Dauphin Island
WATERSHED MANAGEMENT PLAN

December 2022

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Prepared for:
Mobile Bay National Estuary Program

Prepared by:
Environmental Science Associates

Subconsultants:

thompson ENGINEERING

Barry Vittor & Associates

EPHRIAM ENVIRONMENTAL LLC.
CONSULTING · ECOASSESSMENTS · PERMITTING

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CHAPTER 1 Introduction

Introduction

Dauphin Island is a barrier island approximately five square miles in area and is the southernmost point of Mobile County, Alabama. The Island is 14 miles long and is 1.75 miles at its widest point. First settled by the French in the early 18th century, the Island has a rich cultural and ecological heritage which draws tens of thousands of visitors every year from across the United States.

There is a desire among a variety of stakeholders to protect, restore, and enhance the Island's ecological assets while simultaneously implementing innovative solutions to promote and sustain the Island's community and economy. In the aftermath of the *Deepwater Horizon* oil spill, multiple restoration, conservation, regulatory, and economic actions were undertaken and are in various stages of planning and implementation by federal and state agencies, local government, academic institutions, and others; with the goal of preserving Dauphin Island's natural beauty and cultural heritage to ensure a sustainable, vibrant, and resilient Island for future generations.

However, historical and recent hurricanes and human-made disasters such as Hurricanes Ivan (2004), Katrina (2005), and the *Deepwater Horizon* oil spill (2010), have resulted in substantial ecological changes on the Island. These events, coupled with commercial and residential development since the 1950s, have resulted in the loss and degradation of natural habitats, including wetlands, seagrasses, oyster reefs, beach and dune habitats, and maritime forest. Impacts from a changing climate, including sea level rise and coastal storms, continue to impact the habitats, ecological resources, and economies of this barrier island.

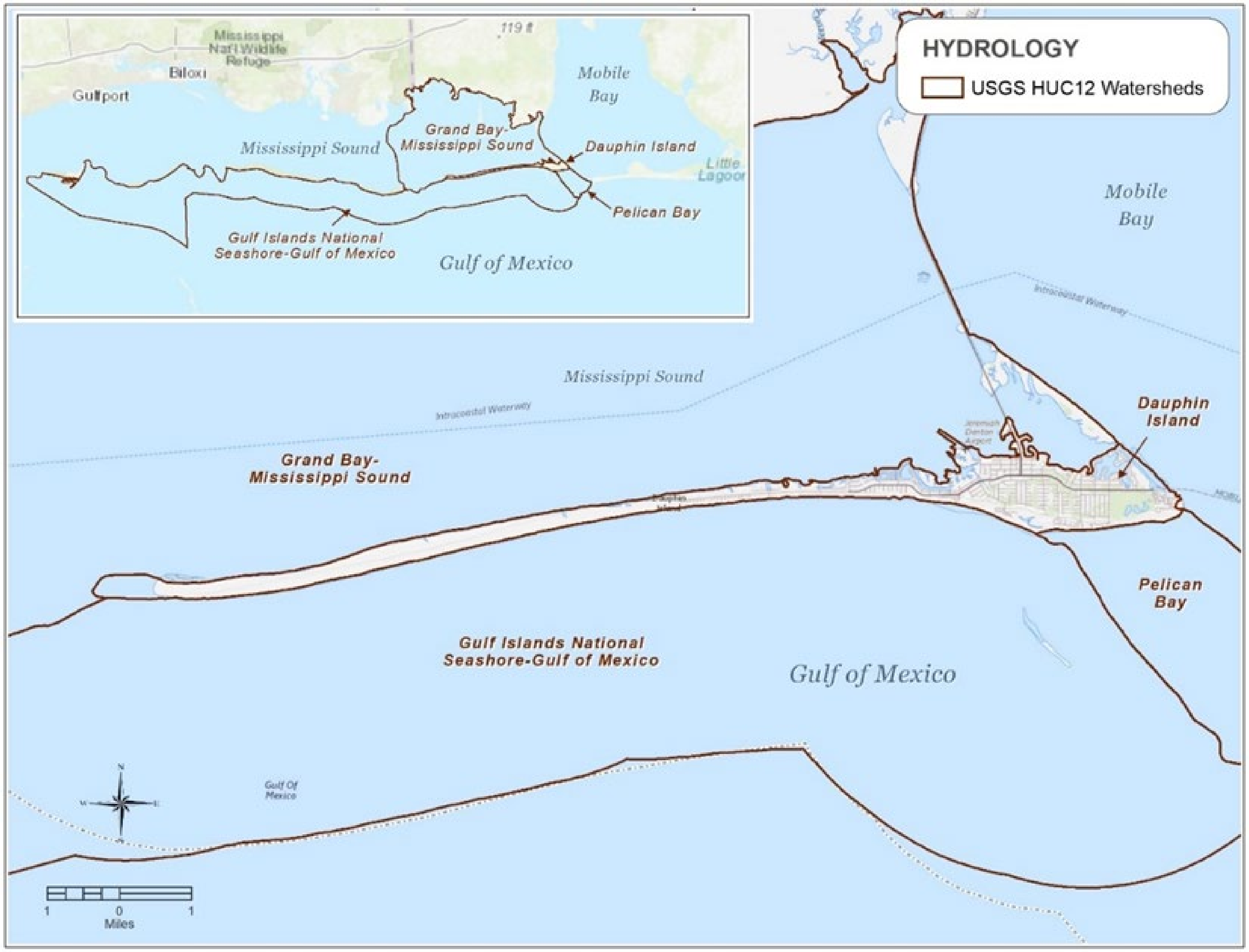
The Dauphin Island Watershed Management Plan has been developed to provide a community road map for improving environmental management across the Island for greater community resilience and conservation of the Island's cultural heritage that makes Dauphin Island unique.

1.1 Plan Overview

The Mobile Bay National Estuary Program (MBNEP), in partnership with the State of Alabama, secured funding through the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States (RESTORE) Act to develop watershed management plans (WMPs) for tidally influenced watersheds along the Alabama coast. MBNEP has partnered with stakeholders to develop these WMPs, which provide a roadmap for restoring or conserving watersheds and improving water and habitat quality in areas where resources could have been damaged by the *Deepwater Horizon* oil spill.

The Dauphin Island Watershed was identified as one of the priority watersheds by the MBNEP Project Implementation Committee (PIC). **Figure 1-1** presents an overview of the Dauphin Island Watershed area and the surrounding U.S. Geological Survey (USGS) 12-digit Hydrologic Unit Code (HUCs). Some areas within the neighboring HUCs are included in the WMP due to their importance to Dauphin Island (e.g., Little Dauphin Island, Sand Island, Dauphin Island Causeway).

The Dauphin Island WMP was developed to improve and protect the things people value most about living along the Alabama coast, as identified in the MBNEP Comprehensive Conservation and Management Plan **(Figure 1-2)**. The WMP identifies issues and data gaps related to watershed conditions; provides an implementation program recommending a prioritized list of actions to improve water quality, ecological integrity, and resilience; and includes a project implementation schedule, interim milestones, ways to measure or monitor progress, an education/outreach plan, and identification of technical and financial resources needed to address implementation success.



SOURCE: Thompson Engineering

FIGURE 1-1 Dauphin Island Watershed Area and Surrounding HUCs

SOURCE: MBNEP

FIGURE 1-2 MBNEP Comprehensive Conservation and Management Plan Six Values

- **Water** – The coastal community desires water that is drinkable, swimmable, and able to support aquatic and marine life. WMPs identify actions to reduce point and non-point source pollution and remediate past effects of environmental degradation, thereby reducing outgoing pollutant loads into Mississippi Sound and the Gulf of Mexico.
- **Fish**, wildlife, and the habitats that support them – The WMP identifies actions to reduce the incidence and impacts of invasive flora and fauna and improve habitats necessary to support healthy populations of fish and shellfish. It also provides strategies for conserving and restoring coastal habitat types providing critical ecosystem services and identified by the MBNEP's Science Advisory Committee (SAC) as most threatened by anthropogenic stressors. These habitat types – freshwater wetlands; streams, rivers, and riparian buffers; and intertidal marshes and flats—were classified as most stressed from dredging and filling, fragmentation, and sedimentation—all related to land use change.
- **Resilience** and environmental health – The coastal community relies upon coordinated actions to reduce vulnerability to, and recover from, the range of hazards we face—natural and otherwise. The WMP identifies vulnerabilities in the Watershed from accelerated sea level rise, storm surge, temperature increases, precipitation, and recommends improvements to watershed resilience through adaptation strategies.
- **Access** – The WMP characterizes existing opportunities for public access, recreation, and ecotourism and identifies potential sites to expand access to open spaces and waters within the Watershed.
- **Heritage** and culture – Preserving heritage and culture was at the core of resident's concerns on Dauphin Island. The WMP characterizes customary uses of biological resources and identifies actions to preserve culture, heritage, and traditional ecological knowledge of the watershed.

- **Coastlines**, beaches, and dunes – Provide critical edge habitat to aquatic and terrestrial animals and recreational opportunities for residents and visitors. The WMP assessed shoreline conditions and identifies strategic areas for shoreline stabilization and enhancements.

1.1.1 WATERSHED MANAGEMENT PLANNING TEAM

The development of a WMP is a community-based process bringing stakeholders together to collaborate on the development of a science-based planning document to guide the future of the Watershed. Through a competitive selection process, the MBNEP contracted with Environmental Science Associates (ESA) to lead the development of the Dauphin Island WMP. The ESA Team included Thompson Engineering, Barry Vittor and Associates, and Ephriam Environmental. The ESA Team worked in close collaboration with MBNEP, the Town of Dauphin Island, and other local and regional stakeholders to develop the WMP.

1.1.2 PERIOD ADDRESSED BY THE PLAN

The scope and breadth of the recommended improvements from this WMP will require significant time to implement. This WMP provides a 10-year framework to begin the implementation of recommended actions. This time frame is subject to change, depending on the availability of funds, success of recommended projects, and watershed response. As part of the recommended adaptive management approach, a review of the WMP recommendations should be performed every two years, with an in-depth assessment every three- to five-years. This review should consider monitoring results from implemented projects and whether changes are warranted to the project type, scope, or area of implementation to achieve the stated goals and objectives of the WMP.

1.2 Plan Purpose, Goals, and Objectives

1.2.1 PLAN PURPOSE

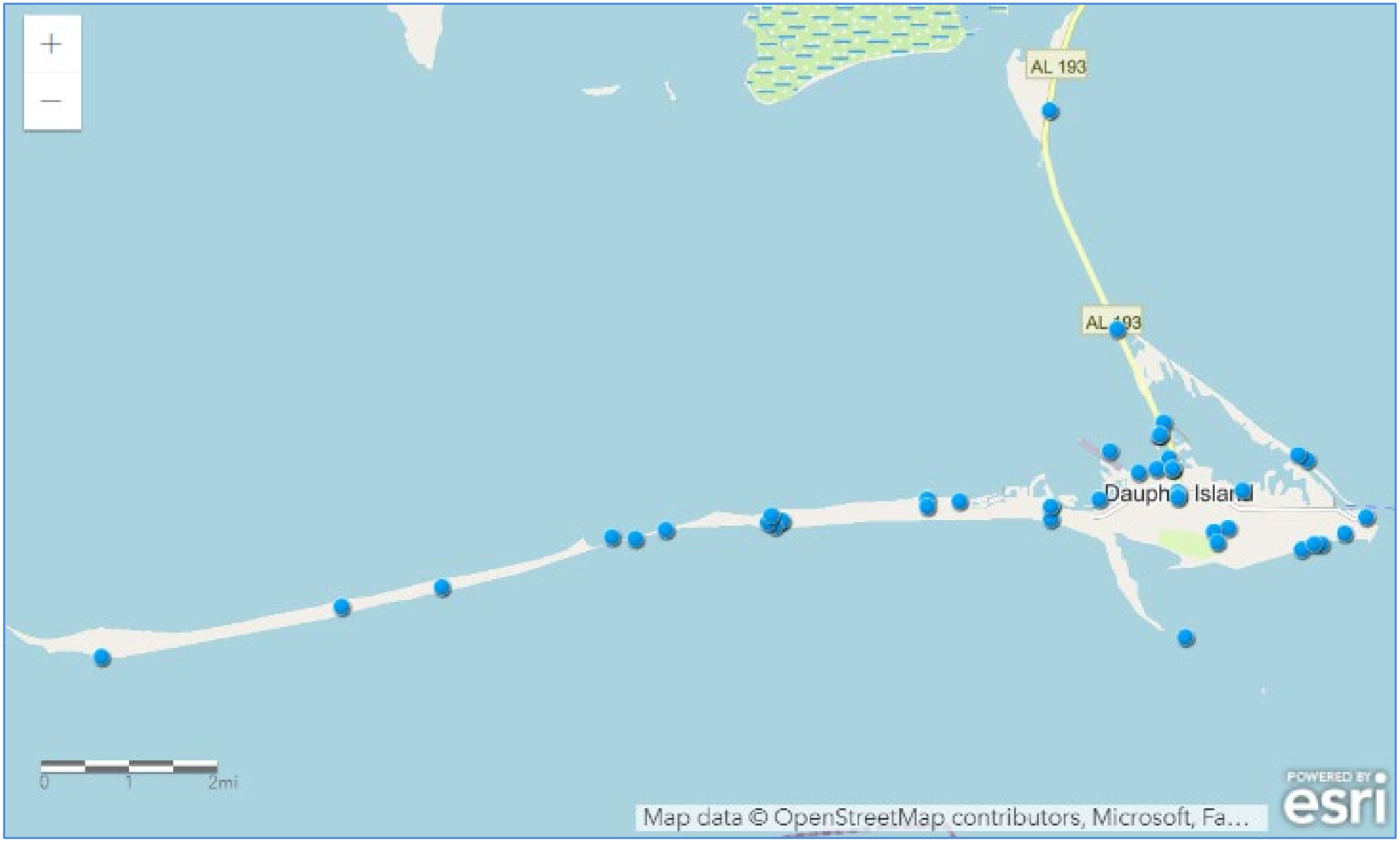
The purpose of this WMP is to guide resource managers, policy makers, community organizations, and citizens to protect the hydrological, biological, and cultural integrity of the Dauphin Island Watershed, and, specifically, its waters and habitats to support healthy populations of fish, shellfish, and wildlife; and provide for recreational opportunities. To achieve this purpose, the WMP documents current conditions within the Watershed, evaluates potential management measures to improve impaired conditions and create a healthier Watershed, and recommends a prioritized list of actions to improve water quality, ecological integrity, and, by extension, the quality of life for all inhabitants of Dauphin Island.

This WMP is also intended to build upon past and ongoing planning and implementation efforts. The Town of Dauphin Island, and its partners, have made great strides in developing long-range planning documents including:

- Dauphin Island's Strategic Plan – A 20 Year Vision: Final Report & First Five Years of Implementation Recommendations (Five E's Unlimited 2007);
- Town of Dauphin Island Comprehensive Plan 2030 (Town of Dauphin Island and SARPC 2013); and
- Interim and Final Alabama Barrier Island Restoration Assessment Reports (USGS and USACE 2017 and 2020).

They have also made significant progress in implementing recommendations from these plans. At the onset of this project, the WMP Team catalogued over 50 projects (**Figure 1-3,** which is interactive on the MBNEP website) categorized as proposed, planned, ongoing, or recently completed. A brief list of projects occurring during the development of this WMP is presented below and more details are provided in **Chapter 7, Management Measures**:

- Aloe Bay Town Master Plan
- Aloe Bay/Mississippi Sound Water Quality Enhancement Project
- Dauphin Island Sensitive Habitat Protection and Management Plan
- Dauphin Island Adaptation Pathway Project
- Dauphin Island East End Beach and Dune Restoration Project
- Dauphin Island West End Beach and Dune Restoration Project
- Cedar Point Pier Acquisition and Upgrades
- Dauphin Island Causeway Shoreline Restoration Project
- Desoto Avenue Boat Ramp Construction
- Dauphin Island West End Bird Conservation and Management Plan
- Graveline Bay Marsh Restoration Project
- Little Billy Goat Hole and East End Beach Access Improvements Project
- Little Dauphin Island Restoration Assessment
- Multiple Land Acquisitions (Far West End, West End, Mid-Island, Graveline Bay, Aloe Bay, Desoto Ave., Steiner Property, Tupelo Swamp, Gorgas Swamp, Tupelo Gum Swamp, Little Dauphin Island, and others)



SOURCE: Figure by Environmental Science Associates

FIGURE 1-3 Dauphin Island Proposed, Planned, Ongoing, or Recently Completed Projects

1.2.2 PLAN VISION, GOAL, AND OBJECTIVES

The **vision** for the WMP was carried froward from the Dauphin Island's Strategic Plan (Five E's Unlimited 2007) and Comprehensive Plan 2030 (Town of Dauphin Island and SARPC 2013):

> *On behalf of the people of Dauphin Island, the Town will lead this small island community through the 21st century by preserving the Island's history, culture, and environmental assets, while planning for a future that capitalizes on its natural resources to promote economic well-being.*

The **goal** of the WMP is to improve the community's ability to manage the diversity of unique Island habitats to support a sustainable, vibrant, and resilient Island for future generations.

