiences chronic erosion. Renourishment is conducted on the island as it is needed and as funding can be provided.

While it is difficult to obtain a precise hazard frequency of beach erosion, it is definite that the hazard occurs frequently in Beaufort County and that mitigation actions should be undertaken to slow its progress.

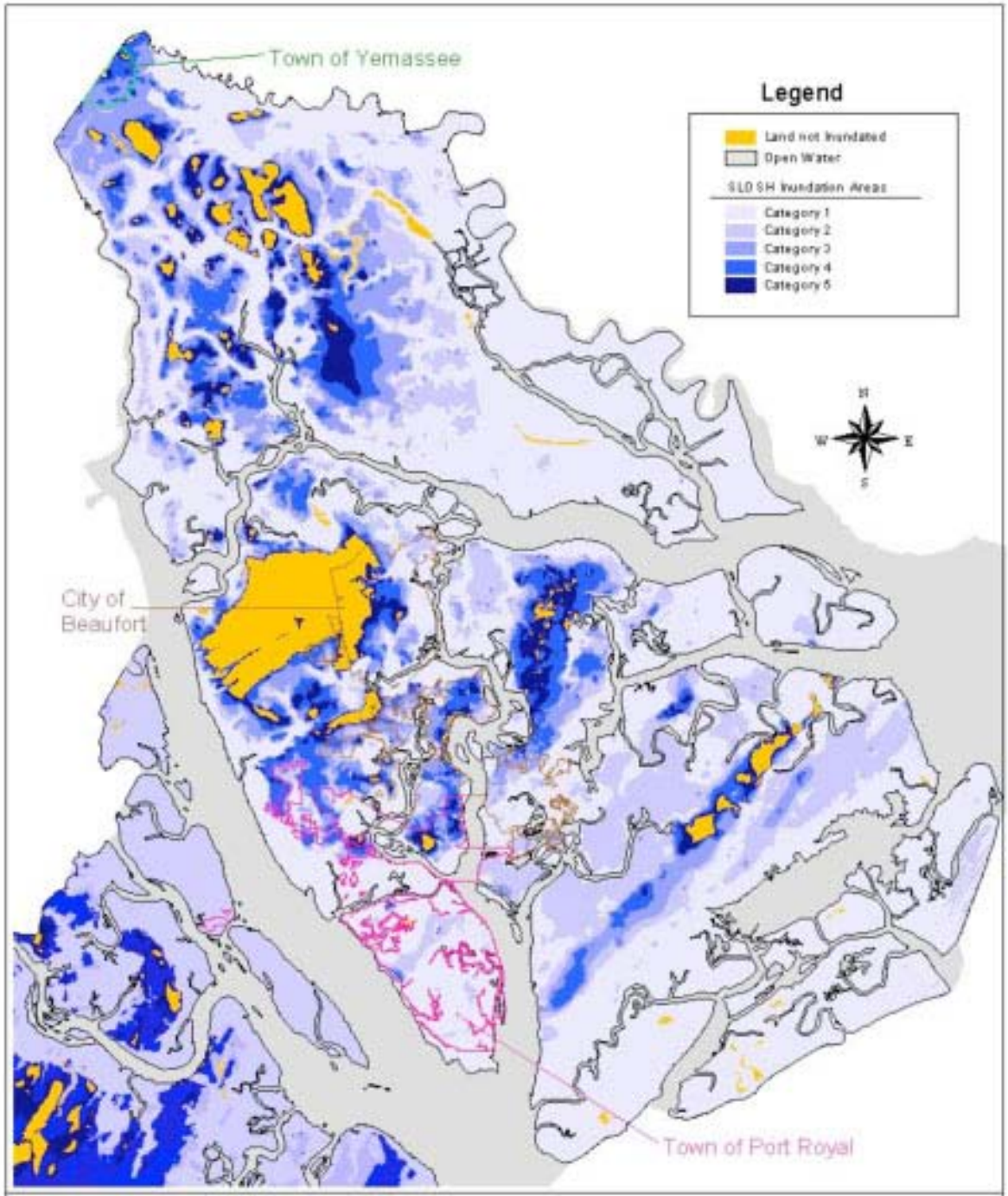


Figure 2-5. Northern Beaufort County Storm Surge Inundation

3.5 0 3.5

Scale of Miles

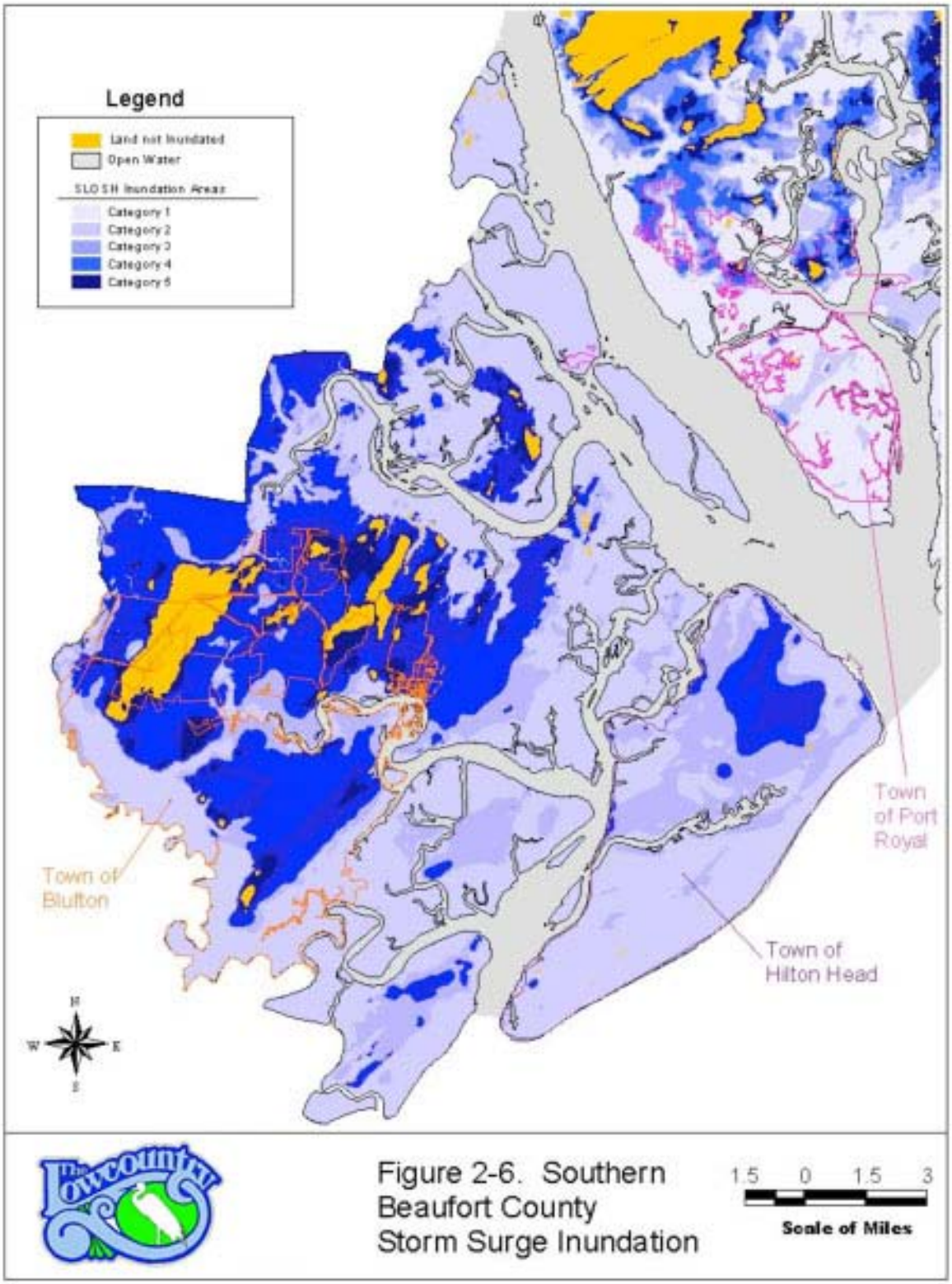


Figure 2-6. Southern Beaufort County Storm Surge Inundation

Winter Storms

Winter storms can be very disruptive, particularly in areas where they are not frequent occurrences. While winter storms have had an affect on South Carolina and Beaufort County, they occur relatively infrequently compared to areas of the northern U.S.

Winter storms can combine different types of precipitation including snowfall and ice storms, as well as high winds, and cold temperatures. According to SC Hazard Research Lab assessment, there is a 1.69 percent chance in any given winter of a cumulative snow depth total of up to approximately 10 inches of snow in Beaufort County. The area is thus expected to experience this type of winter once on average every 59 years over a long time period.

Past Occurrences of Winter Storms

Significant winter storms occur occasionally in the State of South Carolina. Beaufort County had a near miss with an event that occurred in early December 2002. A winter snow storm resulted in a Presidentially-declared disaster in 6 counties in Northwest South Carolina including Cherokee, Greenville, Laurens, Spartanburg, Union and York. As a result of this storm, tens of thousands in the Greenville area lost power.

On January 4, 2002 an ice storm occurred that hit northern Beaufort County particularly hard. Weather stations reported some freezing drizzle and light snowfall. In Yemassee, residents were without power for several days.

On January 24, 2000, 1-2 inches of snow was measured in Beaufort County and was the first measurable event since 1989. Areas along the coast experienced mixtures of small amounts of sleet and freezing rain with the snow. The northwest portion of the state was particularly hard hit and received up to 6 inches of snow. This had a significant impact on major highways in including Interstate 85 where numerous accidents were reported. Tens of thousands of people in the state lost power due to power lines downed by the ice and snow.

The March 1993 northeaster was a winter storm event that caused damage and the loss of life in South Carolina. While there was no snow accumulation reported in Beaufort County, there were reports of high winds along the coastlines of the southeastern states leading to some property damage.

A winter storm event in 1989 caused snow accumulation in Beaufort County. While the highest snow depths in the state, about 14-15 inches, were recorded near Myrtle Beach, Beaufort County received approximately 5 inches of snow.

A snow storm that occurred from February 10-11, 1973 in South Carolina resulted in Beaufort receiving 11 inches of snow depth. The storm caused about 30,000 tourists to be stranded on the State's highways; many of them had to be rescued by helicopter. The storm also brought severe winds and cold weather. Damage estimates reports indicated that at least 200 buildings collapsed. The damage estimate for property, and road damage as well as the cost of snow removal and rescue operations was approximately $30 million (1973 dollars).

Future Probabilities of Winter Storms

Based on the limited period of record for winter events, 5 major winter storm events have occurred within South Carolina in the last 20 years. However, only one of these resulted in winter precipitation and had a moderate to major impact on Beaufort County. The recording period is 59 years; therefore, the estimate for the county's winter storm probability is 1.69 percent.

Drought

Drought is caused by lack of precipitation, but can be heightened or worsened by other circumstances such as high temperatures, high winds, and low relative humidity. Droughts can result in a shortage of water for consumption and can affect hydroelectric power, recreation, and navigation. Additionally, severe droughts can lead to losses of crops, wildlife and livestock, as well as wildfires.

Future Probability of Drought

Beaufort County is located within the state's Drought Management Area No. 6 which includes all of the counties in southeastern South Carolina. According the SC Hazard Research Labs hazard profile for Beaufort County, 21 droughts have occurred in Beaufort County in the last 59 years**.** This represents an annual probability of 35.59 percent. Also, the South Carolina Department of Natural Resources' Drought Response Program has records showing how much time the drought management area has been subject to various drought conditions as defined by the Palmer Drought Severity Index for a period of record of about 75 years (895 months) beginning in 1925; this information is presented in Table 2-6, and it represents data through 2000. According to the records, the area was not subject to drought conditions for over half of the period of record. For about 29 percent of the period of record, the area was subject to mild drought conditions. The area was subject to moderate to extreme conditions for a total of 20 percent of the period of record with less than 4 percent of this time falling under extreme drought conditions.

Table 2-6. Time Spent in Drought Conditions, 1925-2000

DROUGHT CONDITION	PERCENTAGE OF TIME (895 MONTHS)
Mild	28.7
Moderate	10.5
Severe	5.9
Extreme	3.7

During 2000, 2001 and 2002, NOAA declared drought conditions in Beaufort County at total of 18 times, but with no property or crop damage. There were no drought incidents reported after 2002.

The State of South Carolina has had a drought management plan in effect since 1985 that continues to be updated, and also has a State Drought Program Coordinator. The Executive Director of LCOG serves of the statewide Drought Committee.

Wind: Thunderstorms and Tornadoes

Beaufort County's coastal location lends itself to being vulnerable to hurricanes and brings not only the threat of flooding, but also damage from wind. Figure 6-1 of The American Society of Civil Engineers (ASCE) publication, *Minimum Design Loads for Buildings and Structures*, 1998 (also referred to as ASCE 7-98) shows that for Beaufort County the design wind speed (3-second gust) for structures ranges from 130 mph along the coast to 110 mph at the County's furthest inland point. While most of the continental U.S. is mapped as having a design wind speed of 90 mph, the Atlantic and Gulf Coast areas have design wind speeds ranging from 100 mph to 150 mph (along the tip of the Florida peninsula and a portion of the Gulf Coast).

FEMA's publication, *Taking Shelter from the Storm*, 2008, presents a map of four wind zones in the U.S. and provides design wind speeds for shelters and other critical facilities. Zone IV shows the areas of highest wind activity which are situated in the Midwest and Tornado Alley, while Zone I shows the areas of lowest activity which are in the western U.S. All of South Carolina is mapped in Zone III. For shelters in this zone, a design wind speed of 200 mph is recommended.

Past Occurrences of Thunderstorms

Wind events can also be the result of thunderstorms which occur more often than hurricanes. Historical records from the SCHRL shows that there have been 167 wind events in Beaufort County since 1950 related to thunderstorms. Sixty-three of the events have wind speeds recorded in the NCDC. For 127 of these storms, wind speeds greater than 50 kts were recorded.

Future Probability of Thunderstorms

Based on the information from the South Carolina Hazard Research Laboratory, thunderstorms are predicted to occur in Beaufort County at high rate**.** For the 59 years of record, the 167 storms represent an annual probability of 285.05 percent. Obviously, this means Beaufort experiences multiple thunderstorms annually, and this hazard is one that merits serious attention.

Tornadoes

The National Weather Service defines a tornado as a violently rotating column of air pendant from a thunderstorm cloud that touches the ground. Tornadoes are generally considered the most destructive of all atmospheric-generated phenomena, with an average of 800 touching down annually in the United States. In the U.S., more tornadoes occur during the months of May and June than in other months. Additionally, over 30 percent of recorded tornado activity has occurred between the hours of 3:00 pm and 6:00 pm, and an additional estimated 25 percent have occurred between 6:00 pm and 9:00 pm.

Tornadoes are considered a major natural hazard threat for areas in the Midwest known as Tornado Alley. Tornado Alley includes portions of Texas, Oklahoma, Arkansas, Missouri and Kansas. Some portions of Texas and Oklahoma have recorded over 15 tornado touch downs in a 1,000 square mile area (FEMA 361, Figure 2-3). Tornadoes follow the path of least resistance and therefore valleys and flatter land areas are most susceptible to them.

The entire State of South Carolina has 1.5 tornadoes recorded for every 1,000 square miles; this is considered a relatively low concentration of tornado touchdowns (FEMA 320, Figure 1.1).

Tornadoes are classified using the tornado scale developed by Dr. Theodore Fujita. The Enhanced Fujita Scale went into effect in 2007, and replaces the original. The Fujita Tornado Scale assigns a category to tornadoes based on their wind speed and relates this to the general type of damage that is expected. Ratings range from EF0 (light damage), to F5 (total destruction of a building). The scale is presented in

Table 2-7. Approximately ninety percent of tornadoes nationwide recorded between 1956 and 2001 have been F2, F1, and F0 tornadoes. Most of these (nearly 88 percent) have been F1 and F0 tornadoes.

Table 2-7. Enhanced Fujita Tornado Scale

SCALE VALUE	WIND SPEED RANGE (MPH)	TYPE OF DAMAGE
EF0	65-85	*Light* – May be some damage to poorly maintained roofs. Unsecured lightweight objects, such as trash cans, are displaced.
EF1	86-109	*Moderate* – Minor damage to roofs occurs, and windows are broken. Larger heavier objects become displaced. Minor damage to trees and landscaping can be observed.
EF2	110-137	*Considerable* – Roofs are damaged. Manufactured homes, on nonpermanent foundations, can be shifted off their foundations. Trees and landscaping either snap or are blown over. Medium-sized debris becomes airborne, damaging other structures.
EF3	138-167	*Severe* – Roofs and some walls, especially unreinforced masonry, are torn from structures. Small ancillary buildings are often destroyed. Manufactured homes on nonpermanent foundations can be overturned. Some trees are uprooted.
EF4	168-199	*Devastating* - Well constructed homes, as well as manufactured homes, are destroyed. Some structures are lifted off their foundations. Automobile-sized debris is displaced and often tumbles. Trees are often uprooted and blow over.
EF5	200-234	*Incredible* – Strong frame houses and engineered buildings are lifted from their foundations or are significantly damaged or destroyed. Automobile-sized debris is moved significant distances. Trees are uprooted and splintered.

Past Occurrences of Tornadoes

Scale specific intervals are reported below. However, some of the touchdown locations are recorded for the same date and are therefore either the same tornado or the same system moving through (there are 15 separate tornado days). There were also three recorded funnel clouds from 1956-2006 years without a touchdown—an annual percentage of 18.75 percent.

Most of the recorded incidents of tornadoes in Beaufort County have been low strength tornadoes; only one tornado with a rating of F2 has been recorded. The other incidents were all F0 or F1 tornadoes. Some of the touchdown locations are recorded for the same date very close in time to one another. They are likely the same tornado or the same system moving through. Following the general trend of tornado touchdowns, most of the 19 recorded tornadoes occurred in May and June. Table 2-8 presents a list of the recorded tornado activity in Beaufort County and includes incidents of sighted funnel clouds and waterspouts. Damage estimates are given as costs from the time when they occurred, if available.

Table 2-8. History of Known Tornadoes in Beaufort County, 1950 – 2006

	Date	Time	Location	Type	Magnitude	Property Damage
1	9/25/1956	9:00AM	Beaufort (County)	Tornado	EF0	0K
2	4/12/1961	9:00AM	Beaufort (County)	Tornado	EF	25K
3	10/7/1965	1:55AM	Beaufort (County)	Tornado	EF1	250K
4	10/7/1965	2:10AM	Beaufort (County)	Tornado	EF1	25K
5	5/29/1973	12:00PM	Beaufort (County)	Tornado	EF1	25K
6	5/3/1984	3:00PM	Beaufort (County)	Tornado	EF1	25K
7	6/16/1985	1:00	Beaufort (County)	Tornado	EF0	0K
8	6/30/1994	1:50 AM	Beaufort (County)	Tornado	EF0	0
9	6/5/1995	11:05 AM	Hilton Head Island	Tornado	EF1	500K
10	6/12/1995	7:10 PM	St. Helena Island	Tornado	EF1	60K

11	9/3/1998	7:28 AM	Frogmore	Tornado	EF2	360K
12	6/12/2001	7:10 PM	Gardens Corner	Tornado	EF0	0
13	6/12/2001	7:25 PM	Bluffton	Tornado	EF0	0
14	6/12/2001	7:55 PM	Parris Is	Tornado	EF0	0
15	6/12/2001	8:15 PM	Beaufort	Tornado	EF0	0
16	6/15/2004	7:21 AM	Parris Is	Tornado	EF0	0
17	9/6/2004	1:40 PM	Hilton Head Is	Tornado	EF1	0
18	7/13/2005	1:17 PM	Parris Is	Tornado	EF0	0
19	7/13/2005	1:39 PM	19 Beaufort	Tornado	EF0	0
20	7/13/2005	4:19 PM	Bluffton	Tornado	EF0	0
21	6/13/2006	1:30 PM	Laurel Bay	Tornado	EF0	0
						1.270M TOTAL

County emergency management and local community staff recalled that there was significant damage associated with the June 5, 1995 tornado because the tornado hit a fairly densely developed area and caused damage to a grocery store and a nearby construction project/site. The June 12, 1995 tornado also hit a fairly densely developed area causing damage to several residential structures. Finally, there was one death that of a manufactured home resident in Frogmore, associated with the September 1998 tornado (no. 14).

Figure 2-7 shows the known locations of the tornado touchdowns within Beaufort County for which exact location data is available[3].

[3] Exact location data is available for only some of the tornadoes reported, as reflected in the map.

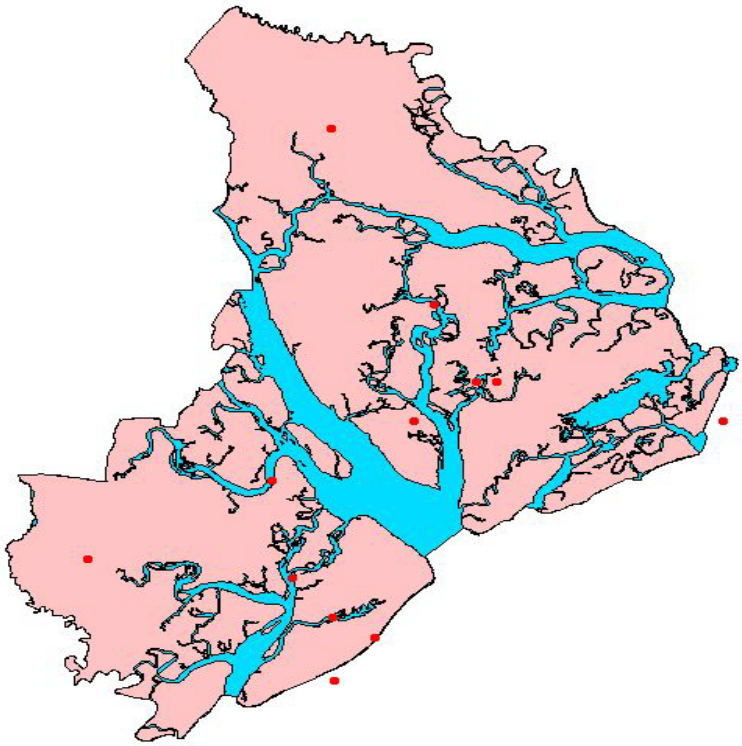


Figure 2-7. Tornado Events in Beaufort County, 1950 – 2006

Future Probabilities of Tornadoes

In order to estimate the frequency of occurrence, the number of tornado days (not actual tornado incidents since tornadoes that occurred close in time on the same day are likely the same tornado that has re-formed, or a tornado that is part of the same system) is compared to the length of the period of record which is from 1950 to June 2006. The recurrence interval is defined from this information and is a rough estimate of the amount of time, *on average*, during which one occurrence of a given category of tornado will take place. It is important to note that in reality, a tornado can occur multiple times during one recurrence interval, and that the recurrence interval is only an estimated average time period. Recurrence intervals for tornadoes within Beaufort County are presented in Table 2-9. This data is based on information reported directly from the NCDC. Data obtained from the SC Hazard Research labs indicates 21 tornadoes have touched down in the last 59 years in Beaufort County, meaning the overall probability for tornadoes is 35.59 percent.

Table 2-9. Estimated Recurrence Intervals of Tornadoes (based on data from 1950 to 2006)

TORNADO CLASS	NUMBER OF OCCURRENCES WITHIN BEAUFORT COUNTY (TORNADO DAYS)	RECURRENCE INTERVAL (years)
F0	12	4.91
F1	7	8.43
F2	1	59
F3	no record	----------
F4	no record	----------
F5	no record	----------
All Tornado Events	17[1]	3 ½

[1] For some of the records, the intensity and thus the Fujita Scale classification was unknown.

There is a moderate rate of occurrence of tornadoes in Beaufort County, and this has slightly increased since the original hazard mitigation plan, but they are generally not considered as significant of a hazard as flooding and wind associated with storms and hurricanes. Wind hazard mitigation will be addressed in the goals and actions section of this plan, as high wind speed is the most harmful effect of a tornado.

Earthquakes

Earthquakes are classified according to their magnitude. The magnitude is a measurement of the maximum motion caused by an earthquake and is recorded by a seismograph. While several scales have been defined, the most commonly used is the magnitude local (ML) which is used by the Richter Scale. Table 2-10 presents a classification of earthquakes according to their Richter Scale magnitude.

The USGS rates areas of the United States for their susceptibility to earthquakes based on a 10 percent probability of a given peak force (% g for a 1.0 SA)[4], being exceeded in a 50 year period. Beaufort County's peak acceleration is 5-6% g which is considered significant.

[4] Ground motion hazard values are expressed as a percent of the acceleration of gravity or %g. The acceleration of gravity is 980 cm/sec/sec. Spectral acceleration, SA, relates ground motion activity to the motion experienced by a structure or building.

Table 2-10. Richter Scale Magnitude Classes

MAGNITUDE CLASS	MAGNITUDE RANGE ML = MAGNITUDE
Great	ML ≥ 8
Major	7 ≤ ML < 7.9
Strong	6 ≤ ML < 6.9
Moderate	5 ≤ ML < 5.9
Light	4 ≤ ML < 4.9
Minor	3 ≤ ML < 3.9
Micro	ML<3

Past Occurrences of Earthquakes

Earthquake epicenter location data (gathered by the HRL from the University of South Carolina Seismic Network), was collected for the period from 1698 to 2001 and indicates that there has only been one earthquake with it's epicenter in Beaufort County. The Beaufort County earthquake had an epicenter located on Hilton Head Island and occurred on January 4, 1989. Its magnitude measured 2.8 on the Richter scale. Earthquakes with magnitudes less than 3.0 are considered micro earthquakes, and those with magnitudes less than 2.5 are generally not felt by humans. Earthquakes that measure magnitudes of at least 5.0 on the Richter scale are considered moderate, and those above 5.9 are classified as strong, major or great.

Earthquakes near Beaufort County: potentially a major impact.

Information from Charleston Southern University's Earthquake Education Center indicated that 12 measurable seismic events occurred in 2002. Of these 12 events, 3 had magnitudes higher than 3, and no events had epicenters in Beaufort County.

Although only one epicenter is located within the County for the period of record, there are areas of more intense earthquake activity located near Beaufort County. One major area of more intense seismic activity is located along the borders of Charleston, Dorchester, and Berkeley Counties northwest and west of the City of Charleston about 30-35 miles from Beaufort County. In this area, approximately 700 earthquakes occurred over the period of record (1698- 2001). The average magnitude of the earthquakes was a low 2.4 on the Richter scale. However, the highest magnitude recorded was 6.90 in 1886. Of the 700 earthquakes, four earthquakes measured magnitudes above 5.0, and 12 measured magnitudes greater than or equal to 4.0. The Charleston Southern University data indicates that an earthquake with a magnitude of 3.02 occurred in this vicinity in 2002 (along with several micro earthquakes).

A second area with a sizeable number of past incidents is located off the coast of southern Charleston County. It is situated to the southwest of the City of Charleston and is approximately 20-25 miles from Beaufort County. An estimated 44 earthquakes have occurred here during the period of record. However, at least one additional earthquake event

occurred in this general area since 2001. An earthquake with an epicenter located approximately 30 miles southeast of Charleston and a magnitude of 3.8 occurred in November 2002. Prior to this incident, the highest recorded magnitude during the period of record was 2.75 and the average for all of the 44 earthquakes was a low 1.5. In addition, the Charleston Southern University data indicates that an earthquake with a magnitude of 3.83 and one with a magnitude of 4.32 occurred in this vicinity in 2002 (along with several micro earthquakes).

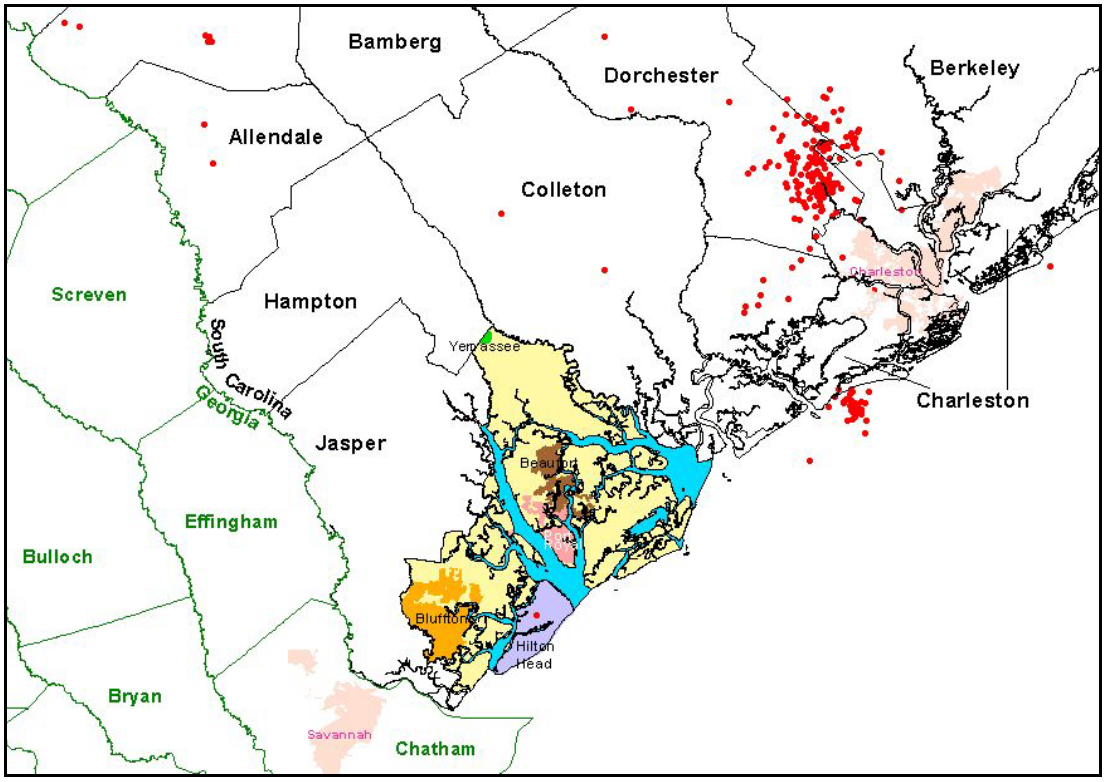


Figure 2-8. shows these areas of concentrated, historical epicenter locations for the period of record from 1698 to 2008.

1886 Earthquake

The Charleston Earthquake of 1886 was the largest earthquake of record for the southeastern United States, and one of the largest earthquakes in eastern North America. Its major shock, which lasted less than one minute, had a magnitude of 6.9, and occurred on August 31, 1886. It resulted in serious damage to the City of Charleston, and a death toll of approximately 60 people. The areas of most significant damage were Charleston and areas directly northwest of the city including Summerville and Jedburg.

More than 300 reported earthquakes that occurred in South Carolina after the 1886 earthquake occurred in the 35 years following the 1886 event and were actually aftershocks of the 1886 earthquake.

In addition to the recorded events for the period of record, research has shown that there have likely been several events, of strong to major magnitude along the South Carolina Coastal

Plain (Talwani and Schaeffer) over the last 6,000 years. Some of these events, along with the 1886 earthquake have caused seismically induced liquefaction which has been observed at several sites in Coastal South Carolina, including the Bluffton area. According to Talwani and Schaeffer, one possible scenario puts one of the seismic events epicenters' near Bluffton with a magnitude of about 6.0. However, the study suggests that earthquakes with epicenters near Charleston are much more likely and that major earthquakes at Charleston have a recurrence interval of about 500-600 years. Because of the proximity to fault lines near Charleston and Bluffton, Beaufort County has a strong commitment to seismic safety.