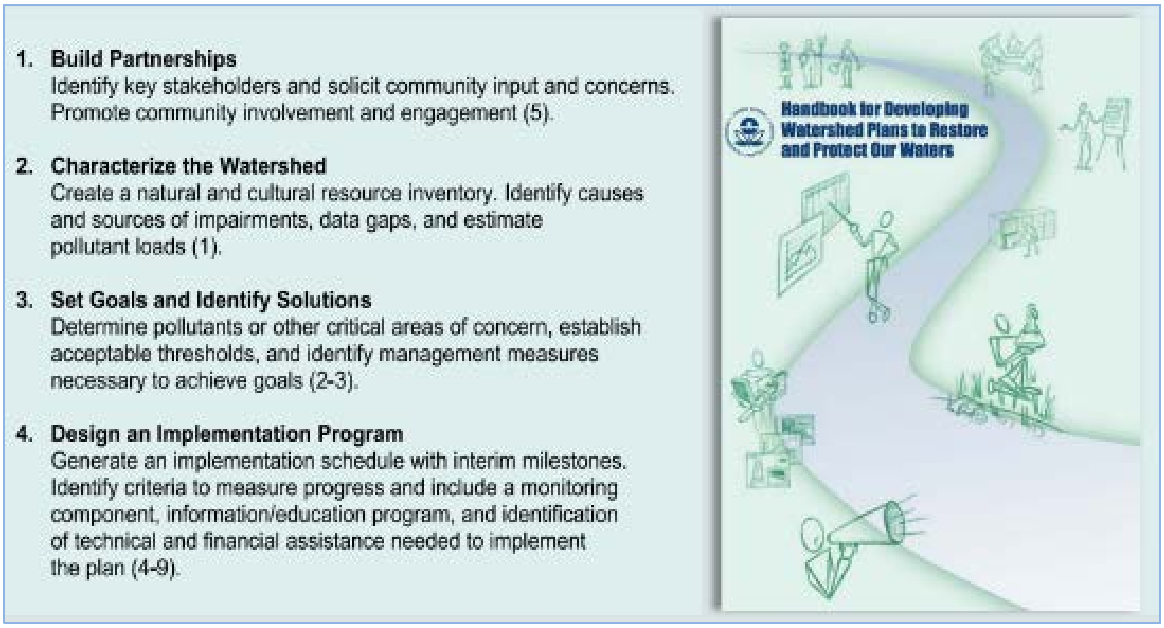
Specific **objectives** for this WMP include:

1. Maximize environmental health and resilience by identifying a suite of concrete actions and innovative solutions to improve local governance of the environment and long-term economic resilience.
2. Improve stormwater and infrastructure management and water quality by identifying critical areas and issues and developing management measures for improvements.
3. Protect and restore habitats and sensitive areas to improve ecological function and enhance ecosystem services.
4. Manage coastlines and dunes for long-term Island sustainability.
5. Promote community ownership, knowledge, and involvement in watershed management by engaging 10% of the Island population.

1.3 Regulatory Conformance

1.3.1 EPA NINE KEY ELEMENTS

Although there is no formal requirement for U.S. Environmental Protection Agency (EPA) to approve watershed management plans, the EPA has identified elements that are critical for the development of WMPs and requires that "nine key elements" be addressed in watershed plans funded with incremental Clean Water Act section 319 funds (EPA 2008). The MBNEP watershed planning objectives conform to the EPA's "nine key elements" of watershed planning, listed parenthetically in **Figure 1-4** below.



SOURCE: EPA 2008

FIGURE 1-4 EPA Nine Key Elements

1.3.2 COASTAL ZONE ACT REAUTHORIZATION AMENDMENT SECTION 6217(G)

The MBNEPs watershed planning process also conforms to the National Oceanic and Atmospheric Administration Coastal Zone Act Reauthorization Amendment Section 6217 (g) Management Measures. As the State lead on water quality, the Alabama Department of Environmental Management's Alabama Coastal Nonpoint Pollution Control Program must conform to Section 6217 (g) requirements to be compliant for funding under Section 306 of the Coastal Zone Management Act and Section 319 of the Clean Water Act. These 6217 (g) requirements include geographic scope of the program; the pollutant sources to be addressed; the types of management measures used; the establishment of critical areas; and technical assistance, public participation, and administrative coordination.

1.4 Document Overview

This WMP is organized into the following chapters:

- **Chapter 1 Introduction** provides an overview of the watershed planning process.
- **Chapter 2 Community Engagement** provides and overview of the public outreach and stakeholder engagement efforts that were conducted as part of the development of the WMP.

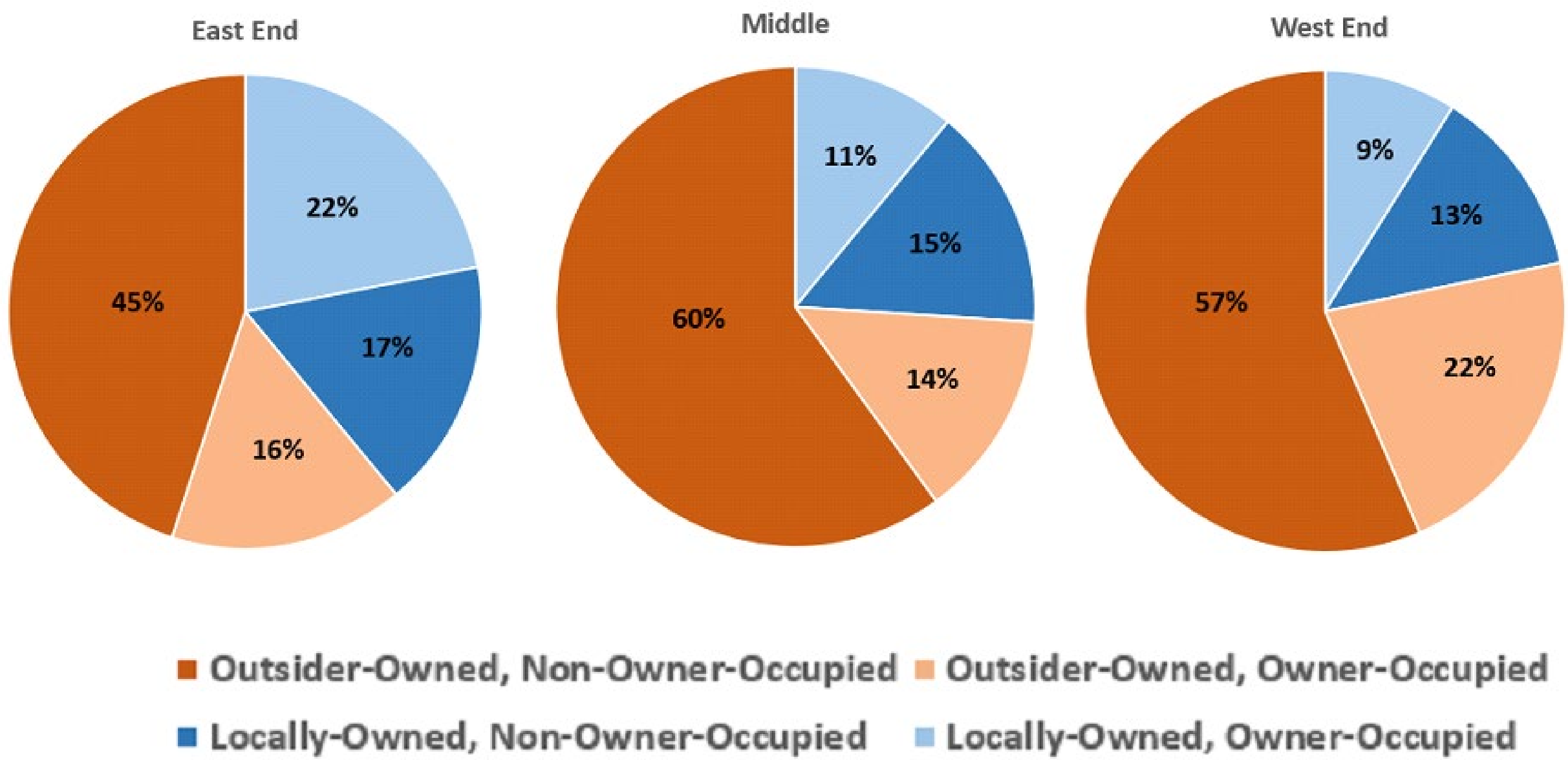
- **Chapter 3 Watershed Characterization** describes the Dauphin Island Watershed, providing background on characteristics and current conditions—including topography, hydrology, habitats, demographics, land use, etc.—to provide an understanding of current and historical conditions and insight into the problems of concern.
- **Chapter 4 Watershed Conditions** evaluates the existing conditions within the Watershed and helps to focus management efforts to address the most pressing needs.
- **Chapter 5 Climate Vulnerability Assessment** addresses vulnerabilities associated with climate change and sea level rise and looks at potential adaptation strategies.
- **Chapter 6 Identification of Critical Issues and Areas** identifies the critical areas and issues within the Watershed. These issues help shape the overall goals of the WMP and determine what information is needed to accurately define and address community concerns.
- **Chapter 7 Management Measures** describes the conceptual management measures considered to address the critical issues and areas of this WMP.
- **Chapter 8 Implementation Strategies** provides a list of concrete action items timelines and prospective partnerships to help facilitate the implementation of the identified management measures.
- **Chapter 9 Regulatory Review** discusses the regulatory framework of laws, regulations, and ordinances that pertain to stormwater management, coastal zone issues, wetlands, etc. under the jurisdiction of the Federal, State, County, and the Town of Dauphin Island governmental entities.
- **Chapter 10 Financing Alternatives** presents a financial strategy, including available sources of funding (e.g., grants, partnerships) for restoration projects, and examines innovative mechanisms and alternatives for leveraging funding sources.
- **Chapter 11 Monitoring** outlines a monitoring program to evaluate the success of the management measures over the 10-year planning period.
- **Chapter 12 References** lists all sources cited in this document.

CHAPTER 2 Community Engagement

Introduction

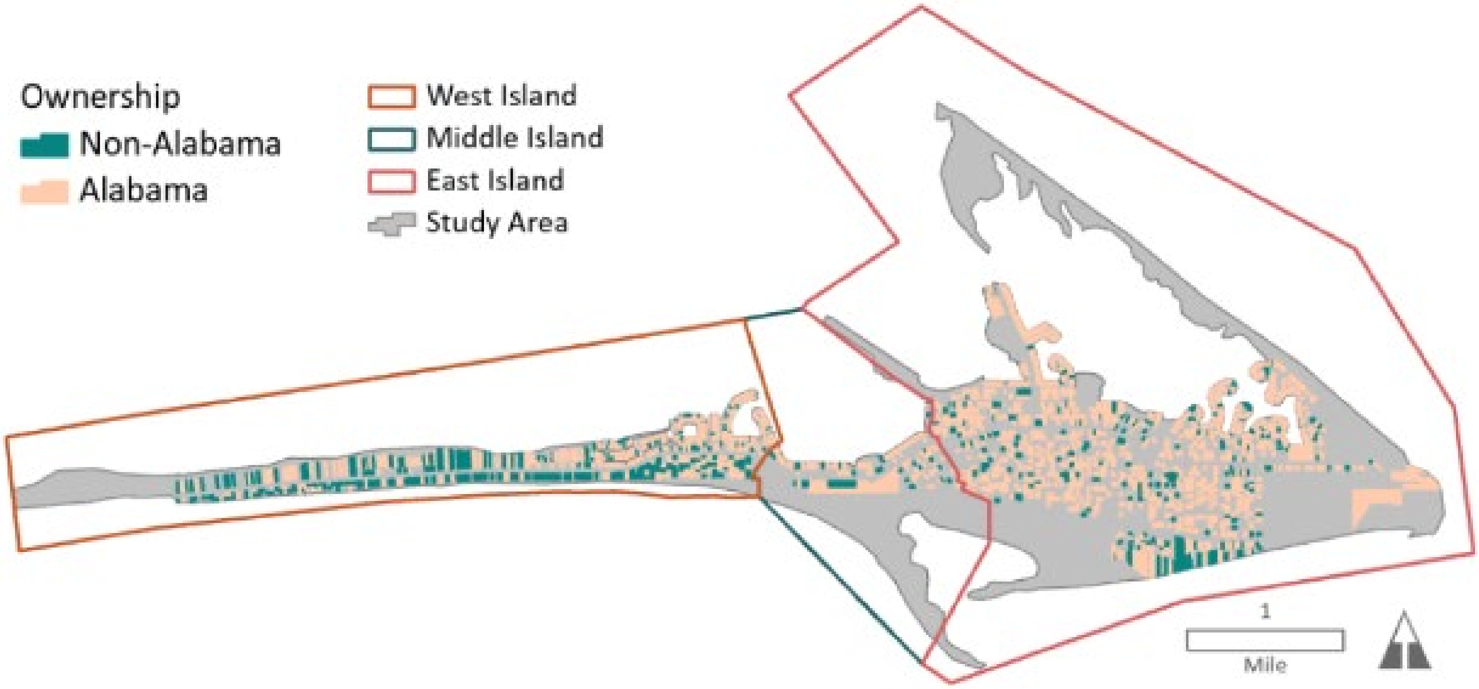
The Dauphin Island Watershed Management Plan (WMP) Community and Stakeholder Engagement Program was designed to be an integral part of the watershed management planning process; centered on the principal of building a partnership with the community and local stakeholders, informing them of watershed conditions, and working collaboratively to identify issues and develop implementation strategies.

The challenges of engaging citizens in a watershed study are complex, and on Dauphin Island one of the biggest challenges was the ownership and residential status of Watershed residents. **Figure 2-1** and **Figure 2-2** below present ownership and occupation statistics of Island parcels broken out by area, as presented from the Dauphin Island Fiscal Impact Analysis conducted by the Mobile Bay National Estuary Program (MBNEP) in support of this WMP (**Appendix A**). As presented in **Figure 2-1**, the majority of parcels are owned by off-Island property owners. **Figure 2-2** presents a large amount of these parcels are owned by people who live outside of the State of Alabama, with a predominance of parcels on the West End of the Island.



SOURCE: King and Jenkins 2022

FIGURE 2-1 Classification of 2021 Parcel Data for Dauphin Island



SOURCE: King and Jenkins 2022

FIGURE 2-2 Ownership Status of Parcels on Dauphin Island

Another challenge encountered in development of the WMP was the COVID-19 pandemic, which was well underway at the onset of the watershed management planning effort and continued throughout the plan development. In recognition of these challenges and other factors, the WMP Team designed a Community and Stakeholder Engagement Program to connect with the community in order to maximize trust, participation, and effectiveness. Throughout the course of the project, the Watershed community was kept informed of milestones and accomplishments and was encouraged to participate in community meetings, surveys, and engagement activities.

The primary mechanisms for community and stakeholder engagement were steering committee meetings, public meetings and open houses, small-group meetings, Island events (e.g., Alabama Deep Sea Fishing Rodeo), Town of Dauphin Island Town Crier and website, MBNEP Flight of the Frigate Bird and Dunes of Dauphin Island videos, MBNEP website, and social media. The WMP Team also attended select Town Council meetings to hear public opinion on Island issues (e.g., wetlands ordinance). Additionally, the WMP Team participated in and/or reviewed other Island projects' public outreach efforts including Aloe Bay, Adaptation Pathway Project, Dauphin Island West End Bird Conservation and Management Plan, East End Beach and Dune Restoration Project, and Graveline Bay Project.

Source: MBNEP

MBNEP at Alabama Deep Sea Fishing Rodeo

2.1 Steering Committee

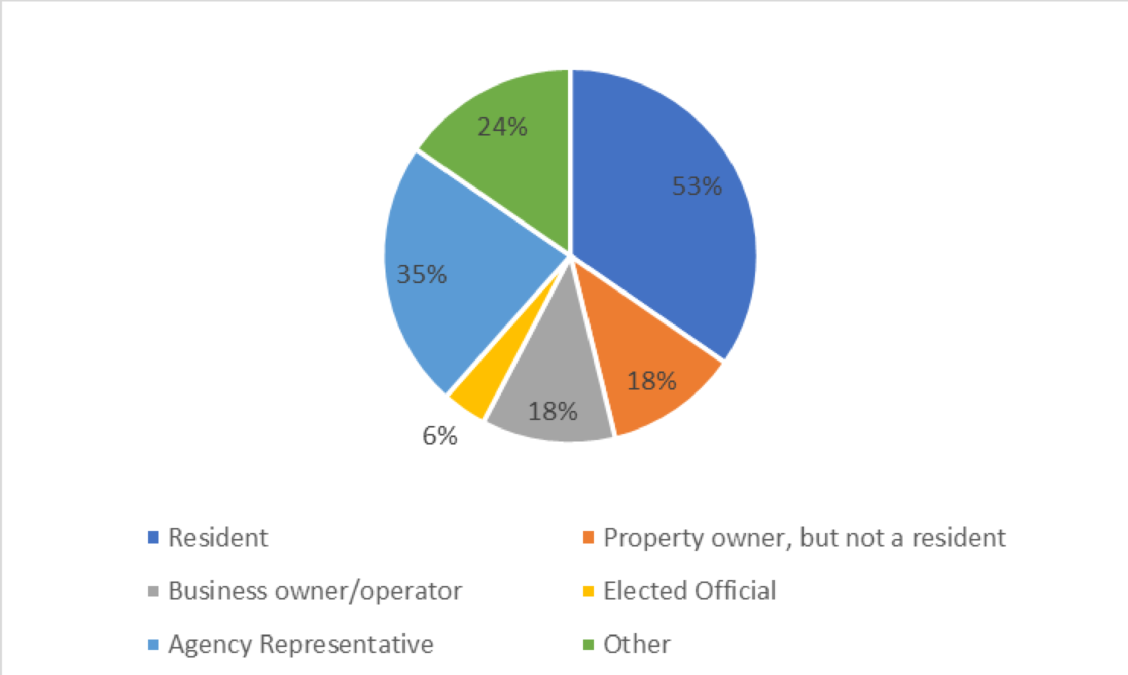
The Dauphin Island WMP Steering Committee was assembled to help guide development of the WMP and assist in the future implementation of the plan. The goal in building the Steering Committee was to get participation from a diverse set of community members and stakeholders with comprehensive knowledge of watershed conditions and community perspectives. The Steering Committee served not only a conduit for the watershed management planning team to share information and status about planning efforts with the community, but to also bring back community feedback to the Steering Committee and WMP Team to incorporate into the WMP. Steering Committee meetings were generally scheduled to coincide with WMP milestones; and scheduled with consideration to other WMP meetings (e.g., WMP Open House) and other Island project meetings (e.g., Aloe Bay Charette). These meetings were also scheduled around Covid-19 surges to minimize safety impacts. Steering Committee meetings were held on April 15, 2021; February 17, 2022 (**Figure 2-3**); and April 20, 2022. The Dauphin Island WMP Steering Committee consisted of representatives of the following groups:

- Mobile Bay National Estuary Program (Director and staff)
- Town of Dauphin Island (Mayor and Town Council)
- Dauphin Island Planning Commission
- Mobile County
- Alabama Department of Conservation and Natural Resources
- U.S. Army Corps of Engineers
- Dauphin Island Sea Lab
- Dauphin Island Bird Sanctuary
- Dauphin Island Heritage and Art Council
- Mississippi-Alabama Sea Grant
- PLACE: SLR
- Alabama Association of Conservation Districts
- Construction Industry
- Dauphin Island Residents

SOURCE: Photo by Environmental Science Associates

FIGURE 2-3 Dauphin Island Steering Committee Meeting, February 17, 2022

Prior to the first Dauphin Island WMP Steering Committee meeting on April 15, 2021, a survey was conducted of its members to gauge their views on Island conditions. There were 17 responses to the survey, with 53% of respondents identifying as Island residents (**Figure 2-4**).



SOURCE: MBNEP (some respondents fell into multiple categories)

FIGURE 2-4 Dauphin Island Steering Committee Survey – Affiliation, March 29, 2021

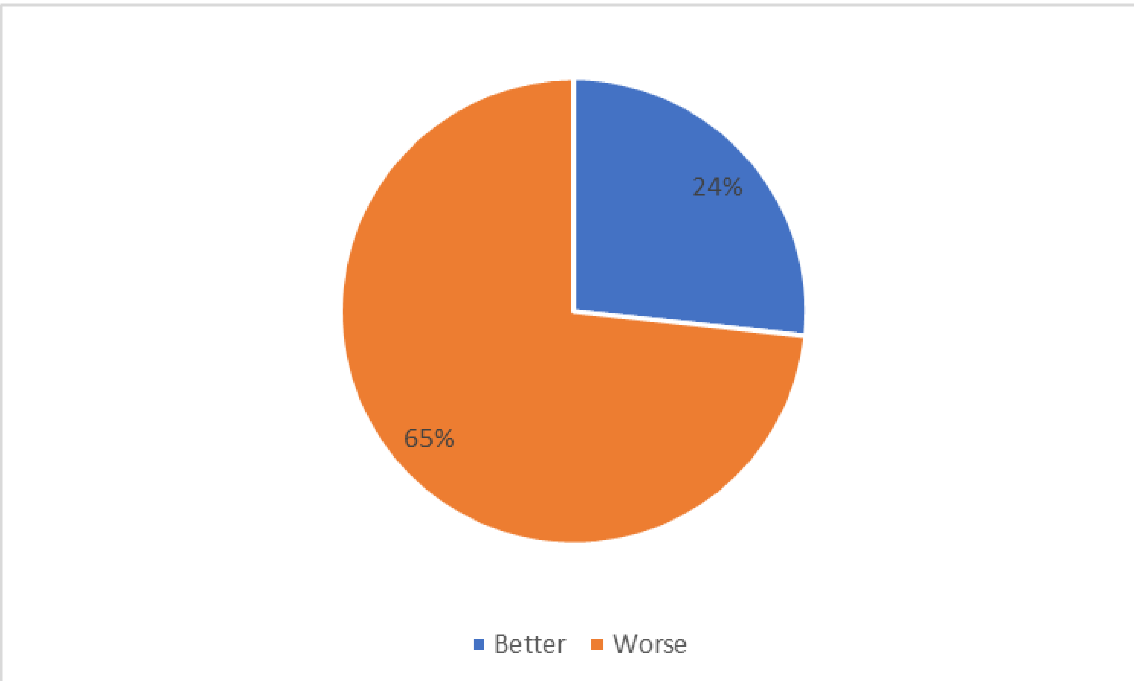
When asked whether the Island was better or worse today compared to the past, 65% of respondents replied that they thought it was worse (**Figure 2-5**). Response highlights that the Island was better included:

- because of the people who love the Island and work to protect it;
- environmentally, the awareness has greatly improved;
- recognition of the importance of and recent move to protect West End;
- the focus on increasing ecotourism opportunities; and
- better from a standpoint of quality of life, cleanliness, services provided, amenities and more.

Response highlights that the Island was getting worse included:

- repeat storms/hurricanes, erosion, deforestation, clear-cutting of residential lots;
- accelerated growth, over development, impervious structure going in;
- less beach access and no improvement for boating access;
- Little Dauphin Island is getting very small very fast;

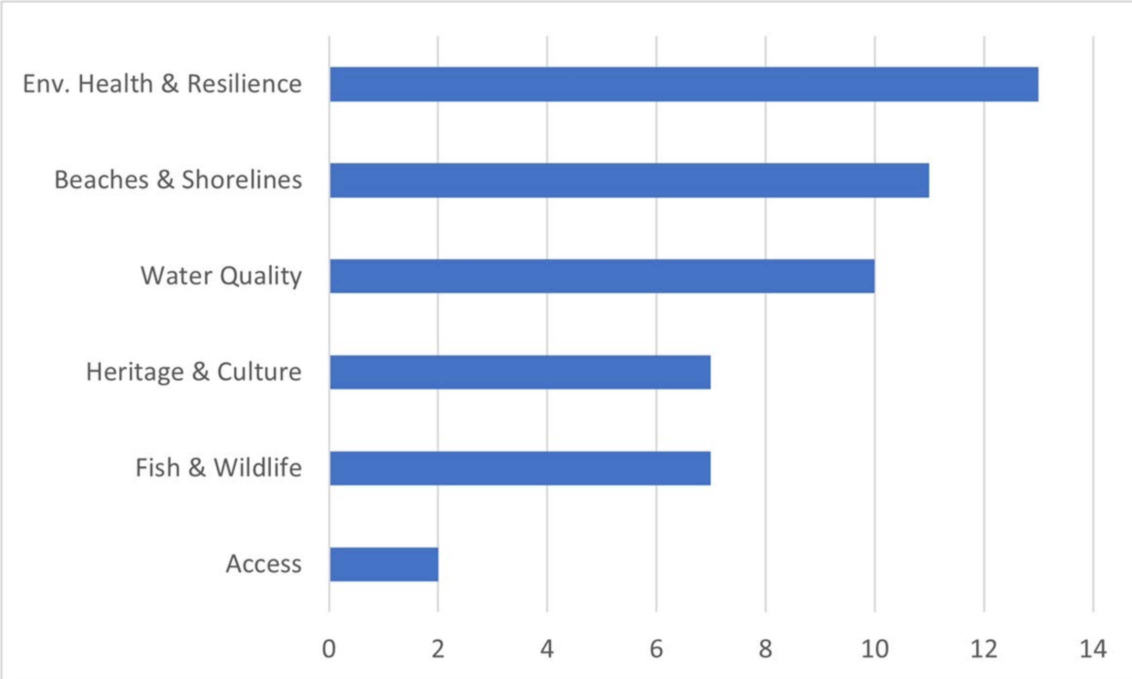
- stormwater drainage and water quality;
- loss of dunes;
- the old Isle Dauphine due to neglect and lack of funds;
- lack of commitment for addressing the problems;
- lack of funding for restoration; and
- with new people moving in it is getting harder to sustain knowledge or traditional life and heritage and culture.



SOURCE: MBNEP

FIGURE 2-5 Dauphin Steering Committee Survey – Island Better or Worse Today? March 29, 2021

Overall, the top three issues identified by the committee were related to environmental health and resilience (76%), beaches and shorelines (65%), and water quality (59%) (**Figure 2-6**). The complete survey results are presented in **Appendix B.1**.



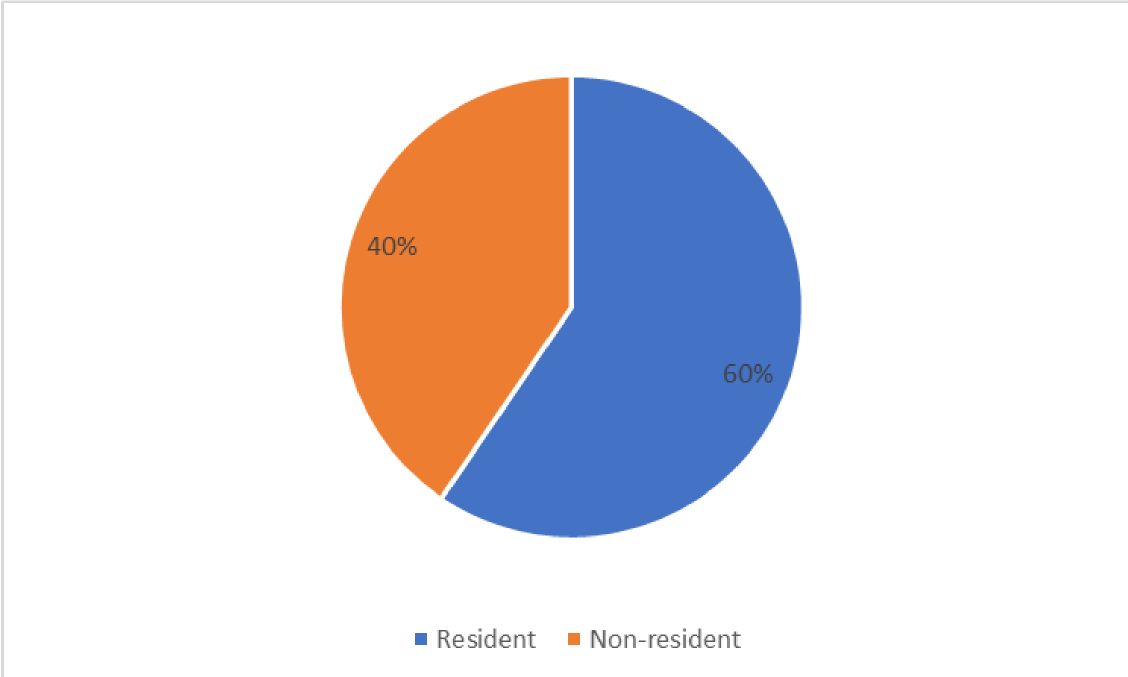
SOURCE: MBNEP

FIGURE 2-6 Dauphin Steering Committee Survey – Top Issues, March 29, 2021

2.2 Public Outreach and Participation

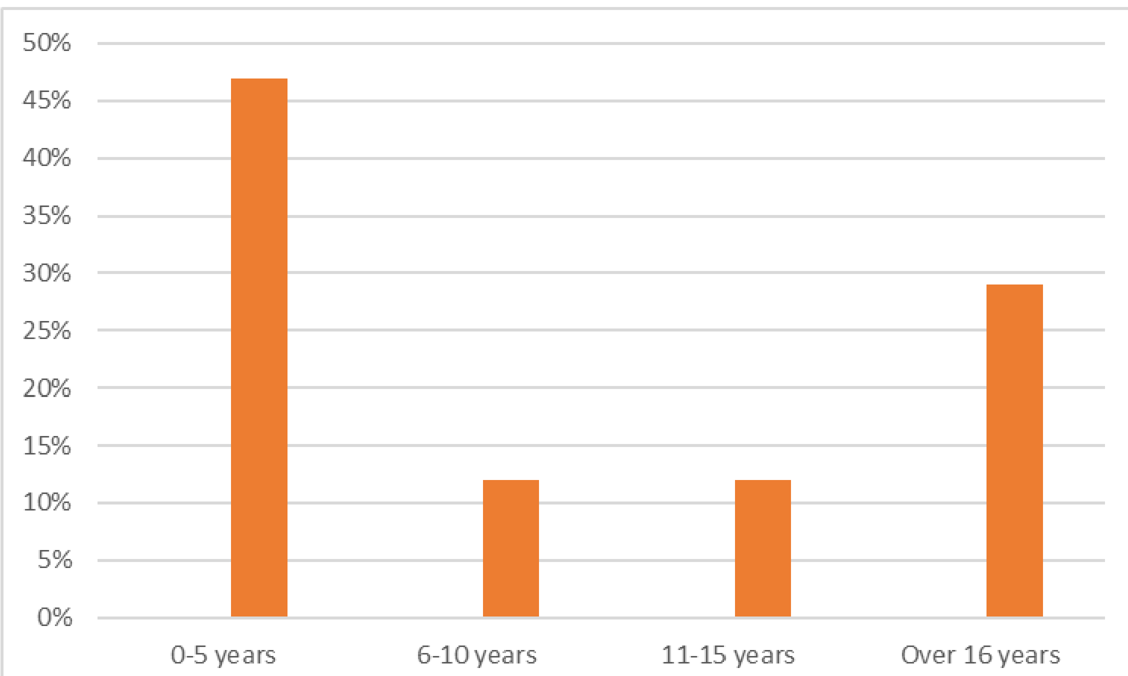
2.2.1 PRELIMINARY PUBLIC OUTREACH

Public outreach for the Dauphin Island WMP initially started during the development of the West Fowl River WMP. Given the importance of Dauphin Island as a protective barrier island to the coastal watersheds (i.e., West Fowl River and Bayou La Batre); the MBNEP and WMP planning team for the West Fowl River watershed engaged the residents of Dauphin Island to gain a better understanding of their perspective on local and regional issues. A public meeting was held at the Dauphin Island Sea Lab Shelby Hall on September 8, 2016, with a total of 42 people in attendance. To facilitate information gathering from the Dauphin Island community, an online stakeholder survey was developed and shared with the community. There were 42 survey respondents, of which 60% identified as being Dauphin Island residents with 47% of those residents living on the Island for less than five years (**Figures 2-7** and **2-8)**.