Future Probabilities of Earthquakes

Looking at the occurrences of earthquakes over the period of record from 1698-2001, the following recurrence intervals for earthquake events were determined (Table 2-11). These figures are based only on seismic activity with magnitudes of 3 or more and therefore include 145 events with epicenters in the previously described locations north and west of Charleston and 2 events in the area south of Charleston. While the SCHRL reports only a .32 percent annual probability of occurrence, the effects of an earthquake on Beaufort County could be devastating—especially considering its proximity to major fault lines. Therefore, earthquakes are a considered a major hazard to be taken seriously.

Table 2-11. Estimated Recurrence Intervals of Earthquakes in Beaufort County

(based on occurrence data from 1698-2002)

MAGNITUDE CLASS	NUMBER OF OCCURRENCES	RECURRENCE INTERVAL (YEARS)
Great	0	------
Major	0	------
Strong	0	-----
Moderate	0	------
Light	0	------
Minor	1	300

Fire

According to the U.S. Forest Service's Wildland Fire Assessment System (http://www.wfas.net/), Beaufort County is located in a low risk fire danger area. Generally, there are three major factors to consider in assessing the threat of wildfires to a community: topography, vegetation and weather.

An area's terrain and land slopes affect its susceptibility to wildfire spread. Wildfire travels much faster upslope than it does down slope. Wildfire can spread rapidly on steep slopes; where the ground slope doubles, the rate of wildfire spread upslope will be likely to double. Beaufort County is situated on the coastal plain and is very flat; the County's highest ground elevation is approximately 50 ft NGVD 29.

Vegetation and land use is another characteristic that affects the spread of wildfire. In particular, forests/dense wooded areas and grasslands provide readily accessible fuel for wildfires. Besides just the existence of this type of vegetation, its moisture content is also a

significant factor. This is dependent on weather; droughts or dry weather cause vegetation to become dryer and thus serve as better fuel. While there are sizeable marsh areas in Beaufort County, there are also numerous undeveloped forested areas and grasslands that during dry conditions, can be susceptible to wildfires.

Weather is the third factor for consideration. High temperatures combined with low humidity offer the most conducive environment for wildfires. Beaufort County's climate is considered Subtropical Humid. While the County may experience high temperatures during the summer months, this is usually combined with high levels of humidity which are not conducive to the ignition and spread of wildfires. However, during periods of drought, the threat of wildfire increases. According to the Beaufort County Forest Ranger, drought conditions have persisted for the last three summers (2000-2002) and have left Beaufort County more susceptible to wildfires.

Past Occurrences of Fire

The National Climatic Data Center has no records of wild or forest fires for Beaufort County during the period 1950 to June 2008. Records for wildfire events were obtained from the South Carolina Forestry Commission (SCFC). The SCFC responds to fires occurring in forested areas or brush areas and terms these types of fires landfires. The number of annual landfire events for Beaufort County for the period of record from 1988 to 2000 was provided by the SCFC. Also included in the data is information on the total number of acres affected annually by the fires. Table 2-12 presents this information.

Table 2-12. Occurrences of Landfires in Beaufort County, 1988-2008

Year	Number of Landfires	Acreage Affected
1988	121	763
1989	59	291
1990	69	211
1991	114	890
1992	64	192
1993	76	450
1994	89	313
1995	67	439
1996	113	710
1997	99	580
1998	51	197
1999	101	1,102
2000	90	450
2001	92	514
2002	12	33
2003	73	333
2004	36	255
2005	45	178
2006	41	178
2007	29	118
2008	43	120

According to the Beaufort County Forest Ranger, typical wildfires occur in forested areas of the County and in areas known as broomstraw fields where there is ample fuel for fires in the form of tall grass. Typically, these fires do not cause damage to structures, but affect only uninhabited areas. The SCFC has records of the damage caused by each individual fire event, but it has not been compiled electronically or on an annual basis.

According to Beaufort County Emergency Management officials, these fires are generally started by people through careless actions such as improper disposal of lit cigarettes or charcoal type fuel for outdoor cooking, and starting outdoor camp fires that are not properly controlled.

Given the relatively small land areas affected by the fires and the terrain of Beaufort County, wildfires are considered a minor to moderate threat for the unincorporated and incorporated areas of Beaufort County. Furthermore, the potential for loss from wildfires (less that one percent of Beaufort's total potential loss) means this is considered a relatively low risk hazard, yet will be addressed by a mitigation action.

Future Probabilities of Fire

Based on fire event data from the past 21 years, The SC Hazards Lab reports an average of 72 wildfires occur annually in Beaufort County. The SC Forestry Commision reports an average of 396 acres of land burned per year. The annual probability for fire in Beaufort County is well over 100 percent per year. However, looking at past occurrences as an indicator, it is likely that less than one square mile of land on average will be affected annually by wildfires.

Hazards not Historically Prevalent

Dam Failure

According to GIS data and previous HAZUS data collection, there are 15 dams within Beaufort County. Most of these dams are less than 10 feet in height and all are under 25 feet in height. Dams less than 25 feet in height are generally exempt from the Dams and Reservoirs Safety Act because, in most cases, their failure would not pose a serious threat to life, safety, or property. The Relative Hazard Rating for all of the dams in Beaufort County is low (previous HAZUS assessment).

Data for neighboring counties of Colleton, Jasper and Hampton shows that there are 39 dams within those counties, 38 of which also have a low relative hazard rating. There is one dam within Hampton County classified as having a significant hazard rating. This dam has an emergency action plan, and is located along Black Creek, a tributary of the Coosawhatchie River which flows to the tidally-influenced Broad River. Although the dam is located in the drainage basin of the Broad River, it is located approximately 35 stream miles above Beaufort County. The dam reservoir has a drainage area of approximately 60 square miles, but given the dam's distance from Beaufort County and the fact that the Coosawhatchie and Broad Rivers' drainage areas are relatively high, a dam failure at the Hampton County dam is not likely to have a significant impact on Beaufort County. The SC Hazard Research Lab has no record of dam failure for Beaufort County. Therefore, dam failure is not considered a significant hazard within Beaufort County.

Landslides

Landslides are often prompted by the occurrence of other disasters. Floods or long duration precipitation events create saturated, unstable soils that are more susceptible to failure. The forces of earthquakes can also cause landslides. In the eastern U.S., landslides are common in the Appalachian region and New England; in this portion of the country, clay-rich soils are a concern and are considered more susceptible to landslides.

The USGS has a National Landslide Hazards Program and has mapped the landslide risk for the entire conterminous U.S. All of eastern South Carolina is mapped in the lowest risk zone where there is a low landslide incidence that involves less than 1.5 percent of the land area. Given the relatively flat relief of Beaufort County, and its low landslide incidence as mapped by the USGS, landslides are not considered a significant threat within the County. According the SCHRL, there are no recorded occurrences of landslides in the County.

Tsunamis

Tsunamis are sea waves created by underwater earthquakes. When a tsunami is generated and makes its way to the shoreline, it can cause extensive damage to nearby structures and infrastructure, as well as significant inland flooding. Tsunamis generally occur in the Pacific Ocean but there have been some recorded events of tsunamis in the Caribbean area of the Atlantic Ocean.

Tsunamis are not generally considered a threat along the eastern seaboard of the continental U.S. The National Oceanic and Atmospheric Administration (NOAA) prepared a Tsunami Mitigation Plan for the Senate Appropriations Committee in the Fall of 1995 that included an area of mapped tsunami risk. This area did not include the eastern U.S. and only showed the tsunami risk area to include coastline along Alaska, California, Hawaii, Oregon and Washington.

Recent findings have indicated that tsunamis can occur along coastal Virginia and North Carolina. In coming years, tsunami scenarios for these portions of the Atlantic Coast will be further studied. However, the South Carolina coast is not currently included as part of this potential risk area and at present, the South Carolina Geological Survey does not consider tsunamis to be a significant hazard to the State. There are no recorded occurrences of tsunamis in Beaufort County, but this plan considers the hazard a serious one, and plans to mitigate against it because of the devastating nature of only one occurrence.

Volcanic Hazards

Volcanic eruptions threaten human life as well as buildings and infrastructure. Among the hazards of volcanic eruptions are lava flows and domes, ashfalls and gasses, and lateral blasts. There are more than 65 active or potentially active volcanoes in the United States; 55 of these volcanoes have been active since the U.S. was founded. While volcanic eruptions can pose a serious threat to life and property, most of the United State's volcanoes are located in Alaska. On the mainland of the U.S., only western states have been identified as being vulnerable to volcanic hazards; this vulnerability is based on the possibility of the areas being subject to lava flows and ashfall (FEMA's Multi-Hazard Identification and Risk Assessment Report, 1997). Therefore, volcanic hazards are not considered a threat to Beaufort County.

Table 2-13, Overall Probability Table

Hazard	Probability (percent chance)
Hurricane/Tropical Storm	12.66
Earthquake	0.32
Avalanche	n/a
Tsunami	n/a
Landslide	n/a
Dam Failure	n/a
Drought	35.59
Flood	42.37

Thunderstorm and Wind	283.05
Tornado	35.59
Fire	7180.95
Winter Weather	35.59

Table 2-13 represents the overall probability for each of the hazards discussed annually. If the is given as "n/a," that simply means that the hazard has not occurred in the recorded history, according to the data from the SCHRL.

3. Vulnerability Assessment

The results of the Hazard Identification indicate that some of the hazards warrant a Vulnerability Assessment. A Vulnerability Assessment is performed to determine the impact that hazards have on the built environment and how they can affect people's safety. For those natural hazards with a relatively short frequency of occurrence or those which have caused major damage in the County, a vulnerability assessment was deemed appropriate. Therefore, the effects of flooding, wind events and earthquakes on Beaufort County will be analyzed. Some hazard events that were identified, such as thunderstorms and tornadoes, are considered to be events that create much larger hazards, such as flooding and wind hazards. This analysis recognizes such, and addresses vulnerability considering that. Overall, unless this analysis indicates so, all hazards appear to affect each of Beaufort County's multiple jurisdictions equally. Both during and after the Vulnerability Assessment, LCOG staff consulted with Committee members individually and organizationally to ensure that both the data and the analysis truly reflected current conditions in the jurisdictions. Changes were made as needed.

Vulnerability Summary

The hazards to which Beaufort County has a notable vulnerability to are discussed in this section, and available data has been used. The tables below reflect an over all summary of description of the each jurisdictions vulnerability to each hazard.

The valuation chart, 3.1 below, shows the total number of buildings, based on the Beaufort County Tax assessor's estimates, for residential, commercial, industrial facilities. It also estimates the value of the critical facilities based on value data. The severity/loss numbers represent the impact of hazards, and that information is reflected in the tables below.

Table 3.1, Assessor Valuation Data

Jurisdiction	Residential	Commercial
Beaufort (City)	$1,203,122,492	$473,292,571
Port Royal	$356,003,588	$174,297,716
Hilton Head	$19,055,715,633	$1,691,949,007
Bluffton	$7,504,802,467	$1,071,752,821
County	$5,466,749,210	$460,983,277
TOTAL	*$33,586,393,390*	*$3,872,275,392*

Losses per hazard are in Table 3.2, on the following page.

Table 3.2, Loss information per hazard in Beaufort County based on historical data (NCDC)

Hazard	Property Damage
Drought	$14,201,478
Flooding	$10,849,940
Hurricane/Tropical	$13,114,269
Thunderstorm	$1,467,873
Tornado	$2,168,661
Wildfire	$334,042
Wind	$3,111,284
Winter Weather	$14,226,954

To assess the vulnerability of the Beaufort County and all of its jurisdictions to each identified hazard, the frequency and severity were used. Each hazard was assessed based on compiled data. The "vulnerability and rankings" chart reflects how the vulnerability of the entire planning area to each of the hazards. Below, the terms and methodology is defined:

Frequency is valued at very high, high, medium, low and very low. These values are based on annual probability supplied from the NCDC, based on historical data. The values are as follows:

- Very High-over 100% (event will happen more than once annual)
- High-60-100%
- Medium-30-59%
- Low-11-29 %
- Very Low 0-10%

Severity is based on the estimated loss of structures if the event occurred based on previous data and magnitude. For instance, based on the historical data for a hurricane, there would be significant damage (very high based on the hazard profile) if Category 3 or 4 struck (which is historically possible). Severity is defined as follows:

- Very High-over 75% loss
- High-50-75% loss
- Medium-26-49% loss
- Low-11-25% loss
- Very Low-0-10% loss

Historical data from the SCHRL was used to estimate the magnitude of the event. Where an actual weather-based valuation (i.e., the Enhanced Fujita scale) was available, that number is shown.

Methodology: To calculate the vulnerability, frequency was multiplied by the severity. Each severity and frequency value was given an assigned numerical value. Frequency was valued at one-through-given. Because loss concerns the county much more, the loss structure was valued at 10,20,30,40,50, respectively. Therefore, a vulnerability of 250 would be the highest, and a vulnerability of ten would be the lowest.

Loss information, Table 3.2 was based on data on information from the SCHRL, but was also examined using several sources. Data from the NCDC about severity and loss information was utilized to see how severe losses in past occurrences of hazards have been. Using this data, an estimate of total loss percentage was determined. GIS information from the County and Hilton Head were used to determine structure counts and locations. Data from the SLOSH models, a map which is shown in this plan, was also reviewed. The Planning Mitigation Teams expertise was also drawn upon to understand the amount of loss that would be suffered in the event of a hazard. A compilation of all of the data above led to severity/loss scores. Valuation data was also compiled from the Beaufort County Assessor's office, seen previously in Table 3.1.

Table 3.3 Overall Vulnerability Summary

Hazard	Frequency (annual probability)	Severity (loss)	Vulnerability	Relative Numerical Value
Hurricanes	low (12.6)	Very high (Cat. 4 or higher)	100	2 (tied)
Thunderstorms	Very high(283)	medium	150	1
Flood	Medium(42.37)	Medium	90	3 (tied)
Winter Event	Very low(1.69)	Very low	10	12
Dam Failure	Very low(n/a)	Very low	10	12
Drought	Medium(35.59)	Very Low	30	11
Tornadoes	Medium(35.59)	Medium	90	3
Earthquakes	Very Low(.32)	High	40	10
Fire	Very High(over 100)	Very Low	10	12
Landslides	Very Low(n/a)	Very Low	10	12
Tsunamis	Very Low(n/a)	High	40	10

Table 3.4 demonstrates the varied and unique risks, based on data from the Hazard Planning Team and historical data, that each jurisdiction faces from each hazard. Mostly, it distributed evenly, but as the chart reflects, there are some differences.

Table 3.4 Multi-jurisdictional Risk Assessment, varied and unique risks

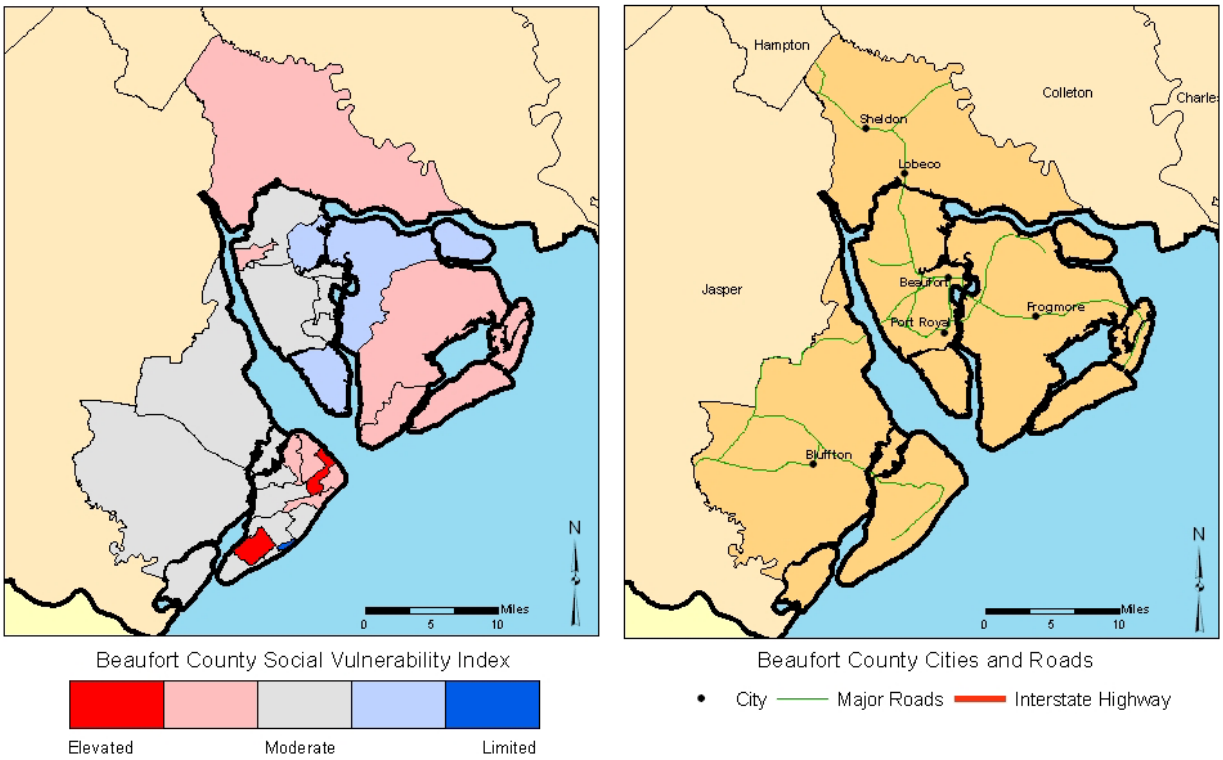
	Beaufort County	City of Beaufort	Town of Hilton Head	Town of Port Royal	Town of Bluffton
Hazard					
Hurricanes	x	x	x	x	x
Thunderstorms	X	X	X	X	X
Flood	X	X	X	X	X
Erosion	X	X	X	X	
Winter Event	X	X	X	X	X
Dam Failure	x				
Drought	x				
Tornadoes	X	X	X	X	X
Earthquakes	X	X	X	X	X
Fire	X				
Landslides					
Tsunamis	X	X	X	X	X

Social Vulnerability

Social vulnerability examines the socioeconomic and demographic character of places and helps to explain the variation in the population's ability to prepare for and respond to hazards. The Social Vulnerability Index (SoVI) is a statistical measure that compares social vulnerability to environmental hazards among places, and then visually displays these comparisons on a map. SoVI thus illustrates where there is uneven capacity for preparedness and response and where additional planning and response resources might be used most effectively to help residents. The variables used in determining the Social Vulnerability (SoVI) score along with how SoVI is calculated are available on the Hazards and Vulnerability Research Institute SoVI website (http://www.sovius.org).

According to SCEMD, Beaufort County has a wide range of social vulnerability, with most tracts exhibiting moderate levels. However, Hilton Head Island shows the two extremes—with two tracts in the elevated category, many in the moderate category, and one tract in the limited category. Figure 1 provides maps of the Beaufort County depicting (on the left) social vulnerability by census tract and (on the right) cities and major roads.

Figure 3.1 Social Vulnerability



Inventory Information

In order to assess the vulnerability of the community, particularly to natural hazards, an inventory of the county's structures and critical facilities was performed.

ArcGIS shape files with existing structure locations were provided by Beaufort County for all unincorporated areas and for the City of Beaufort, Bluffton, Port Royal in Beaufort County. This information includes structures digitized from aerial photography as well as updates based on recent Certificates of Occupancy as they are issued. The Town of Hilton Head also provided shape file inventory information, and aerial photography was also used to identify some of the structures in the Hilton Head area located outside of the town boundary. Figure 3- provides a graphic representation of structure locations within the County (shown in gray).

Critical facilities are those facilities that warrant special attention in preparing for a disaster and/or facilities that are of vital importance to maintaining citizen life and health safety, and community order during and/or directly after a disaster event. Beaufort County, along with Hilton Head Island, has prepared an inventory of critical facilities that includes emergency response facilities such as police stations, fire departments, emergency medical services

stations (EMS) and medical centers/hospitals; public facilities including schools and local government buildings; and important transportation facilities including airports. Hazard Mitigation Planning Committee Members reviewed and updated the county's list during the planning process. A count of the types of facilities in each community is provided in the tables below.

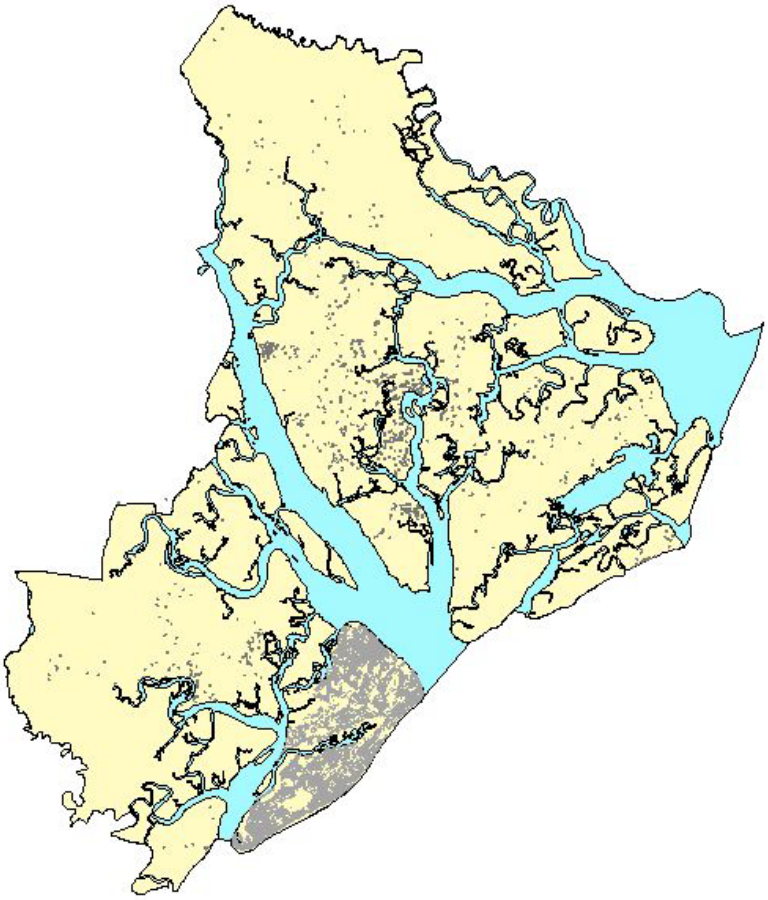


Figure 3-2. Structures in Beaufort County

Table 3-5. Critical Facilities

LOCATION	NUMBER OF FACILITIES							
FACILITY TYPE	Emergency Facilities	Military Facilities	Schools	Public Buildings	Utilities	Airports	Commercial Facilities	TOTAL
INCORPORATED COMMUNITIES								

Beaufort	9	1	8	10	4	1	---	30
Bluffton	3	---	3	---	3-	---	---	6
Hilton Head	15	---	5	3	8	1	10	42
Port Royal	5	1	2	2	1	---	---	10
UNINCORPORATED AREAS								
Burton	3	---	4	1	---	---	1	9
Daufuskie	2	---	---	---	---	---	---	2
Chechessee	1	---	---	1	1	---	---	3
Frogmore	1	---	---	---	---	---	---	1
Lady's Island	---	---	3	1	---	---	---	4
Lobeco	1	---	1	---	---	---	1	3
Pritchardville	2	---	---	---	---	---	---	2
Seabrook	---	---	---	1	---	---	---	1
Sheldon	2	---	1	1	---	---	---	4
St. Helena	4	---	2	1	1	---	---	7
Total in Unincorporated Areas								36

Flooding

This section discusses the vulnerability of Beaufort County to damage by the flooding described in the Hazard Identification. Flooding of vacant land or land that does not have a direct effect on people or the economy is generally not considered a problem. Flood problems arise when floodwaters cover developed areas, locations of economic importance and infrastructure. Damage to buildings, particularly residential buildings, is usually the largest single flood problem a community faces.

Floodplain

The majority of land in Beaufort County lies within the 100-year floodplain as shown on the communities' FIRMs. Therefore, a significant portion of existing development in the County is located in 100-year flood zones and is vulnerable to flooding and flood damages.

Flood Depths

Base flood elevations within the County range from 22 ft NGVD within VE zones on Hilton Head Island to 8 ft NGVD in inland areas of the northern county. Flood depths within the county also vary.

City of Beaufort

In the City of Beaufort, properties along the Beaufort River in the downtown portion of the city are subject to flood depths of about 3-6 feet during the base flood according to FEMA FIRM base flood and reference mark elevations. The base flood elevation along the river here is 13 ft NGVD while ground elevations range from approximately 7 feet (at the end of Hancock Street by Beaufort River) to approximately 11 feet on the northwest side of the intersection of Carteret and Port Republic Streets.

Town of Bluffton

Within incorporated Bluffton, the majority of development lies outside of the 100-year floodplain. There are some developed areas along May River that lie within the Town of Bluffton where the base flood elevation is 13 ft NGVD. Ground elevations along the May River in developed areas within the Town are about 8-12 ft NGVD. Therefore, a very limited amount of structures within the town are subject to base flood depths 1-5 feet.

Town of Hilton Head

Within the Town of Hilton Head Island, most areas are subject to flood elevations of about 14ft NGVD, although the flood elevations along the shoreline range from 22 ft to 15ft NGVD. According to reference marks on the Hilton Head Island FIRMs, much of the inland areas are subject to flooding of about 1-3 feet in depth. Most of the built environment near the coastline in Hilton Head Island lies in areas subject to base flood elevations of 14-15 ft NGVD; ground elevations in these areas generally range from 8 to 12 feet resulting in base flood depths of 3 to 7 feet. However, in some areas where properties are located further towards the shoreline and within VE zones, base flood depths are higher. In the Forest Beach Drive Area, several structures located seaward of the road are within VE zones with water surface elevations of 18-20ft NGVD while ground elevations are approximately 12 ft NGVD resulting in flood depths of 6-8 feet.

Town of Port Royal

Within the Town of Port Royal, most of the mapped base floodplain that affects the developed area is located along the Beaufort River in the southern portion of the Town. This includes properties along Sixth through Tenth Streets, eastern portions of Eleventh and Twelfth Streets, and southern portions of Richmond, London, Paris, and Madrid Avenues. The base flood elevation here is 13 ft NGVD. Ground elevations are mostly 4-8 feet south of Seventh Street, and 9-13 feet between seventh and tenth. Therefore, south of Seventh Street, flood depths are about 5-9 feet for the 1 percent annual chance flood, while between Seventh and Tenth, depths are less than 1 foot up to 4 feet.

Unincorporated County – Bluffton Township

In the Moss Creek Plantation area, portions of the community lie in the base floodplain. Flood depths for the base flood range from about 1 to 9 feet; the BFE here is 14ft NGVD and ground elevations range from 5 ft NGVD upward.

Unincorporated County – Dafuskie

In northwestern Dafuskie where the BFE is 14-15 ft NGVD, ground elevations are 4-9 ft NGVD resulting in base flood depths of about 5-11 feet. In central Dafuskie along the Calibogue sound, BFE's range from 14-16ft NGVD while ground elevations are at 4 ft near the shoreline. Slightly further inland where the BFE is 14ft NGVD, ground elevations are from about 6 to 9 ft NGVD putting flood depths in this area from 5 to 11 feet.

Unincorporated County – Fripp Island

Fripp Island's development consists mostly of the Fripp Island resort which spans 3-1/2 miles of coastline along the Atlantic Ocean. The base flood elevation within the majority of

this development is 13ft NGVD, while ground elevations range from 4 ft NGVD to 10 ft NGVD. Therefore, flood depths are an estimated 3 to 9 feet. Closer to the coast, the BFE ranges from 15 to 20 ft NGVD, but landward of the frontal dune where there is development, the elevation is 15 to 16 ft NGVD and ground elevations are 4 to 11 ft NGVD. Therefore, right along the coastline, but landward of the dunes the flood depth ranges from 4 to 12 feet. Therefore, flood depths vary dramatically from as much as about 11 feet in low-lying areas near the coastline to 3 feet in areas on some of the higher ground of the development located inland where the base flood elevation is 13 ft NGVD. The Fripp Island development is relatively new with development occurring after the county joined the NFIP. Therefore, the structures are post-FIRM and should all be elevated above the level of the base flood.

Unincorporated County – St. Helena

In the Fort Fremont area of St. Helena located at the mouth of the Beaufort River, there is development located along the river within the base floodplain; the base flood elevation here is 13-14 ft NGVD. Ground elevations of properties located adjacent to the river are generally 5-8 ft NGVD where the BFE is 14 ft NGVD. East of Bay Point Road/Fort Fremont Road, ground elevations in developed areas are about 5-9 ft NGVD while the BFE is 13 ft NGVD. Therefore, flood depths are approximately 4-9 feet in the Fort Freemont area for the 100-year flood.

Along Sea Island Parkway in eastern St. Helena, a significant portion of the developed area is within the 100-year floodplain. The base flood elevation ranges from 14-15 ft NGVD in and ground elevations are generally 6-10 ft NGVD in much of the developed areas. This puts flood depths as high as 9 feet in some areas with a range of 4-9 feet.

Unincorporated County – Sheldon-Dale

Along the Coosaw River in the Sheldon-Dale area, the base flood elevation is 13 ft NGVD according to the county's FIRMs. Flood depths in this area are then an estimated 1-5 feet as ground elevations in the developed area generally range from 8 ft NGVD upwards.

Flood prone Structure Counts

Table 3- provides the results of the analysis indicating the number of structures in Beaufort County and its incorporated areas that are vulnerable to flooding according to the data supplied by the jurisdictions and the building shape files, and is deemed to be relatively up-to-date.

The data supplied in Table 3-6, shows that a significant portion of the structures in Beaufort County lie within the 100-year floodplain. In Hilton Head, the incorporated area with the most structures (over 18,000), an estimated 76 percent of structures are located in the 100 year floodplain. Thus, the vast majority of the town's structures lie within areas vulnerable to flooding where there is at least a 1 percent chance of being flooded in any given year. In the City of Beaufort, where there are over 4,000 structures, approximately 29 percent lie within the 100-year floodplain. In Port Royal, 38 percent of structures lie within the 100-year floodplain. The Town of Bluffton has a relatively low percentage of structures within the 100-year floodplain; only 12 structures, or about 2 percent of the town's total structures, lie within the 100-year floodplain.

Table 3-6. Number of Structures in Flood Zones

COMMUNITY	V ZONE(S)	A ZONE(S)	Subtotal		B ZONE	C ZONE	*TOTAL*
	100-YEAR FLOOD ZONE						
BEAUFORT COUNTY (UNINCORPORATED)	132	7,924	8,056		511	10,920	19,487
BEAUFORT (CITY)	------	1,254	1,254		988	2,059	4,301
BLUFFTON	------	12	12		0	508	520
HILTON HEAD	163	15,788	15,951		481	4,135	20,567
PORT ROYAL	18	691	709		213	939	1,861

Forty percent of structures in the unincorporated portion of the County are located in the 100-year floodplain. Beaufort County is divided into 7 planning districts that include the entire County. One of these is the Hilton Head Island district most of which is the Town of Hilton Head. The remaining five planning districts encompass larger portions of the unincorporated County. Building counts for structures vulnerable to flooding are presented for each of the 7 planning districts as shown in Figure 3.3. Building count results are presented in Table 3.7.

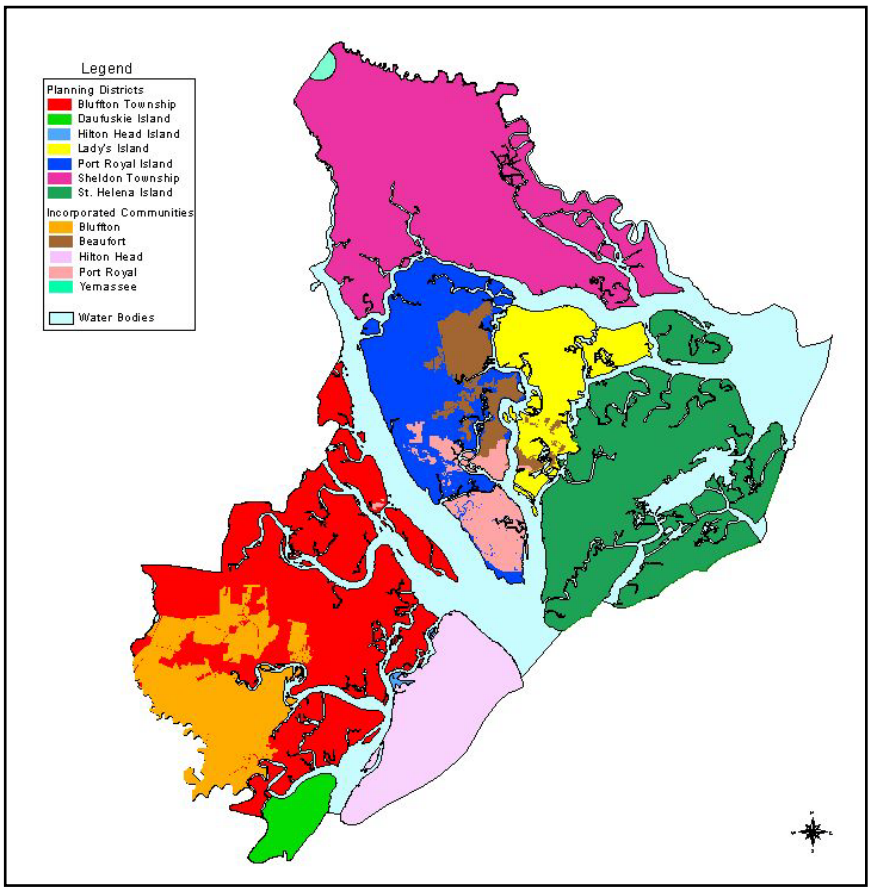


Figure 3-3. Planning Districts and Incorporated Areas

Table 3-7. Structures in Flood Zones in Unincorporated Beaufort County by Planning District

COMMUNITY	V ZONE(S)	A ZONE(S)		*SUBTOTAL*	B ZONE	C ZONE	*TOTAL*
	100-YEAR FLOOD ZONE						
BLUFFTON TOWNSHIP	------	1,248	------	1,248	53	1,685	2,986
DAUFUSKIE ISLAND	4	109	------	113	26	57	196
HILTON HEAD ISLAND	------	373	------	373	------	26	399
LADY'S ISLAND	------	972	------	972	26	1,289	2,287
PORT ROYAL ISLAND	18	1,593	------	1,611	43	5,963	7,617
SHELDON	------	436	------	436	252	1,217	1,905
ST. HELENA	110	3,193	------	3,303	111	683	4,097

Therefore, most of the structures in the unincorporated County are located in the northern portion of the County outside and to the east of the Beaufort/Port Royal area. The planning district with the highest overall number of flood prone structures is St. Helena Island which includes the Frogmore area and Fripp's Island. There are over 3,000 structures in this area located in the 100-year floodplain. While relatively few in overall numbers, it is noteworthy that all structures in the Hilton Head Island District that are not in the Town of Hilton Head, are in the 100-year floodplain. The Port Royal Island area has about 1,600 flood prone

structures, and the unincorporated Bluffton area has over 1,300 structures located in the 100-year floodplain.

Flood insurance policy information was provided by SC Department of Natural Resources and the jurisdictions and is presented in the Table 3-6. Note that flood insurance is available to anyone in the County (except those in CoBRA zones that don't meet the restrictions), even those structures outside of the mapped floodplain area. Therefore, in some cases, the number of policies includes policies for structures that are not in the mapped floodplain.

Table 3-8. Flood Insurance Policies as of May 2009

COMMUNITY	NO. STRUCTURES IN THE 100-YEAR FLOODPLAIN	NO. OF FLOOD INSURANCE POLICIES
UNINCORPORATED COUNTY	7,667	22,188
BEAUFORT (CITY)	1,254	1482
BLUFFTON	42	227
HILTON HEAD	9,149	29,515
PORT ROYAL	709	391

In addition to performing a count of structures in the 100-year floodplain zones, a count of structures in storm surge zones was completed. This was done for each of the Category 1 through 5 surge zones and is divided by planning area. Results of the analysis are presented in Table 3-.

Table 3-9. Structures in Storm Surge Zones in Beaufort County by Planning District

PLANNING DISTRICT	CATEGORY 1		CATEGORY 2		CATEGORY 3		CATEGORY 4		CATEGORY 5		TOTAL
	COUNT	PERCENT	COUNT	PERCENT	COUNT	PERCENT	COUNT	PERCENT	COUNT	PERCENT	
BLUFFTON TOWNSHIP	673	19	1,368	39	2,127	60	2,842	80	3,145	89	3,536
DAUFUSKIE	89	45	185	94	190	97	196	100			196
HILTON HEAD ISLAND	11,799	57	17,615	86	19,392	94	20,556	99.93	20,557	99.9	20,557
LADY'S ISLAND	317	14	871	38	1,464	63	1,929	83	2,253	97	2,319
PORT ROYAL ISLAND	1,400	10	3,302	24	6,232	45	9,679	70	1,1097	81	13,747
SHELDON	263	13	660	34	1,242	63	1,704	87	1,861	95	1,961
ST. HELENA	1,752	43	3,381	83	3,664	89	3,872	95	3,998	98	4,097

Results from the Storm Surge Building Count show that for a Category 2 storm, building counts for storm surge inundation generally seem to correspond to building counts for inundation from the 100-year flood. Table 3-8 provides a numerical comparison of the building inundation counts.

Table 3-10. Structure Inundation Counts for the 100-year floodplain versus the Category 2 storm surge zone

PLANNING DISTRICT AND INCORPORATED COMMUNITIES	NUMBER OF STRUCTURES IN THE 100-YEAR FLOODPLAIN	PERCENT OF TOTAL	NUMBER OF STRUCTURES IN THE CATEGORY 2 STORM SURGE ZONE	PERCENT OF TOTAL
Bluffton Township Town of Bluffton	1,260	36	1,368	39
Daufuskie Island	113	58	185	94
Hilton Head Island Town of Hilton Head	15, 788	77	17,615	85
Lady's Island	972	43	871	38
Port Royal Island City of Beaufort Town of Port Royal	3,574	26	3,302	24
Sheldon (Beaufort Co.)	453	23	660	34
St. Helena	3,303	81	3,381	83

One notable exception to this pattern is seen for Daufuskie Island where only 113 structures (57 percent) are shown as being in the 100-year floodplain, but 94 percent of structures are within the Category 2 surge zone (It is worth noting that Daufuskie has the smallest overall number of structures. Differences in building counts will thus have a greater affect on the overall percentage.). Significant differences in the building counts also exist for Hilton Head Island and Sheldon, where a Category 2 storm would inundate more area than the 100-year flood. This analysis suggests that a storm with a magnitude equal to or in excess of that of a Category 2 storm would damage many structures outside of the 100-year floodplain on Daufuskie, Hilton Head and in Sheldon. The vast majority of these structures are likely not built to resist flooding or to prevent flood damage since they lie outside of the regulatory floodplain. This is also true for Category 3 and higher magnitude storms for the entire county. Therefore, many of the structures vulnerable to Category 2 and higher magnitude storm surge flooding were not designed or constructed to withstand the effects of flooding.

Critical Facilities

Beaufort County's critical facilities GIS coverage (pubplcs.shp) was used as the basis for determining the county's critical facilities. Also, the Lowcountry Council of Governments' GIS department participated in verifying the both critical facility numbers and floodplain data. Committee members reviewed the list of facilities included in this coverage and made modifications as appropriate. A total of 96 facilities within the County were identified as critical. Upon analysis of their location, it was determined that 26 of these facilities are located within the 100-year floodplain; all of these are in the AE zone. Seventeen of these facilities lie within incorporated areas of the County. Nine of them are in the City of Beaufort, 7 are in Hilton Head and 1 is in Port Royal. Most of the remaining facilities are located in unincorporated portions of Northern Beaufort County with one exception; one facility is located in the southern part of the county near the Jasper County border. Table 3- and

Table 3- provide the name of the facilities and address information where it is available.

Table 3-11. Critical Facilities located in the 100-year floodplain of Incorporated Communities

ADDRESS	FACILITY
BEAUFORT	
237 SEA ISLAND PKWY	LADIES ISLAND FIRE DISTRICT 1
237 SEA ISLAND PKWY	LADIES ISLAND AIRPORT
30 COUGAR DR	LADIES ISLAND MIDDLE SCHOOL
501 CHARLES ST	BEAUFORT POST OFFICE
302 CARTERET ST	BEAUFORT CITY HALL
2510 MOSSY OAKS RD	MOSSY OAKS ELEMENTARY SCHOOL
2501 MOSSY OAKS RD	BEAUFORT HIGH SCHOOL
2517 MOSSY OAKS RD	BEAUFORT FIRE DEPT STATION #2
311 SCOTT ST	COUNTY LIBRARY
Hilton Head	
120 Beach City Road	Beaufort County Airport Terminal Building
27 Dillon Road	Fire Station #9
40 Summit Drive	Hilton Head Island Fire and Rescue Headquarters
70 Cordillo Parkway	HHI Fire and Rescue Station #1
65 Lighthouse Road	HHI Fire and Rescue Station #2
534 William Hilton Parkway	HHI Fire and Rescue Station #3
400 Squire Pope Road	HHI Fire and Rescue Station #4
20 Whopping Crane Way	HHI Fire and Rescue Station #5
16 Queens Folly Road	HHI Fire and Rescue Station #6
1001 Marshland Road	HHI Fire and Rescue Station #7
21 Oak Park Drive	Hilton Head Island Fire and Rescue Dispatch
1 Town center Court	Municipal Government Offices
3 Town Center Court	Court
539 William Hilton Parkway	Beaufort County Government Offices
10, 70, 80 Wilborn Road	Beaufort County Schools Hilton Head Campus
11 Beach City Road	Beaufort County Library Hilton Head Branch
7 Lagoon Road	Beaufort County Sheriff's Department
175 Greenwood Drive	Sea Pines Plantation Security Office
980 William Hilton parkway	Wexford Plantation Security Office
10 Shipyard Drive	Shipyard Plantation Security Office
399 Long Cove Drive	Long Cove Plantation Security Office
10 Queens Folly Road	Palmetto Dunes Plantation Security Office
100 Indigo Run Drive	Indigo Run Plantation Security Office
11 Surrey Lane	Hilton Head Plantation Security Office
40 Fort Howell Drive	Palmetto Hall Plantation Security Office
1 Brams Point Road	Spanish Wells Entrance Gate Security Office
10 Coggins Point Road	Port Royal Plantation Security Office
25 Hospital Center Blvd	Hilton Head Medical Center and Clinics
3 Marina Side Drive	Broad Creek PSD
25 Bow Circle	South Island PSD
21 Oak Park Drive	Hilton Head No 1 PSD
870 William Hilton Parkway	Hargray Telephone Company
111 Mathews Drive	Palmetto Electric Coop

ADDRESS	FACILITY
4 Nature's Way	Jarvis Creek Pump Station
179 Greenwood Drive	Sea Pines Lawton Canal Pump Station
54 Yorkshire Drive	Wexford Canal Pump Station
PORT ROYAL	
700 PARIS AV	PORT ROYAL TOWN HALL

Table 3-12. Critical Facilities located in the 100-year floodplain of the Unincorporated County

ADDRESS	FACILITY
CHECHESSEE	
6 SNAKE ROAD	BJWSA
FROGMORE	
----------	EMS-5
LADY'S ISLAND	
73 DISTANT ISLAND RD	LADIES ISLAND ELEM SCHOOL
LOBECO	
----------	PROPOSED ELEMENTARY SCHOOL
41 SEABROOK POINT DR	SEABROOK POST OFFICE
ST. HELENA	
74 POLOWANA RD	LI/STHEL FIRE DEPT STA 24
291 TARPON BLVD	FRIPP ISLAND FIRE DEPT
1609 SEA ISLAND PKWY	LI/STHEL FIRE DEPT STA 23
774 SEA ISLAND PKWY	ST HELENA POST OFFICE

Repetitive Loss Areas

A repetitive loss structure is defined by FEMA as any structure for which two or more flood insurance claims have been paid for more than $1,000 in a 10-year period. While these properties make up only 1-2 percent of the flood insurance policies currently in force, they account for 40 percent of the country's flood insurance claim payments. A report on repetitive loss structures recently completed by the National Wildlife Federation found that 20 percent of these structures are listed as being outside of the 100-year floodplain. FEMA has reported that the NFIP's 75,000 repetitive loss properties have already cost billions of dollars in flood insurance payments and numerous other floodprone properties continue to remain at high risk in the Nation's floodplains. Therefore, there are several programs that encourage communities to identify the causes of their repetitive losses and to work to mitigate these losses.

Identifying areas of repetitive losses within a community is a good indicator to use in determining areas of the highest flood damage vulnerability. Although flood damage is not necessarily limited to these areas, repetitive loss data provides location indicators for areas where structures are experiencing recurring and costly flooding damage.

Unincorporated County

The County's participation in the Community Rating System has encouraged a thorough review of repetitive loss structures. As a result, many of the previously listed repetitive loss

properties have been investigated and in some cases mitigated so that many of the structures are no longer considered repetitive losses.

AW-501 forms (Repetitive Loss Update Worksheets) indicated that there is currently only one structure in the County that is under County jurisdiction and is still considered a repetitive loss property. This structure is located in the unincorporated Bluffton area along the May River. Three claims were made on the structure: one each in 1994, 1995 and 1999.

Seven structures were removed from the list for various reasons including two structures for which flood protection mitigation in the form of stormwater management improvements were provided and funded by the property owner. Additionally, one listing was an error, and for one structure, the cause of flooding was not identifiable. Three structures are situated on the Hunting Island State Park area and are not under the jurisdiction of the County, but fall under the jurisdiction of the South Carolina Office of Parks and Tourism.

Beaufort

There are no repetitive loss properties in the City of Beaufort. Since the original plan was written, two properties were taken off the list.

Bluffton

There are no repetitive loss structures in Bluffton.

Hilton Head

The Town of Hilton Head's participation in CRS has also encouraged a review of this community's repetitive loss structures which has resulted in the mitigation and/or removal of many structures from the list. Currently, there are 27 properties on the repetitive loss list for the town, eleven of which are insured. All of the properties except one are single-family dwellings; the remaining property is a multi-family dwelling.

A GIS coverage of the repetitive loss areas provided by the town allowed for the following observations of the properties:

- 23 of the properties are located in the AE flood zone
- 4 of the properties are in the X zone which is outside of both the 100-year and the 500-year floodplain. Two of these are within 200 feet of the AE zone.
- 14 of the properties are located along the Atlantic Coast of the island in the Forest Beach area adjacent to the VE zone.
- 2 are located in the Palmetto Bay area along Broad Creek at its confluence with the Intracoastal Waterway
- 3 are in the Palmetto Dunes area. One of these is adjacent to the VE zone, and the other 2 are approximately ½ mile inland.
- 4 properties are in the AE flood zone on northeastern part of the island on the Atlantic Coast Side
- 4 of the properties are in the X zone on the northeastern part of island

Although the construction of new buildings (and the issuing of permits for the foreseeable future) on Hilton Head has slowed considerably during the past few years, it is expected that any new construction in the repetitive loss areas will be residential, given the locations of the properties involved. Little or no new infrastructure will be required since the subject areas are already provided with services. A detailed review of recent building permits (providing an estimate of construction activity expected during the next 18 months) and a reasonably optimistic trend projection of similar activity during the succeeding four years, produced an estimated county total in 2010 of $29,590,800 in new homes in the flood plain, almost all on Hilton Head; by the end of 2014 there would be approximately $148,000,000 invested there

The only **critical** structures planned to be built in the flood plain are on Hilton Head Island. They are either new fire and safety buildings or substantial additions, with an estimated total value of $4,400,000 by 2014. This information was obtained from the departments responsible.

Figure 3-4 shows the general areas of repetitive loss within the Town of Hilton Head.

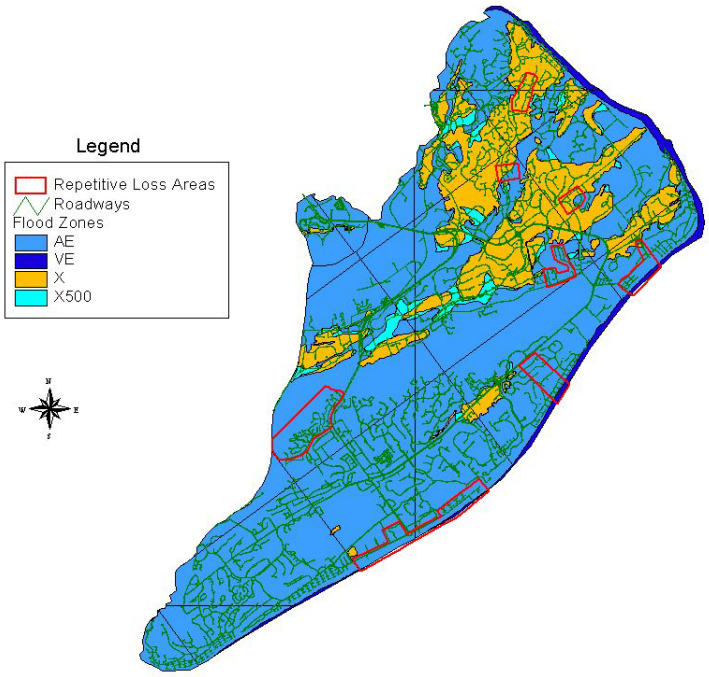


Figure 3-4. Repetitive Loss Areas in Hilton Head

Port Royal

There are no repetitive loss properties in the Town of Port Royal.

Access

In addition to building and facility vulnerability, communities must consider transportation and roadway accessibility during and after a flood. Drowning in vehicles is the number one cause of flood deaths. If residents wait too long to evacuate, how will flooding affect their chances of being able to get out (via roadways) of potentially dangerous areas? If residents

and business owners chose not to evacuate during a storm, will there be a way for them to leave their property once the storm has ended, but flood conditions remain? Will returning evacuees have access to their homes? Although most people are in a hurry to return after a flood to assess damage and begin repairs, flooded roadways and bridges can prevent them from accessing these structures for several days. Therefore, roadway vulnerability to flooding should be considered.

Because a majority of the land area within the county lies in the 100-year floodplain, portions of all of the major highways within the county would be inundated by a 100-year event. As illustrated in Figure 3-, this includes the major portions of South Carolina Routes 116, 170, and 802 in the Beaufort City and Port Royal areas. In the northern portion of the county, it includes much of US Route 21 from Fripp Island up to the Sheldon area. Major portions of U.S. Route 17 would also be inundated by the 100-year flood. In Southern Beaufort County which includes Hilton Head and Bluffton, approximately half of the length of US Route 278 lies within the 100-year floodplain. Additionally, most of South Carolina Route 170 in Southern Beaufort would be inundated.

An important fact in considering Beaufort's evacuation routes is that there essentially are no alternatives to the ones existing now because of the topography of the area. Because of Beaufort County's physical composition, bridges should be considered as critical facilities because they are the essential connectors for both people and freight (including food). Their future evaluation for planning activities is essential.

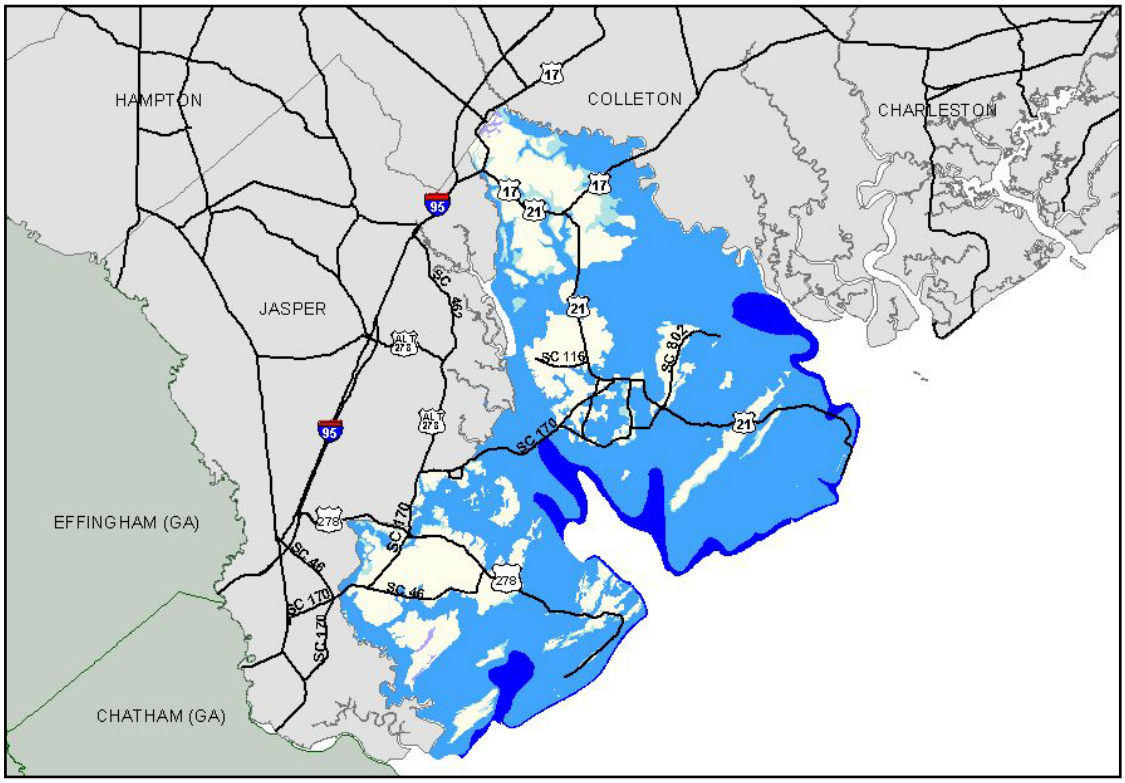


Figure 3-5. Major Routes in the Floodplain in Beaufort County

It is also important to note that highway mile has not increased, which population has "boomed." This is a cause for concern for the area because of evacuation issues. Table 3-13 reflects this trend by reporting on the vehicle ownership relative to the highway miles.

Table 3-13, Vehicle Ownership Increases vs. Miles of New Roadway in Evacuation Area

Registered Motor Vehicles				
	2000	**2005**	**2009**	**%increase 2000-2009**
Beaufort	89,851	128,351	131,226	46.05%
Colleton	27,653	38,209	35,019	26.64%
Hampton	13,733	17,605	16,320	18.84%
Jasper	13,696	20,728	21,673	58.24%
TOTAL	144,933	204,893	204,238	40.92%
Roadway Miles				
	2000	**2005**	**2009**	**%increase 2000-2009**
Beaufort	771.2	884.2	884.2	14.65%

Colleton	1347	1347	1347	0.00%
Hampton	835.4	838.7	838.7	0.40%
Jasper	648	659.5	659.5	1.29%
TOTAL	3601.6	3729.4	3729.4	3.46%

Conclusions

The analysis suggests that while the entire county is vulnerable to flooding and flood damages, there are some areas where this threat is greater due to the amount of land area susceptible to flooding, and the amount of development within these areas. While the Town of Bluffton and the unincorporated area of the County known as Sheldon have relatively smaller vulnerabilities to flooding, the Town of Hilton Head Island, the City of Beaufort, the Town of Port Royal, and unincorporated areas of the county including Daufuskie, St. Helena, and areas directly surrounding Hilton Head Island, have larger numbers of structures and more infrastructure exposed to flooding.

Erosion

The South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management (DHEC-OCRM) publishes the *Annual State of the Beaches Report* which summarizes changes that have occurred along the state's shoreline. Results of the 2009 report for Beaufort County areas are presented above in Table 2-5. The table notes what, if any, type of shoreline change is occurring for the given area; what the average long term change rate is; whether or not the area is an unstablized inlet zone, which is the type of shoreline zone where the greatest amount of change is likely to occur; and the date of the last nourishment project in the area. By using this chart for analysis, which is most best data available, Beaufort's susceptibility to damage and loss from erosion can be better understood.

Beaufort County is vulnerable to erosion, but there are no critical facilities in a highly instable area. While erosion exists as a hazard, for the purpose of this plan, vulnerability and mitigation are addressed primarily through the flooding and other items.

Development Trends

To understand the vulnerability of the built environment within each community, an assessment of the development trends was necessary. This allows us to focus on where and what type of future development will occur and thus determine how to fortify it to be hazard resistant. As noted in Chapter 1, Beaufort County is one of South Carolina's fastest growing counties, by percentage of population change, with an overall population increase of 40 percent in the 1990s and 24 percent since 2000. This suggests significant development of residential structures as well as commercial structures and infrastructure to keep up with the resulting demands.

Beaufort County

Unincorporated Beaufort County continues to grow with considerable residential and commercial development occurring in areas close to the City of Beaufort, the Town of Port Royal, and the Town of Bluffton. The Town of Bluffton, however, continues to annex significant land area in southern Beaufort County. Based on U.S. Census data, it is estimated that the overall population growth in the unincorporated county was 39 percent from 1990-2000 with a 52 percent increase in the number of housing units. From 2000-2008, there was nearly a 43% increase in population.

City of Beaufort

According to U.S. Census data, the City of Beaufort's population increased by 35 percent between 1990 and 2000, and the number of housing units in the City increased by 22 percent in this time period. From 2000-2008, population actually decreased by just over 7 percent. The city's land area is relatively small, 23 square miles, and will thus serve as a limit to growth in the future, as is evidenced by the decrease in population, as citizens moved heavily to the unincorporated areas. From 2004-2008, a total of 300 building permits were issued.

Town of Bluffton

The Town of Bluffton has grown considerably in overall land area over the last 10-15 years. In 1990, it had a land area of approximately 1 square mile whereas in 2000, land annexations brought the land area total to 34 square miles. As of June 2009, the Town's land area was approximately 52.24 square miles. Bluffton's population increased by 73 percent during the 1990's and the number of housing units in the town increased by 68 percent. This is a result of both land annexation, and increased development/migration to the Town of Bluffton. From 2000-2008, the development trend increased again. Though slowed by the current economic situation, the population has increase by 93 percent in around eight years. From 2004-2008, a total of 3,310 building permits were issued.

Town of Hilton Head Island

The Town of Hilton Head Island has remained steady in terms of growth over the last decade or so. The Town is generally a resort and retirement community with many plantation type residential developments as well as considerable commercial development to support residents and vacationers. From 1990 to 2000, the population of Hilton Head Island increased 43 percent to an estimated 33,900 people. However, housing units in the town

increased only by 15 percent in that time, and that sort of trend continues. From 2000-2008, the population actually decreased by just under one percent. This continues to suggests a trend in the community towards more people gaining permanent residential, but the influx of new residents may be leveling off. From 2004-2008, a total of 1,063 building permits were issued.

Town of Port Royal

Within the Town of Port Royal, population increased by 32 percent in the 1990's with the number of housing units increasing by 40 percent. The Town continues to experience significant growth and to annex portions of the county along its borders. The Town population increased by over 18 percent from 2000-2008. From 2004-2008, a total of 435 building permits were issued.

Table 3.14, Development Trends at a glance

Jurisdiction	1990-2000 population/housing unit percentage increase	2000-2008 population increase estimates	Development Trend
Beaufort County	39%/52%	43%	Steady Development
City of Beaufort	32%/22%	-7%	Housing increase, population leveling
Town of Port Royal	73%/68%	93%	Large Annexation, steady development
Town of Hilton Head Island	43%/15%		Development stable but leveling out
Town of Bluffton	32%/40%	18%	Large Annexation, steady development

Summary

Based on the findings of the vulnerability assessment, the hazards considered were ranked in order of the perceived risk to each of the county's communities. These results are presented in

Table 3-22. It is obvious from the vulnerability assessment and from the perception of the planning group that wind and flood related events are by far the most imminent danger to Beaufort County and its municipalities.

Table 3-15. Ranking of Perceived Risk due to Hazards by Community

Planning District and Incorporated Communities	Hurricane/ Flood	Thunderstorm/ Wind	Tornado	Erosion	Winter Event	Drought	Dam failure/Other Hazards
City of Beaufort	1	2	3	4	5	6	7
Town of Bluffton	1	2	3	4	5	6	7
Town of Hilton Head	1	2	4	3	5	6	7
Town of Port Royal	1	2	3	4	5	6	7
Unincorporated Beaufort County	1	2	3	4	5	6	7

HAZUS-MH Data for the 2009 Update

The original plan (2004) used HAZUS -99 for evaluation of its vulnerability to hazards. Because of technical limitations, the preceding Vulnerability Assessment was based on historical data provided from NCDC, SCEMD and the SCHRL. However, because of the thoroughness of the previous HAZUS data, the following information has been left in the plan. The Hazard Mitigation Planning Committee will seek out opportunities to update this data when it becomes feasible with HAZUS-MH in order to obtain the most accurate data.

For this plan, the Steering committee has decided to modify the 2004 data in a very simplistic way. Essentially, we are taking the number of buildings identified in the previous plan and adding the number of permits that have been issued since then for each jurisdiction. The plan will reflect the percent increase, and that should be a close estimate of the increase in potential damage. The tables below reflect the approximate changes based on the 99 HAZUS data using the increase property value based on permit data. This information may differ slightly from the Assessor's office, but still serves as a valuable tool. The Beaufort County GIS department has agreed to revisit this, and using their technology, they will perform a full HAZUS-MH assessment in the annual review.

Table 3-16, Data with increases based on building permit data

Jurisdiction	Building Totals 2004	Increase in Buildings According to Permit Data	2008 Estimate Total	% increase	TOTAL VALUE (DOLLARS IN THOUSANDS)	TOTAL DAMAGE 99 HAZUS CATEGORY 1--DOLLARS IN THOUSANDS)	PERCENTAGE OF TOTAL VALUE SUSTAINING DAMAGE (BASED ON 99 HAZUS) CATEGORY 1/CATEGORY 3	TOTAL DAMAGE 99 HAZUS CATEGORY 3
Beaufort	3,689	225	3,914	6.09	471,841	31,595	7__43	203,215
Bluffton	497	2853	3,350	474	45,754	3,999	9__48	21,749
Hilton Head	12,271	736	13,007	5.99	1,929,118	125,227	6__43	838,927
Port Royal	1,414	387	1,801	27.4	399,721	20,683	5__35	140,503
Unincorporated County	16,576	8240	24,816	49.7	1,276,550	255	10__51	654,467
County Total	34,447	12441	46,888	36.11	4,125,282	122,292	7__45	1,860,115

Table 3-17 Wind Scenarios based on building increases (damage sustained)

Jurisdiction	2008 Total Value estimate based on building permit increase	2008 Damage Estimate Category 1/ Category 3 (dollars in thousands)
Beaufort	$500576	$35040/ $215247
Bluffton	- - -	- - -
Hilton Head	$2032935	$75503/ $360738
Port Royal	$507645	$25382/ $177675
Unincorporated County	$1910995	$191099/ $974607
County Total	$5610383	$392726/ $2524672

Table 3-18 Total Damage (building numbers) from earthquake of 6.9 Magnitude based on percent increase of building permit data

COMMUNITY	TOTAL 2004	99 HAZUS number plus % increase
Beaufort	313	335
Bluffton	64	Permit data records 474% increase—number large but unfeasible
Hilton Head	652	690
Port Royal	189	240
Unincorporated County	2,634	3924
County Total	3,860	5189

2004 HAZUS Information

Wind

Having investigated the different wind hazard issues of concern in Beaufort County, a series of analyses designed to assess current, relative vulnerability of structures in the County to high wind hazards was performed. Tropical storms and hurricanes were the types of events considered most probable to have a widespread effect on the County.