SOURCE: MBNEP

FIGURE 2-7 Dauphin Island Survey – Residential Status, September 8, 2016



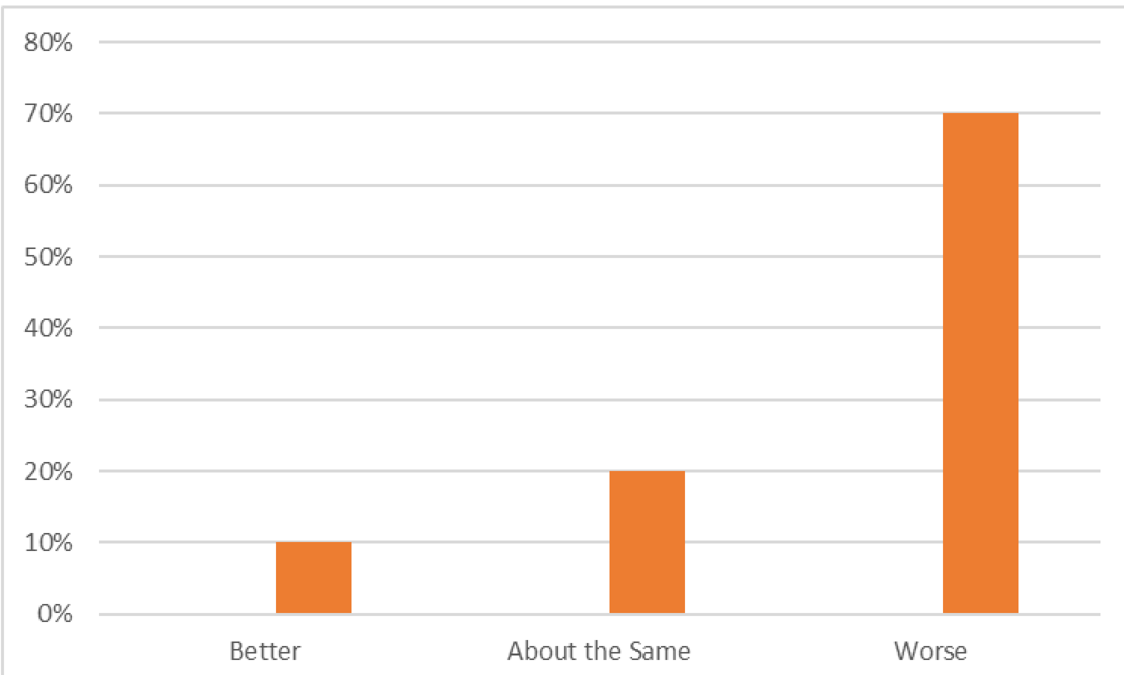
SOURCE: MBNEP

FIGURE 2-8 Dauphin Island Survey – Length of Residence, September 8, 2016

When asked to about the environmental conditions of the Island, 70% of respondents described conditions as worse compared to when they first remembered (**Figure 2-9**);

40% of respondents identified beach erosion as the top reason for Island conditions being worse. Other responses included:

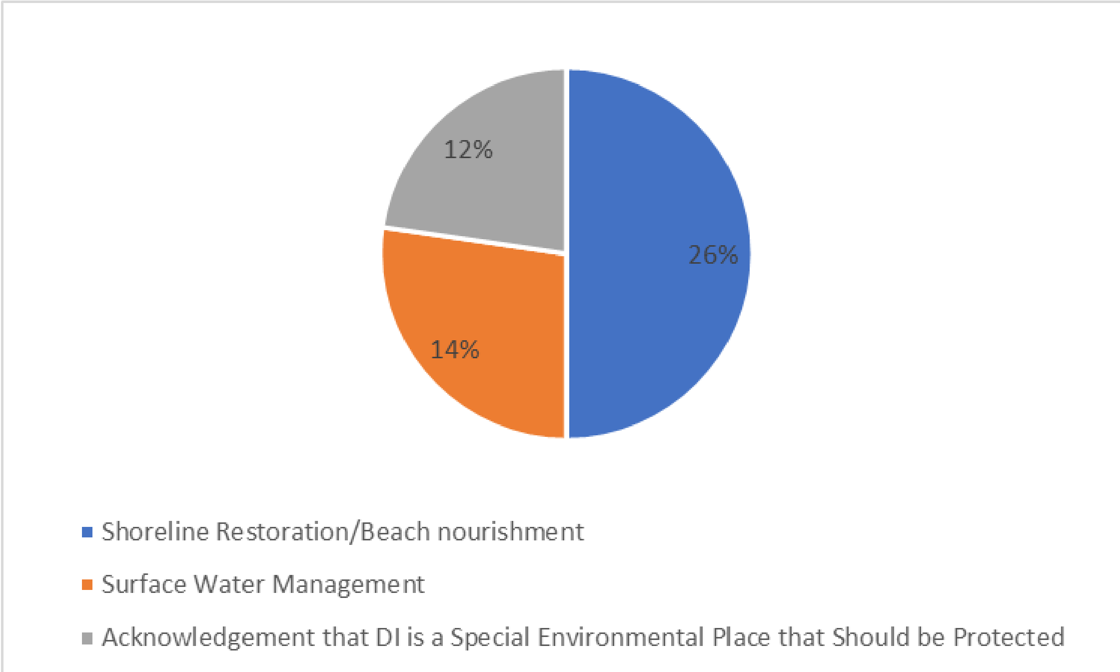
- West End system disrupted;
- increased human intervention and development/loss of trees;
- Deepwater Horizon oil spill;
- litter;
- oil rigs;
- loss of wetlands;
- poor water quality; and
- diminished habitat for sea turtles and other wildlife.



SOURCE: MBNEP

FIGURE 2-9 Dauphin Island Survey – Environmental Condition of Dauphin Island, September 8, 2016

When asked "*what are the most important environmental issues that need attention?*" the top three survey responses were related to shoreline restoration and beach nourishment (26%), surface water management (14%), and the acknowledgement that Dauphin Island is special environmental place that should be protected (12%) (**Figure 2-10**). The complete survey is presented in **Appendix B.2**.



SOURCE: MBNEP

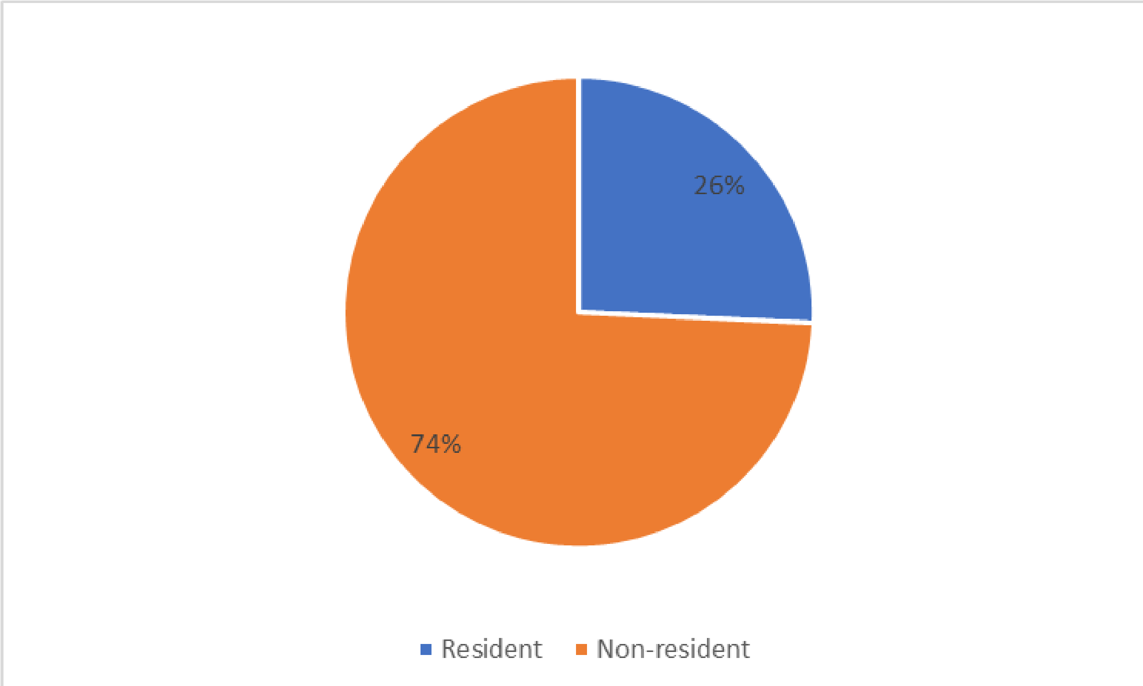
FIGURE 2-10 Dauphin Island Survey – Most Important Environmental Issues on Dauphin Island – Top Three Responses, September 8, 2016

2.2.2 DAUPHIN ISLAND WMP PUBLIC OUTREACH

Once the Dauphin Island WMP effort was kicked-off, a series of public outreach events were initiated at various points in the WMP process; and polls were conducted to gather public input for the planning process where appropriate. The large public outreach events are discussed in the following sections.

Alabama Deep Sea Fishing Rodeo

The Alabama Deep Sea Fishing Rodeo attracts thousands of anglers and spectators to Dauphin Island. On July 17, 2021, the MBNEP conducted a poll of Rodeo attendees to gather input for the WMP. There was a total of 241 participants in the poll, of which 26% were Island residents (**Figure 2-11**). As part of the polling process, a map was presented for poll respondents to identify their favorite place on Dauphin Island (**Figure 2-12**). The top five responses are presented in **Figure 2-13.** Respondents were also asked what they liked least about coming to the Island. The top five answers are presented in **Figure 2-14**. Detailed poll responses are included in **Appendix B.3.**

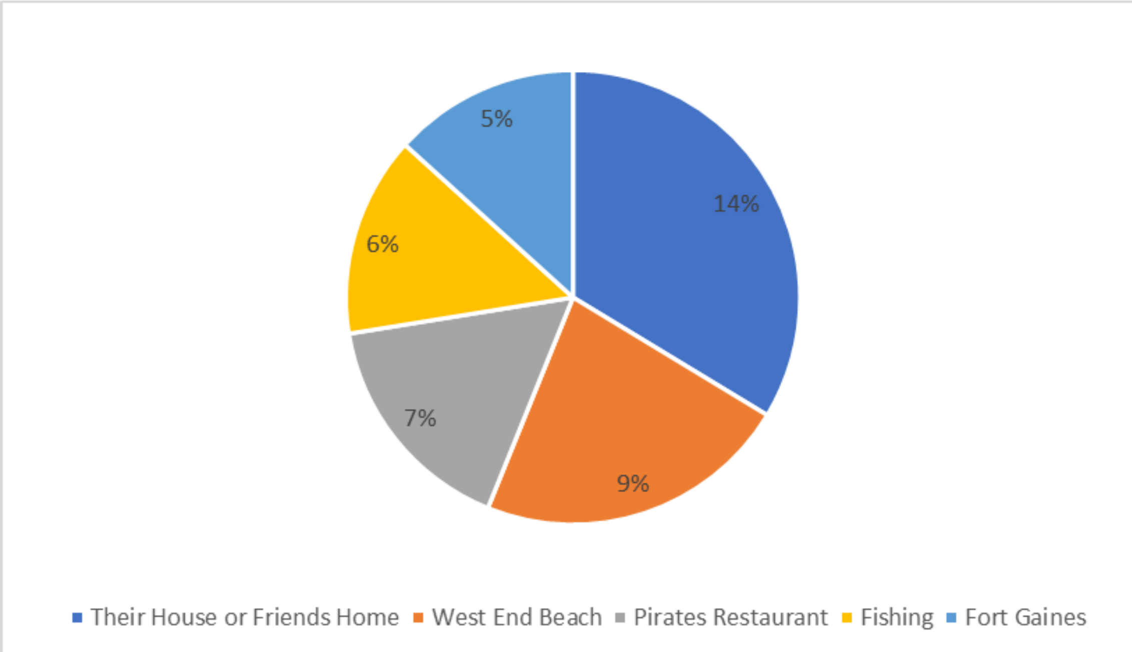


SOURCE: MBNEP

FIGURE 2-11 Dauphin Island Poll – Residential Status, July 17, 2021

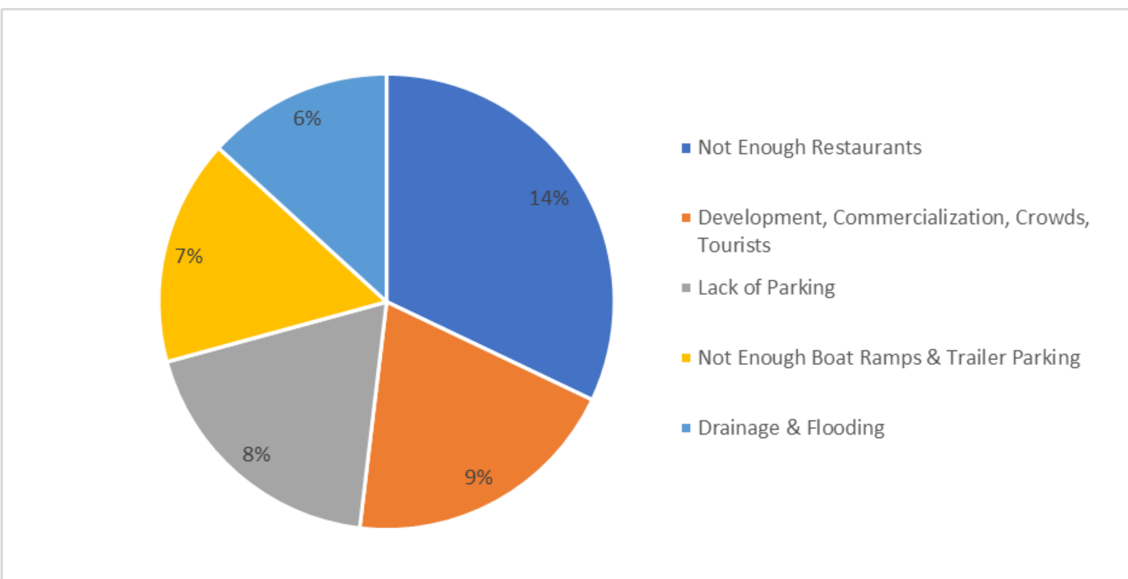
SOURCE: MBNEP

FIGURE 2-12 Dauphin Island Poll – Favorite Place on the Island, July 17, 2021



SOURCE: MBNEP

FIGURE 2-13 Dauphin Island Poll – Top Five Favorite Places on Dauphin Island, July 17, 2021



SOURCE: MBNEP

FIGURE 2-14 Dauphin Island Poll – Like Least About Coming to Island, July 17, 2021

Dauphin Island Open House Meeting

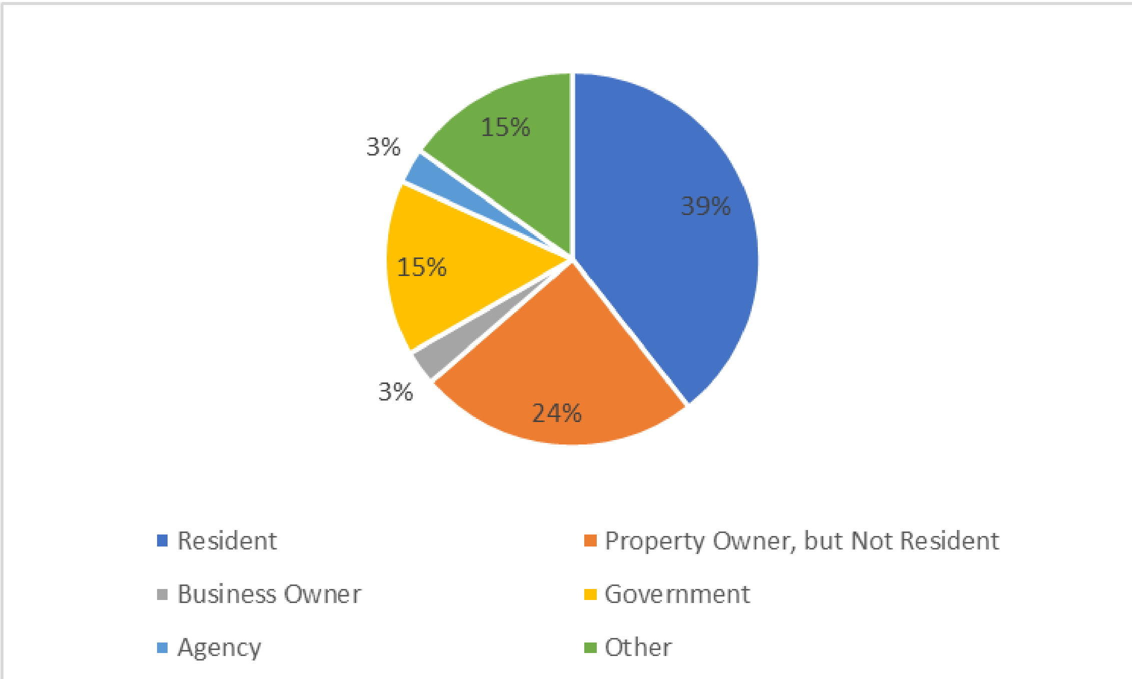
On November 8, 2021, the WMP Team conducted an open house meeting at Dauphin Island Sea Lab Shelby Hall (**Figure 2-15**) in collaboration with project teams from many of the projects that were occurring on Dauphin Island during the development of the WMP including:

- Aloe Bay Town Master Plan
- Dauphin Island Adaptation Pathway Project
- Dauphin Island East End Beach and Dune Restoration Project
- Dauphin Island West End Bird Conservation and Management Plan
- Graveline Bay Marsh Restoration Project
- Little Billy Goat Hole and East End Beach Access Improvements Project
- Little Dauphin Island Restoration Assessment
- South Alabama Land Trust (SALT) Land Acquisitions and Easement on Dauphin Island

SOURCE: Photo by Environmental Science Associates

FIGURE 2-15 Dauphin Island Open House, November 8, 2021

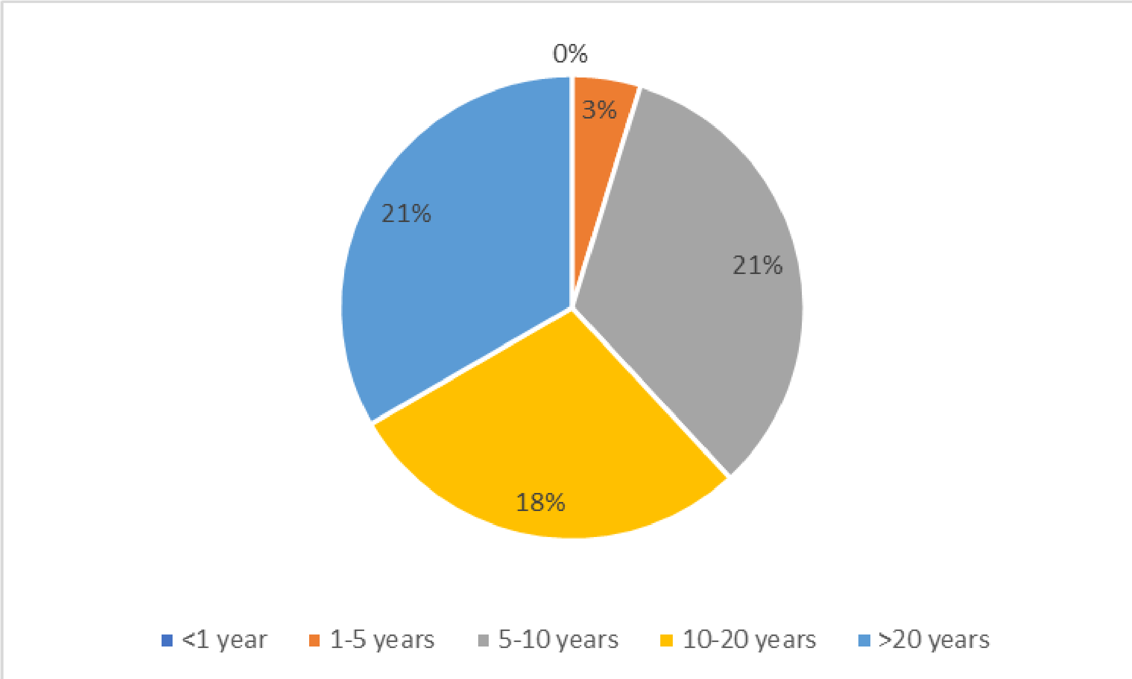
The intent of the open house was for project teams to share progress and information related to their specific project and to get public and stakeholder feedback about issues on Dauphin Island. The WMP Team presented an overview of findings and issues on Dauphin Island and conducted a poll of meetings attendees. There were a total of 48 people in attendance, of which 33 responded to the live electronic poll; 39% of respondents identified as Dauphin Island residents (**Figure 2-16**).