Damage Functions

The wind vulnerability of structures is dependent on several factors including:

- structure location particularly coastal vs. inland areas,
- level of design attention (a measure of the level of engineering design for the structure),
- quality of materials and construction,
- structure exposure and height,
- beneficial or adverse effects of nearby trees and structures,
- age and condition, and
- degree of rainfall or water penetration.

For this analysis, a simplified approach is being used for which the factors being considered are structure location and the level of design attention. This approach will provide simplified results with an appropriate level of detail for this study. Furthermore, review of post-hurricane damage reports such as Mehta, et al. (1981) show that structural damages typically correlate well with structure type and degree of engineering attention.

Default wind damage functions for structures are included as part of FEMA's Benefit-Cost Program for Hurricane Wind Damage. The User's Guide for version 1.0 of this program, dated January 20, 1995, provides information about how hurricane winds affect coastal and inland areas and show that for wind events with a recurrence interval of from 10 to 2000 years, the wind speed along coastal areas is only slightly higher (5 mph or less) than that found 125 miles inland from the coast. Beaufort County's inland most area is approximately 35-40 miles from the Atlantic Coast. Therefore, a constant wind speed for the County was considered in evaluating wind vulnerability.

The User's Guide for the Hurricane Wind Benefit-Cost Program provides wind damage functions for each category of hurricane based on the level of design attention for structures. Structures are classified into 5 categories that for the purposes of this study will be termed:

- non-engineered wood
- non-engineered masonry
- marginally engineered
- fully engineered
- pre-engineered

Loss estimates for each classification of building are provided as percentages of the total building replacement value. This information is provided in Table 3-1.

Table 3-19. Wind Damage Percentages for Structure Classifications based on the Level of Engineering Design **(percentage of building replacement value)**

		LEVEL OF DESIGN ATTENTION				
HURRICANE CATEGORY	WIND SPEED (1-MINUTE SUSTAINED MPH)	NON-ENGINEERED WOOD	NON-ENGINEERED MASONRY	MARGINALLY ENGINEERED	FULLY ENGINEERED	PRE-ENGINEERED
Tropical Storm	39-73	0	0	0	0	10
1	74-95	7.5	5	5	2.5	25
2	96-110	20	15	15	5	50
3	111-130	50	40	40	20	80
4	131-155	90	80	80	40	100
5	> 155	100	100	100	60	100

Building Inventory Information

GIS building coverages provided by Beaufort County and the Town of Hilton Head did not contain data as to the structures age, building type, or level of design attention, but instead provided building footprints and locations. Therefore, FEMA's HAZUS program was used in order to obtain information about the specific types of buildings within the County including information used to classify the building's level of engineering design.

While the HAZUS program available at the time of this analysis (HAZUS 99, SR 2) can be used to assess building vulnerability and damage potential from earthquake events, it is not yet programmed to run analysis for wind events. However, there is a significant amount of basic structure and infrastructure data available from the program. Structure information is available on a census tract basis that provides information about the building type and occupancy class. The data are based on a combination of decennial census data from (1990) and information provided by the Dun and Bradstreet Corporation (Arlington, Virginia) in 1996. Also included in HAZUS are dollar replacement values for various classifications of buildings. Dollar replacement values are based on Means cost estimating values in 1994 dollars and regional cost modifiers were applied in HAZUS that are generally used on a statewide basis.

A comparison of the building information between community-provided GIS building coverages and the HAZUS data showed that that the HAZUS data has 34,569 structures assigned to Beaufort County. GIS building footprint coverages provided by Beaufort County and the Town of Hilton Head indicate that there are a total of 36,555 in the County which is a difference of only 5-6 percent.

Building types provided by HAZUS were evaluated to determine under which of the 5 engineering design level categories they fell. The results of this evaluation are provided in Table 3-2.

Table 3-20. Building Types Grouped by Level of Engineering Design

NON-ENGINEERED WOOD	NON-ENGINEERED MASONRY	MARGINALLY ENGINEERED	FULLY ENGINEERED	PRE-ENGINEERED
• Wood light frame	---NONE---	• Wood, greater than 5,000 square feet • Concrete frame buildings with unreinforced masonry infill walls • Precast concrete tilt-up walls • Unreinforced masonry bearing walls	• Steel moment frame • Steel braced frame • Steel frame with cast-in-place concrete shear walls • Steel frame with unreinforced masonry infill walls • Reinforced concrete moment resisting frames • Concrete Shear Walls • Precast concrete frames with concrete shear walls • Reinforced masonry bearing walls with precast concrete diaphragms	• Steel light frame • Manufactured (mobile) homes

A general building analysis was performed to determine how the structures were distributed among each of the incorporated communities. Building classification distribution information is available on a census tract basis within HAZUS. Therefore, an analysis was performed using the community GIS building coverages to determine the number of buildings within a particular census tract, and to determine the relative percentage of buildings within the tract that were located within incorporated areas. This percentage was then applied to the building counts from the census tract information. For instance, Census Tract Number 45013002100 encompasses the Town of Bluffton as well as unincorporated areas of Southern Beaufort County within the Bluffton Township planning district. Upon analyzing the County's GIS data, it was determined that there are an estimated 2,573 structures in the census tract and 553 in incorporated Bluffton. Therefore 21 percent (553 ÷2,573 = 0.21) of the census tract's structures are within the Town of Bluffton. The remainder is in the unincorporated portion of the Bluffton Township planning district.

For, Census Tract Number 45013002100 to determine the approximate percentage of building census data associated with the incorporated portion of Bluffton, a ratio of 0.21 was used so that where the census tract data reported 1,360 wood, light frame structures, 291 of these were assumed to be in incorporated Bluffton. Using this method, the building type distribution shown in Table 3-23 was developed.

Table 3-23. Building Type (by Engineering Design Level) Distribution

AREA	NON-ENGINEERED WOOD		MARGINALLY ENGINEERED		FULLY ENGINEERED		PRE-ENGINEERED		TOTAL
	NUMBER	PERCENT-AGE OF TOTAL	NUMBER	PERCENT-AGE OF TOTAL	NUMBER	PERCENT-AGE OF TOTAL	NUMBER	PERCENT-AGE OF TOTAL	
Beaufort	2,949	80	319	9	80	2	340	9	3,689
Bluffton	291	59	30	6	6	1	171	34	497
Hilton Head	10,329	84	1,152	9	306	2	458	4	12,271
Port Royal	874	62	133	9	98	7	309	22	1,414
Yemassee	18	52	2	5	0	0	15	43	34
Unincorporated County	10,217	61	968	6	94	1	5,405	33	16,576
County Total	24,678	71	2,604	8	585	2	6,698	19	34,565

HAZUS dollar exposure information provides estimated replacement costs based on structure classification. For the wind vulnerability analysis, the replacement cost information for the entire County was summed and grouped by building types based on the level of engineering design.

Using the same methodology discussed to determine building counts for incorporated areas as provided in Table 3-23, building replacement values were developed for the incorporated and unincorporated portions of the County and are presented in Table 3-24. Thus, the overall replacement value of all structures in the Town of Bluffton is equal to 21 percent of the overall replacement value for all structures in Census Tract Number 45013002100.

Table 3-24. Replacement Values for Structures Based on the Degree of Engineering Design (dollars in thousands)

AREA	NON-ENGINEERED WOOD	MARGINALLY ENGINEERED	FULLY ENGINEERED	PRE-ENGINEERED	TOTAL VALUE
Beaufort	263,595	90,870	98,052	19,324	471,841
Bluffton	22,538	9,218	7,343	6,655	45,754
Hilton Head	1,185,902	375,916	330,384	36,916	1,929,118
Port Royal	105,518	108,485	173,709	12,009	399,721
Yemassee	1,444	211	108	533	2,296
Unincorporated County	825,248	154,562	95,623	201,117	1,276,550
County Total	2,404,245	739,263	705,220	276,554	4,125,282

Wind Assessment Scenarios

Using the damage ratios along with the replacement values for the structures, 2 wind scenarios were considered. The first was a Category 1 storm where wind speeds range from 74-95 mph (1-minute sustained). Five such storms have passed directly through Beaufort County between 1850 and 2001, and 10 additional Category 1 storms have passed within 50 miles of the County during the same time period.

Assuming a Category 1 storm passed directly through or within close proximity of the County and that all parts of the County experienced similar wind speeds, an analysis of the damage was assessed. Results are presented in Table 3-25.

Table 3-25. Damage Assessments for a Category 1 Hurricane Wind Event (dollars in thousands)

AREA	NON-ENGINEERED WOOD	MARGINALLY ENGINEERED	FULLY ENGINEERED	PRE-ENGINEERED	TOTAL DAMAGE	PERCENTAGE OF TOTAL VALUE
Beaufort	19,770	4,543	2,451	4,831	31,595	7
Bluffton	1,690	461	184	1,664	3,999	9
Hilton Head	88,943	18,796	8,260	9,229	125,227	6
Port Royal	7,914	5,424	4,343	3,002	20,683	5
Yemassee	108	11	3	133	255	11
Unincorporated County	61,894	7,728	2,391	50,279	122,292	10
County Total	180,318	36,963	17,631	69,139	304,051	7

The total amount of damage is estimated at $304 million or approximately 7% of the entire building dollar exposure of the County. Damage as a percentage of the total value of

structures for incorporated communities ranges from 11 percent in Yemassee to 5 percent in Port Royal. Hilton Head, which is the incorporated area with the most structures, has the highest value loss at $126 million. The unincorporated portions of the County have a combined loss estimate that is slightly less than Hilton Head at about $121 million.

Generally the results of the assessment for the Category 1 storm suggest that most areas of the County would experience similar values of damages (relative to their number of structures) with the damage equaling about 5-11 percent of the overall value of the structure, or 7 percent on average for the entire County.

The second scenario considered was a Category 3 Hurricane event. For a Category 3 storm, wind speeds range from 111-130 mph (1-minute sustained). One Category 3 storm passed through Beaufort during the period of record, 1850-2001, in 1885 making landfall at Lady's Island and heading northwestward into Colleton County. An additional three Category 3 storms have passed within 50 miles of the County during the same time period. For one of these storms, Hurricane Gracie which hit the area in September 1959, the center track followed Beaufort County's northeastern border closely and was within 2 miles of the County.

The analysis assumed that the Category 3 storm would pass directly through or within close proximity of the County and that all parts of the County would experience similar wind speeds. Results are presented in Table 3-26.

Table 3-26. Damage Assessments for a Category 3 Hurricane Wind Event (dollars in thousands)

AREA	NON-ENGINEERED WOOD	MARGINALLY ENGINEERED	FULLY ENGINEERED	PRE-ENGINEERED	TOTAL DAMAGE	PERCENTAGE OF TOTAL VALUE
Beaufort	131,798	36,348	19,610	15,459	203,215	43
Bluffton	11,269	3,687	1,469	5,324	21,749	48
Hilton Head	592,951	150,367	66,077	29,533	838,927	43
Port Royal	52,759	43,394	34,742	9,608	140,503	35
Yemassee	722	84	22	426	1254	55
Unincorporated County	412,624	61,825	19,125	160,894	654,467	51
County Total	1,202,123	295,705	141,044	221,243	1,860,115	45

There is clearly a major difference in predicted damage between a lesser storm such as a Category 1 Hurricane and a more powerful storm like a Category 3.

The total amount of damage is estimated at $1.86 billion or approximately 45% of the entire building dollar exposure of the County for the Category 3 storm. Damage as a percentage of the total value for incorporated communities ranges from 35-55; a significantly higher

amount and larger range (20 percent vs. 6 percent) than that for the Category 1 storm. Again, Hilton Head sustains the highest value loss at $845 million with unincorporated portions of the County having a combined loss of $648 million.

The building stock of communities and areas with higher percentages of overall damage can be assessed using Table 3-23. Where the overall percentage of damage is higher, it can be correlated to the community's dominant building types since this is the characteristic used to determine the appropriate damage function as provided in Table 3-1. Damage ratios for pre-engineered buildings are significantly higher than those for the other building types. Additionally, ratios for non-engineered wood structures are higher than for marginally or fully engineered buildings, and ratios for marginally engineered buildings are slightly higher than those for fully engineered buildings.

In unincorporated portions of the County where the damage is equal to about 51 percent of the entire building dollar exposure, only one percent of structures are considered fully engineered and 6 percent are marginally engineered. One-third of the structures are pre-engineered, and 61 percent are non-engineered wood frame structures. In Port Royal where the damage is equal to a significantly lower 35 percent of the overall dollar exposure, 16 percent of structures are marginally or fully engineered, and only 22 percent are pre-engineered. Similar to the unincorporated County area, a high percentage of the structures, 62, are non-engineered wood frame structures.

The wind vulnerability analysis allowed for a simplified approach to assessing wind vulnerability. The analysis showed that more damage is expected in unincorporated areas of the County, Bluffton and Yemassee due to the differences in building inventory between these areas and other areas of the County as it relates to the engineering design levels for the communities' structures. Additionally, the analysis showed that for a more minor Category 1 hurricane, the County can expect an average of approximately 5-10 percent of damage (as a function of building dollar exposure), where as for a Category 3 storm, this percentage increases significantly to an estimated 45 percent.

Conclusions

The wind vulnerability of each of the communities within the county is generally fairly similar as shown in the assessment. Areas directly along the coast such as the Town of Hilton Head Island, Daufuskie Island and the St. Helena area are expected to suffer more direct wind damage from coastal storms than the other areas of the county given their proximity to the shoreline. However, the county's coastal location puts all of its communities at risk from high winds from coastal storms.

Earthquake

The HAZUS program was used to perform an analysis of potential damage to the County by an earthquake. HAZUS allows the user to model earthquakes that are based at historical epicenter locations, but to vary the magnitudes for the events to provide a range of possible earthquake scenarios. Two earthquake scenarios were developed to use in assessing the County's vulnerability to damage from earthquakes.

Building Inventory Information

HAZUS was used to determine the number of structures that would incur at least moderate structural damage as the result of the each of the earthquake scenarios. HAZUS categorizes structural damage into 5 categories: none, slight, moderate, extensive, and complete. There are descriptions of damage provided for each type of building (ex. wood light frame, steel moment frame, unreinforced masonry bearing walls) at all of the 4 damage states above none. A detailed description of these states can be found in Chapter 5 of the HAZUS99-SR2 Technical Manual. Some examples of moderate damage descriptions are presented in Table 3-27.

Table 3-27. HAZUS Moderate Structural Damage Descriptions

WOOD FRAME	STEEL FRAME	UNREINFORCED MASONRY	MANUFACTURED HOMES
• Large cracks at corners of door and windows • Small cracks along shear wall panels	• Steel members have yielded showing observable permanent rotations at connections • Steel braces have yielded showing stretching an buckling	• Most infill walls exhibit large diagonal or horizontal cracks • Some walls show crushing of brick around beam-column connections	• Major movement of the mobile home over its supports resulting in some damage to metal siding • Requires resetting o the home on its supports

For this analysis, building types are divided into 7 basic types:

- Wood frame
- Steel frame
- Reinforced Concrete
- Unreinforced concrete
- Reinforced Masonry
- Unreinforced Masonry
- Manufactured Homes

An initial inventory count of the number of each of these types of buildings within the County was performed and is presented in Table 3-28.

Table 3-28. Building Count by General Building Type

COMMUNITY	WOOD	STEEL	REIN. CONCRETE	UNREIN. CONCRETE	REIN. MASONRY	UNREIN. MASONRY	MANU. HOMES	TOTAL
Beaufort	2,970	60	12	5	16	295	332	3,689
Bluffton	293	5	1	0	1	27	171	497
Hilton Head	10,391	192	49	9	89	1,081	434	12,245
Port Royal	876	37	39	21	18	119	309	1,418
Yemassee	18	0	0	0	0	2	15	34
Unincorporated County	10,246	75	11	3	19	936	5,395	16,686
County Total	24,795	369	111	38	142	2,459	6,655	34,569

Earthquake Assessment Scenarios

As indicated in the Hazard Identification, the most powerful earthquake of historical record in the vicinity was the Charleston earthquake of 1886 which had a magnitude (M_L) of 6.9. This magnitude falls under the strong category as defined by the Richter scale. A scenario was performed based on that event using the same epicenter location and magnitude. A depth of 10 kilometers was used for the epicenter.

Additionally, a scenario was performed using a lesser magnitude to determine potential damages for a smaller, but still significant earthquake event. A magnitude of 5.9, which falls within the moderate earthquake classification, was also chosen for a scenario with the epicenter still located at the site of the 1886 earthquake.

Results

Results are presented for both scenarios as the number of structures that are damaged to the moderate level or higher as defined by the HAZUS program. The strong earthquake (M_L = 6.9) generates results as presented in Table 3-29.

Table 3-29. Number of Structures Incurring at Least Moderate Damage for a ML = 6.9 Event

COMMUNITY	WOOD	STEEL	REIN. CONCRETE	UNREIN. CONCRETE	REIN. MASONRY	UNREIN. MASONRY	MANU. HOMES	TOTAL
Beaufort	100	16	3	1	2	61	130	313
Bluffton	6	1	0	0	0	4	53	64
Hilton Head	263	32	8	0	8	189	152	652
Port Royal	26	7	10	6	2	23	116	189
Yemassee	1	0	0	0	0	0	6	8
Unincorporated County	353	12	0	0	0	192	2,076	2,634
County Total	750	68	21	7	12	469	2,533	3,860

Results from the analysis show that about 11 percent of the County's entire building inventory would be moderately to completely damaged. For each of the incorporated communities and the unincorporated County, this percentage is as follows:

- 8 percent for the City of Beaufort
- 13 percent for the Town of Bluffton
- 5 percent for Hilton Head
- 13 percent for the Town of Port Royal
- 24 percent for Yemasssee
- 16 percent for the unincorporated portions of the County.

The heaviest losses by percentage by building type are for manufactured housing, where 38 percent of the County's inventory is at least moderately damaged, and for unreinforced masonry, reinforced concrete, unreinforced concrete and steel where this percentage is 19, 19, 18 and 18 respectively. However, the heaviest overall losses include not only manufactured housing and unreinforced masonry buildings, but also wood frame buildings where 750 structures are at least moderately damaged.

Results for the analysis of the moderate earthquake run (M_L = 5.9) showed that only two types of buildings incurred moderate damage. These were unreinforced masonry buildings and manufactured homes. Neither of these types of buildings experienced any complete damage, but some extensive damage was experienced by the unreinforced masonry buildings. Most of the rest of the building types experienced some slight damage with wood frame structures having a count of 583 structures being slightly damaged. Seven steel frame buildings were slightly damaged, and only one each of reinforced and unreinforced (pre-cast) concrete experienced slight damage. Building damage count results for unreinforced masonry and manufactured homes that experienced at least moderate damage are presented in Table 3-.

Table 3-30. Number of Structures Incurring at Least Moderate Damage for a ML = 5.9 Event

COMMUNITY	UNREINFORCED MASONRY	MANUFACTURED HOMES	TOTAL
Beaufort	6	14	30
Bluffton	1	3	4
Hilton Head	43	16	59
Port Royal	6	11	17
Yemassee	0	1	1
Unincorporated County	47	237	284
County Total	103	282	395

The vulnerability analysis shows that for the moderate earthquake with a M_L of 5.9, about 1 percent of the County's structures are vulnerable to at least moderate damage as compared to the 11 percent of the structures vulnerable from a strong earthquake (M_L = 6.9). Most of these are manufactured homes located within unincorporated portions of the County (236 out of 395 or 60 percent).

Conclusions

Vulnerability to earthquakes for the communities within Beaufort County is based largely on their proximity to known epicenter areas as well as the distribution of building types within each of the communities. Given these factors, portions of Unincorporated Beaufort County had one of the highest percentages of damaged structures from a major earthquake, most of which were manufactured homes. The Town of Port Royal and the Town of Bluffton had similar damage rates indicating similar vulnerabilities that were slightly less than the unincorporated county due mostly to a different distribution of building types than the county. The City of Beaufort had a lower damage rate also due to its distribution of structure types. Hilton Head Island had the lowest rate of damage for the M_L = 6.9 event due in large part to its distance from the area's major epicenter site (the Charleston area).

4. Community Mitigation Capability Assessment

Thus far, the planning process has identified and updated the natural hazards posing a threat to Beaufort County, and described and quantified the vulnerability of the County and communities to these risks. This has been done by using updated information from FEMA and the local jurisdictions. Prior to finalizing updated Goals and Objectives for improving each jurisdiction's ability to reduce the impacts of these risks, we must assess and update the mechanisms that exist already in these areas to reduce hazard damage. Doing so, the plan can focus the goals, objectives and actions more accurately in this plan. This part of the planning process is referred to as "The Community Mitigation Capability Assessment."

The HMPC took two approaches in conducting this assessment. First, a review of the previous plans inventory of existing policies, regulations and plans was made. These policy and planning documents were collected and reviewed to determine if they contributed to reducing hazard related losses, or if they inadvertently contributed to increasing such losses. Second, an inventory of other mitigation activities was made through the use of a matrix. The purpose for this effort was to identify activities and actions beyond policies, regulations and plans that were either in place, needed improvement, or could be undertaken, if deemed appropriate. Throughout the process there was frequent consultation with the representatives of the jurisdictions to discuss and clarify the issues. When the assessment was completed, the Committee reviewed the results and made further recommendations that were incorporated.

The HMPC collected and analyzed the documents presented in Table 4-1.

Table 4-1. Beaufort County Documents used for Capability Assessment

BEAUFORT COUNTY	CITY OF BEAUFORT	TOWN OF BLUFFTON	TOWN OF HILTON HEAD ISLAND	TOWN OF PORT ROYAL
Comprehensive Plan,	Comprehensive Land Use Plan,	Comprehensive Plan,	Comprehensive Plan,	Comprehensive Plan,
Zoning & Development Standards,	Subdivision Regulations,	Development Standards Ordinance,	Land Management Ordinance	Subdivision Regulations,
Southern Beaufort County Plan	Zoning Ordinance,	Zoning Ordinance,	Ward One Master Land Use Plan,	Zoning Regulations and Map,
			Flood Damage Prevention Ordinance	Flood Damage Prevention Ordinance,
Beaufort Co. Above Ground Historic Resources Survey,	Beaufort Preservation Manual, and Supplement			
Northern Beaufort County Plan			Flood Hazard Mitigation Plan,	Overlay District Standards,
Stormwater BMP Manual; Stormwater Utility developed	Stormwater Utility developed in past five years	Stormwater BMP Manual; Stormwater Utility developed	Stormwater Utility developed	Stormwater Utility developed
All ICC Building codes without amendments	All ICC Building codes without amendments	All ICC Building codes without amendments	All ICC Building codes without amendments and “History of Building Codes”	All ICC Building codes without amendments
Hurricane Response & Recovery Guide,			Comprehensive Emergency Management Plan	
Emergency Operations Plan,			Emergency Operations Basic Plan	

[1] As part of the SWM Utility, all communities will eventually be required to adopt the BMPs as outlined in the BMP manual developed by the SWM Utility that is currently in effect in Beaufort County and The Town of Bluffton.

Below is a bulleted summary of how each of these documents contributes to an overall Hazard Mitigation framework. Each point identifies where and how mitigation concepts, principles and measures are integrated into the normal day-to-day activities of the local governments. Text that is highlighted **in bold underline** identifies opportunities to strengthen or improve activities to reduce future hazard-related losses further.

Beaufort County:

Comprehensive Plan, 2007:

- Document presents policies and strategies for growth management plan, a fundamental principle of coastal mitigation planning. The plan recognizes natural hazards as a constraint to growth.

- Beaufort County's vulnerability to hazards is acknowledged throughout the plan, and hurricanes appear as the area's most devastating, regularly occurring natural hazards

- The Existing Land Use Element identifies Resource Conservation Zoning Districts and Overlay Districts. These districts regulate development in flood hazard areas. The Resource Conservation Zoning District protects and conserves sensitive environmental areas, maintains Open Space, and discourages growth in areas which "pose undue hazards to man." The element calls for lower densities within rural and critical areas.

- The Future Land Use Element stresses preservation of certain area-wide resources. It calls for infill development in the main urban centers. **This could be expanded to include property preservation by calling on development to take place only in areas that are less prone to hazards.**

- The Cultural Resources Element identifies the need to protect the County's valuable resources. **The plan could be strengthened by recommending a disaster preparedness plan to preserve the resources.**

- The Natural Resources Element identifies mainland geology, sea-level changes, erosion and accretion, and drainage issues. It identifies the need for preparation for sea-level rise in the coming decades. It also recognizes the hazard Beaufort County faces, especially hurricanes and flooding. **This plan could be strengthened by recommending strict building regulations to avoid loss in hazard prone areas.**

- The Regulatory framework section references the relationship to OCRM regulations and development.

- The Community Facilities section identifies the Emergency Management Department. It suggests a regional evacuation plan with agreements for cooperation from the surrounding counties; protecting the major evacuation routes, and to continue coordination efforts to ensure maximum efficiency in evacuations. **This section could be**

expanded to include mitigation by, for example, suggesting that new and/or expanded community facilities take hazard protection into their siting decisions (e.g., schools, wastewater, and cultural facilities). Could be expanded to identify existing critical facilities important to protect from disasters in order to preserve a minimum response capability.

Zoning & Development Standards

- ZDSO is the tool to achieve the objectives of the Comprehensive Plan. ZDSO addresses setbacks, buffers, wetland and natural resources protection, and drainage.

- Identifies flood control design criteria for retention/detention ponds; collector, local streets and closed drainage systems; roadside swales; canals and major ditches; and bridges.

Stormwater BMP Manual, 3/98

- Identifies existing federal, state and county regulations.

- Most of document recommends policies and standards for new and existing development. County aggressively pursues protection of water quality.

- Water quality and bacteria data is gathered under this plan.

Hurricane Response & Recovery Guide

- The Damage Assessment Emergency Support Function (ESF) identifies pre-disaster Preparedness and Mitigation actions. Procedures regarding "substantially damaged" structures are in the post-disaster assessment procedures of the Building Code. These procedures are important because when buildings are "substantially damaged" (damaged greater than 50% of their pre-damage value) their repair, reconstruction, or replacement are treated as new construction, requiring compliance with any new codes and standards adopted since the building was constructed. **The county could benefit by hosting pre-disaster training on FEMA's Residential Substantial Damage Estimator (RSDE), a damage assessment software program specifically designed to support decision-making by local building officials when addressing "substantial damage" issues. Using FEMA's RSDE program will qualify NFIP policy-holders for additional payments if their building is substantially damaged, within the mapped 100-year floodplain, and insured under the NFIP.**

Emergency Operations Plan

- The County Hazard Mitigation Plan is appended to this plan. It establishes a Mitigation Committee with listed responsibilities, and describes Pre- and Post-disaster actions.

- Attachment A to Appendix H describes 6 continuing mitigation projects; the Storm Water Utility Comprehensive Development Plan, The NFIP/CRS, The Land Purchase Project, the Flood Alert Program, the Drainage Program, and Mitigation Education. The Storm Water Utility regulates density and land-use, and establishes goals for future

transportation requirements and road development. The land Purchase Project is a mechanism to preserve open zones and reduce development. The Flood Alert Program keeps citizens aware of potential flooding situations through cable TV and radio warnings. The Drainage Program is designed to eliminate existing drainage problems and provide drainage where it is nonexistent. The Mitigation Education Project is a combined effort between the County Building Codes and Emergency Management Departments to teach citizens about potential hazards in order to reduce potential damage.

Other

- The County pursues Open Space preservation through its ZDSO, and a Rural and Critical Land Preservation Program. The R&CLP Program is a voluntary Program which provides the means for private landowners to permanently preserve or maintain the rural character of their land. The main goal of the Program is to preserve open space, protect critical and natural resources and preserve rural uses. Funds available for the Program can be leveraged with federal, state, local, or private conservation efforts and development rights purchase funds to protect property and purchase development rights.

- County promotes sustainability and Growth Management principles and programs through their Comprehensive Plan. The Plan specifically identifies the resident's vision for their future as integrating new development into the County in a way that will protect County values that include: protecting water quality, environmental quality, the scenic landscape of the rural communities and towns, the stability of the communities by retention of land by the residents, and their diversity in terms of age, income and race. A central theme of the Comprehensive Plan is to engender quality development that respects the local values and protects the residents from becoming Anywhere, USA. It is a Public Policy Goal of Beaufort County to "define and perpetuate the ethic of quality growth."

City of Beaufort:

Comprehensive Plan, 2009 revision

- The basic purpose of the land use plan is to provide direction for managing anticipated growth and change. Growth in the City however, has been slow compared to other parts of the County. There has been very little growth within the City limits in the last thirty years, as the population has increased a relatively low rate.

- The plan's Natural Resources Element identifies several critical geologic features. First, there are basically two types of soils: soils generally associated with the locations of wetland areas, and soils associate with areas of stable ground. The wetland areas are rarely suitable for any type of development. Second, the highest elevations in the city are approximately 20 feet above MSL.

- The climate section describes the potential for devastating hurricanes, citing 60 tropical cyclones that passed within 75 nautical miles of the County's barrier islands from 1886-1993. According to the plan, hurricane force storms are expected approximately every 11 years.

- Beaufort's main water supply comes by pipe from the Savannah River. The City's back-up supply comes from wells that tap the Florida Aquifer. The plan states that the aquifer will not be a reliable source in the future due to overuse.

- The document discusses river corridors and floodplains**. This document could be improved with a quality map and discussion of the NFIP development regulations in connection with the map. This would create a nexus between existing and proposed development and the hazards associated with floodplains, and the benefits of river corridors.**

- Historic resources are described in depth in a separate element. The proposed policies promote the renovation and preservation of the Historic District and buildings. In addition, there is a Historic Preservationist working in the County, and the Beaufort Preservation Manual, and Supplement, have been developed to assist owners of historic structures. Also, included as recommendations of this Hazard Mitigation Plan, is the development of specific guidance to assist owners with damage assessment and repair and reconstruction in a post-disaster situation.

- The Housing Element describes how single family housing represents the largest percentage of buildings in the County, and points out that this is somewhat skewed by the resort development of multi-family housing in other areas of the county. Additionally, the plan states that there continues to be a significant surge in housing development with most of it occurring along the waterfront and marshland. **The housing element could be improved by creating a nexus between the proposed housing goals and the maintenance and creation of safe, disaster resistant housing.**

- The Facilities Element speaks to transportation (roads, bridges, bicycle paths), water and wastewater treatment, police and fire, health and medical facilities, parks and recreation, and public education (schools and libraries). The Fire Department maintains an ISO (Insurance Services Organization) Class 2 for fire, and 3 for codes enforcement. These ISO classes are the same type of rating system that ISO applies to the CRS program of the NFIP. The ratings range from 1 to 10; the lower the rating, the better the measurement of community performance (and the lower the rate applied towards that component of insurance cost). Thus, the City does a commendable job in maintaining its capability for fire defense and code enforcement. **The Facilities Element could be improved by including a list of critical community facilities and describing the need for protection of these facilities.**

- The Land Use Element provides a 20-year concept for future land use, and it strives to inventory future development. It defines future densities, **but this could be improved**

by creating a connection between the future development densities and the developable soils (and thus the reduction of potential storm and flood damage).