SOURCE: Thompson Engineering

FIGURE 2-16 Dauphin Island Poll – Stakeholder Group, November 8, 2021

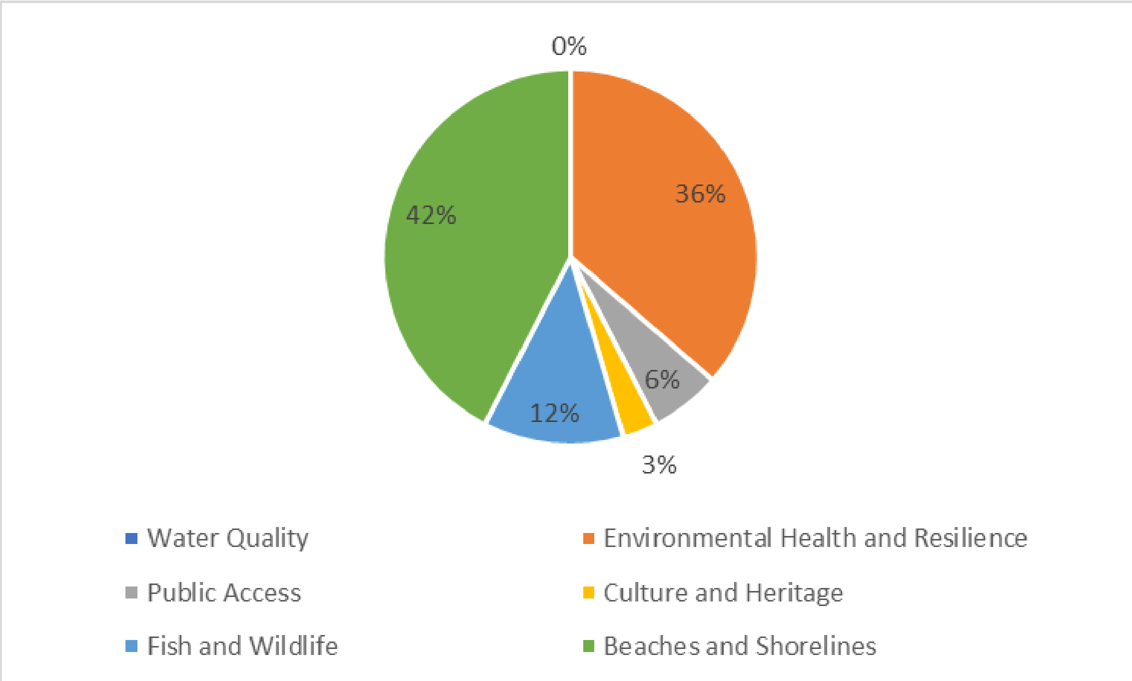
Most respondents (97%) had lived on the Island for more than five years, with 42% living on the Island more than ten years and 21% more than twenty years (**Figure 2-17**).



SOURCE: Thompson Engineering

FIGURE 2-17 Dauphin Island Poll – Time Lived or Owned Property on Dauphin Island, November 8, 2021

The top three most important issues on Dauphin Island were related to beaches and shorelines (42%), environmental health and resilience (36%), and fish and wildlife (12%) **(Figure 2-18)**. **Appendix B.4** provides detailed results of the poll.



SOURCE: Thompson Engineering

FIGURE 2-18 Dauphin Island Poll – Most Important Issues on Dauphin Island, November 8, 2021

2.2.3 SMALL GROUP MEETINGS (VIRTUAL AND IN-PERSON)

The WMP Team also met with a variety of individuals and stakeholder to share information and updates about the WMP planning process, and to gather public and stakeholder input for the development of the WMP. The following is a list of those meetings:

- Project Coordination Meeting (U.S. Army Corps of Engineers – Little Dauphin Island; GMC – Aloe Bay; University of South Alabama (USA) – Adaptation Pathway, National Fish and Wildlife Foundation (NFWF); Town of DI; and MBNEP), December 15, 2020
- Town of Dauphin Island: December 16, 2020; June 2, 2021; August 2, 2021; February 17, 2022; April 19, 2022; May 24, 2022; and October 25, 2022
- University of South Alabama (USA): December 17, 2020; April 5, 2021; July 27, 2022
- Aloe Bay Charette and Outreach Meetings: January 18-22 and September 16, 2021
- Dauphin Island Planning Commission: July 29, 2021
- Aloe Bay Planning and Economics Team: October 29, 2021
- National Oceanic and Atmospheric Administration (NOAA): November 1, 2021, and January 12, 2022

- Dauphin Island Fishermen Meeting, November 17, 2021
- Pelican Conservancy, January 5, 2022
- Dauphin Island Water and Sewer Authority (DIWSA), April 19, 2022
- Dauphin Island Heritage and Arts Council, April 26, 2022
- U.S. Army Corps of Engineers, June 1, 2022

2.3 Multimedia Outreach

MBNEP and the WMP Team utilized a variety of information technologies to educate and inform the public about the watershed planning process, and conditions and issues on Dauphin Island. The primary mechanisms for this aspect of the watershed planning process were the MBNEP website, Town of Dauphin Island website, social media platforms (e.g., Facebook), and the MBNEP Flight of the Frigate Bird and Dunes of Dauphin Island videos.

Source: MBNEP
The Flight of the Frigate Bird

The Flight of the Frigate Bird documentary takes a look at how generations of Islanders have adapted to the ever-changing landscape of barrier island life. The video utilizes interviews and oral history from long-term residents as they share their experience and native knowledge of dune, forest, and marsh habitat conservation because those were their greatest protection from hurricanes and storm-surge. Islanders of the past avoided building right on the beach because it was too vulnerable to storms and erosion. As development boomed after a bridge was built in the 1950s, many of the tenets of the Islanders were forgotten and now the Island community is faced with complex decisions about how to best adapt to eroding shorelines, rising seas, and more severe storms.

The Dunes of Dauphin Island video demonstrates how the dunes are the Island's first line of protection from the damaging winds and waters of coastal storms. Explaining the history and roles of dunes in overall Island resilience, the video presents best practices and recommendations for dune stewardship.

Both videos are available for viewing through the MBNEP website:
https://www.mobilebaynep.com/watersheds/dauphin-island-watershed

2.4 Community Engagement Summary

Through polls and surveys conducted with the Dauphin Island community and stakeholders over the past six years, there has been a general consensus that conditions on Dauphin Island are getting worse over time, despite significant and sustained efforts by local and regional leadership to address the many complex issues on the Island. Top issues throughout the community and stakeholder process have consistently been related to resilience, shoreline erosion, flooding, access, and sustaining the Island's culture and heritage (see **Chapter 6** for further discussion).

Community and stakeholder engagement is a critical element in the watershed management planning process. Input and feedback from the Dauphin Island community, steering committee, and stakeholders guided the development of the WMP and their participation and engagement will be paramount to implementing this plan.

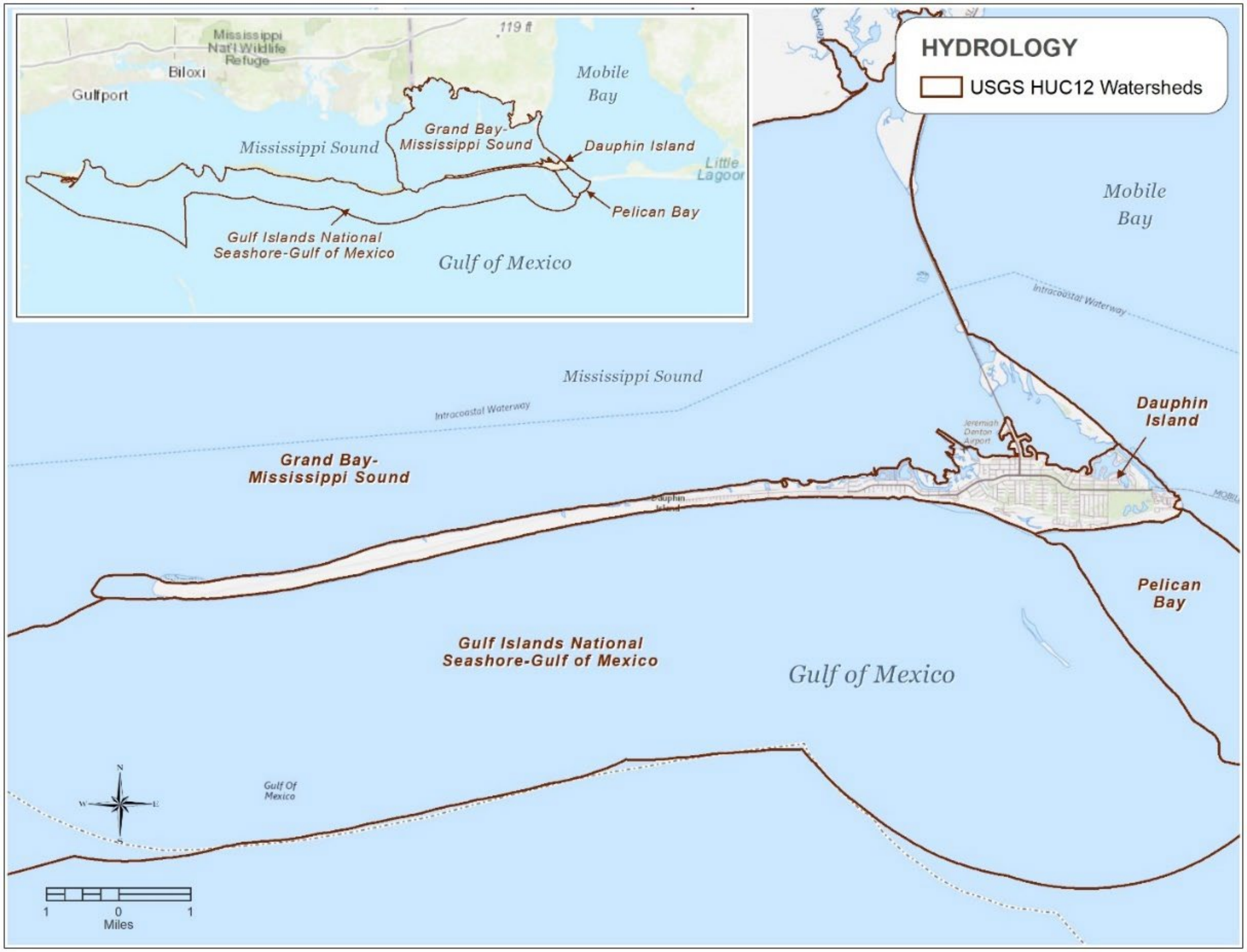
CHAPTER 3 Watershed Characterization

Introduction

A watershed characterization was conducted in the Dauphin Island Watershed to develop a baseline understanding of Island conditions and build on existing information. Characterizing the Watershed provides the basis for developing effective management strategies to meet Watershed goals.

3.1 Watershed Boundary

The Dauphin Island Watershed encompasses approximately 3,262 acres (5 square miles) and is located in south Mobile County, Alabama. Dauphin Island is one of the Mississippi-Alabama barrier islands, with Mobile Bay and the Mississippi Sound to its north and the Gulf of Mexico to its south. The Watershed comprises the U.S. Geological Survey (USGS) 12-digit Hydrologic Unit Code (HUC) 031700090202 and is surrounded by portions of other HUCs, including Gulf Islands National Seashore-Gulf of Mexico (**Figure 3-1**). The single municipality of the Town of Dauphin Island lies within the Dauphin Island Watershed.



SOURCE: Thompson Engineering, Inc.

FIGURE 3-1 Dauphin Island Watershed Hydrologic Unit Code Overview

3.2 Physical Setting

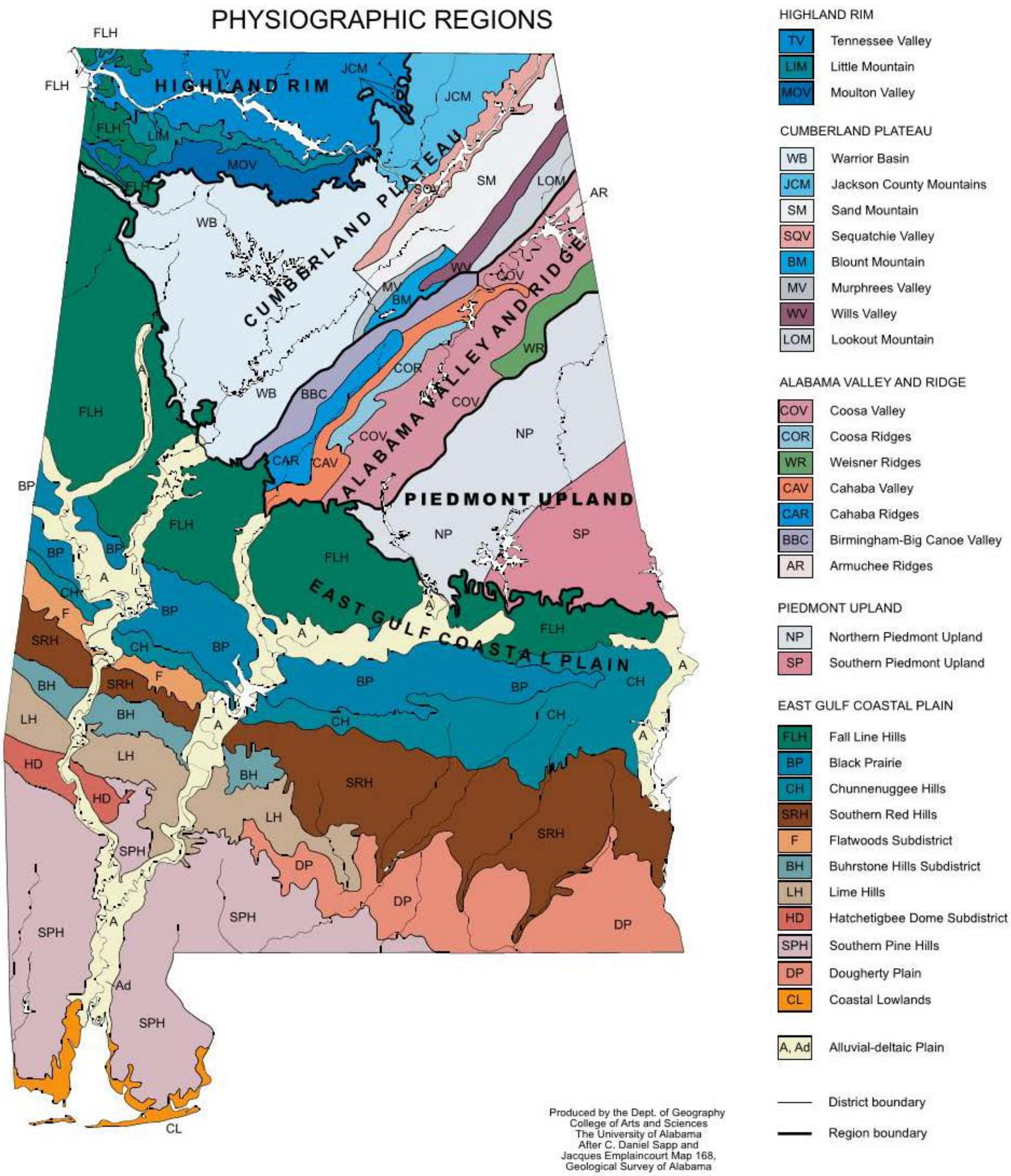
3.2.1 PHYSIOGRAPHY

The Dauphin Island Watershed is located entirely within the Coastal Lowlands district in the East Gulf Coastal Plain physiographic province (**Figure 3-2**). The Coastal Lowlands district in Alabama includes the coastal areas and mainland plains sunken by many tidal streams and edged by tidal marshes and barrier islands. These barrier islands and tidal marshes are continually modified by erosion and deposition. The Coastal Lowlands district is characterized by flat to gently undulating, locally swampy plains (Gillett et al. 2000).