- The Land Use strategies propose establishing criteria for a redevelopment policy within the city, aimed at historic structures and the Board of Architectural Review. **This could be strengthened by establishing and adopting redevelopment policies and procedures for post-disaster redevelopment, regardless of where it is located.**

- Modifications to the existing Zoning Ordinance are made, with particular reference to adopting a Tree Preservation Ordinance. **By including a "maintenance" provision in the proposed ordinance, the City would help to reduce the exposure to the high degree of damage and power losses created by breaking, falling, and uprooted trees during severe storms. A maintenance provision would ensure that trimming tree limbs away from power lines would take place on a routine basis, thus eliminating a major factor in incurring power losses. Such a provision can also strengthen the concept keeping new plantings a set distance away from power lines, and only planting vegetation with root systems appropriate to the local environment.**

- The Short-term Work Program in the Implementation Section recommends preparation of a Coastal Zone Management Plan as well as the preparation and implementation of a Stormwater Drainage Plan including the feasibility of developing a Stormwater Utility. **Storm damage reduction and property protection are additional benefits of these plans that should be mentioned. Drainage plans not only address existing drainage problems, but also establish standards for new development so as not to exacerbate the existing problem any further, thus reducing damage to infrastructure and property. Stormwater Utilities can provide a dedicated ongoing source of funding that can pay for maintenance, new construction, and public education.**

Unified Development Ordinance, 2006

- The document includes all of the City Ordinances. **The Floodplain Management Ordinance (Flood Damage Prevention Ordinance) required for participation in the NFIP should be included.**

- The Ordinance cites the Mobile Home District. However, the Building Code is where tie-downs, special foundation requirements, or on-site sheltering requirements are cited.

- Article six defines the Historic District that is bordered on 3 sides by water. **A reconstruction/redevelopment standard should be considered. This standard would reinforce that any post-disaster reconstruction, as well as normal redevelopment/rehabilitation must adhere to all other standards for historic preservation as well.**

- Article 7 Deals with nonresidential signs. **This section could be strengthened because it dictates the size and types of signs that can be erected and signs suffer and cause significant damage during windstorms. By restricting large, flat signs, and canopies, such as those frequently found at fueling service stations, certain frequent damages can be reduced. Additionally, collateral damage is often caused by flying debris in severe wind storms, so it is important to dictate how to securely attach signs that are permitted.** (Building Code contains requirements for fastening/ attachments.)

- The UDO references non-conforming buildings or uses. Zoning regulations require structures damaged greater than 50% of their pre-damage appraisal be removed and replaced with confirming buildings and uses.

- Article 3 requires drainage facilities as part of the review criteria for subdivision of land.

- The UDO requires underground utilities in new developments.

- Section 7.20 allows for emergency removal of storm-damaged trees (and allows trimming around utility lines, and sometimes requires trees to be replaced). **Consideration should be given to requiring native species within Article H, Landscaping and Tree Conservation.**
-
- Regarding "Development Standard" (for the Beaufort Historical District)**, reconstruction/redevelopment standard should be considered.**

- Appendix A: Preliminary reviews of subdivisions require that floodplains, and any other conditions affecting the site, be identified.

- Appendix A requires that the location of existing culverts and drainage pipes be identified.

- Appendix A allows the Planning Commission to require a topographic map at an interval deemed necessary by the Commission, if conditions peculiar to the site warrant special consideration.

- Appendix A outlines requirements for final approval for subdivision of land. **This would be an opportunity for Emergency Management/Fire Department to conduct a preliminary review for access/egress and evacuation considerations. Many communities lament that Emergency Management is not involved in the Development process until after-the-fact.**

Appendix A outlines Required Street Improvements, drainage requirements and encourages the use of the most up-to-date and innovative drainage techniques.

Town of Bluffton:

Comprehensive Plan, 2007:

- Since 1998, the town limits of Bluffton have increased from one square mile to approximately 54.24 square miles.

- In the Natural Resources Element, floodplains and floodways are defined and addressed as areas where development and variances to floodplain development should be prohibited.

- The plan identifies and acknowledges the vast amount of wetlands within the Town and surrounding areas and the need to protect those systems.

- The Town requires all development to comply with the latest version of the their Stormwater Ordinance and Best Management Practices.

- The plan recommends review of ordinances and practices to ensure compliance with FEMA and National Flood Insurance programs.

- Water quality protection for the all watersheds is a priority with the Town of Bluffton with immediate attention being dedicated to the May River. The Town is currently developing the May River Action Plan to ensure a sustainable and protected watershed is maintained both now and in the future.

- Scenic River status for the New and May Rivers is recommended.

- The plan recommends reducing parking requirements, street widths, and driveway widths or imposing a maximum impervious surface percentage to help control increased surface runoff.

- Retaining or installing natural buffers along waterways and wetlands is recommended to reduce the potential for pollution from surface runoff.

- Open ditches and grass-lined swales are preferred to concrete lined or piped drainage ways and the plan states that the maintenance of such needs to be routine. Additionally, it notes that care must be taken to balance the designs to move stormwater quickly from potential flood locations while preserving water quality.

- **Plan states that the Old Town's drainage system needs to be upgraded.**

- Through development agreements, all new development in the Town's newly annexed areas will have proper supporting infrastructure i.e. BJSWA (water and sewer – no septic systems), stormwater BMPs, and roadways that meet County and SCDOT standards.

Zoning Ordinance

- The zoning ordinance includes a River Protection Overlay District with buffers and setbacks depending on use and distance from critical line.

- The Density Bonus Ordinance encourages sustainable development and protection of wetlands, trees, and floodplains.

- Revision to the tree ordinance is underway and recognizes the crucial role of trees in reducing stormwater impacts. **Consideration should be given to tree maintenance (trimming) and "native" vegetation, in order to reduce storm damage from falling trees and branches interrupting power.**

- Historic District Standards apply for Bluffton Conservation Neighborhood and the Bluffton Preservation Sub-District that are located within the Town's original one-square mile area.

- Non-conforming buildings or uses with damage greater than 50% of the pre-damaged appraisal must be removed and replaced with conforming buildings and uses. An example might be a commercial establishment (e.g., a home-based hairdresser, or corner convenient store) that has been *grand-fathered* into what is now a residential neighborhood. However, a pre-FIRM building within the 100-year mapped floodplain that is *substantially damaged* becomes nonconforming when that level of damage is incurred. Such a residential structure can be elevated in lieu of being removed (relocated). Such a commercial structure could be elevated or flood-proofed.

- Non-conforming buildings or uses must implement conforming practices i.e. landscaping, stormwater retention, open space, as a condition of approval for redevelopment. Redevelopment is the term applied towards substantially improving existing buildings for reasons other than the repair of significant damage.

Stormwater BMP Manual, 2007.

- The Town is currently represented on the Stormwater Utility Advisory Board.

- The manual compiles federal, state, and Town regulations into one document thereby simplifying the process of stormwater treatment and mitigation.

- The stormwater ordinace is currently under revision to add additional measures to ensure post-=development surface runoff volume is the same as predevelopment surface runoff volume.

Unified Development Ordinance

- Unified Development Ordinance undergoing comprehensive overhaul to address form-based land use management techniques within a watershed framework
- The subdivision standards were adopted in June 2001.
- The subdivision review application requires identification of floodplains, topography, wetland, waterways, trees, drainage ditches, etc.
- Subdivision plans must be approved by each of the following entities: the County Engineer, the Town Engineer, the Fire Marshall, SCDOT, BJWSA, EMS Addressing, and other utilities.
- Conservation and Flood Hazard Districts are defined with special standards applied in conjunction with NFIP.
- Development and building permits are valid for one year.

Town of Hilton Head Island:

Comprehensive Plan, 2009

- The Comprehensive Plan includes the Beaufort County Multi-jurisdictional Hazard Mitigation Plan as an Appendix.. Additional Appendices include:
    - Post-Disaster Recovery & Mitigation Plan
    - Beach Management Plan
    - Islandwide Drainage Study, and the
    - Fire and Rescue Master Plan
- The process of conducting the state mandated Comprehensive Plan update fulfilled the Town's Community Rating System (CRS) planning requirements by updating this Hazard Mitigation Plan.
- The Natural Resources Element identifies and assesses coastal resources, wetlands, floodplains, and soils among other concerns.
- The Community Facilities Element includes an analysis of stormwater management, and Fire Protection and Emergency Medical Services.
- Hazard Mitigation is promoted to minimize the vulnerability of Town infrastructure and public facilities to storm damage by including the Beaufort Multi-jurisdictional Hazard Mitigation Plan as an integral part of the Town Comprehensive Plan.

- The Land-Use Element includes a future land-use map, and includes redevelopment strategies and policies that address pre- and post-disaster issues. The strategies are within the Town's Land Management ordinance (LMO).

- The Land-Use Element includes the consideration of land purchases in areas of the Island that are vulnerable to severe storms and flooding and would be prime areas for future development.

- Implementation of the Islandwide Drainage Study is identified as a critical activity, and its continued implementation is vital to the Island.

- The Natural Resources Element identifies 56 percent of the Island surface as having soils that are poorly drained, and though Hurricanes pose a catastrophic threat, the limited drainage capacity of the soils, the lack of connected wetlands, and poorly maintained rural ditches cause sustained periods of rain to be the foremost threat of flooding.

- The Town supports the use of Best Management Practices including innovative nonstructural and structural technology for the prevention and control of urban runoff.

- The Town promotes the protection of water quality, and combines those techniques to lessen drainage and flooding problems where appropriate.

- Sustainability and Growth Management are planning principles woven throughout the Comprehensive Plan.

- Maintenance of the ocean beachfront is described as a balance between tourism and the island's sensitive environment.

Beaufort County Hazard Mitigation Plan

- The Beaufort Multi-jurisdictional Hazard Mitigation Plan is an Element of the Comprehensive Plan.

- The Town is in the top 4% of communities nationwide that manage their floodplains well and exceed minimum NFIP requirements through the CRS program.

- The Town has a Public Information Program and an annual Flood Awareness Week

- The Town has more than 30,000 NFIP policies

- The Town has taken a proactive approach to Flood Hazard Mitigation. They developed a disaster Recovery and Mitigation Plan in 1991 following the devastation Hurricane Hugo created in South Carolina. This was one of the first Recovery Plans in the nation, and the first that defined "re-entry" following an evacuation as the beginning of Recovery. In 1995, the Town recognized that while they are extremely vulnerable to hurricanes, their

foremost problem with flooding was due to inadequate drainage and the more normal rainstorms typical to coastal South Carolina. This led to the development of the Town *Island-Wide Drainage Study*, which continues to be updated. Then, in 1999, the Town of Hilton Head Island developed their *Flood Hazard Mitigation Plan.* This was one of the first mitigation plans in the nation to be officially incorporated it with the Town *Comprehensive Plan* – a concept now embraced by the American Planning Association (APA) through their *Planning Advisory Series*, and FEMA, through the DMA regulations. The Town continues to enforce and update their plan, when necessary, and takes a proactive approach to flood mitigation.

- The Town is susceptible to drainage system flooding, coastal erosion, and Tropical Storms and Hurricanes. Wind hazards present additional concerns.

- The highest priority flood mitigation issue is the coordination of new development with drainage improvements and stormwater management. This is followed by the protection of critical facilities, with an emphasis on water supply and wastewater treatment facilities.

- The Town pursues a variety of flood mitigation activities, including:
    - Preventative Measures
        - Open Space Preservation
        - Storm Water Management
    - Property Protection Measures
        - Building Elevation
        - Floodproofing
        - Flood Insurance
    - Natural Resources Protection
    - Structural Protection
        - Beach Nourishment
        - Sand Fencing
        - Drainage Improvements
    - Emergency Services

Island Wide Drainage Study, August 30, 1995

- Comprehensive study inventoried existing drainage facilities, determined major drainage paths, identified bottlenecks, and recommended prioritized improvements.

- Primary drainage problems within the Town include the changing drainage design standards over time while the island was being developed, separate systems not planned with an island-wide perspective, lack of maintenance of stormwater management facilities, and the low and flat topographic nature of the island.

- The study notes that the island is incapable of handling storm surge from Atlantic Ocean.

- Cleaning, dredging and maintaining the existing drainage system is the foremost priority.
- The study recommends that lagoon and ditch levels be lowered prior to major storm events.
- The study recommends that future construction require finished floor elevations to be 1 foot higher than existing lot topography and adjacent roadways.
- The study makes recommendations for improvements totaling $17.5 million, many of which have been completed.
- The drainage study is continually updated, and the staff looks for improvements and recommendations on a regular basis.

Floodplain Management and Land Management Ordinance

Floodplain Management and Development policies and procedures are in good order and contribute to Hilton Head Island's commendable CRS rating of 6, which provides a 20% reduction in the cost of flood insurance to the more than 30,000 policyholders. This represents an approximate annual savings of $1.75 million.

OTHER:

- There are over 30,000 NFIP policies in force on HHI
- The 1999 Flood Hazard Mitigation Plan calculated damages to structures from the 100 year flood would be approximately $680 million. If HHI was not an active participant in the NFIP, it estimates that the damage would have been $1.66 billion.
- HHI has an established beach renourishment program, funded by a local accommodation tax, which excavates sand from offshore shoals and places it onto retreating beaches every 5-7 years.
- HHI has an extensive Sand Fencing Project, aimed at preserving existing and enhancing new dunes, where they have placed over 40,000 linear feet of fencing and indigenous vegetation.
- HHI has adopted all ICC codes in full, and enforces these codes stringently.

Town of Port Royal:

Comprehensive Plan (update nearly complete in 2009)

- The vision of Port Royal is to become the choice place to live and do business when considering small, unique, and ***safe*** coastal communities and neighborhoods.

- The Town strives for continuous improvement, orderly and planned growth, and Historic Preservation.

- The Natural Resources Element strives to ensure harmony between the natural and manmade environment.
    - The barrier islands that surround the Town provide some natural protection from severe weather events.
    - The highest points in Town are 20 feet above sea level.
    - The Town has two types of predominant soils, eighty-five (85) percent of which can be used for development as it can accommodate septic systems. Fifteen (15) percent cannot support development.

- Within the Natural Resources Element, the following are identified as implementation strategies:
    - Implement a program to bury overhead utility lines and require new utility lines be placed underground
    - Strengthen and enforce tree preservation ordinances
    - Encourage the use of indigenous plants
    - Designate areas for uses compatible with their natural functions and their potential for recreational and economic activities
    - Recognize and protect wetlands for their capacity to filter pollutants and control flooding and erosion
    - Employ wetland buffers and storm water Best Management Practices to reduce contamination into marshes
    - Budget to acquire undeveloped land that are set aside to remain in their natural state (greenways)
    - Minimize impervious surface roadways to reduce storm water runoff
    - Design storm water drainage systems to mimic the path of runoff in natural systems
    - Discourage the trading or filling of wetlands by developers
    - Develop programs to promote natural resources education, appreciation, and appropriate recreational use
    - Create a River Overlay District

Comprehensive Plan could be improved simply by making mention that each of the above strategies relates to, and contributes to natural hazard mitigation or loss prevention.

- The Cultural Resources Element seeks to preserve and enhance the Town's historical integrity.
    - The Element details the 1893 hurricane that was responsible for "the loss of thousands of lives in Port Royal and the surrounding vicinity."
    - A survey is described that identified 1,506 historical sites within 1320 properties . A County survey identifies 1488 sites, 1121 of which are residences. These figures substantiate the enormous percentage of Port Royal that is culturally significant and worthy of special care and protection.)

- The Community Facilities Element cites the new Russell Bell Bridge as the replacement for an old drawbridge that was damaged extensively in Hurricane Hugo.

- The Land Use Element identifies the FH (Flood Hazard) Zoning District (which is delineated by the community's NFIP map)

Plan could be enhanced by adding and describing how the Floodplain Management Ordinance/Flood Hazard Zoning District prevents future flood damages.

Building Regulations

- The Town uses the current IBC and International Mechanical, Fire, Fuel Gas, and Residential Codes. The Town also uses the current National Electric Code.

Town Code

- Chapter 9 of Port Royal Code is the Flood Damage Prevention Ordinance (standard). Section 9-73 requires that the Town Manager review and approve subdivision proposals and new developments to assure that:
    - They are consistent with the need to minimize flood damage,
    - Public utilities and facilities are located and constructed to minimize or eliminate flood damage,
    - Adequate drainage is provided to reduce exposure to flood hazards, and
    - All proposals include flood elevation data.

- Chapter 17.5 contains the Subdivision Regulations
    - Section 17.5.62 defines the Design Standards
    - Section 17.5.67 defines the Drainage System requirements
    - Section 17.5.68 defines the Flood Hazard Area requirements

- Chapter 22 contains the Zoning Ordinance of the Town of Port Royal, South Carolina
    - Section 22-73 defines the MH (Mobile Home) District, where subsection *(h)* (1) requires MH Parks be located on a well drained site
    - Section 22-77 defines the FH (Flood Hazard) District

The Local Government Capability Matrix

In addition to the assessment of community policies, regulations and plans, the Planning Team also reviewed a matrix as a way of taking inventory of additional mitigation capabilities in each community. The intent of this effort was to see if there were any similarities or gaps in community programs and tools that might indicate where some improvements could be made.

There were a some key improvements that have been made since the last plan

- Jurisdictions have taken steps to protect their critical facilities as fund as become available. While not all jurisdictions have a formalized facilities protection plan outside of the hazard mitigation plan, all new construction has been built to mitigate loss, and existing buildings have in some cases been retrofitted.
- Bluffton has clarified its role in participating in the NFIP, and now fully participates.

The matrix and the key to the matrix labels are located on the following pages. There are boxes that are shaded yellow, and others that are red. The yellow boxes highlight an opportunity to make an improvement, such as:

- Moving forward with incorporating the Hazard Mitigation Plan into all comprehensive plans should be a priority. However, all jurisdictions have expressed the desire to put the Hazard Mitigation Plan into their plan, and all plans have elements of hazard mitigation in them. Hilton Head Island is currently updating their plan together with the hazard mitigation plan, and other jurisdictions (such as the County, City of Beaufort and Port Royal) which are updating their plans currently are doing so in conjunction with the update of this hazard mitigation plan and intend to include it as a part of the plans.

- Port Royal should consider joining the CRS program. The data indicates that Port Royal has 709 buildings within the 100-year floodplain, and only 181 flood insurance policies in force (25%). Interestingly, the Planning Team determined that many of the 709 are military facilities and wouldn't be insured under the NFIP. However, the fact remains that 75% of the floodprone structures are uninsured against flood damages. The public, and the military, should be informed of the community's flood vulnerability and the availability of flood insurance. Additionally, if insurance coverage and the number of policies in the community do increase, the Town should then consider joining the CRS program (because there would be a large enough policy base to make it cost effective). Community participation in the CRS program decreases the cost of flood insurance for all policyholders in the community.

- Monitoring the reduction of the number of Repetitive Losses on Hilton Head Island. There are 27 repetitive losses within the Town of Hilton Head Island. At first glance, this is a high concentration of repetitive losses. At second glance, it is only a little more than 1/10 of 1% of the total number of policyholders on the Island. The Planning Team knows that there is a drainage project underway that is intended to address the cause of these repetitive losses. Thus, this issue is worth noting as one to monitor, but it does not warrant being tagged a "red flag."

The red boxes highlight issues that should generate a higher level of concern, and thus warrant further investigation. For example, the red highlighted boxes indicate:

- That no incorporated municipality has undertaken any special efforts to create a water supply plan. This could easily be a mitigation priority.

Table 4-2. Capability Matrix

	Unincorporated Beaufort County	Beaufort City	Bluffton	Hilton Head	Port Royal
Comp Plan	Y	Y	Y	Y	Y
- with HM?		Y		Y	
Land Use Plan	Y	Y	Y	Y	Y
Subdivision Ord	Y	Y	Y	Y	Y
Zoning Ord	Y	Y	Y	Y	Y
BFM Plan	Y			Y	
HM Plan	Y			Y	
FPM Ord	Y	Y	Y	Y	Y
- Sub.Damage?	Y	Y	Y	Y	Y
- Administrator?	Y	Y	Y	Y	Y
- # of FP Bldgs?	7,667	1,254	42	9,149	709
- # of policies	12,347	1,106	264	29,515	181
- # of RL's?	0	2		27	0
CRS Rating	8	8		6	
Stormwater Program	Y	BMP	Y	Y	BMP
Building Code	Y	Y	C	Y	Y
Building Official.	Y	Y	C	Y	Y
- Inspections?	Y	Y	C	Y	Y
BCEGS Rating	4	6	4C	3	6
LEOP?	Y	C	C	C	C
Warning-sirens?	Y	Y	Y	Y	Y
- NOAA W.Radio?	Y	Y	Y	Y	Y
- Cable Override?	Y	Y	Y	Y	Y
- Reverse 911?					
- Lead Time	72 hours Parris Island and MCAS have own sirens				
Structural Projects	Bulkhead Permits at Cherry Pt			Y	Y
Property Protection	Stmwtr Util &	Detention/ Retention		Y	Y
Crit.Fac.Protection				Y	

	Unincorporated Beaufort County	Beaufort City	Bluffton	Hilton Head	Port Royal
Water supply plan	Y	BJWSA	BJWSA	PSD	BJWSA
Nat/Cult Res. Inv.	Y	Y	Y	Y	Y
Erosion Control	Y	C	C	Y	Y
Sediment Control	Y	C	C	Y	Y
Pub. Info Prgrm	Y	Y	Y	Y	Y
Env. Ed Prgrm	Y	N	Y	Y	N

EXPLANATION OF CAPABILITY ASSESSMENT MATRIX

Comp Plan: Does your community have a Comprehensive Long-Term Community Growth Plan?

Land Use Plan: Does your community have a plan that designates type of Land Use desired/required?

Subdivision Ordinance: Does your community have an ordinance that dictates lot sizes, density, setbacks, construction type, etc?

Zoning Ordinance: Does your community have an ordinance that dictates type of Use and Occupancy in certain areas?

BFM Plan: Does your community have a Beachfront Management Plan, as required by SC-DHEC

HM Plan: Does your community have an existing stand-alone Hazard Mitigation Plan?

FPM Ord: Does your community have a Floodplain Management Ordinance: Directs development in identified Flood Hazard Areas.

Sub. Damage: Does your FPM Ordinance contain language on Substantial Damage/Improvements?

Administrator: Does your community have a Floodplain Administrator (someone responsible for enforcing the ordinance)?

# of FP Bldgs: How many buildings are in the floodplain in your community?

# of policies? How many buildings in the floodplain are insured against flood through the NFIP?

# of RL's: How many NFIP Repetitive Losses are in your community? (Paid > $1,000, twice in the past 10 years)

CRS Rating: Are you in the Community Rating System of the NFIP, and if so, what's your rating?

Stormwater Prgram: Does your community have a Stormwater Management program?

Building Official: Does your community have a Building Official?

Inspections: Does your community conduct building inspections during and after completion of the development process?

BCEGS: Building Code Effectiveness Grading System Rating

LEOP: Does your community have a Local Emergency Operations Plan (a disaster RESPONSE plan)?

Warning: Do you have any type of system, such as:
Sirens? NOAA Weather Radio reception? Cable (TV) Override? "Reverse 911"? How much "lead time" is provided?

Structural Protection Projects: (levees, drainage facilities, detention/retention basins)

Property Protection Projects: (buy-outs, elevation of structures, floodproofing, small "residential" levees or berms/floodwalls)

Critical Facility Protection: (for example, protection of power substations, sewage lift stations, water-supply sources, the EOC, police/fire stations. medical facilities ... that are at risk ... e.g., in the floodplain)

Natural And Cultural Inventory: Do you have an inventory of resources, maps, or special regulations within the community? (Wetlands and historic structures/districts, etc.)

Erosion Or Sediment Control: Do you have any projects or regulations in place?

Public Information And/Or Environmental Education Program: Do you have an ongoing program even if its primary focus is not hazards? Examples would be "regular" flyers included in city utility billings, a website, or an environmental education program for kids in conjunction with Parks & Recreation?)

There are some regional capabilities that should also be considered, and an additional layer of regulations at the State and Federal Level enhance these local capabilities. The Planning Team looked also reviewed the following:

State Plans and Regulations

The South Carolina Emergency Management Division (SCEMD) publishes an annual *South Carolina Hurricane Plan* which includes a listing of hurricane shelters for various regions in the state including the Southern Coastal Conglomerate, of which Beaufort County is a part. While there are some shelters within Beaufort County, they do not open for storms that are greater than a Category 1 Hurricane. However, there are several shelters in adjacent counties within the conglomerate that are meant for use by Beaufort County residents. These include schools and community centers in the adjacent counties of Colleton, Hampton, and Jasper (as well as southern counties located further inland in Aiken, Allendale, Bamberg and Barnwell Counties). Some of these shelters are opened only for mandatory evacuations as ordered by the Governor, others are opened for both mandatory and voluntary evacuations, and a third group of reserve shelters are opened as determined necessary by local officials. A list of these shelters in adjacent counties is provided as Table 4-3.

Table 4-3. Regional Hurricane Shelters in Adjacent Counties

Colleton County Shelters		
Shelter	**Address**	**Type**
Northside Elementary	1929 Industrial Blvd Walterboro, SC 29488	V
Colleton High School	1379 Mighty Cougar Drive Walterboro, SC 29488	M
Contact: Suzanne Gant, Emergency Prep Director Phone: 843-549-5632		

Jasper County Shelters		
Shelter	**Address**	**Type**
Jasper County High School*	US Highway 278 West Ridgeland, SC 29936	V
Ridgeland Elem. School	Bees Creek Road Ridgeland, SC 29936	M
Ridgeland Middle School	Bees Creek Road Ridgeland, SC 29936	M
Coosawhatchie Community Center	SC Highway 462 West Coosawhatchie, SC 29940	R
Robertville Community Center	US Highway 321 Robertville, SC 29922	R
Contact: Wilbur Daley, Disaster Prep Director Phone: 843-726-7797		

Hampton County Shelters		
Shelter	**Address**	**Type**
Varnville Elementary	395 Pine Street, East Varnville, SC 29944	V
Wade Hampton High School*	115 Airport Rd. Hampton, SC 29944	V
Hampton Elementary	705 South Hoover Street Hampton, SC 29924	M
Estill High School	1450 Columbia Hwy North Estill, SC 29918	M
North District School	507 Tillman Avenue Varnville, SC 29944	R
Ben Hazel Primary School	628 West Railroad Ave. Hampton, SC 29924	R
Estill Middle School	555 West Third Street Estill, SC 29918	R
Estill Elementary	318 Fourth Street, East Estill, SC 29918	R
Contact: Suzanne Peeples, Disaster Prep Coordinator Phone: 803-943-7522		

*These shelters are also special medical needs shelters. In Colleton County, the Colleton Medical Center in Walterboro serves as a special medical needs shelter.

Although these shelters are available for use by Beaufort County residents, many residents are not aware of their existence and their function during disaster situations. **Beaufort County citizens should be better informed about the existence and locations of the shelters and the fact that they are available for their use.**

The South Carolina Local Government Comprehensive Planning Enabling Act of 1994 gave local governments (counties and incorporated towns/cities) five years to bring their planning programs and regulatory ordinances into compliance. The Act repealed existing planning legislation as of May 4, 1999, requiring that a Comprehensive Plan be used as a tool for guiding future development. The Act consolidates existing planning legislation for local governments into one law and defines a set of requirements that must be met for the planning activities of a local government to be legal. In particular, the Act describes required comprehensive plan elements; defines the roles of the town council, planning commission, and zoning board of adjustment; and outlines the public review process and procedures for adopting comprehensive plans and land use ordinances.

South Carolina Department of Health and Environmental Control (SC-DHEC)
Ocean and Coastal Resource Management (OCRM)

- ***The Coastal Tidelands and Wetlands Act*** (1977) was amended in 1993, creating the South Carolina Coastal Zone Management Act.

- ***The South Carolina Coastal Zone Management Act***, which merged the South Carolina Coastal Council with DHEC, creating OCRM whose general purpose is to:
    - Protect the coastal environment, and
    - Promote economic and social improvement of the Coastal Zone
    - It identifies "Critical Areas" as coastal waters, tidelands, dune systems, and the beach, and gives DHEC permitting authority in those areas.
    - Identifies salt/brackish marshes as protecting highlands from erosion and storm damage

- ***The Beachfront Management Act*** (BFMA, 1988) establishes authority to address erosion hazards due to persistent sea level rise, a lack of comprehensive beach management planning, and poorly planed coastal development. The BFMA establishes "retreat" as the basic approach to beachfront management, rejecting "armoring" and including beach nourishment as a mechanism to assist in retreat.

  The basic policy is one of a 40-year retreat, and establishes a Baseline and Setback on all oceanfront properties. The Baseline is the crest of the primary dune (or where it *would have been*). The Setback is 40 times the annual rate of erosion, but always at least 20 feet.

  The BFMA also establishes rules for rebuilding structures, seawalls and bulkheads. Structures (including swimming pools) cannot be repaired or replaced if they are destroyed, or damaged greater than 66.67% of their replacement cost. Seawalls and bulkheads cannot be repaired or replaced if they are destroyed, or damaged greater than 66.67% of their (above grade) replacement cost between July 1, 1995 and June 30, 2005. Beginning July 1, 2005, seawalls and bulkheads cannot be repaired or replaced if they are destroyed, or damaged greater than 50%.

Federal Regulations

- ***The National Flood Insurance Program (NFIP)***: Established in 1968, the NFIP provides flood insurance in communities that agree to regulate new development in identified Special Flood Hazard Areas through the adoption and enforcement of a minimum Flood Damage Prevention Ordinance. It also requires, as a condition of every federally backed mortgage within an identified Special Flood Hazard Area, to require the purchase and maintenance of a flood insurance policy for the life of the loan.

- ***The Coastal Barrier Resources Act (CoBRA)***: Established in 1972, the CoBRA is environmental legislation administered by the Fish & Wildlife Service. It provides for the identification and protection of Coastal Barrier Resources. It prohibits the availability of federally backed assistance within identified areas, including grants, loans, mortgages and flood insurance.

- ***Coastal Zone Management Act (CZMA):*** Established in 1972, and amended by the Coastal Zone Protection Act of 1996, the CZMA defines a national interest in the effective management, beneficial use, protection and development of the Coastal Zone and identified the urgent need to protect this natural system from these competing interests. The Act encourages states to exercise their full authority over the lands and waters of the Coastal Zone. Annual cost-share grants to states creates an incentive to establish land-use and environmental protection standards that have served to reduce damage from coastal storms, as well as achieve its other multi-objective goals.

5. Mitigation Goals and Objectives

Introduction

This section of the Beaufort County Hazard Mitigation Plan describes the goals and objectives established by the Hazard Mitigation Planning Committee, and the completed and anticipated actions for implementation and maintenance of this plan in an ongoing effort to achieve these goals.

Goals and Objectives for the Mitigation Plan

The Beaufort County Hazard Mitigation Planning Committee has established a number of goals and objectives to guide its work in the development of this plan. The goals and objectives help to focus the efforts of the group in the mitigation planning effort to achieve an end result that matches the unique needs, capabilities and desires of Beaufort County. Recommendations were evaluated against these goals and objectives by the representatives of the jurisdictions and later by the entire Committee; changes were made as needed.

The goals and objectives selected by the Hazard Mitigation Planning Committee for the planning process are listed below. In the planning approach, the goals are established for the entire County. As this is an update to the original plan, the updated goals are listed here, and have changed slightly from the original goals and objectives. However, the action items that were created in the original goal are addressed in terms of their completeness and as to why any item may have not been completed (table 5.3). The goals were reviewed by the Hazard Mitigation Planning Committee, and it was determined that their ranking remained the same as the original plan. Some language was changed, but the general principles behind each goal was agreed to have remained the same. The goals and objectives are listed below:

1. Improve the protection of critical facilities.

a. Identify at-risk facilities in the 100-year floodplain and within areas subject to Storm Surge inundation.

b. Develop measures to address the risk to vulnerable critical facilities to prevent future damages.