Ecoregions

The Dauphin Island Watershed lies entirely within the Gulf Barrier Islands and Coastal Marshes (Ecoregion 75k) physiography or ecoregion, which is described as follows (Griffith et al. 2001, and O'Neil and Chandler 2003; in GOMA 2013a):

> **Ecoregion 75k.** The Gulf Barrier Islands and Coastal Marshes region contains salt and brackish marshes, dunes, beaches, and barrier islands that enclose the Mississippi Sound and Mobile Bay. Cordgrass and saltgrass are common in the intertidal zone, while xeric coastal strand and pine scrub vegetation occurs on parts of the dunes, spits, and barrier islands.



SOURCE: University of Alabama 2017

FIGURE 3-2 Physiographic Provinces of Alabama

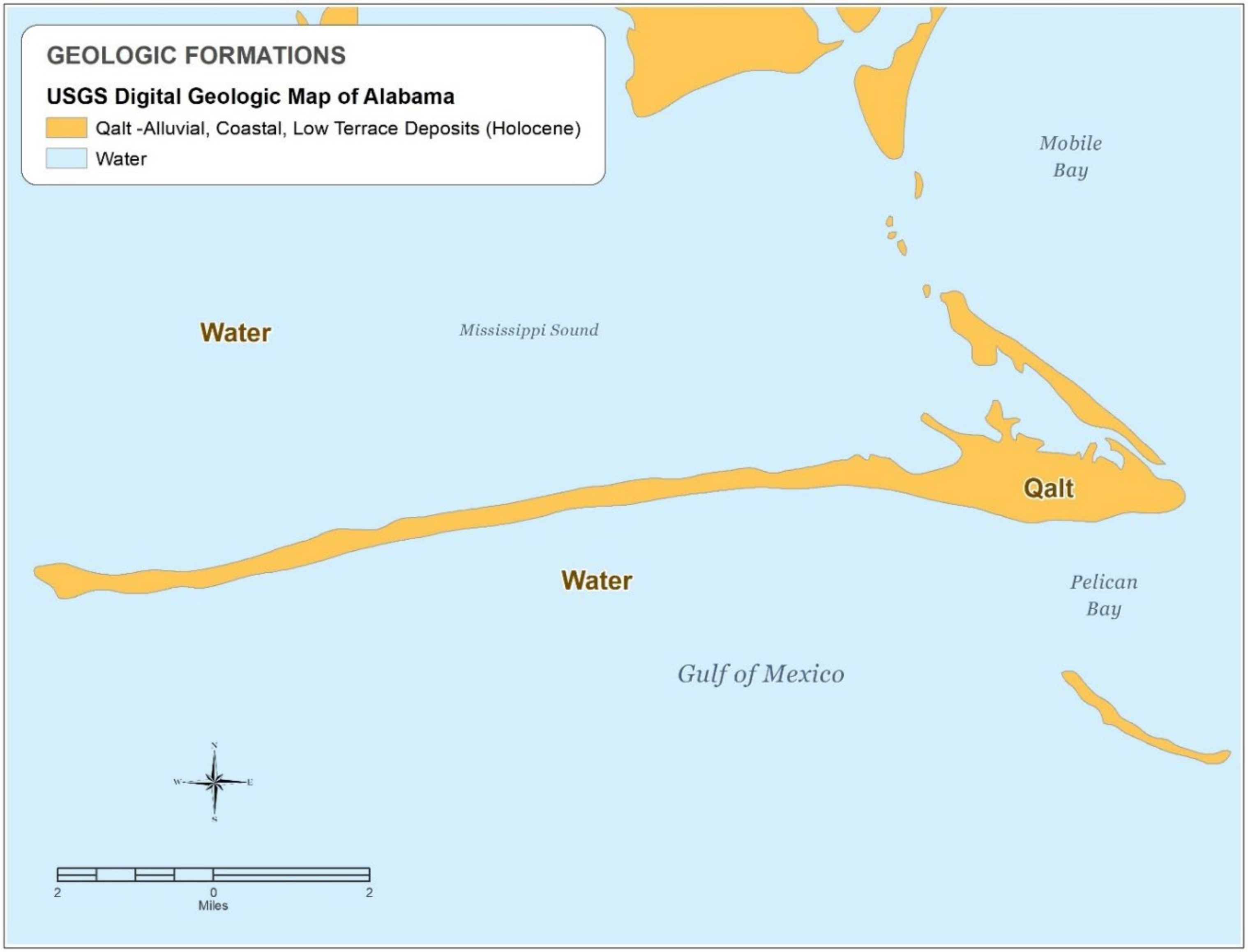
3.2.2 GEOLOGY

All of Dauphin Island overlies one geological formation – the alluvial, coastal, and low-terrace deposits of the Pleistocene to Holocene age (**Figure 3-3**). The Alluvial low terrace and coastal deposits represent complex beach, dune, lagoonal, estuarine, and deltaic depositional environments, which generally consist of white, gray, orange, and red, very fine to coarse quartz sand containing gray and orange clay lenses and gravel in places (Szabo and Copeland 1988). The gravel is composed of quartz and chert pebbles.

These deposits are estimated to be 0 to 200 feet thick, based on the first occurrence of coarse siliciclastic sediment (Chandler and Moore 1983). The Quaternary sand and gravel beds represent buried channel deposits. Their widths and depths are similar to those of present riverbed sediments. The length of individual sand and gravel beds may range from a few hundred to a few thousand feet. These buried channel deposits are surrounded by silt and clay sediments similar to those being deposited on the present flood plain of a river. Pleistocene sediments occur at a shallow depth (approximately 100 feet) just off the East End of Dauphin Island (Raymond et al. 1993). The alluvial, low terrace, and coastal deposits are part of the watercourse aquifer.

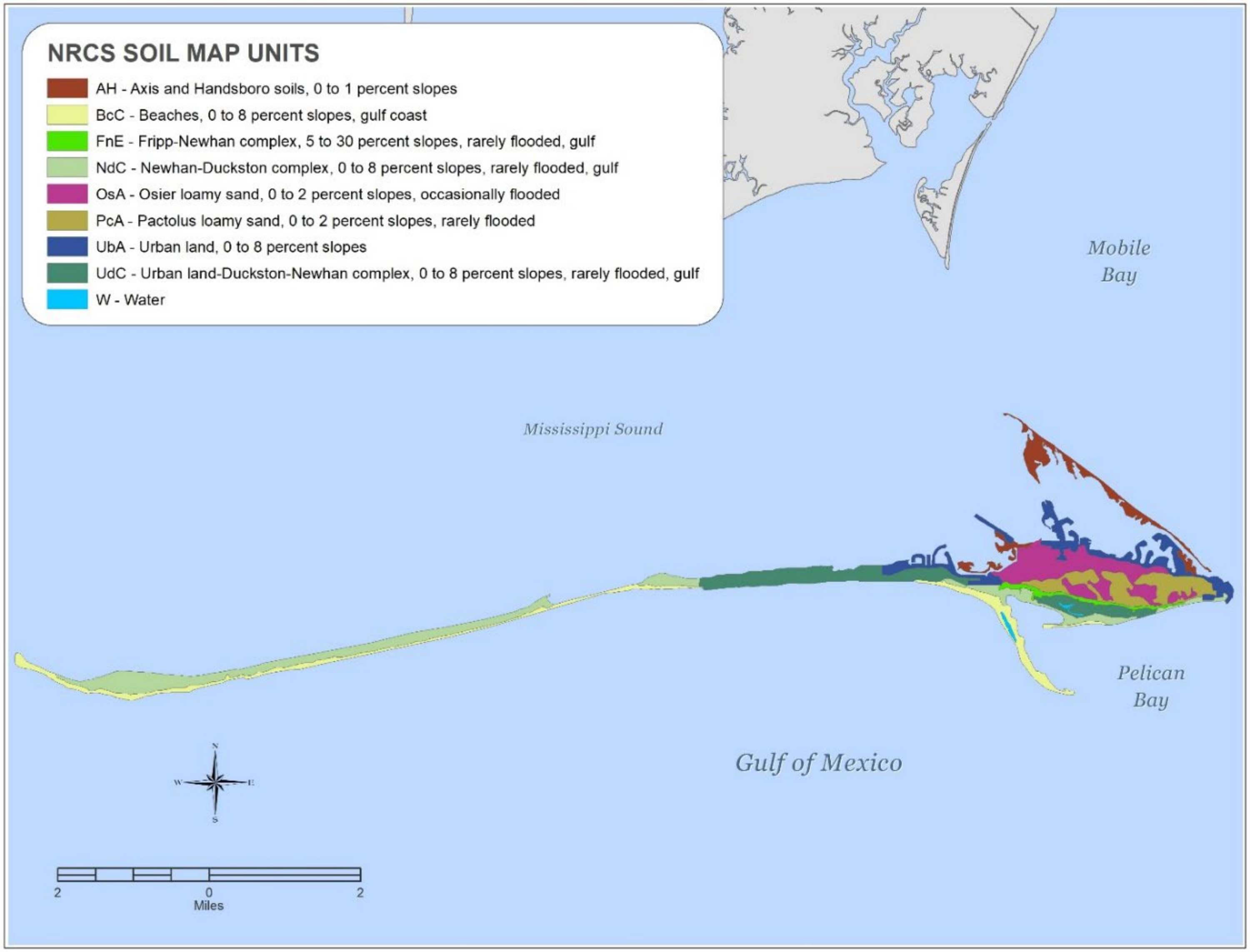
Soils

There are nine different soil types associated with Dauphin Island (**Figure 3-4**). The principal soil types include Axis-Handsboro, Beaches, Fripp-Newhan complex, Newhan-Duckston complex, Osier loamy sand, Pactolus loamy sand, Urban Land, Urban Land-Duckston-Newhan complex, and Water. These soil types comprise a few major soils and several minor soils grouped together based on characteristic patterns. Soil classifications are useful to provide a general idea of the soils in an area, compare different parts of a county, or know the possible location of adequately sized areas suitable for a certain kind of farming or other land use (McBride and Burgess 1964). The Axis-Handsboro, Osier, and Urban Land-Duckston-Newhan complex soil types are low sloping and poorly or very poorly drained. The Fripp-Newhan complex, Newhan-Duckston complex, and Beaches types are excessively drained and rarely flooded. None of the soil types on the Island are suitable for agriculture (NRCS 2021).



SOURCE: USGS Digital Geological Map of Alabama

FIGURE 3-3 Geological Formations of Dauphin Island



SOURCE: USDA-NRCS Soil Survey Geographic Database

FIGURE 3-4 Major Soil Types of Dauphin Island

Soil Erodibility Factor

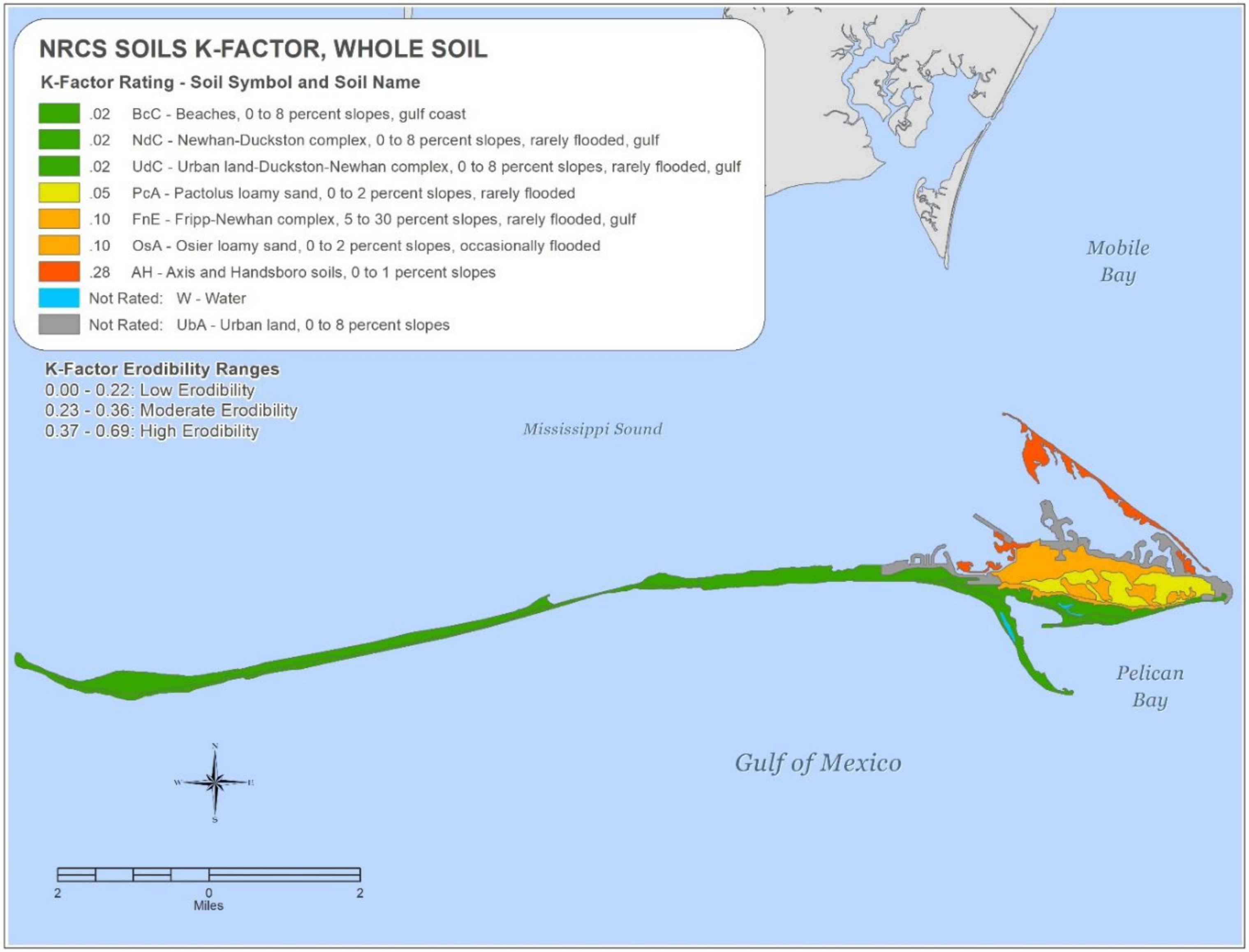
The soil erodibility factor (K-Factor) indicates the susceptibility of a soil to erosion and determines the rate of runoff. The K-Factor is based primarily on percentage of silt, sand, and organic matter; soil structure; and saturated hydraulic conductivity. The K-Factor value ranges from the lowest erodibility, 0.02, to the highest, 0.69. A range of 0 to 0.22 is considered low erodibility, 0.23 to 0.36 medium erodibility, and a K range of 0.37 to 0.69 is considered high erodibility. All other factors being equal, the higher the K-Factor value, the greater the susceptibility of the soil to rill and sheet erosion by rainfall. In general, soils with greater permeability, higher levels of organic matter, and improved soil structure have a greater resistance to erosion and, therefore, a lower K-Factor value.

Typically, subsoils have higher K-Factors and are more erodible than topsoils. When land clearing and grading activities expose subsoils, the K-Factor increases. Exposed subsoils can be expected to erode faster because they have less organic matter and plant root mass to hold the soil particles together structurally. The formation of micropores that allow percolation of rainfall is reduced in subsoils, resulting in increased runoff. Increased runoff produces greater sheer forces for detaching soil particles from the surface and accelerating erosion.

K-Factors for the soil series occurring on Dauphin Island vary from 0.02 to 0.28 (USDA 2022). The majority of soils on the Island (78%) have a K-Factor less than 0.23 and are considered to have low erodibility. The Axis and Handsboro soils (constitute approximately 8% of the Island soils) have a K-Factor of 0.28, which is on the lower end of the moderate erodibility range. These soils comprise the areas of Cedar Island and Little Dauphin Island, and smaller areas near Billy Goat Hole, and along Graveline Bay. The Urban Land soils, and Water are not rated and comprise about 13% and 1% of Island soils respectively. **Figure 3-5** presents a visual summary of the soil erodibility within the Watershed based on the soil K-Factors.

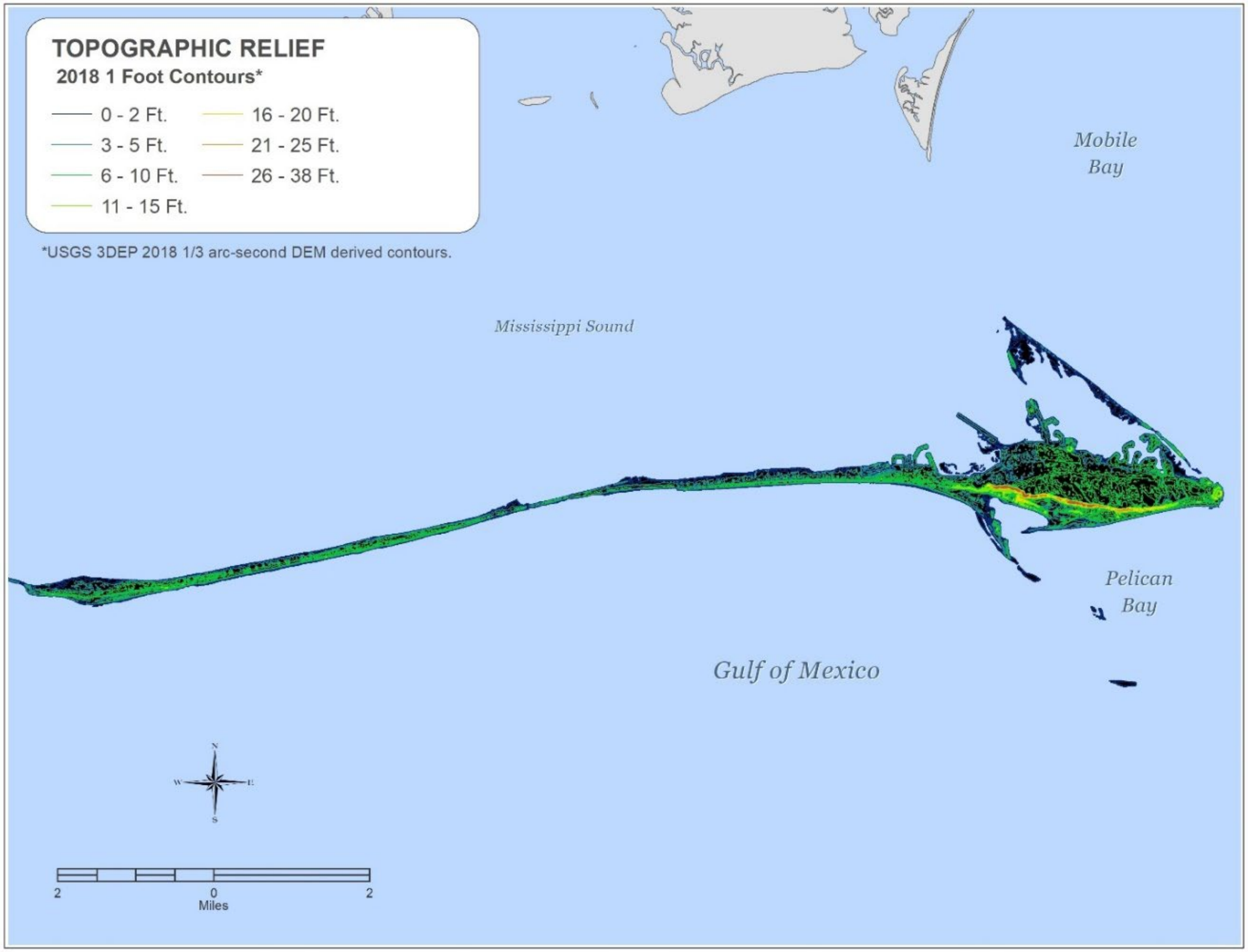
3.2.3 TOPOGRAPHY

The Dauphin Island Watershed is characterized by generally flat topography marked by beach, dune, overwash fans, intertidal flats, wetlands, maritime forest, and freshwater ponds and lakes. Elevations on the Island range from zero/sea level around most of the Island to approximately 38 feet National Geodetic Vertical Datum (NGVD) on the East End of the Island (**Figure 3-6**).



SOURCE: USDA-NRCS Soil Survey Geographic Database

FIGURE 3-5 Soil Erodibility K Factors on Dauphin Island



SOURCE: USGS

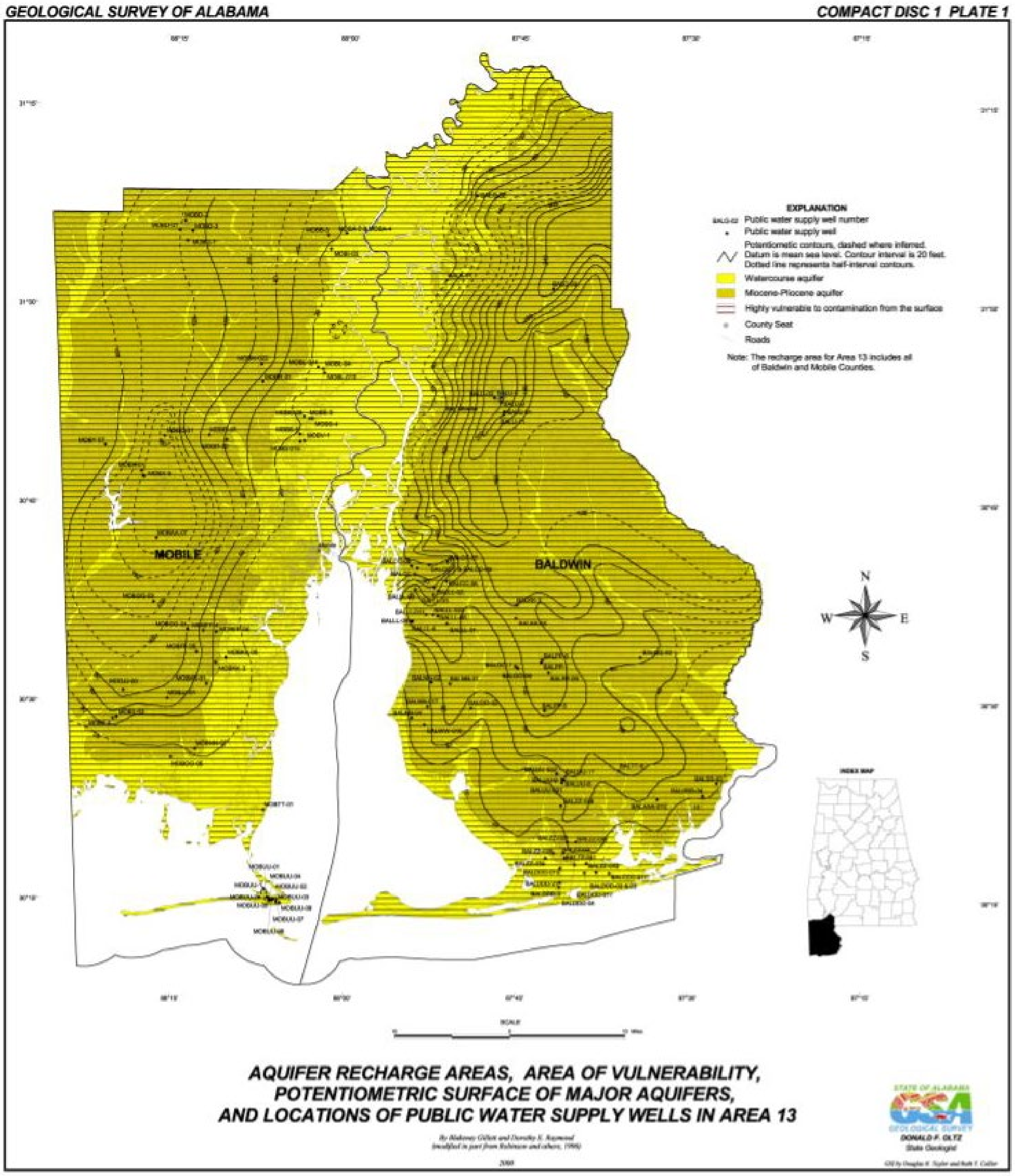
FIGURE 3-6 Dauphin Island Topography

3.3 Hydrology

According to Gillet et al. (2000), the major aquifer underlying Dauphin Island is the watercourse aquifer (**Figure 3-7**). Quaternary alluvial, coastal, and terrace deposits consisting of interbedded sand, gravel, and clay make up the watercourse aquifer. Buried sand and gravel channels are surrounded by silty and clayey sediments that do not yield significant amounts of water but do allow slow infiltration of water to recharge the sand and gravel beds. Individual buried channels may be directly connected to present channels of the Mobile River. The watercourse aquifer is hydraulically connected to the underlying Miocene-Pliocene aquifer (Gillet et al. 2000).

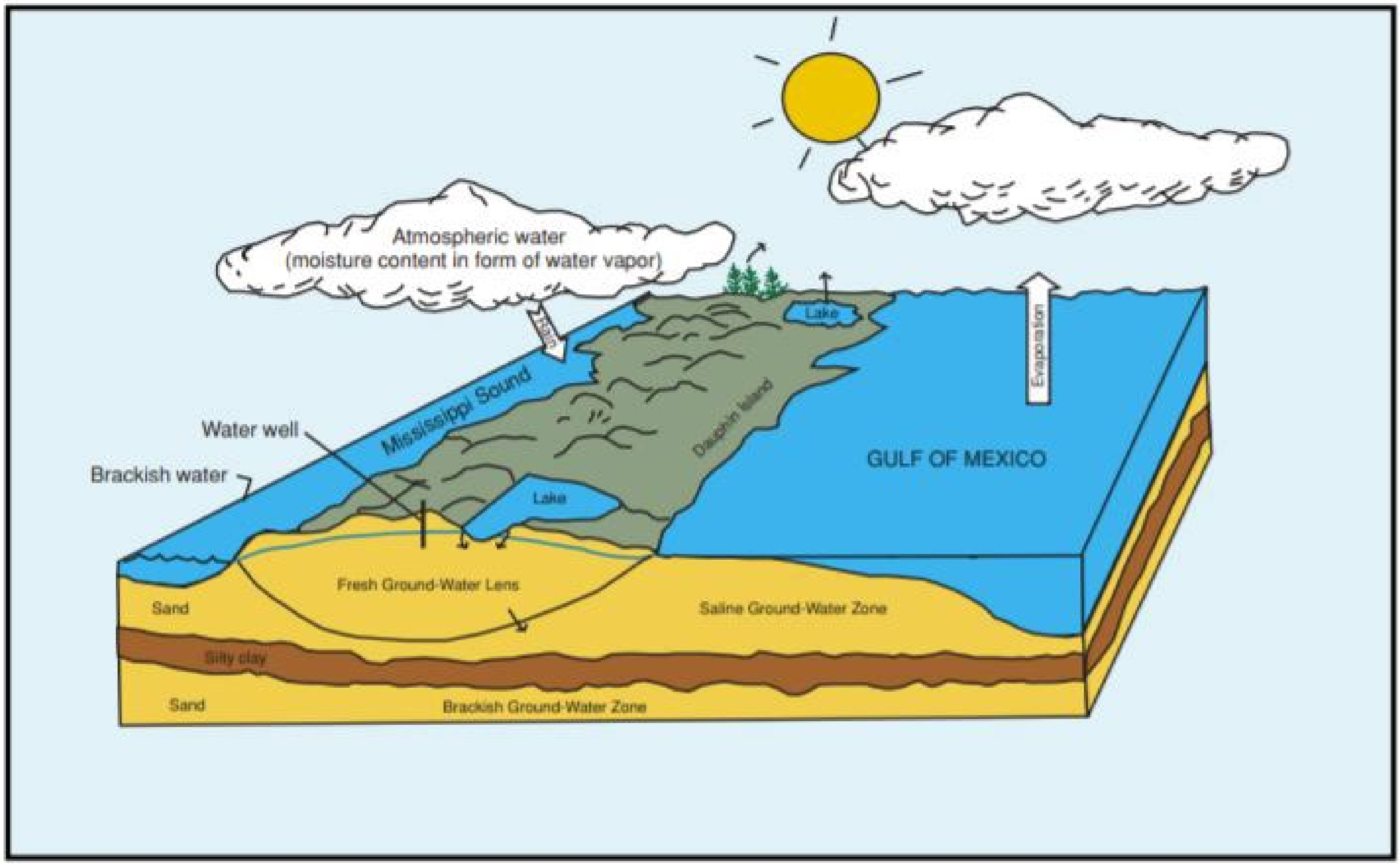
The sand and gravel beds in the watercourse aquifer and those at shallow depths in the Miocene-Pliocene aquifer are hydraulically connected to the land surface. The watercourse aquifer locally provides recharge for the underlying Miocene-Pliocene aquifer. Few public supply wells are complete in this aquifer because of its vulnerability to contamination from the land surface. Dauphin Island is one area that has completed wells, but the Island's hydrologic situation is unique to the rest of the State. Because it is an island, isolated from the rest of Mobile County by the brackish water of the Mississippi Sound, its primary source of fresh water is a freshwater lens that "floats" on top of more dense saline water (**Figure 3-8**). Like other coastal aquifers, these sands are subject to contamination by storm tides and surges. The deeper sands underlying the watercourse aquifer also tend to be high in salt. Gillet et al. (2000) found saline water in the shallow sands occurring down to approximately 30 feet (630 mg/L Cl) and in deep sand between 260 and 350 feet (320 mg/L Cl). Chloride levels in the shallow upper sands can vary significantly as rainfall flushes out salt water from storm surge over wash. Dauphin Island uses a reverse-osmosis treatment system to reduce chloride levels in water from wells completed in the watercourse aquifer and from two deeper wells (Gillet et al. 2000).

Rain is the primary source of recharge to the aquifer. The annual mean rainfall for the Mobile area from 1991 to 2020 is 67.08 inches (NOAA 2022c). Approximately 28 inches per year of rainfall runs off during and immediately after storms (Reed and McCain 1971). A small percentage of rainfall infiltrates the subsurface as recharge to the aquifers; the remainder is returned to the atmosphere by evaporation and transpiration from trees and other plants. The amount of water that infiltrates the soil depends on the hydraulic conductivity and permeability of the soil, the amount of water present in the soil during rainfall, and the land slope. Infiltration is greater in an area that is flat and underlain by gravel and coarse sand sediments rather than in an area with a sloping land surface that is underlain by dense clay.



SOURCE: GSA 2000

FIGURE 3-7 Aquifer Recharge Areas in Alabama



SOURCE: Gillet et al. 2000, modified from Chandler and Moore 1983

FIGURE 3-8 Hydrologic Cycle of Dauphin Island

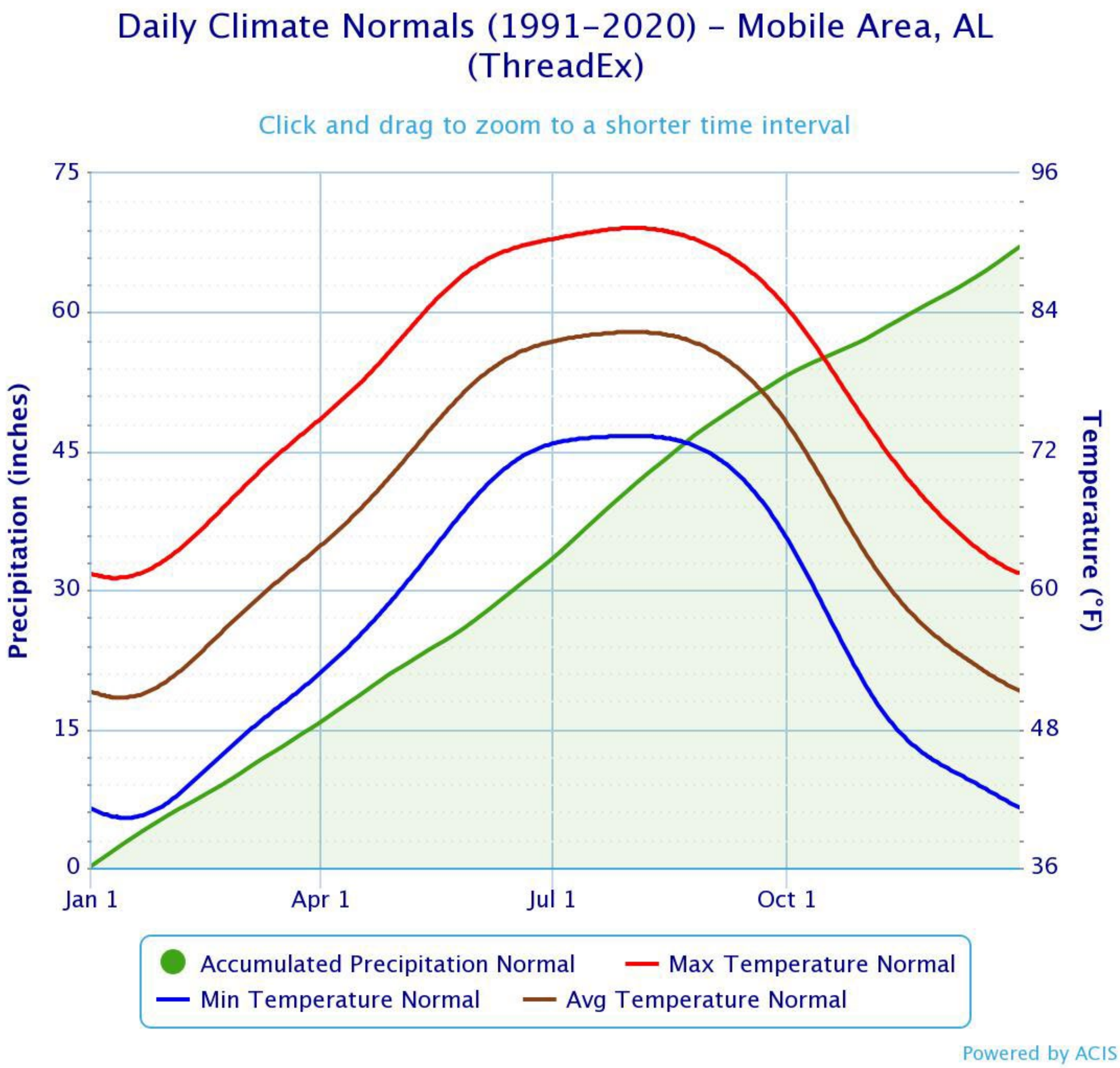
3.3.1 CLIMATE AND RAINFALL

The climate of the Dauphin Island Watershed is considered humid and subtropical with abundant rainfall. Summers are normally dominated by high pressure and southerly winds frequently resulting in afternoon thunderstorms. Summer temperatures generally range from 80° to 90° F with 100° F not uncommon. Winters are generally mild with frequent cold fronts and showers originating from the northwest and low temperatures in the range of 20° F occurring most every year. The ground rarely freezes.