2. Enhance the Hazards Education/Public Information Program

a) Identify & Solicit Low/No cost “Partners” (TV, radio, papers)

- Promote Flood Insurance sales in B/C/X zones through Agents, Realtors & Banks
- Promote Public Awareness of FEMA Regulations
- Continuing Education of Elected Public Officials
- Seismic Safety (Explain the risk)
- Educate Homeowner Inspection staff and homeowners
- Explain Maintenance Responsibilities
- Conduct Building Code Workshops for contractors and other pertinent stakeholders

3. Continue to update all Comprehensive Plan, land use ordinances and other relevant policy documents in a way that supports mitigation activities.

a) Promote appropriate designations:

- Land-use
- Affordable Housing Issues - high and dry land is currently lowest development priority

b) Integrate vulnerability data into the Zoning and Land-use policies

- Note: The floodplain ordinance is already integrated into comp plan, under land-use, by reference

c) Incorporate this all-hazard mitigation plan into the community comprehensive plan and work to integrate mitigation into all community decisions

- Get concept accepted by political body
- Identify appropriate comprehensive plan element(s) or include as an appendix

4. Protect Community Historic Preservation Resources

a) Identify all Historic Resources and utilize the list compiled for historic resources in the County

b) Identify Repair and Reconstruction Rules and Policies where they differ for policies for other types of structures

c) Continue with Pre-disaster Coordination with SHPO and local Historic Preservation groups.

5. Promote Seismic Safety

a) Implement and Enforce Seismic Safety Provisions

6. Continue to Identify Drainage Problems and Work towards their Resolution

a) Ensure the proper maintenance of existing drainage systems and the improvements and/or replacements as necessary

b) Expand the existing drainage system to meet increasing demands

7. Preserve and Protect Natural Resources

a) Much of the county's land area is considered marshlands which should be preserved for water quality and flood water storage purposes through the use of wetland buffers, wetlands protection, and river buffers.

b) Open Space initiatives.

c) Continue the planning and implementation of projects from the Island Wide Drainage Study

8. Continue to Ensure Emergency Response Personnel are Adequately Equipped

a) Focus on pre- and post-disaster coordination and access to important information.

9. Ensure the Communities Continue to be Compliant with NFIP Requirements, that Flood Risk Maps are Accurate and Up to date and that the Flood Maps are used to achieve FEMA mandated compliance within in the special flood hazard area.

a) Work with FEMA to conduct restudies as necessary to ensure that maps are accurate.

b) Continue to include flood development permitting as an important part of building and development permitting.

10. Promote building code enforcement, encouraging all policymakers to adopt the most up-to-date versions of universally accepted codes.

a) Inform state and local lawmakers about the importance of following all newly adopted codes in terms of safety, property values flood insurance for the CRS.

b) Promote building codes (without amendments) to homeowners and homebuilders, demonstrating the added safety measures and cost savings benefits that come with applying the universally accepted building codes to new construction and significant renovations.

c) Encourage property owners to retrofit and renovate homes to meet the current building codes standards as part of continuing maintenance

6. Mitigation Action Plan (and update of previous actions)

Based on the goals and objectives, the hazard Mitigation Planning Committee established several action items that they intend to implement over the next five years. These action items were carefully considered, and they were developed to address the protection of both new and existing buildings and all critical facilities. As the funding and political timing deems implementation appropriate, the actions will be undertaken by the appropriate jurisdiction and department. Particular mitigation actions were considered using methods such as the FEMA STAPLLE method, and all are focused on continued compliance with Federal Programs such as NFIP. Throughout the process there was frequent consultation with the representatives of the jurisdictions to discuss and improve the specific recommendations. When the assessment was completed, the Committee reviewed the results and made further County-wide and individual municipality recommendations that were incorporated.

Explanation of Tables

For clarity's sake, a brief explanation of the mitigation action table should be addressed. There are three tables pertinent for clarification: Table 6.1 was created as a scoring table was created as cost benefit review tool to further prioritize the actions. Based on this table, each mitigation action was given a score and a priority designation of High (a score greater than 20), Medium (a score of 10-19) and Low (a score less than 10).

Table 6.2 is a status report of what happened with all of the proposed mitigation actions from the previous plan. This prioritization is intended to comply with the intent of the NFIP and reflect a cost-benefit review of each action. Any action that is has not been completed or is ongoing is indicated, and it is reflected in table 5.3.

Table 6.3 through Table 6.7 are the most up-to-date list of the goals, actions, prioritization, , approximate time of completion and approximate cost for each jurisdiction. It reflects the work of the HMPC throughout this process, and it gives an idea of where we would like to be in five years. Each action is given a designation of high, medium or low based on the score it received. This enables the Beaufort County Hazard Mitigation Planning Committee to identify which of the established goals and objectives are to be addressed by the proposed action item. By considering the goals when establishing new action items, the Hazard Mitigation Planning Committee focused its efforts on implementing mitigation actions based on the established goals and objectives.

Each of the four jurisdictions has its own table. While some of the actions are similar or the same, it is necessary for each jurisdiction to have its own list of actions to mitigate hazards.

National Floodplain Insurance Program—prioritization and participation

All of the actions that the Hazard Mitigation Planning Committee developed were established and prioritized using several criteria. Primarily, the Hazard Mitigation Planning Committee established the actions based on the National Floodplain Insurance Program; the actions are intended to fulfill the requirements of the NFIP, and the goals and mitigation actions reflect this. All participating jurisdictions are participants in the NFIP and not under any sanctions. Beaufort County and its municipalities participating in this plan have been mapped for flooding. All of the communities in Beaufort County are committed to NFIP's continued success. All of the identified hazards are addressed by an action item, and a significant number of the mitigation actions were formulated in order to reduce loss and damage from flood (See Table 6.4).

The Prioritization Scoring Table (6.2) was developed as a means of prioritization of the action items based on the NFIP. The scoring criteria represent a cost-benefit review and the project's feasibility is reflected from these scores. A score was figured for each mitigation action which was evaluated on the criteria from table 5.2, with the highest score being 27 and the lowest being zero (0). The actions were then prioritized based on the scores.

Table 6.2 was created as a scoring table was created as cost benefit review tool to further prioritize the actions. Based on this table, each mitigation action was given a score and a priority designation of High (a score greater than 20), Medium (a score of 10-19) and Low (a score less than 10).

Addressing Known Risks and Vulnerabilities

The process of selecting actions to mitigate known threats to hazards began with a review of the previous action items and goals, as is mentioned in the Planning Section of this plan. Committee members also consulted personnel from within their respective agency or organization. The resulting list is part wish-list and part a reflection of the threats to Beaufort County. This list is an indication of the problems that Beaufort County needs to address, based on complaints, cost of repairs, and perceived future needs.

As the Beaufort County Hazard Mitigation Plan is reviewed and updated by the Hazard Mitigation Planning Committee, the goals / objective statements are also reviewed to ensure they are still applicable to meeting the unique needs, interests and desires of the community.

Table 6.1, Prioritization Scoring Table

Priority Criterion	Numeric Score 0	1	2	3
Strategy effectiveness	No affect on risk or hazard	Affects several structures within the community	Affects many structures within the community	Affects most structures within the community
Percentage of population benefitted	Less that 10% benefitted	10% to 15% benefitted	50% to 75% benefitted	Greater than 75% benefitted
Time to implement	Cannot be implemented	Long term	Within one year	Immediate
Time to impact	Cannot be implemented	Long term	Within one year	Immediate
Cost to community	Completely unaffordable	Expensive	Inexpensive	Little to no Cost
Funding source	No known Funding source is available	Requires outside Funding	Requires budget consideration	Within existing county budget
Cost to others	Cost to others is unacceptable	Expensive, but manageable	Cost is easily managed by others	No cost to others
community support	Opposed by the entire community	Some community opposition	Acceptable only to those affected by the project	Acceptable community wide
Project feasibility	Not possible	Accomplished with extensive design and planning	Accomplished with some design and planning	Easily accomplished

Benefit-to-Cost Review

A key analytical measure commonly used in vulnerability assessments is the benefit to cost ratio, which expresses the estimated benefits, in dollars, in comparison to the estimated costs to implement and maintain the proposed mitigation initiative. For an action to be considered cost effective, the dollar value of the benefits derived needs to exceed the costs to implement and maintain the initiative, or, in other words, the benefit to cost ratio should be greater than 1.0. The process for calculating a benefit to cost ratio begins with estimating the direct and indirect costs of the "worst case" disaster scenario that the mitigation initiative is intended to address. If the initiative were to be implemented, these are the future costs that would be avoided, or, in other words, the benefits derived from implementing the action.

Both direct costs of the disaster scenario are considered, such as structural damages, as well as indirect costs, such as lost wages. The total of the direct and indirect costs are then divided by the predicted life of the initiative, in years. This then gives the dollar benefits of the project on an annual basis. The cost side of the benefit to cost ratio is by determining the estimated cost to initially implement the proposal, such as initial construction cost for a "bricks and mortar" project, or the development costs for a training program. To this amount is then added any annual costs that implementation of the project would incur, such as annual operations and maintenance costs or annual implementation costs.

Next, the approach then considers any cost impact of the proposal, or the costs that would be incurred by others in the County due to implementation of the initiative, such as the economic effect on new construction of adopting a more stringent building code. The cost impact figure is also annualized by the life of the project, and then any annual cost impact values, such as an annual user fee or tax, is added to give a total annual cost impact. Finally, by dividing the annual costs of the benefits of the proposal by the annual cost and cost impact necessary to implement the proposal, a benefit to cost ratio is estimated. A more sophisticated methodology for calculating a benefit to cost ratio is likely to be necessary at the time of actual implementation, applying to state or federal agencies for funding, or for the design and construction stage of development.

Cost Benefit Review—Prioritization of Mitigation Actions

Currently, no benefit-cost analysis has been conducted for each of the mitigation actions in this plan. This is due to both the lack of information and this type of evaluation is beyond the scope of the plan. However, the Hazard Planning Committee considers the priority scoring table a valuable cost-benefit review tool, and thus has prioritized the actions based on those scores. The higher scored mitigation actions reflect actions that meet a higher standard on more criteria, and are thus considered much more cost efficient and beneficial to the community. Furthermore, when each mitigation action is considered for particular funding, the responsible agency will conduct an in depth cost-benefit analysis of the project.

It is possible to see from this table that the minimum priority rank for a proposed initiative would be zero, while the maximum would be twenty-seven. As noted above, this priority

ranking may differ from the true priority for implementation assigned to a specific mitigation initiative based on unanticipated conditions or situations occurring at a certain time, which could change with such conditions. The priority ranking given through application of the ten criteria in the above table will remain constant through time because of the inherent characteristics of the proposed initiative, unless those characteristics are also modified.

All of the actions are listed with their priority designation assigned to each (table 5.4) as a result of the common process to characterize and prioritize mitigation initiatives that is used by all participants in the planning process. This priority ranking is a long-term characterization value directly associated with each specific initiative based on its own merits at the time it was first proposed by the individual participant. The priority ranking is intended to serve as a guideline for the Hazard Mitigation Planning Committee regarding the relative desirability of implementation of a specific mitigation initiative in relation to the other proposed initiatives incorporated into the plan.

Multi-jurisdictional action items

As reflected in Table 6.4, each mitigation action is assigned to a particular jurisdiction—and, when possible, a particular department within that jurisdiction. Table 6.3 shows the action items that were taken from the previous plan. The status of these items was reported, and the update is given. For this plan's update, while some action items may have been modified, no mitigation action was deleted from the list. If the item has not been completed since the original plan, the reason is listed in table65.3, and the item re-appears in table 6.4. Below, please find the original action items with their status. If the project is listed as "ongoing," some form of that mitigation action still appears in the updated plan.

Table 6.2, Previous Mitigation Actions and Status Report

Project	Implementation	Community/Agency Responsible	Status Report
Fortify County Archive Facility at 2727 Depot Road to protect it and its contents from flooding and high winds.	Inspection of the facility; try to find funding for retrofits	County/building codes; archives personnel	Facility has been relocated; the new facility is in zone C and is a sturdier building
Relocate the Archer Road Communications Facility	Identify new sites; ensure new building is resistant damage	HHI/communications system administrator; EMD	Facility has been relocated to a C zone and out of flood hazard zone
Retrofit both the Cleveland Point and Shell Point Communications Facilities to increase their ability to withstand flood and high wind events.	Relocate Cleveland site; Inspect Cedarbrook site to determine potential mitigation measures	Beaufort County/EMD; building codes	Project has been completed
Conduct engineering inspections of county fire stations to determine mitigation retrofitting measures necessary	Application for federal funds	All Communities/County EMD; building codes from all communities	Some inspections have been done; some work is being done supported by grant funding. Hilton Head has completed all inspections and three new facilities have been built. HHI has shutters able to withstand a category 5 hurricane. All HHI fire facilities are sprinkled
Make improvements to the St. Helena Wastewater Treatment Plant to protect it from flood damage	BJWSA /County EMD Office to pursue mitigation funding for the proposed project.	Unincorporated Beaufort County/BJWSA Safety & Risk Manager	not done/no funding
Protect the Chelsea Water Treatment Plan from flood damage.	BJWSA /County EMD Office to pursue mitigation funding for the proposed project.	Unincorporated Beaufort County/BJWSA Safety & Risk Manager	not done/no funding
Protect the Bay/Lauren Streets stormwater collection system from inflow problems.	BJWSA /County EMD Office to pursue mitigation funding for the proposed project.	Unincorporated Beaufort County/BJWSA Safety & Risk Manager	Bay Street upgrade completed in FY 2009

Maintenance and replacement of critical bridges	Engineers to develop inventory/priority list	All communities/community engineering offices; Beaufort County EMD; Beaufort County Council and Community Councils.	Not done/ No funding
Train Building Officials on most up to date code requirements for hazard resistant construction	Annually evaluate their building inspectors' capabilities and recent training experience.	All communities/Beaufort County Building Codes Director; building codes officials from all municipalities	Not done (CoB); Annually review with staff all updates as to current Codes and proceedures(PR); All distribute Citizens Guide to Hurricane Preparedness (18,000/yr for HHI)
Sponsor and conduct workshops for local engineers, architects and contractors on IBC and hazard resistant construction	Will quarterly advertise these training sessions via the community web site and by using flyers to be posted in building permit offices.	All communities/building codes directors and officials	Annual review with staff engineer and local contractors and architects advising of any changes or requirements (PR). All jurisdictions conduct classes, and this is an ongoing effort. HHI held a class (FEMA sponsored) here based on Guide to Coastal Construction; HHI also has annual June Hurricane forum with chamber of commerce
The county will work with stations WTOC and WSAV to promote public awareness of disaster preparedness	Coordination with the local station reprters to promote public awareness of disaster preparedness and mitigation.	All communities/Beaufort County public information; Beaufort County EMD; municipal EMD.	Efforts have been made to include the TV station, and this is an ongoing effort
County will include the Hazard Mitigation Plan as an element of the Comp Plan.	Hazard mitigation will be incorporated into the comprehensive plan at the next (07-08) update.	Beaufort County/Planning Department	The plan has either been adopted as an appendix or as a reference in all comp. plans.

Municipalities will include the Hazard Mitigation Plan as an element of the Comp Plan.	Each community responsible for incorporation of the hazard mitigation plan into their comprehensive plan and other planning tools.	All municipalities/ planning directors and officials	The Beaufort County Hazard Mitigation Plan was adopted by reference in the City of Beaufort's Comprehensive Plan which was adopted in July 2004. The updated County plan will be adopted by reference in the City's new comprehensive plan which is expected to be completed by late 2009; Port Royal adopted the Hazard Mitigation Plan as Appendix J of the town's Comp Plan on August 11, 2004, Ordinance number 2004-21(PR)
Updated to fire stations (Land's End and St. Helena)	Continued to enforce seismic provisions in the building code.	Beaufort County Building Codes	Hazard mitigation plan will be soon attached to the Beaufort County Comprehensive Plan.
County will consider the use of priority development zones in non-hazard prone areas	The use of priority development zones will be considered in the next comprehensive plan update (07-08).	Beaufort County/planning; coordination with other agencies	Plan adoption/AICUZ, HHI has priority INVESTMENT zones for infrastructure
Pamphlet for mitigation and recovery regarding historic structures	Greenhorne & O'Mara, Inc. will provide text to the county for the county to use in developing the pamphlet by September 2003; distribution in 2004.	Beaufort County; City of Beaufort/Historic preservation officers from the County and City	The City of Beaufort prepared a Hurricane Preparedness Brochure for Historic Properties in 2005. This brochure has been included in the mailings we do on an annual basis to all property owners in the flood hazard area.
Work to develop public education program for historic property	Tagert meeting date: December 2003 to discuss coordination of the program and to schedule the first property owner workshop.	Beaufort County; City of Beaufort; Town of Bluffton; Town of Hilton Head Island/historic preservation officers from all communities.	The City's Preservation Planner works with property owners on a regular basis to educate them on the importance and value of their properties and to guide them in making appropriate improvements.

County to work to expedite re-build of historic structures post disaster	Gather better historic property value data; become familiar with resources to use for estimating costs of repair and materials for historic structures.	Beaufort County; City of Beaufort; Town of Bluffton; Town of Hilton Head Island/historic preservation officers from all communities.	The City of Beaufort developed emergency permitting process to be used after major disaster: Minor repairs (<10% of value of the structure) will not require permits. Permits for moderate repairs (>10% but <50% of value of structure) are anticipated to be issued "on the spot" at emergency permitting center. These expedited permits for structures in Historic District are issued after applicant consultants with City team comprised of the Preservation Planner and building inspector who discuss damage with applicant and agree on appropriate repairs.
Technical assistance to historic property owners and advise them of funding sources.	Historic preservation in all communities will continue to provide technical assistance as requested by property owners and relay funding information to them.	Beaufort County; City of Beaufort; Town of Bluffton; Town of Hilton Head Island/historic preservation officers from all communities.	The City's Preservation Planner works with property owners on a regular basis to complete forms for state and federal income tax credits for repair of properties.
The County will enforce seismic provisions in their building code.	Building Code Department will continue to enforce the seismic provisions.	Beaufort County/Arthur Cummings; Ed Nelson	ongoing
Hilton Head will continue to implement structural drainage projects (1995 Island Wide Drainage Study)	Continue to include structural drainage project funding in its annual budget development process and work to identify projects	Hilton Head/Engineering	Ongoing; The 2010 Budget has been set for this project, all 16 original projects have been completed ($15M). Second phase: continue inventory of shipyard, replace 12 miles of culvert pipe, Jarvis Creek wetland restoration, Tide Point ditch improvement, stormwater easements, 278/Arrow road study, continue maintenance

All communities to continue to support Beaufort Co.'s SWM Utility/plan for future SWM project	The advisory board has begun work on the county wide inventory and analysis of the SWM facilities which has a completion date of September 2004.	All communities/chairman of the stormwater utility advisory board.	Ongoing; stormwater management agreements on HHI
County will continue to use the Zoning Ordinance and best management practices to mitigate stormwater and erosion protection	Ongoing effort	Beaufort County/engineering	ongoing
Hilton Head will continue to use their land purchasing plan to obtain floodprone properties and designate them as open space.	Continue to impose the real estate transfer tax and use proceeds from the tax for the land purchasing plan.	Town of Hilton Head/Town manager and town council	ongoing
Hilton Head will continue to perform periodic renourishment of its beaches.	Use proceeds from the beach preservation fee to conduct renourishment projects and to coordinate renourishment plans.	Town of Hilton Head/Engineering	Ongoing: HHI spent $17M in 2005, dune accretion has occurred, critical stormwater protection zone laws passed
City of Beaufort to create a centralized information technology system to access pertinent information during a disaster.	research information technology options available to them for a back up system and will	City of Beaufort/City manager	The City has computerized FEMA damage assessment forms and developed a spreadsheet that is linked to the County tax assessment data. This will expedite the damage assessment reporting process. In addition, this information will be available at the City's emergency permitting center to expedite permitting.
City of Beaufort to be equipped with radios for use during emergency to improve communications	work to apply for funding for radio equipment to guarantee reliable emergency communications	City of Beaufort/Emergency Service appointee	The City has purchased satellite phones for the key departments involved in disaster recovery.
County will continue to work with SCDNR to update maps based on newer/more accurate topography data.	Work with SCDNR /State floodplain coordinator to produce changes to floodplain maps/create digitized versions	Beaufort County/County Engineer.	Floodplain maps should be released officially by 2011; Communities have floodplain permitting system in place; HHI has new floodplain ordinance; maps will update in 2010

Hilton Head will continue to work with the USACE and FEMA to develop new maps	The Town will continue to work with the USACE and FEMA to restudy and create the floodplain maps.	Town of Hilton Head/Hilton Head Island plans examiner; programs coordinator.	Floodplain maps should be released officially by 2011
Continue to enforce floodplain regulations to ensure proper development in compliance with all building codes, FEMA regulations and any other pertinent ordinances.	This is an on-going project	All communities/building permitting offices; Beaufort County building codes and department of inspections; City of Beaufort Codes enforcement; Bluffton planning department ; Town of Hilton Head building and fire codes department; Port Royal planning administrator	The City enforces the International Code Council and FEMA regulations for development in the flood hazard area. The City's local flood hazard mitigation ordinance is more stringent than FEMA requirements. The City's regulations require additions in the flood hazard area be elevated (residential) or flood-proofed (nonresidential) (CoB); Port Royal has continually, without exception, enforced all federal, state and local regulations regarding development in the floodplain.

Implementing the Actions

The Beaufort County Hazard Mitigation Plan contains the compilation of the proposed mitigation actions that have been formulated as the result of the planning efforts by the Hazard Mitigation Planning Committee. The matrix below demonstrates how the plan will be administered and implemented based on jurisdiction, department responsible, potential funding sources, implementation timeline and a cost estimate (where available), based on the Hazard Planning Committee's evaluation. These mitigation actions form the fundamental mechanism for the implementation of the local mitigation plan. When the resources and opportunity to do so become available, the responsible organization implements an action to address the vulnerabilities of the facilities, systems and planning areas that have been identified through the mitigation planning process. After each successful implementation of an initiative, the benefited community will become that much more resistant to the impacts of future disasters.

Following is the Hazard Mitigation Action Item Matrix (Table 6.4), which describes all of the newly formulated actions, their related goal, their priority based on the prioritization score, funding sources, impediments (which is funding), estimated cost and approximate implementation date:

Table 6.3, Beaufort County NEW Mitigation Actions

Mitigation Action	Associated Hazards	Priority/Score	Associated Goal (number)	Estimated Cost	Department (subject to change)	Potential Funding	Implemen-tation Schedule	Implementation Impediments
Storm shutters on should be placed on all administrative buildings to ensure administrative functions can continue.	Thunderstorms, Hurricanes, tornadoes	High/20	1	$50,000.00	Public Works, Engineering	PDM, HMGP, County and all municipalities	2010	funding
Conduct engineering inspections of county fire stations to determine mitigation retrofitting measures necessary	All Hazards	Medium/17	1	$20,000.00	Engineering	County, PDM, HMGP	2010 (ongoing)	funding
Monitor all existing dams for structural integrity and work to replace any faulty structures	Dam Failure	Low/9	1	$50,000.00	Public Works	PDM, HMGP	2014	funding, public will
Study of vulnerable bridges to determine which ones should be hardened	Hurricane, wind	Medium/15	1	50000	SCDOT, Public Works	SCDOT, PDM, HMGP, County, municipalities, Federal Highways	2014 (ongoing as funds are available)	funding

Maintenance and replacement of critical bridges	hurricanes, wind, earthquakes	Medium/15	1	$5,000,000.00	SCDOT	SCDOT, PDM, HMGP, County, municipalities, Federal Highways	2014 (ongoing as funds are available)	funding
Work toward the TsunamiReady community designation	Tsunami, Flood	Medium/15	1	10,000.00	Emergency Preparedness	PDM, HMGP, County,	2014	Funding, political will
Include fire sprinklers in buildings for when emergency personnel are unable to reach them during a hazard.	Fire, All Hazards	Medium/11	1	$75,000.00	Engineering	County	2014	funding
Make improvements to the St. Helena Wastewater Treatment Plant to protect it from flood damage	Thunderstorms, Hurricanes	Low/9	1	$50,000.00	BJWSA	BJWSA, PDM, HMGP	2010	funding
Protect the Chelsea Water Treatment Plan from flood damage.	Thunderstorms, Hurricanes	Low/9	1	$52,000.00	BJWSA	BJWSA, PDM, HMGP	2010	funding
Protect the Duke and Lauren Streets wastewater collection system from inflow problems.	Thunderstorms, Hurricanes	Low/9	1	$1,600,000.00	BJWSA	BJWSA, PDM, HMGP	2010	funding

Distribute "Citizen's Guide to Flood Awareness" brochure regularly	Hurricanes	High/25	2	$5,000.00	Building Codes	All Jurisdiction, PDM, HMGP	2010 (ongoing)	funding
The county to work with Regional media to promote public awareness of disaster preparedness	All Hazards	High/24	2	$2,000.00	Building Codes/Emergency Preparedness	County, all municipalities	2009	Funding
Enhance programs dealing with drought, educating the public about proper water usage and appropriate behavior during drought conditions (to include distribution of drought education materials)	drought	Medium/17	2	$3,000.00	Planning	All Jurisdiction, PDM, HMGP	2011 (ongoing)	funding
Ensure all fire marshal burn bans are strictly enforced, especially during drought conditions	Drought	Low/9	2	$10,000	Fire	Beaufort County	2010 (ongoing)	Political will, funding
Create a brochure and education program to inform the community about the danger of land fires and resources on how to prevent them	fire (wild fire/land fire)	Medium/17	2	$5,000.00	Planning/Fire	All Jurisdiction, PDM, HMGP, SCDNR	2010 (ongoing)	funding

Work to enhance public education program for historic property, including a pamphlet for distribution to the public	flood, seismic	Medium/14	2	$2,000.00	Planning	SHPO, all jurisdictions	2010	funding
Beaufort to create a centralized information technology system to access pertinent information during a disaster.	All Hazards	Medium/11	2	$10,000.00	Emergency Preparedness , Building	City of Beaufort, PDM, HMGP	2010	funding
Append this to all comprehensive plans as they are updated, or at earliest date available	All Hazards	High/27	3	n/a	Planning	All jurisdictions	2010	funding
Make hazard mitigation a stand alone element of comprehensive plans as updated	All Hazards	High/25	3	n/a	Planning	all jurisdictions	2012	funding
Create tree survey for vulnerable trees to re-enforce them against hazards (wind, flood)	flood, wind	Medium/17	3	$20,000.00	Planning	all jurisdictions, PDM< HMGP, SC Forrestry Commission	2011	funding
County will consider the use of priority development zones in non-hazard prone areas	Flood	Medium/13	3	n/a	Planning	County	2012	funding

Create survey to ID most vulnerable structures in County and create a CIP list of these structures	wind, flood,	Medium/17	4	$6,000.00	Planning, Administratio n	County	2012	funding
Harden historic structures at USCB	All Hazards	Low/8	4	$200,000.00	USCB	SHPO, all jurisdictions, PDM, HMGP	2014	Funding
County to work to expedite re-build of historic structures post disaster	All Hazards	Low/8	4	$5,000.00	Building Codes	All jurisdictions, HMGP	2011	funding
Continue enforcing seismic program & regulations in building codes	Seismic/earthqua kes	High/26	5	n/a	Building Codes	All jurisdictions	2010 (ongoing)	funding
All communities to continue to support Beaufort Co.'s SWM Utility/plan for future SWM project	Flood	High/21	6	n/a	Public Works, Planning, Building	BJWSA, all jurisdictions	2010 (ongoing)	funding
The County will undertake a program to study poorly drained areas and remedy them through best practices.	Flood	Medium/17	6	$20,000.00	Public Works, Engineering	All jurisdictions (except HHI), HGMP, PDM, CDBG	2010	funding

Create an education program for the agricultural sector that promotes sustainable practices during drought conditions	Drought	Medium/14	7	$3,000.00	Planning	all jurisdictions	2010	funding
Incentivize sharing of docks in zoning ordinances	Erosion	Medium/13	7	unknown	Planning	All jurisdictions	2010	funding
Updated GPS systems available for emergency personnel	All Hazards	Medium/19	8	$50,000.00	Emergency Preparedness, Building	PDM, HGMP, All jurisdictions	2012	funding
County will conduct periodic surveys of the equipment used by emergency personnel and write the appropriations into their budget	All Hazards	Medium/18	8	n/a	Building, Engineering	all jurisdictions	2010 (ongoing)	funding
Enhance radio technology for all building officials for hazard preparation	All Hazards	Medium/17	8	$10,000.00	Emergency Preparedness, Police, Fire	all jurisdictions, PDM, HGMP	2011	funding
County will continue to work with SCDNR to update maps based on newer/more accurate topography data.	Flood	High/20	9	unknown	SCDNR, Planning, Building	County, SCDNR, PDM, HGMP	2011	funding

Digitize elevation certificates for convenience and ease of access (although all written documents will be maintained	Flood	Medium/13	9	$10,000.00	Building	all jurisdictions, PDM, HGMP	2014	funding
Update all flood maps with new municipal and county boundaries	Flood	Medium/12	9	n/a	SCDNR/FEMA, Building	all jurisdictions	2011	funding
Continue to enforce floodplain regulations to ensure proper development in compliance with all building codes, FEMA regulations and any other pertinent ordinances.	Flood	High/25	10	n/a	Building	all jurisdictions	2010 (ongoing)	funding
Train Building Officials on most up to date code requirements for hazard resistant construction	All Hazards	High/22	10	$5,000.00	Building	all jurisdictions, PDM, HGMP	2010 (ongoing)	funding
Building Codes Department will conduct SCDNR approved classes for floodplain management	Flood	Medium/15	10	No Cost	Building	Beaufort County with all jurisdictions participating	2010 (ongoing)	Funding, cooperation
Sponsor and conduct workshops for local engineers, architects and contractors on IBC and hazard resistant construction	All Hazards	High/21	10	$10,000.00	Building	all jurisdictions, PDM, HGMP	2010 (ongoing)	funding

Actively advocate to public officials the adoption of the latest version of universally accepted building codes without amendments	All Hazards	High/20	10	$20,000.00	Planning, Building	All jurisdictions	2010 (ongoing)	funding
Create a joint permitting center for post-hazard recovery.	All Hazards	Medium/16	10	n/a	Building	all jurisdictions	2012	funding

Table 6.4, Hilton Head Island NEW Mitigation Actions

Mitigation Action	Associated Hazards	Priority/Score	Associated Goal (number)	Estimated Cost	Department (subject to change)	Potential Funding	Implemen-tation Schedule	Implementation Impediments
Continue to Conduct engineering inspections of fire stations as necessary to determine mitigation retrofitting measures necessary (HHI has already conducted many inspections)	All Hazards	Medium/17	1	$20,000.00	Engineering	Town CIP	2010 (ongoing)	funding
Study of vulnerable bridges to determine which ones should be hardened and conduct	Hurricane, wind, earthquakes	Medium/15	1	unknown	SCDOT, Engineering	SCDOT, PDM, HMGP, County, municipalities, Federal Highways	2014 (ongoing as funds are available)	funding

maintenance of these bridges and HHI Causeways								
HHI will work with regional media to promote public awareness of disaster preparedness	All Hazards	High/24	2	$2,000.00	Administration, Building	County, all municipalities	2009	funding
Distribute "Citizen's Guide to Flood Awareness" brochure regularly	Hurricane, flood	High/25	2	$10,000	Building, Planning	HHI	2010 (ongoing)	funding
Use EMD's centralized information technology system to access pertinent information during a disaster.	All Hazards	Medium/11	2	$10,000.00	Emergency Preparedness	County, HHI, PDM, HMGP	2010	funding
Hilton Head will continue to implement structural drainage projects (1995 Island Wide Drainage Study)	flood	High/27	6	$100,000.00	Building, Planning	Hilton Head Island, HGMP, PDM	2010 (ongoing)	funding

All communities to continue to support Beaufort Co.'s SWM Utility/plan for future SWM project	flood	High/21	6	n/a	All Departments	BJWSA, all jurisdictions	2010 (ongoing)	funding
The County and municipalities will undertake a program to study poorly drained areas and remedy them through best practices.	flood	Medium/17	6	$20,000.00	Building	All jurisdictions (except HHI), HGMP, PDM, CDBG	2010	funding
Hilton Head will continue to use their land purchasing plan to obtain flood prone properties and designate them as open space.	flood	Medium/17	7	unknown	Planning, Administration	Town of Hilton Head Island, PDM, HGMP	2010 (ongoing)	funding
Hilton Head will continue to perform periodic renourishment of its beaches	flood, erosion	Medium/17	7	$17,000,000.00	Planning, Public Works	PDM, HGMP, Town of Hilton Head	2010 (ongoing)	funding
Updated GPS systems available for emergency personnel	All Hazards	Medium/19	8	$50,000.00	Building, Emergency	PDM, HGMP, All jurisdictions	2012	funding

Conduct periodic surveys of the equipment used by emergency personnel and write the appropriations into their budget	All Hazards	Medium/18	8	n/a	Emergency	all jurisdictions	2010 (ongoing)	funding

Enhance radio technology for all building officials for hazard preparation	All Hazards	Medium/17	8	$10,000.00	Building	all jurisdictions, PDM, HGMP	2011	funding
Continue to work with SCDNR to update maps based on newer/more accurate topography data.	flood	High/20	9	unknown	SCDNR, Building, Planning	County, SCDNR, PDM, HGMP	2011	funding
Hilton Head will continue to work with the USACE and FEMA to develop new maps	flood	High/20	9	unknown	SCDNR, Building, Planning	USACE, HGMP, Town of Hilton Head, PDM	2011	funding
Scan and storeelevation certificates for convenience and ease of access (although all written	flood	Medium/13	9	$10,000.00	Planning	all jurisdictions, PDM, HGMP	2014	funding

documents will be maintained for convenience and ease of access (although all written documents will be maintained								
Update all flood maps with new municipal and county boundaries	flood	Medium/12	9	n/a	SCDNR, Planning	all jurisdictions	2011	funding
HHI will continue to enforce floodplain regulations to ensure proper development in compliance with all building codes, FEMA regulations and any other pertinent ordinances	flood	High/25	10	n/a	Building	all jurisdictions	2010 (ongoing)	funding
Continue to Train Building Officials on most up to date code requirements for hazard resistant construction	All Hazards	High/22	10	$5,000.00	Building	all jurisdictions, PDM, HGMP	2010 (ongoing)	funding

Sponsor and conduct workshops for local engineers, architects and contractors on IBC and hazard resistant construction	All Hazards	High/21	10	$10,000.00	Building	all jurisdictions, PDM, HGMP	2010 (ongoing)	funding
Actively advocate to public officials the adoption of the latest version of universally accepted building codes without amendments	All Hazards	High/20	10	$20,000.00	Building, Planning Administration	All jurisdictions	2010 (ongoing)	funding

Table 6.5, City of Beaufort NEW Mitigation Actions

Mitigation Action	Associated Hazards	Priority/Score	Associated Goal (number)	Estimated Cost	Department (subject to change)	Potential Funding	Implemen-tation Schedule	Implementa-tion Impedieme-nts
Storm shutters on should be placed on all administrative buildings to ensure administrative functions can continue.	Thunderstorms, Hurricanes, tornadoes	High/20	1	$50,000.00	Building	PDM, HMGP, County and all municiaplities	2010	funding
Conduct engineering inspections of county fire stations to determine mitigation retrofitting measures necessary	All Hazards	Medium/17	1	$20,000.00	Planning, Building, Engineering	County, PDM, HMGP	2010 (ongoing)	funding
Study of vulnerable bridges to determine which ones should be hardened	Hurricane, wind	Medium/15	1	unknown	SCDOT, County Engineering	SCDOT, PDM, HMGP, County, municipalities, Federal Highways	2014 (ongoing as funds are available)	funding
Maintenance and replacement of critical bridges	hurricanes, wind, earthquakes	Medium/15	1	$5,000,000.00	SCDOT, County Engineering	SCDOT, PDM, HMGP, County, municipalities, Federal Highways	2014 (ongoing as funds are available)	funding

Harden New City of Beaufort Building	All Hazards	Medium/12	1	$50,000.00	Building	PDM, HMGP, County and all municipalities	2010	Funding
Include fire sprinklers in buildings for when emergency personnel are unable to reach them during a hazard.	Fire, All Hazards	Medium/11	1	$75,000.00	Engineering, Fire	County	2014	Funding
Make improvements to the St. Helena Wastewater Treatment Plant to protect it from flood damage	Thunderstorms, Hurricanes	Low/9	1	$50,000.00	BWJSA	BJWSA, PDM, HMGP	2010	funding
Protect the Chelsea Water Treatment Plan from flood damage.	Thunderstorms, Hurricanes	Low/9	1	$52,000.00	BJWSA	BJWSA, PDM, HMGP	2010	funding
Protect the Bay/Lauren Streets stormwater collection system from inflow problems.	Thunderstorms, Hurricanes	Low/9	1	$170,000.00	BJWSA	BJWSA, PDM, HMGP	2010	funding
Distribute "Citizen's Guide to Flood Awareness" brochure regularly	Hurricanes	High/25	2	$5,000.00	Planning	All Jurisdiction, PDM, HMGP	2010 (ongoing)	funding

The county to work with Regional media to promote public awareness of disaster preparedness	All Hazards	High/24	2	$2,000.00	Planning, Administration	County, all municipalities	2009	funding
Enhance programs dealing with drought, educating the public about proper water usage and appropriate behavior during drought conditions (to include distribution of drought education materials)	drought	Medium/17	2	$3,000.00	Planning, BJWSA	All Jurisdiction, PDM, HMGP	2011 (ongoing)	funding
Create a brochure and education program to inform the community about the danger of land fires and resources on how to prevent them	fire (wild fire/land fire)	Medium/17	2	$5,000.00	Planning	All Jurisdiction, PDM, HMGP, SCDNR	2010 (ongoing)	funding

Work to enhance public education program for historic property, including a pamphlet for distribution to the public	flood, seismic	Medium/14	2	$2,000.00	Planning	SHPO, all jurisdictions	2010	funding
City of Beaufort to create a centralized information technology system to access pertinent information during a disaster.	All Hazards	Medium/11	2	$10,000.00	Building, Planning	City of Beaufort, PDM, HMGP	2010	funding
Append this to all comprehensive plans as they are updated, or at earliest date available	All Hazards	High/27	3	n/a	Planning	All jurisdictions	2010	funding
Make hazard mitigation a stand alone element of comprehensive plans as updated	All Hazards	High/25	3	n/a	Planning	all jurisdictions	2012	funding

Create tree survey for vulnerable /historic trees to re-enforce them against hazards (wind, flood)	flood, wind	Medium/17	3	$20,000.00	Planning	all jurisdictions, PDM< HMGP, SC Forrestry Commission	2011	funding
City will consider the use of priority development zones in non-hazard prone areas	flood	Medium/13	3	n/a	Planning	County	2012	funding
Create survey to ID most vulnerable structures in County and create a CIP list of these structures	wind, flood,	Medium/17	4	$6,000.00	Planning	County	2012	funding
Harden historic structures at USCB	All Hazards	Low/8	4	$200,000.00	USCB	SHPO, all jurisdictions, PDM, HMGP	2014	funding
Continue enforcing seismic program &regulations in building codes	earthquakes	High/26	5	n/a	Building	All jurisdictions	2010 (ongoing)	funding

All communities to continue to support Beaufort Co.'s SWM Utility/plan for future SWM project	flood	High/21	6	n/a	Planning, Building, Engineering	BJWSA, all jurisdictions	2010 (ongoing)	funding
The City and municipalities will undertake a program to study poorly drained areas and remedy them through best practices.	flood	Medium/17	6	$20,000.00	Engineering	All jurisdictions (except HHI), HGMP, PDM, CDBG	2010	funding
Incentivize sharing of docks in zoning ordinances	erosion	Medium/13	7	unknown	Planning	All jurisdictions	2010	funding
Updated GPS systems available for emergency personnel	All Hazards	Medium/19	8	$50,000.00	Emergency	PDM, HGMP, All jurisdictions	2012	funding
Conduct periodic surveys of the equipment used by emergency personnel and write the appropriations into their budget	All Hazards	Medium/18	8	n/a	Fire, Police, Emergency	all jurisdictions	2010 (ongoing)	funding

Enhance radio technology for all building officials for hazard preparation	All Hazards	Medium/17	8	$10,000.00	Building	all jurisdictions, PDM, HGMP	2011	funding
City will continue to work with SCDNR to update maps based on newer/more accurate topography data.	flood	High/20	9	unknown	SCDNR, Building, Planning	County, SCDNR, PDM, HGMP	2011	funding
Work with the USACE and FEMA to develop new maps	flood	High/20	9	unknown	SCDNR, Building, Planning	USACE, HGMP, Town of Hilton Head, PDM	2011	funding
Digitize elevation certificates for convenience and ease of access (although all written documents will be maintained	flood	Medium/13	9	$10,000.00	Planning, Building	all jurisdictions, PDM, HGMP	2014	funding
Update all flood maps with new municipal and county boundaries	flood	Medium/12	9	n/a	Planning, SCDNR, FEMA	all jurisdictions	2011	funding
Continue to enforce floodplain regulations to ensure proper	flood	High/25	10	n/a	Building	all jurisdictions	2010 (ongoing)	funding

development in compliance with all building codes, FEMA regulations and any other pertinent ordinances.								
Train Building Officials on most up to date code requirements for hazard resistant construction	All Hazards	High/22	10	$5,000.00	Building	all jurisdictions, PDM, HGMP	2010 (ongoing)	funding
Sponsor and conduct workshops for local engineers, architects and contractors on IBC and hazard resistant construction	All Hazards	High/21	10	$10,000.00	Building	all jurisdictions, PDM, HGMP	2010 (ongoing)	funding
Actively advocate to public officials the adoption of the latest version of universally accepted building codes without amendments	All Hazards	High/20	10	$20,000.00	Building	All jurisdictions	2010 (ongoing)	funding
Enforce property maintenance code to correct	All Hazards	Medium/16	10	n/a	Building	All jurisdictions	2010 (ongoing)	funding

deteriorating conditions								
Create a joint permitting center for post-hazard recovery.	All Hazards	Medium/16	10	n/a	Building	all jurisdictions	2012	funding

Table 6.5, Port Royal NEW Mitigation Actions

Mitigation Action	Associated Hazards	Priority/Score	Associated Goal (number)	Estimated Cost	Department (subject to change)	Potential Funding	Implemen-tation Schedule	Implementa-tion Impedieme-nts
Storm shutters on should be placed on all administrative buildings to ensure administrative functions can continue.	Thunderstorms, Hurricanes, tornadoes	High/20	1	$50,000.00	Building, Engineering	PDM, HMGP, County and all municipalities	2010	funding
Conduct engineering inspections of county fire stations to determine mitigation retrofitting measures necessary	All Hazards	Medium/17	1	$20,000.00	Engineering	County, PDM, HMGP	2010 (ongoing)	funding
Study of vulnerable bridges to determine which ones should be hardened	Hurricane, wind	Medium/15	1	unknown	SCDOT, County Engineering, Planning	SCDOT, PDM, HMGP, County, municipalities, Federal Highways	2014 (ongoing as funds are available)	funding
Maintenance and replacement of critical bridges	hurricanes, wind, earthquakes	Medium/15	1	$5,000,000.00	SCDOT, County Engineering, Planning	SCDOT, PDM, HMGP, County, municipalities, Federal Highways	2014 (ongoing as funds are available)	funding

Include fire sprinklers in buildings for when emergency personnel are unable to reach them during a hazard.	Fire, All Hazards	Medium/11	1	$75,000.00	Fire, Planning	County	2014	funding
Distribute "Citizen's Guide to Flood Awareness" brochure regularly	Hurricanes	High/25	2	$5,000.00	Planning	All Jurisdiction, PDM, HMGP	2010 (ongoing)	funding
The town to work with Regional media to promote public awareness of disaster preparedness	All Hazards	High/24	2	$2,000.00	Planning, Administration	County, all municipalities	2009	funding
Enhance programs dealing with drought, educating the public about proper water usage and appropriate behavior during drought conditions (to include distribution of drought education materials)	drought	Medium/17	2	$3,000.00	Planning	All Jurisdiction, PDM, HMGP	2011 (ongoing)	funding

Create a brochure and education program to inform the community about the danger of land fires and resources on how to prevent them	fire (wild fire/land fire)	Medium/17	2	$5,000.00	Planning	All Jurisdiction, PDM, HMGP, SCDNR	2010 (ongoing)	funding

Work to enhance public education program for historic property, including a pamphlet for distribution to the public	flood, seismic	Medium/14	2	$2,000.00	Planning	SHPO, all jurisdictions	2010	funding
Town to create a centralized information technology system to access pertinent information during a disaster.	All Hazards	Medium/11	2	$10,000.00	Planning, Building	City of Beaufort, PDM, HMGP	2010	funding
Append this to all comprehensive plans as they are updated, or at earliest date available	All Hazards	High/27	3	n/a	Planning	All jurisdictions	2010	funding
Make hazard mitigation a stand alone element of comprehensive plans as updated	All Hazards	High/25	3	n/a	Planning	all jurisdictions	2012	funding
Create tree survey for vulnerable trees to re-enforce them against hazards (wind, flood)	flood, wind	Medium/17	3	$20,000.00	Planning	all jurisdictions, PDM< HMGP, SC Forestry Commission	2011	funding
Town will consider the use of priority development zones in non-hazard prone areas	flood	Medium/13	3	n/a	Planning, Administration	County	2012	funding
Create survey to ID most vulnerable structures in Town and create a CIP list of these	wind, flood,	Medium/17	4	$6,000.00	Planning	County	2012	funding

structures								
Harden historic structures in downtown	All Hazards	Low/8	4	$200,000.00	USCB	SHPO, all jurisdictions, PDM, HMGP	2014	funding
Work to expedite re-build of historic structures post disaster within historic building/remodeling guidelines	All Hazards	Low/8	4	$5,000.00	Planning, Building	All jurisdictions, HMGP	2011	funding
Continue enforcing seismic program &regulations in building codes	Seismic/earthquakes	High/26	5	n/a	Building	All jurisdictions	2010 (ongoing)	funding

All communities to continue to support Beaufort Co.'s SWM Utility/plan for future SWM project	flood	High/21	6	n/a	Public Works, BJWSA, Planning	BJWSA, all jurisdictions	2010 (ongoing)	funding
The town will undertake a program to study poorly drained areas and remedy them through best practices.	flood	Medium/17	6	$20,000.00	Planning	All jurisdictions (except HHI), HGMP, PDM, CDBG	2010	funding
Incentivize sharing of docks in zoning ordinances	erosion	Medium/13	7	unknown	Planning	All jurisdictions	2010	funding
Updated GPS systems available for emergency personnel	All Hazards	Medium/19	8	$50,000.00	Fire, Building	PDM, HGMP, All jurisdictions	2012	funding
Town will conduct periodic surveys of the equipment used by emergency personnel and write the appropriations into their budget	All Hazards	Medium/18	8	n/a	Fire, Police, Building	all jurisdictions	2010 (ongoing)	funding

Enhance radio technology for all building officials for hazard preparation	All Hazards	Medium/17	8	$10,000.00	Building	all jurisdictions, PDM, HGMP	2011	funding
Town will continue to work with SCDNR to update maps based on newer/more accurate topography data.	flood	High/20	9	unknown	SCDNR, FEMA, Planning, Building	County, SCDNR, PDM, HGMP	2011	funding
Digitize elevation certificates for convenience and ease of access (although all written documents will be maintained	flood	Medium/13	9	$10,000.00	Building, Planning	all jurisdictions, PDM, HGMP	2014	funding
Update all flood maps with new municipal and county boundaries	flood	Medium/12	9	n/a	SCDNR, FEMA, Planning, Building	all jurisdictions	2011	funding
Continue to enforce floodplain regulations to ensure proper development in compliance with all building codes, FEMA regulations	flood	High/25	10	n/a	Building	all jurisdictions	2010 (ongoing)	funding

and any other pertinent ordinances.								
Train Building Officials on most up to date code requirements for hazard resistant construction	All Hazards	High/22	10	$5,000.00	Building	all jurisdictions, PDM, HGMP	2010 (ongoing)	funding
Sponsor and conduct workshops for local engineers, architects and contractors on IBC and hazard resistant construction	All Hazards	High/21	10	$10,000.00	Building	all jurisdictions, PDM, HGMP	2010 (ongoing)	funding
Actively advocate to public officials the adoption of the latest version of universally accepted building codes without amendments	All Hazards	High/20	10	$20,000.00	Planning, Building	All jurisdictions	2010 (ongoing)	funding
Enforce property maintenance code to correct deteriorating conditions	All Hazards	Medium/16	10	n/a	Building, Codes, Planning	All jurisdictions	2010 (ongoing)	funding

Create a joint permitting center for post-hazard recovery.	All Hazards	Medium/16	10	n/a	Building	all jurisdictions	2012	funding

Table 6.6, Bluffton NEW Mitigation Actions

Mitigation Action	Associated Hazards	Priority/Score	Associated Goal (number)	Estimated Cost	Department (subject to change/revision)	Potential Funding	Implemen-tation Schedule	Implementa-tion Impedieme-nts
Storm shutters on should be placed on all administrative buildings to ensure administrative functions can continue.	Thunderstorms, Hurricanes, tornadoes	High/20	1	$50,000.00	Building, Engineering, Planning, Public Works	PDM, HMGP, County and all municipalities	2010	funding
Conduct engineering inspections of county fire stations to determine mitigation retrofitting measures necessary	All Hazards	Medium/17	1	$20,000.00	Engineering	County, PDM, HMGP	2010 (ongoing)	funding
Study of vulnerable bridges to determine which ones should be hardened	Hurricane, wind	Medium/15	1	unknown	SCDOT, Public Works, Planning, Engineering	SCDOT, PDM, HMGP, County, municipalities, Federal Highways	2014 (ongoing as funds are available)	funding
Maintenance and replacement of critical bridges	hurricanes, wind, earthquakes	Medium/15	1	$5,000,000.00	SCDOT, Public Works, Planning, Engineering	SCDOT, PDM, HMGP, County, municipalities, Federal Highways	2014 (oingoing as funds are available)	funding

Include fire sprinklers in buildings for when emergency personnel are unable to reach them during a hazard.	Fire, All Hazards	Medium/11	1	$75,000.00	Fire, Engineering	County	2014	funding
Distribute "Citizen's Guide to Flood Awareness" brochure regularly	Hurricanes	High/25	2	$5,000.00	Planning, Emergency Preparedness, Building	All Jurisdiction, PDM, HMGP	2010 (ongoing)	funding
The town to work with Regional media to promote public awareness of disaster preparedness	All Hazards	High/24	2	$2,000.00	Planning, Building	County, all municipalities	2009	funding
Create a brochure and education program to inform the community about the danger of land fires and resources on how to prevent them	fire (wild fire/land fire)	Medium/17	2	$5,000.00	BJWSA, Planning	All Jurisdiction, PDM, HMGP, SCDNR	2010 (ongoing)	funding

Work to enhance public education program for historic property, including a pamphlet for distribution to the public	flood, seismic	Medium/14	2	$2,000.00	Planning	SHPO, all jurisdictions	2010	funding
Create a centralized information technology system to access pertinent information during a disaster.	All Hazards	Medium/11	2	$10,000.00	Building, County Emergency and Town Emergency	City of Beaufort, PDM, HMGP	2010	funding
Append this to all comprehensive plans as they are updated, or at earliest date available	All Hazards	High/27	3	n/a	Planning	All jurisdictions	2010	funding
Make hazard mitigation a stand alone element of comprehensive plans as updated	All Hazards	High/25	3	n/a	Planning	all jurisdictions	2012	funding
Create tree survey for vulnerable trees to re-enforce them against hazards (wind, flood)	flood, wind	Medium/17	3	$20,000.00	Planning	all jurisdictions, PDM< HMGP, SC Forrestry Commission	2011	funding

Consider the use of priority development zones in non-hazard prone areas	flood	Medium/13	3	n/a	Planning	County	2012	funding
Create survey to ID most vulnerable structures in Town and create a CIP list of these structures	wind, flood,	Medium/17	4	$6,000.00	Planning	County	2012	Funding
Work to expedite re-build of historic structures post disaster	All Hazards	Low/8	4	$5,000.00	Building	All jurisdictions, HMGP	2011	funding
Continue enforcing seismic program &regulations in building codes	Seismic/earthquakes	High/26	5	n/a	Building	All jurisdictions	2010 (ongoing)	funding
All communities to continue to support Beaufort Co.'s SWM Utility/plan for future SWM project	flood	High/21	6	n/a	Public Works, BJWSA, Planning	BJWSA, all jurisdictions	2010 (ongoing)	funding
The town will undertake a program to study poorly drained areas and remedy them through best practices.	flood	Medium/17	6	$20,000.00	Public Works, Planning	All jurisdictions (except HHI), HGMP, PDM, CDBG	2010	funding

Create an education program for the agricultural sector that promotes sustainable practices during drought conditions	drought	Medium/14	7	$3,000.00	Planning	all jurisdictions	2010	funding
Incentivize sharing of docks in zoning ordinances	erosion	Medium/13	7	unknown	Planning	All jurisdictions	2010	funding
Updated GPS systems available for emergency personnel	All Hazards	Medium/19	8	$50,000.00	Emergency, Building	PDM, HGMP, All jurisdictions	2012	funding
Conduct periodic surveys of the equipment used by emergency personnel and write the appropriations into their budget	All Hazards	Medium/18	8	n/a	Building	all jurisdictions	2010 (ongoing)	funding
Enhance radio technology for all building officials for hazard preparation	All Hazards	Medium/17	8	$10,000.00	Building	all jurisdictions, PDM, HGMP	2011	funding
Town will continue to work with SCDNR to update maps	flood	High/20	9	unknown	SCDNR, FEMA, Planning, Building	County, SCDNR, PDM, HGMP	2011	funding

based on newer/more accurate topography data.								
Digitize elevation certificates for convenience and ease of access (although all written documents will be maintained	flood	Medium/13	9	$10,000.00	Planning, Building	all jurisdictions, PDM, HGMP	2014	funding
Update all flood maps with new municipal and county boundaries	flood	Medium/12	9	n/a	SCDNR, FEMA, Planning, Building	all jurisdictions	2011	funding
Continue to enforce floodplain regulations to ensure proper development in compliance with all building codes, FEMA regulations and any other pertinent ordinances.	flood	High/25	10	n/a	Building	all jurisdictions	2010 (ongoing)	funding
Train Building Officials on most up to date code requirements for hazard resistant construction	All Hazards	High/22	10	$5,000.00	Building	all jurisdictions, PDM, HGMP	2010 (ongoing)	funding

Sponsor and conduct workshops for local engineers, architects and contractors on IBC and hazard resistant construction	All Hazards	High/21	10	$10,000.00	Building	all jurisdictions, PDM, HGMP	2010 (ongoing)	funding
Actively advocate to public officials the adoption of the latest version of universally accepted building codes without amendments	All Hazards	High/20	10	$20,000.00	Building, Planning	All jurisdictions	2010 (ongoing)	funding
Enforce property maintenance code to correct deteriorating conditions	All Hazards	Medium/16	10	n/a	Building	All jurisdictions	2010 (ongoing)	funding
Create a joint permitting center for post-hazard recovery.	All Hazards	Medium/16	10	n/a	Building	all jurisdictions	2012	funding

Actions Incorporated into the Mitigation Plan and Implementation

The mitigation action matrix table reflects the prioritization that was conducted by the Hazard Mitigation Planning Committee during development of the Hazard Mitigation Plan. That table contains the most up-to-date information regarding mitigation actions. The proposed actions discussed in this section are specific mitigation actions and projects being considered to reduce the effects of each hazard pursuant to federal regulations.

Each proposed mitigation action was subjected to a review and analysis by the Hazard Mitigation Planning Committee, as mentioned previously. The purpose of this review and analysis is to ensure that an initiative proposed by a participating organization or community group is based on an adequate level of technical analysis, that all needed information about the proposal is presented, that any assumptions utilized are reasonable and logical, that the proposal is consistent with the goals and objectives of the Hazard Mitigation Planning Committee, and that it is addressing identified vulnerabilities of the community or shortfalls in the communities' mitigation policy framework. More specifically, the review and analysis process is focused on ensuring the technical validity of the proposal, making a judgment whether the initiative would be technically effective and cost-beneficial, if it is duplicative or in conflict with other proposed initiatives, or if its implementation would have an adverse affect in another jurisdiction.

All actions were proposed by the committee, assembled and sent to the members for review and comment. Over the course of several meetings, the list of action items was refined, shortened and crafted for viability. The Hazard Mitigation Planning Committee then reviewed the proposal for any other concerns, such as its consistency with other plans, political and community objectives. By doing this thorough review of the actions, the plan reflects the values of the community, and supposedly will be met with less resistance in the future.

All of the actions listed in this plan have been approved by the Hazard Planning Committee. An approved mitigation action is one that has been fully reviewed and deemed acceptable to be incorporated in the Hazard Mitigation Plan. However, it is appropriate to report that many of the actions from the previous plan were completed, and the following chart reports the progress of the actions and goals of the previous plan:

The Mitigation Action Matrix Table lists actions that are currently in the Beaufort County Hazard Mitigation Plan and their priority scores. Again, the priority scores are based on 10 separate prioritization criteria used by all of the planning participants to allow the Beaufort County Hazard Mitigation Planning Committee to compare various mitigation actions. The specific priority scores are based on a numeric classification system shown in table 5.2

Implementation through Existing Plans and Programs

One of the methods to most effectively implement the Beaufort County Hazard Mitigation Plan is to propose and implement actions that will modify other community plans, policies, and programs. By including personnel from a variety of departments in the hazard mitigation planning process, concepts derived from the planning process will be spread throughout County departments such as; public works, storm water management, GIS, and planning. Mitigation activities initiated by this plan have been incorporated into the Community Rating System (CRS) plan and vice versa. Furthermore, as is discussed in the community capability portion of this plan, other planning documents should reflect the objectives of the Hazard Mitigation Plan. Beaufort County and its municipalities are committed to hazard mitigation, and it is shown that some comprehensive plans include the Hazard Mitigation Plan by reference. As the goals state, there is a consensus that all comprehensive plans (and other appropriate planning documents) should have the Hazard Mitigation Plan appended in some fashion. Such commitment is reflected in the fact the participants intend to either include the Hazard Mitigation Plan as a separate element of their Comprehensive Plans or Development Codes, or that this Plan would be at least appended to all other plans.

As all of the comprehensive plans for each jurisdiction go through their state mandated updates (every five years), hazard mitigation will be an element of these plans. For instance, the Town of Hilton Head is joining this year's update of their comprehensive plan with the update of the hazard mitigation plan, and public meetings are being held in conjunction. The section of this hazard mitigation plan that addresses capability also shows where hazard mitigation elements have been incorporated into existing documents, and ways each jurisdiction should incorporate these elements in the future.

Continued Public Involvement

The Hazard Mitigation Planning Committee will continue efforts to develop and implement a year- round program to engage the community in the mitigation planning process and to provide them with mitigation-related information and education. These efforts will be to continually invite public comments and recommendations regarding the mitigation goals for the community, the priorities for the planning, and the unique needs of each community for mitigation-related public information.

Public information activities that have been completed or are planned by the organizations making up the Beaufort County Hazard Mitigation Planning Committee are listed in Section 5 of this plan. Each of these activities continues to engage the community in the planning process through the presentation of a specific topic or program related to, or relevant for, hazard mitigation.

The Next Planning Cycles

As given in this section, the Beaufort County Hazard Mitigation Planning Committee has established a schedule and procedure for both plan implementation and plan maintenance that is expected to be very helpful in improving and expanding the mitigation planning process.
In addition to these activities for plan maintenance, the Hazard Mitigation Planning Committee will establish a recommended schedule for implementation of the proposed priority initiatives included in this edition of the plan. It is expected that the agencies and organizations that sponsored these initiatives for the plan will, during the next planning cycles, take advantage of timely opportunities and available resources to implement them on the desired schedule, if it is possible to do so.

The Beaufort County Hazard Mitigation Plan is a dynamic document, reflecting a continuing, and expanding planning process. The efforts of the Disaster Mitigation
Committee will continue into the future, striving to make all of the jurisdictions of Beaufort County truly disaster resistant communities.

Idealized schedule of implementation

The Mitigation Action Matrix Table in this section also includes an ideal schedule of implementation of the action items. This time-table is based on the Hazard Mitigation Planning Committee's knowledge of the feasibility of completion.

Monitoring, Evaluating, and Updating the Plan

Beaufort County (Unincorporated, City of Beaufort, Town of Bluffton, Town of Hilton Head Island and the Town of Port Royal) has developed a method to ensure that regular review and update of the Hazard Mitigation Plan occurs. The HMPC Chairman (currently Ed Nelson of Beaufort County Building Codes) is responsible for ensuring viability of the HMPC. If a member is inactive or wishes to no longer participation, the chairman is responsible for finding a replacement.

Plan Maintenance

The HMPC will meet once a year at a date to be set by the current Committee Chairman to be coordinated with the participating communities and their local governing bodies. At this meeting, the Committee will review the plan to determine if the information is up to date and should be updated or modified. The parties responsible for implementing action items detailed in Chapter 6 of the plan will report on the status of their projects. The chairman will be responsible for updating the Hazard Mitigation Plan to reflect the progress made of the annual meeting.

The Committee may choose to meet more often as the need requires such as if there is a change in State or federal policy or after disasters affect the County. Committee members will be responsible for monitoring and evaluating the progress of the mitigation strategies outlined in the Plan.

The chairman will be responsible for ensuring that updated copies of the plan are made available at the Beaufort County Administrative Building (Building Codes or Planning Department). If deemed necessary and appropriate, a public meeting will be held after each annual Hazard Mitigation Planning Committee meeting. This meeting will provide the public an opportunity to ask questions about the progress of the items in the Action Plan (Chapter 6) as well as make suggestions for updates to the plan.

Updating the Plan

No later than five years from now, the committee (or designated appointees) will meet in order to conduct the FEMA required five-year update of the plan. The next planned update to this plan will be in 2014.

Potential Funding Sources

Each initiative incorporated in the Beaufort County Mitigation Plan has been ranked based on the ability to fund it, either within County budget or from outside funding sources. The Hazard Mitigation Planning Committee developed a subset of the potential sources for the approved initiatives, shown below. Using this list, funding sources are assigned to initiatives by their primary area of appropriateness.

As of the current date on this plan, Beaufort County has not verified the true availability of all sources on this list. Some may no longer be available, while others may have come into existence since this list was developed.

It is the expectation of the Hazard Mitigation Planning Committee of the Disaster Mitigation Committee that the agencies and organizations that sponsored a specific initiative would utilize the information given in this report to pursue funding opportunities to implement the initiative.

Potential Funding Sources (not intended to be exhaustive)

- Local Governments
- Lowcountry Council of Government Based Grants
- Federal Funding Sources for Mitigation
- State Resources

❖ **FEMA's Hazard Mitigation Grant Program** (HMGP) assists states and local communities in implementing long-term hazard mitigation measures following a

major disaster declaration. As of November 1, 2004, all communities must have an approved hazard mitigation plan in place to remain eligible for HMGP funding. HMGP grants can be used to fund projects that provide protection to either public or private property. HMGP eligible projects include structural hazard control such as debris basins, floodwalls, or stream restoration, and retrofitting measures such as floodproofing, acquisition, or relocation of structures.

FEMA can fund up to 75 percent of the eligible costs of each project. The State or local match does not have to be cash; in-kind services or materials may be used. Federal funding under the HMGP is based on 7.5 percent of the Federal funds spent on the Public and Individual Assistance programs (minus administrative expenses) for each disaster. Eligible applicants must apply for the HMGP through the South Carolina Emergency Management Division – Recovery and Mitigation Group.

- **FEMA's Pre Disaster Mitigation** (PDM) **Funds** provide both planning and project funding to eligible communities. PDM project funding is nationally competitive; there is no 'base' amount guaranteed to each state. A national priority is placed on projects that address NFIP repetitive loss properties and a benefit cost analysis is required for each proposed project. Projects are awarded priority based on the state's analysis and resulting ranking, and on factors such as cost effectiveness, addressing critical facilities, and the percent of the population that benefits from the project.

FEMA funds up to 75 percent of the cost of the project, or up to 90 percent for small, impoverished communities. There is a $3 million cap on the federal share of the cost per project. Eligible applicants must apply for the PDM through the South Carolina Emergency Management Division – Recovery and Mitigation Group.

- **FEMA's Flood Mitigation Assistance Program** (FMA) provides grants to states and communities for planning assistance and mitigation projects that reduce the risk of flood damage to structures covered by flood insurance. The types of grants available include planning and project assistance. FMA monies are available to eligible applicants when a Flood Mitigation Plan has been developed and FEMA has approved it.

  FEMA may contribute up to 75 percent of the total eligible costs. At least 25 percent of the total eligible costs must be provided by a nonfederal source. Of this 25 percent, no more than half can be provided as in-kind contributions from third parties. There are limits on the frequency of grants and the amount of funding that can be allocated to a State or community in any 5-year period. The South Carolina Department of Natural Resources (SCDNR) serves as the administrator of the planning and projects portions of the grant. The State's FMA Coordinator is within the Land, Water and Conservation Division of SCDNR. The agency's web page is www.dnr.state.sc.us.

- **Continuing Authorities Program** (CAP) initiates a short reconnaissance effort to determine Federal interest in proceeding. If there is interest, a feasibility study is performed, and then the project might move on to a plans and specifications phase.

Finally, the project goes to its construction phase. A local sponsor must identify the flood-related problem and request USACE Assistance. Small flood control projects are also eligible.

The cost share for the CAP is 65% USACE and 35 % local. The federal project limit is $7,000,000. The USACE's Charleston District office would review the local sponsor's request for assistance and would request funds from the USACE's annual appropriations.

- **USACE's Floodplain Management Services Program** aims to support comprehensive floodplain management planning to encourage and guide sponsors to prudent use of the Nations' floodplains for the benefit of the national economy and welfare. Some examples of the types of projects that would be funded include:
  - flood warning and flood emergency preparedness
  - floodproofing measures
  - studies to improve methods and procedures for flood mitigating damages
  - preparation of guides and brochures on flood-related topics

  A local sponsor must identify a problem and request USACE assistance under the Floodplain Management Services Program. The USACE may provide up to 100% of funding at the request of the sponsor. The USACE's Charleston District's office would review the local sponsor's request for assistance and determine if it fits within the program.

- **Department of Housing and Urban Development's** (HUD) **Community Development Block Grant - Disaster Recovery Initiative** (DRI) program provides flexible grants to help cities, counties, and States recover from Presidentially-declared disasters, especially in low-income areas. Since it can fund a broader range of recovery activities than most other programs, the DRI helps communities and neighborhoods that otherwise might not recover due to limited resources.

  When disasters occur, Congress may appropriate additional funding for the Community Development Block Grant and as DRI grants to rebuild the affected areas and bring crucial seed money to start the recovery process. Grantees may use DRI funds for recovery efforts involving housing, economic development, infrastructure and prevention of further damage, if such use does not duplicate funding available from the Federal Emergency Management Agency, the Small Business Administration, and the U.S. Army Corps of Engineers. Examples of these activities include:
  - buying damaged properties in a flood plain and relocating them to safer areas;
  - relocation payments for people and businesses displaced by the disaster;
  - debris removal;
  - rehabilitation of homes and buildings damaged by the disaster;

- buying, constructing, or rehabilitating public facilities such as water and sewer systems, streets, neighborhood centers, and government buildings;
- code enforcement;
- planning and administration costs (limited to no more than 20 percent of the grant).

HUD notifies eligible governments, which must then develop and submit an Action Plan for Disaster Recovery before receiving DRI grants. The Action Plan must describe the needs, strategies, and projected uses of the Disaster Recovery funds.

❖ **Certified Local Government** (CLG) **Grants** are available for historic preservation through the **State Historic Preservation Office** (SHPO) which is part of the **South Carolina Department of Archives and History** (SCDAH). Although the funding for this program is administered by state, the funding is allocated by the U.S. Department of the Interior. Ten percent of the total federal appropriation to the State Historic Preservation Office's is awarded annually to Certified Local Governments (CLGs). The City of Beaufort and the Town of Bluffton are both Certified Local Governments and are thus eligible for this funding source. The grants can be used for projects related to historic structures and preservation, and requires matching funds (50/50 share) with awards generally ranging from $1,500 to $25,000. Historic Preservation projects often overlap with hazard mitigation efforts and include Identifying, Recording and Recognizing Historic Properties; Planning for Historic Districts and Multiple Historic Properties; Building Stabilization Projects; Planning for Individual Historic Properties; Preservation Education; and Strengthening Local Government Historic Preservation Programs.

❖ The **SHPO** also administers the **State Development ("Bricks and Mortar") Grants** which can be used for stabilizing historic buildings and structures, or protecting historic buildings and structures from the adverse effects of the weather. Eligible applicants include local governments, nonprofit organizations applying for the grants for buildings or structures that are listed in the National Register of Historic Places or eligible for the National Register and have a planned or current public use. The grants are reimbursable, have a 50/50 cost match requirement and generally range from t$5,000 to $20,000. The SHPO's website is located at www.state.sc.us/scdah/histrcpl.htm.

7. References (includes original plans references and any updates)

Adams, Dennis, *Sea Islands: Erosion Remnant Island and Barrier Islands*, from the **Beaufort County Public Library** webpage, www.co.beaufort.sc.us/bftlib/sea.htm#Barrier%20Islands, last revised August 9, 2002.

Federal Emergency Management Agency (FEMA), *Coastal Construction Manual*, *Third Edition*, Publication No. 55, 2001.

FEMA, *Design and Construction Guidance for Community Shelters*, Publication No. 361, July 2000

FEMA, *Flood Insurance Study – Beaufort County, South Carolina and Incorporated Areas*, January, 17 1991

FEMA, Hazards U.S. (HAZUS) 99, Software, Service Release 2.0

FEMA, *Multi-Hazard Identification and Risk Assessment*, 2007
http://www.fema.gov/library/viewRecord.do?id=2214

FEMA, *Taking Shelter from the Storm, Third Edition*, Publication No. 320, August 2008

Goettel and Horner, Inc. for FEMA**,** *Benefit-Cost Analysis of Hazard Mitigation Projects, Volume 4, Hurricane Wind, User's Guide Version 1.0*, January 20, 1995.

Mehta, K.C., J.E. Minor, R.D. Marshall and T.A. Reinhold. 1981. "Wind Speed-Damage Correlation in Hurricane Frederic," in Proceedings ASCE 1981 Convention. 14 pp.

National Oceanic and Atmospheric Administration, Pacific Marine Environmental Laboratory, Seattle, Washington. *Tsunami Hazards Mitigation – A Report to the Senate Appropriations Committee*, NOAA, March 31, 1995. www.pmel.noaa.gov/~bernard/senatec.html

South Carolina Department of Archives and History and Kilpatrick, John, University of South Carolina, College of Business. Historic Districts Are Good for Your Pocketbook: The Impact of Local Historic Districts on House Prices in South Carolina.
http://www.state.sc.us/scdah/propval.pdf

South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management (DHEC-OCRM), *Annual State of the Beaches Report*, March 2002. www.scdhec.com/ocrm/HTML/sob_02.html

South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management (DHEC-OCRM), *Annual State of the Beaches Report*, March 2009. http://www.scdhec.gov/environment/ocrm//pubs/docs/SOB/SOB_09.pdf

South Carolina Department of Natural Resources, South Carolina Drought Response Program. *South Carolina Droughts since 1925.* http://www.dnr.sc.gov/climate/sco/Drought/drought_response_program.php

South Carolina Forestry Commission, Russell Mixson, Beaufort County Forest Ranger, *personal communication*, November 12, 2002.

South Carolina Emergency Management Division, *South Carolina 2009 Hurricane Plan*, 2009. http://www.scemd.org/News/publications/2009%20Hurricane%20Guide/Index_New_HG_09.html

South Carolina Geologic Survey, *Personal Communication*, Arthur Maybin, III, Project Leader, Geologic Mapping and Education Outreach, October 2002

South Carolina Seismic Network, Department of Geological Sciences, University of South Carolina. scsn.seis.sc.edu/index.html

United States Army Corps of Engineers (USACE) – Charleston District, *Hurricane Hugo After-Action Report*, April 1990.

United States Coast Guard, National Response Center, web page, http://www.nrc.uscg.mil/nrchp.html

United States Geological Survey, Earthquake Hazards Program, National Seismic Hazard Mapping Project, http://earthquake.usgs.gov/research/hazmaps/

United States Geological Survey, National Landslide Hazards Program, *Landslide Overview Map of the Conterminous United States*, http://landslides.usgs.gov/learning/nationalmap/

University of South Carolina, Beaufort, Pritchard Island Research and Education. Amber VonHarten, Research Coordinator. Personal Interview. March 6, 2003.

University of South Carolina Hazards Research Lab and the South Carolina Emergency Management Division, South Carolina State Hazard Assessment

University of South Carolina Hazards Research Lab and the South Carolina Emergency Management Division, *South Carolina Hazards Mapping Interface - GIS Data*

Appendix A

May 14, 2009

Hazard Mitigation Planning Committee

First Meeting/Kick-off

Participants present:

Ed Nelson

Trudie Johnson

John Webber

Ginnie Kozak

Libby Anderson

Juan Fui

Linda Bridges

Matthew Brady

Wayne Walters

Alice Howard

Jay Hogan

Ken Jordan

Tony Criscitiello

Arthur Cummings

Marjorie Arnold

The meeting began with discussion of the formation of the committee. The group was presented with a list of last plan's participants, and were informed that they were invited because they were on that list. The group generally agreed that the people present and the list represented the necessary staff for the update. The agreed that the previous plan's list should serve as the foundation for the Hazard Mitigation Planning Committee, and that LCOG staff should be responsible for contacting and setting up HMPC meetings. Mr. Brady stated the importance of the planning process, and noted that public meetings should be held and that the HMPC meetings should be documented.

Mr. Brady stated that any information about hazard mitigation should be given to them that they have, included updated planning documents, GIS, etc. He also stated that with the help of data they collect, the LCOG will play the primary role in updating hazard information such as profiles and vulnerability. He discussed what he learned at the SCEMD training session, and gave a brief overview of the materials to be updated. Mr. Brady gave a review of all FEMA requirements for all sections of the plan per the "Guidance."

Finally, Mr. Brady went over all of the sections/elements of the plan with the HMPC. He stated that some of the most important things that the planning committee will need to do will be update the goals/objectives/actions that are associated with the plan. They would also ultimately be responsible for scheduling public meetings. The next meeting time was discussed (June), and the HMPC was instructed to start revising their actions for their particular jurisdiction.

He also discussed the capability section, and stated that he would review the documents for accuracy and that the HMPC would need to check his work to make sure he had the right capability documents in the plan, etc.

Trudie Johnson discussed the important of adhering the NFIP and CRS standards, and stated that they wanted to do a more thorough job in order to produce a higher CRS rating.

After discussion ended, the group was dismissed

Beaufort County Hazard Mitigation Plan Stakeholders Meeting

June 18, 2009

- Overview of community mitigation capability initiatives and documents
- Review action item update list
- Review of goals from hazard mitigation plan
- Update on USC's hazard assessment efforts
- Next meeting and in-office meetings

Beaufort County Hazard Mitigation Meeting, June 19, 2009
Location: Beaufort County Administration Building.
Time: 10: 00a.m.

Attendance:
Edward Nelson, Beaufort County
Marcy Benson, Town of Hilton Head,
Trudie Johnson, Town of Hilton Head
Jay Hogan, Beaufort County
John Webber, Beaufort Country
F. Wayne Walters, Beaufort County Government
Ginnie Kozak, Lowcountry Council of Governments (LCOG)
Matthew Brady, Lowcountry Council of Governments
Jon Lattimore, Lowcountry Council of Governments

- The meeting started at 10:05am

- Matthew Brady began by discussing the previous plans goals/actions/objectives. These were brought up at the first meeting, and each of the members had time to look over them and updates were given to be finalized for the plan. Any other updates for these items were to be sent to Matthew either via email or by individual meetings.

    - Ed discussed the first Action item on the list, mentioning that the archive facility was moved from its former location

    - Emails will be sent on implementation status. Trudie mentioned the construction of new fire stations and also mentioned that the mayor of Hilton Head wanted the bridge in Beaufort County to be retrofitted to mitigate a potential hazard.

    - Edward Nelson said that he will contact someone from Beaufort County engineering in reference to HMP retrofitting. In terms of preparation of employees, Trudie Johnson said that training is being done with the building officials.

- Matthew Brady also discussed the review of mitigation initiatives, requesting each representative at the meeting table to evaluate the list of updated goals, objectives and actions and to check for mistakes or make suggestions for things to be added to the list. Also, the Hazard Mitigation chart with the document checklist for the County and the municipalities was presented with a request that it be evaluated by the representatives at the table. The list was intended to give HMPC a direction to go with new action items that Matthew may have left off the list.

- Capability documents were also discussed again, with Matthew stating that the LCOG staff had reviewed the Community's mitigation Capability, and that he would be going around to each individual community to make sure he had their particular situation reflected correctly.

- Matthew asked about the Town of Yemassee's participation in the Hazard Mitigation Plan. Ed Nelson said that there was no participation from Yemasee previously. Trudie Johnson and John Webber felt the Town of Yemassee should be invited to participate and to attend all meetings. LCOG will take care of this. Town of Yemassee is part of the HMP because 10 percent of it is in Beaufort County and must be included in the planning process. It is important to invite Yemassee because of the part the Town will play in Beaufort County's evacuation and recovery and because there is a large Beaufort County Housing Authority project there.

- Matthew discussed talking to the Department of Natural Resources about repetitive loss structures, and that it is necessary to have the information about those structures in each jurisdiction. Trudie said the Town of Hilton Head's Geographic Information System's manager could provide that information, both numbers and general locations of the properties and which have already been mitigated. to get data in reference to the repetitive loss structures. Ed said that he would provide the data for Beaufort County.

- Matthew mentioned that he talked to University of South Carolina (USC) about their hazard assessment project that is ongoing. USC will have completed hazard assessment data for the County once this project is complete. Also, he briefly went over the status of the Capability, Vulnerability and Hazard profiling portion of the plan, explaining that most of the updated information had been updated and asking for any input into the available updates.

- Matthew initiated a discussion of the Hazard Mitigation Plan (HMP) goals/objectives/actions from the 2004 document. He also went on to discuss vulnerability to each hazard for the County and its jurisdictions. The information would be based on data from the COG, and he took comments

    - Trudie asked what can be done in reference to the HMP goal number 9. Ginnie Kozak felt as though the Beaufort Country evacuation plan is more important and should have be updated.

    - Edward Nelson mentioned evaluating property owners that are remodeling to ensure that they are in compliance with hazard mitigation. Trudie Johnson mentioned the 2006 International Residential Code. Homebuilders have lobbied against it in Columbia, because they felt they would losing money. She feels the code should be adopted in full, because of its strong building

codes and the particular susceptibility to hazards we face on the coast. It is possible that the Community Rating System (CRS) could be lost. Further discussion, Ginnie Kozak and Edward Nelson, it was a general consensus of establishing stringent codes/standards on the coastal line. Ginnie Kozak mentioned the importance of education when it comes to CRS, floodplains, etc.

- John Webber feels as though mitigation improves the recovery process. Trudie Johnson mentioned that a strong link should be connected to HMP and DRP. John Webber said that the municipalities are working collaboratively for HMP (i.e., impact assessment). Ginnie Kozak requested to have combined meetings with representatives from the surrounding counties and other municipalities. Trudie Johnson felt as though that Goal 8 was a little weak and an evaluation of where the emergency personnel stand needs to be performed, and the Goal 8 needed its progress documented.

- Matthew Brady then discussed the flood maps-----how can they be enforced, with a strategy of how people cannot be penalized due to flood map updating. Goal 9 needs to be rewarded to ensure the process of updating the flood maps.

- John Webber felt as though Goal 3 of the Action Items General Goals need to be more detailed. Trudie Johnson mentioned that the comprehensive plan for the Town of Hilton Head was being updated. John Webber asked about the drainage in reference to water pollution, in reference to Goal 6. Trudie Johnson said that it is not about water pollution but about the maintenance of stormwater.

- Matthew Brady discussed the survey that can be disseminated to the public and how it can be submitted back by the public (i.e. newspaper websites). Ginnie Kozak felt as though this would be a good idea to get public input about Hazard Mitigation. John Webber mentioned the possibility of using the questionnaire as an opportunity to inform the public of lawmakers' influence with the adoption and enforcement of stringent building codes. There were also suggestions of using the questionnaire and related media coverage to provide information about some of the key issues of Hazard Mitigation Planning.

- Matthew Brady mentioned eligible grant activities in which the departments could get FEMA funding for hazard mitigation and hazard recovery projects. There has also very recently been a request to the COGs by SCEMD to encourage local governments to apply for funding for Flood Mitigation since available funding has not been utilized John mentioned that he would like to look into eligible building improvements for the County Administration Building Although no one from the Storm Water Management utility was there, they may have an eligible project available. Another potential project is the completion of Hilton Head's drainage plan.

- Matthew also discussed prioritization of the goals based on NFIP and the methodology to prioritize. He stated that the prioritization was not "set in stone" but required by FEMA.

- Matthew Brady said that he will be contacting everyone in the meeting to talk to each one individually, with the assistance of Jon Lattimore, in order to discuss individual parts of the plan and any other concerns. Matthew Brady mentioned that the next meeting will be on Thursday July 16th @ 10am in the Executive Conference Rm 170, Beaufort County Administrative Building.

Agenda
Flood Mitigation/Hazard Mitigation Planning Meeting
August 27, 2009
(items subject to change)

1. Prioritization of goals in accordance with NFIP
2. Cost Benefit Review/Discussion of Feasibility of action items
3. Timeline for completion of any new action items
4. Planning the Public Meeting schedule (please be thinking of dates)
5. Ranking of Hazards
6. Dismissal

Hazard Mitigation Meeting

Meeting Minute Notes August 27 2009

HMPC members present:

Ed Nelson

Linda Bridges

Matthew Brady

Jay Hogan

Marcy Benson

Trudie Johnson

Arthur Cummings

John Webber

Libby Anderson

Todd Furgeson

Melissa Easler

Colin Kinton

George Owens

Ginnie Kozak

Maggie Hickman

Russell Byrd

Roni Abdella

Robert Klink

Jain Fui

Matthew Brady (did not sign in)

7. **Prioritization of goals in accordance with NFIP**
    - Mr. asked for the group to look over the revised goals and determine if they were written as the HMPC had directed him. Furthermore, he asked them to review the goals for NFIP compliance. It was generally agreed that the goals/objectives/actions were final, and that any changes would be sent directly to Matthew from the HMPC members.

- Mr. Brady emphasized that all of the goals need to be prioritized and written in a manner that is compliant with the NFIP.
- The group made several suggestions (both grammatical and substantive)
  - Expand on all goals to ensure NFIP complians
  - Ensure that FEMA guidelines are emphasized in the objectives and goals
- After the comments, the group decided to allow the LCOG staff to make the changes, and offer any changes within seven-to-ten days for the goals.
- Overall, the group did decide that the goals met the requirements and were established in accordance with NFIP.

8. Cost Benefit Review/Discussion of Feasibility/Prioritization of action items

- Mr. Brady discussed the necessity of a cost-benefit review for the actions that were listed.
- He also presented a chart that would allow all stakeholders to assign a numerical ranking to each of the proposed action items.
- The chart/worksheet gave a score to each item based on nine criteria: strategy effectiveness, percentage of population benefitted, time to implement, cost to community, funding source, cost to others, community support and project feasibility. The worksheet will produce a score.
- Mr. Brady also stated that he will electronically send everyone the worksheet.
- He asked every to make changes to the action items as they saw they were appropriate.

9. Timeline for completion of any new action items

- Mr. Brady mentioned that all of the stakeholders should look at the action items, and the responsible jurisdiction should give an estimated time for completion of the action item, cost, etc.
- Any changes to the first drafts of action plans were decided to be on track and finalized

- Matthew also generally discussed where the draft of each section of the plan stood.

10. Planning the Public Meeting schedule (please be thinking of dates)
    - Mr. Brady mentioned that the HMPC should come up with dates for two more public meetings regarding this plan.
    - Mr. Cummings stated that they would look into a meeting time.
    - Ms. Johnson and others stated that having a meeting while the planning commission meets would involve more stake holders in the process.

11. Ranking of Hazards

    - Mr. Brady mentioned that only four main hazards were reported according to the data previously, and these generally fall in line with the data reported this time
    - He also mentioned, however, that during hazard assessment, there were other hazards that could pose a threat and that the HMPC should rank them
    - The HMPC decided to keep the ranking of the hazards as the original plan had them described, as nothing had changed dramatically since the original plan

12. Dismissal

APPENDIX B
SIGN IN

SIGN IN SHEET 5-14-2009

Name	Email Address	Phone Number
Edward Nelson	edwardn@bcgov.net	470-2691
TRUDIE JOHNSON	trudiej@hiltonheadislandsc.gov	341-4665
John Wilson	johnw@bc.gov.net	470-2830
Ginnie Kozak	gKozak@lowcountrycog.org	
Libby Anderson	landvoss@city.of.beaufort.org	525 7412
Jian Fei	Jfei@bcgov.net	470-2621
Linda Bridges	lbridges@portroyal.org	986-2207
Matthew Brady	mbrady@lowcountry.org.org	776-5536
Wayne Walters	waynew@bcgov.net	470-4763
Alice Howard	alice.Howard@usmc.mil	228-7558
Jay Hogan	jhogan@bcgov.net	470-2728
Ken Jordan	kenj@bjwsa.org	987-9224
Tony Criscitiello	tonyc@bcgov.net	470-2724
ARTHUR CUMMINGS	arthurc@bc.gov	470-2684
Marjorie Arnold	marjoriea@bcgov.net	470-2684

Hazard Mitigation Workshop

8-27-09

SIGN IN SHEET

Name	Email Address	Phone Number
ED NELSON	edwardn@bcgov.net	470-2691
Linda Bridges	lbridges@portroyal.org	986-2207
Matthew Brady	mbrady@lowcountrycog.org	725-5536
Jay Hogan	jhogan@bcgov.net	470-2728
Marcy Benson	marcyb@hiltonheadislandsc.gov	341-4689
TRUDIE JOHNSON	trudiej@hiltonheadisland.gov	341-4665
ARTHUR CUMMINGS	arthurc@bcgov.net	470-2684
John Webber	johnwebber05@BCGov.net	470-2830
Libby Anderson	landerson@cityofbeaufort.org	525 7012
Todd Ferguson	Toddf@bcgov.net	470-3100
Missy Easler	melissae@bcgov.net	470-3055
Colin Kinton	ckinton@bcgov.net	470-2631
GEORGE OWENS	GOWENS@TOWNOFBLUFFTON.COM	706-4525
Ginnie Kozak	gkozak@lowcountrycog.org	726-5536
County Eng. Admin - Maggie Hickman	Maggieh@bcgov.net	470-2625
Russell Byrd	Russell.Byrd@usmc.mil	228-7119
Roni JoAbdella	Ronij@ibcode.net	209-3275
County Eng Robert Klink	robertk@bcgov.net	470-2625
Asst County Eng. Jain Fei	jfei@bcgov.net	470-2625

Hazard Mitigation Workshop

12-14-04

SIGN IN SHEET

Name	Email Address	Phone Number
EDWARD NELSON	edwardn@bc.gov.net	843-470-2691
Matthew Brady	mbrady@lowcountrycog.org	726-5536
[illegible]	[illegible]	525 7012
Arthur L. Cummings	arthurc@bcgov.net	470-2684
Linda Bridges	lbridges@portroyal.org	986-3307
TRUDIE JOHNSON	trudiej@hiltonheadislandsc.gov	843 341 4665
Roni Abdella	ronij@ibcode.net	843-209-3275

Hazard Mitigation Workshop

APPENDIX C
PUBLIC MEETING NOTICES

GOOD MORNING

LOCAL GOVERNMENT

TODAY

Beaufort-Jasper Water & Sewer Authority board meeting: 9 a.m., administration room, 6 Snake Road, Okatie

Agenda: Presentation on draft integrated water resources plan, wastewater consolidation project, capital improvement project additions.

On the Web: www.bjwsa.org

S.C. Department of Health and Environmental Control public hearing: 6 p.m., Palmetto Electric, 1 Cooperative Way, Hardeeville

Agenda: Discussion of permit application by the Sembler Co. to fill in 2.55 acres of wetlands at Okatie Crossings, along U.S. 278 and S.C. 170.

On the Web: www.scdhec.gov

BEAUFORT COUNTY

Airports Board: 1:30 p.m., County Council Chambers, county administration building, 100 Ribaut Road, Beaufort

Agenda: Updates on Hilton Head Island Airport and Beaufort County Airport on Lady's Island; hangar rental rates, aircraft tax rates, operating agreement with Signature Flight Services, airport grant discussion.

On the Web: www.bcgov.net

TOWN OF HILTON HEAD ISLAND

Neighborhood meetings: 10 a.m., Hilton Head Island library, 11 Beach City Road; and 6 p.m., Benjamin M. Racusin Council Chambers, Town Hall, One Town Center Court, Hilton Head Island

Agenda: Public input on three chapters of proposed comprehensive plan: land use, economic development and natural resources. Discussion about an update to the all hazards mitigation plan, which lays out how the town will prevent or lessen damage from natural disasters.

On the Web: www.hiltonheadislandsc.gov

CITY OF BEAUFORT

Northwest Quadrant Study Group: 5 p.m., 1211 Boundary St., Beaufort

Agenda: Discussion of first neighborhood association meeting, interviews within the four-block core area, architects' reactions, results of interviews with property owners and other topics.

On the Web: www.cityofbeaufort.org

TOWN SEEKS INPUT

By DANIEL BROWNSTEIN
dbrownstein@islandpacket.com
843-706-8125

The Town of Hilton Head Island is asking the community to comment on the first three chapters of its upcoming comprehensive plan during two meetings Thursday.

The chapters on land use, economic development and natural resources will be available at the meetings.

Senior planner Shawn Colin said the town plans to unveil the comprehensive plan three chapters at a time over three months before the entire package heads to the Planning Commission and on to the Town Council this fall.

The comprehensive plan is used as a blueprint for all planning decisions on the island.

Titled "Charting the Island's Future from Here to 2030," it will be the first full update since the plan was created in 1999, though some changes were made in 2004.

Before town employees and a board of residents began crafting the new plan, they met with more than 300 people and organizations and considered about 500 responses to a survey.

The meetings will also include a presentation about disaster plans.

IF YOU GO:

Both meetings soliciting input on the comprehensive plan are Thursday.

- **10 a.m.,** Hilton Head Island Public Library, 11 Beach City Road
- **6 p.m.,** Benjamin M. Racusin Council Chambers, Town Hall, One Town Center Court

More information about the comprehensive plan is available online at www.hiltonheadislandsc.gov. Click on the "Charting the Island's Future" link on the home page.

We would like to know what you think!

Neighborhood Meeting

"Charting the Island's Future - from Here to 2030"
(Town of Hilton Head Island Comprehensive Plan Update)

The Comprehensive Plan Committee of the Planning Commission would like to present a summary of broad strategies developed for three elements to the community and ask for input. The elements to be presented include:

- **Community Facilities**
- **Transportation**
- **Recreation**
- **Priority Investment**

Each meeting listed below will include a formal presentation and a facilitated discussion.

"Charting the Island's Future from Here to 2030" is a collaborative effort between the community and its leaders to form a vision for the future of the Town over the next 20 years.

So far, more than a hundred stakeholder interviews, over 500 responses from a community assessment survey, and input from over 200 citizens during a series of neighborhood meetings, have provided important information that has been considered during the update of the plan.

In addition, there will be a presentation on the updated draft of the Hazard Mitigation Plan.

Please plan to attend one of the meetings and join us in "Charting the Island's Future from Here to 2030!"

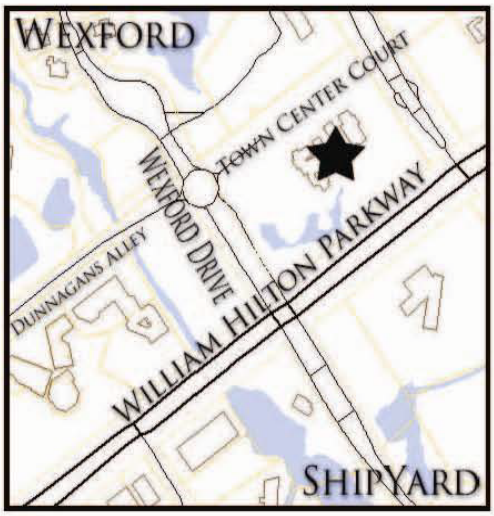
Neighborhood Meeting Choices

(A map for each location can be found on the page that follows.)

1. **Thursday, October 29th in Benjamin M. Racusin Council Chambers at Town Hall. Presentation at10am.**

2. **Thursday, October 29th at Hilton Head Island Public Library. Presentation at 6pm.**

Location of Neighborhood Meetings



Hilton Head Island Library
11 Beach City Road
Hilton Head Island, SC 29926

Thursday, October 29th at 6:00pm

Hilton Head Island Town Hall
1 Town Center Court
Hilton Head Island, SC 29928

Thursday, October 29th at 10:00am

NOTES:

Information on the plan can also be found on the Town's website at www.hiltonheadislandsc.gov
(Click on: "Charting the Island's Future - Comp Plan Update.")
or
Contact Shawn Colin at 843-341-4696 or shawnc@hiltonheadislandsc.gov

APPENDIX D
SURVEY

Beaufort County Multi-jurisdictional Hazard Mitigation Plan Survey

7. If damage occurred, please describe the date of the event and the cost of damage.

8. If flooding caused the damage, what was the source of the flooding? (Check all that apply)

- [ ] Storm Surge
- [ ] Insufficient storm Drainage
- [ ] overbank flooding of an adjacent stream or river

Other (please specify)

9. If the damage was caused by wind, what type of wind event was it?

- [ ] Tropical Storm
- [ ] Tornado
- [ ] Nor'easter

Other (please specify)

10. If the damage was caused by events other than flooding or wind, please describe the event and how the damage was caused.

11. Please describe any corrective measures taken to protect your property from damage due to natural hazards such as flooding, wind, erosion, etc. Please include the cost and effectiveness of these measures, if available.

* **12. Protective mitigation measures have several benefits, including decreasing damage from hazards (such as flooding) and lower insurance rates. In light of this, would you be willing to pay for any retrofits to your property in order to mitigate from hazard damage?**

- ( ) Yes
- ( ) No

Page 2

Beaufort County Multi-jurisdictional Hazard Mitigation Plan Survey

13. Would you support the enforcement of more stringent building codes on new construction and significant improvements to existing structures?

- ◯ Yes
- ◯ No

14. If you ever received any federal assistance or assistance from your county/town/city for damage to your property due to flooding, wind, erosion, etc. , please describe.

15. Please provide any suggestions your have on how to protect your property/neighborhood from flooding, wind, erosion or other types of natural hazards.

16. Please provide any additional comments.

Page 3