Tropical storms and cyclones are common along the northern Gulf Coast. As a barrier island, Dauphin Island often bears the brunt of associated storm surges and storm force winds. As of July 2021, 83 tropical and subtropical cyclones have directly or indirectly affected Alabama since 1951. Only four major hurricanes, the 1926 Miami hurricane, Hurricane Frederic (1979), Hurricane Ivan (2004), and Hurricane Sally (2020) have made landfall in Alabama. Of these, Hurricane Frederick is the only major hurricane to have made landfall on Dauphin Island (NOAA 2022a). Storms that have made the most significant modern impacts to the Island were Hurricanes Camille (1969), Frederic (1979), Georges (1998), Ivan (2004), and Katrina (2005). The estimated return frequency for a hurricane passing within 50 miles of Mobile County is 10 years, and the return frequency for a major hurricane (Category 3 or higher) is 28 years (NOAA 2022b). Significant amounts of rainfall can occur during tropical events, resulting in flooding conditions, high erosion rates, and the transport of large amounts of sediment and debris into the wetlands, rivers, and bay. Dauphin Island is particularly subject to damage and saltwater intrusion form storm surge flooding. Episodic events such as tropical systems can be expected to cause changes to the landform of Dauphin Island over time. In addition to changes caused by storms, Dauphin Island has historically experienced a strong western movement due to longshore drift and westward littoral transport, similar to other barrier islands in the Mississippi Sound (Otvos 1970; Morton 2008).

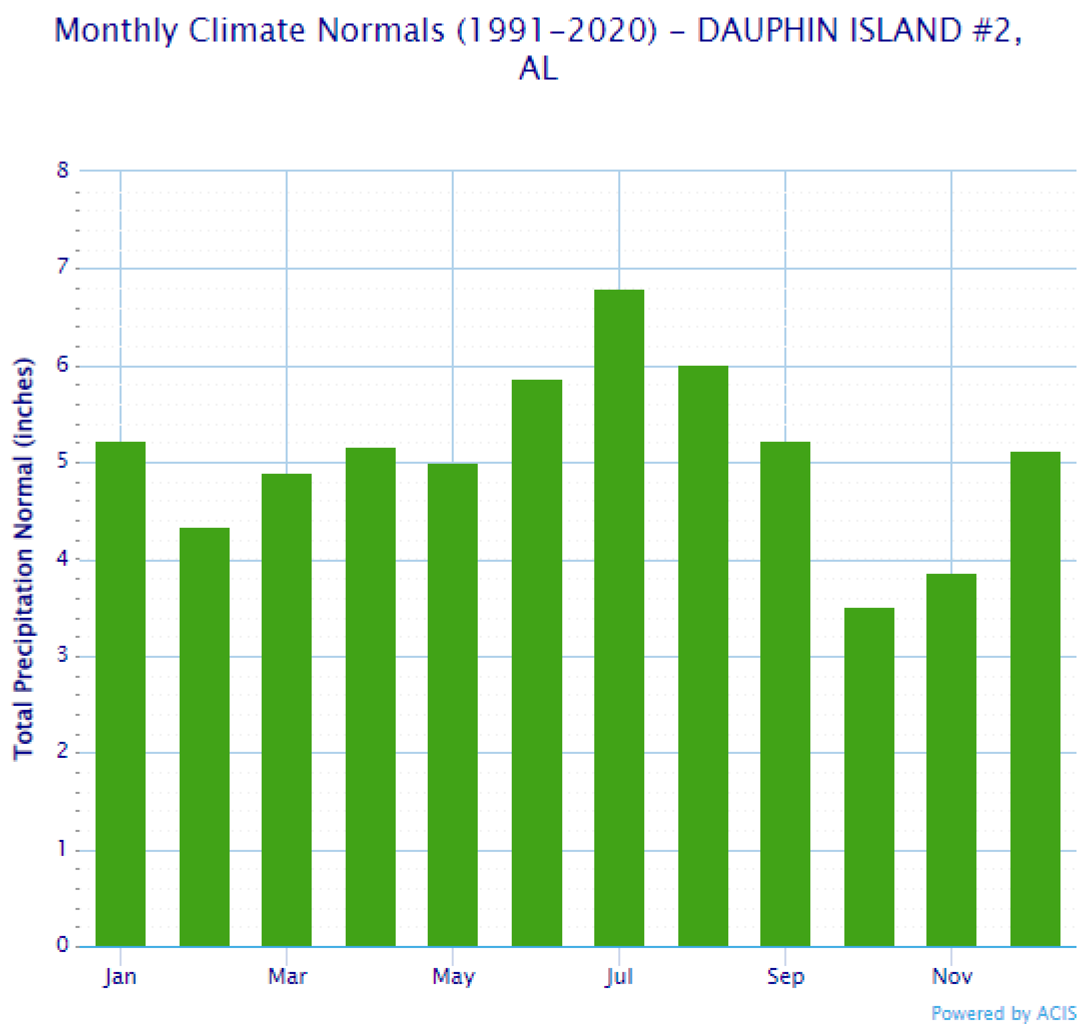
Wave action is the primary natural factor affecting sediment transport of the Island itself. Rainfall fed stormwater flows can have a significant impact on stormwater driven sediment transport and flooding affecting infrastructure. Stormwater generated from rainfall is the main transport mechanism for eroded soils and other pollutants (e.g., nutrients, pathogens), particularly in areas with a higher percentage of impervious cover. The mild, humid climate favors rapid decomposition of organic matter and hastens chemical reaction in the soil.

The Alabama Gulf Coast is one of the wettest areas in the United States, with average annual rainfall of 67 inches and approximately 60 rain days per year. Rainfall occurs throughout the year with the most precipitation during the months of April through September. Rainfall is usually of the shower type. Storms with long periods of continuous rainfall are less common. Tropical summer thunderstorm events are capable of producing localized heavy rainfall totals of several inches within a one-to-two-hour time frame. The annual mean rainfall from 1991 to 2020 reported for the Mobile area is 67.08 inches (NOAA 2022c) (**Figure 3-9**). **Figure 3-10** demonstrates monthly climate normals from Dauphin Island station number USC00012172 (NOAA 2022d).



SOURCE: ThreadEX NOAA

FIGURE 3-9 Daily Climate Normals in the Mobile, AL Area

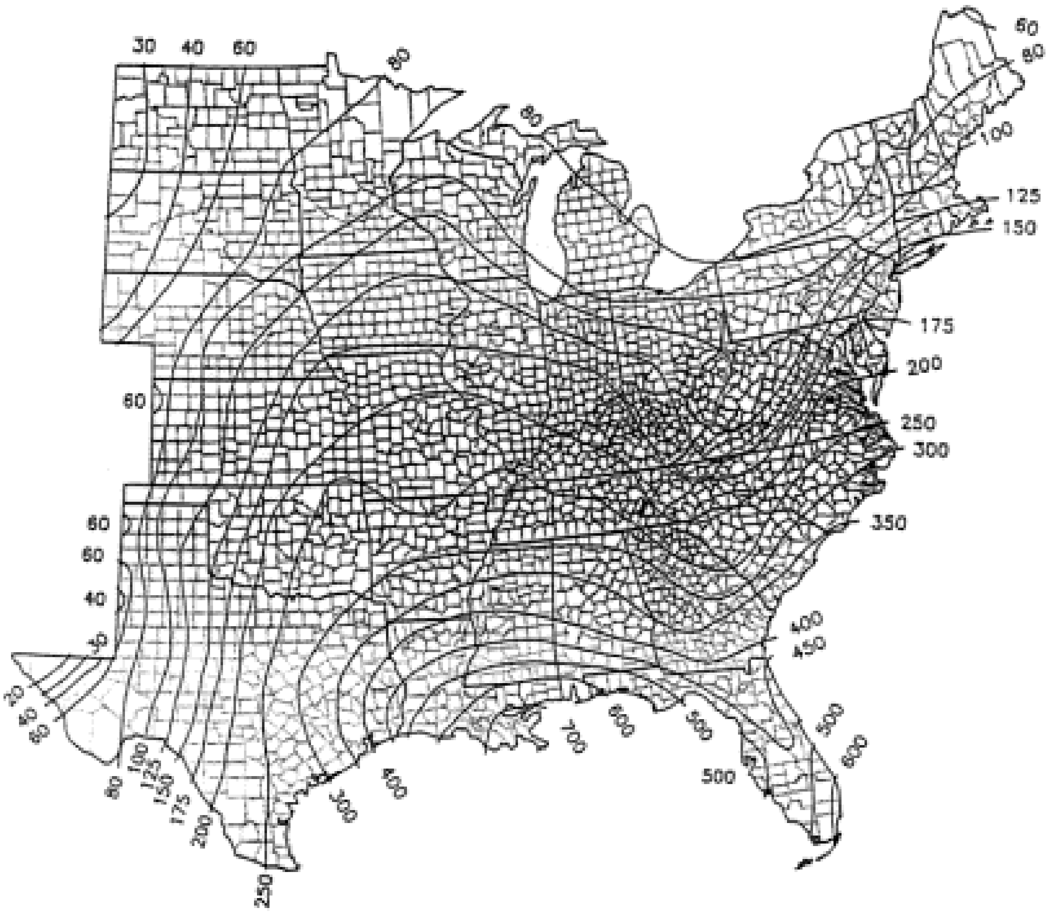


SOURCE: NOAA NCEI

FIGURE 3-10 Total Precipitation Normal for Dauphin Island

The intensity or type of rainfall events are an important consideration for this region. The Natural Resources Conservation Service (NRCS) (formerly the Soil Conservation Service) categorizes rainfall into four types of distribution pattern (I, IA, II, III) based on rainfall intensity (inches/hour). Most of the northern Gulf Coast, including the southern two-thirds of Alabama, experience NRCS Type III events with approximately 50% of the rain falling during a short interval around the middle of the event. Another measure of the intensity of rainfall events is reflected in the Universal Soil Loss Equation by the "R" factor, a value determined from raindrop energy, rainfall intensity, rainfall frequency, and storm duration. The R factor along the Alabama coastal areas is around 650 (**Figure 3-11**). By comparison, the R factor in the Olympic National Forest in the State of Washington, which receives on average twice the volume of rain (approximately 120 inches/year), is only 340. These high intensity rainfall events that occur in the Dauphin

Island Watershed necessitate proper use of appropriate best management practices and stormwater management practices.

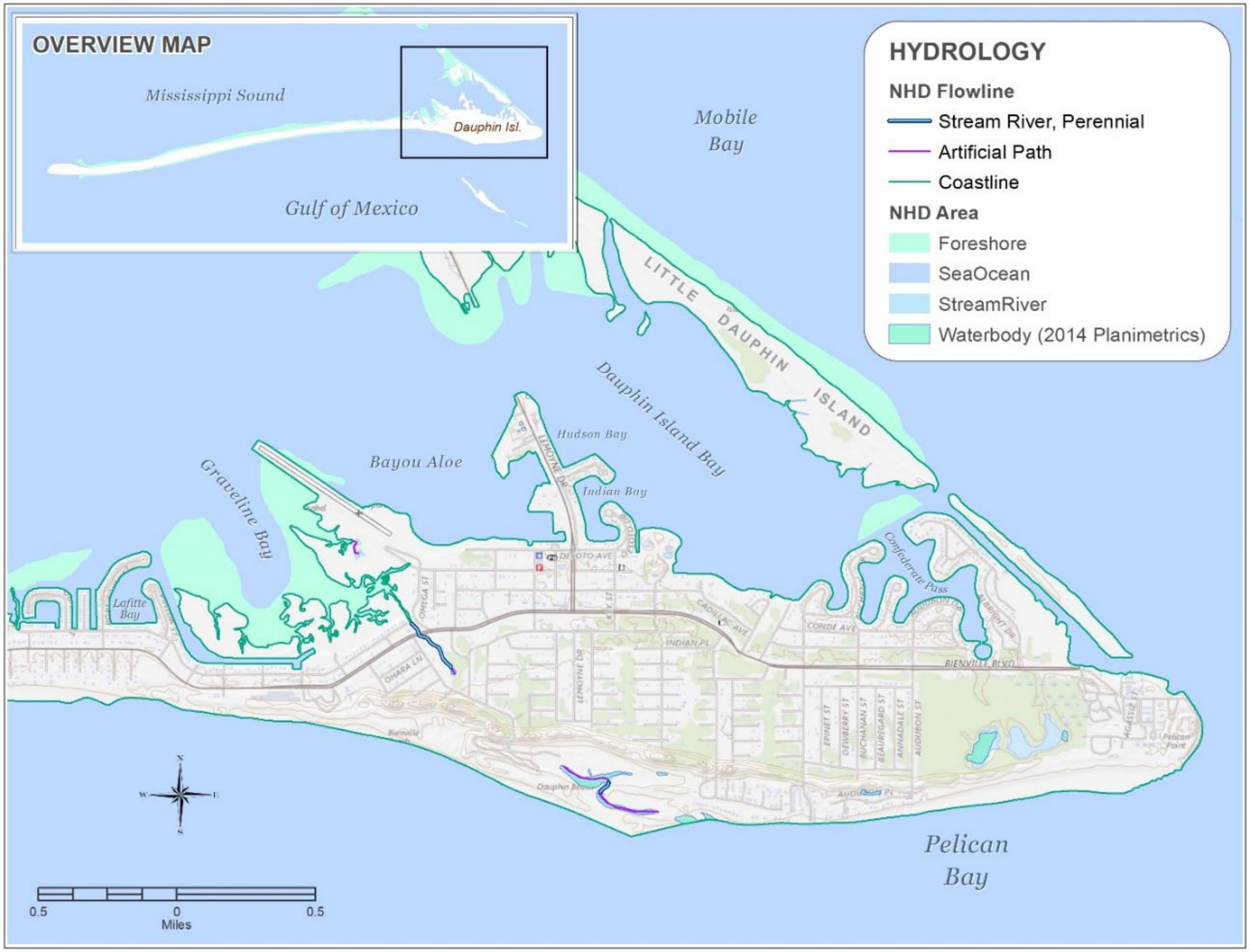


SOURCE: Renard et al. 1997

FIGURE 3-11 Isoerodent Map of Eastern U.S.

3.3.2 SURFACE WATER RESOURCES

In terms of available water features on Dauphin Island, there is one tidal creek that totals 1,773.6 linear feet contributing a negligible amount of flow into the Mississippi Sound and Gulf of Mexico (**Figure 3-12**). There are also small ponds/lakes totaling approximately 13.3 acres on the East End of the Island. These ponds change minimally in size with varying hydrologic conditions. There are two established freshwater lakes: one in the Dauphin Island Bird Sanctuary on the East End and another that forms a physical feature on the Isle Dauphine golf course (Jordon, Jones, and Goulding, Inc. 1980).



SOURCE: USGS National Hydrology Dataset 2021

FIGURE 3-12 Stream Network on Dauphin Island

3.3.3 GROUNDWATER RESOURCES

One of Alabama's great natural treasures is the variety and quantity of its water resources, with 586.5 trillion gallons of water, of which 553 trillion gallons is stored in underground aquifers (GSA 1994a). Groundwater is a reliable source of water for many people in Alabama (roughly 44% of the population) (Moore and Szabo 1994), with several large cities and many smaller towns utilizing groundwater in South Alabama. Approximately seven inches of the overall State's 55 inches of annual rainfall enters the ground to become groundwater (GSA 2001c).

Groundwater Use and Recharge

Dauphin Island is underlain by one major aquifer, the watercourse aquifer (sometimes referred to as the beach sand aquifer) (**Figure 3-13**). The watercourse aquifer is the uppermost aquifer. It is unconfined and composed of Quaternary alluvial, terrace, and coastal deposits. Deposits consist of sand and gravel interbedded with clay and sandy clay units and represent complex coastal depositional environments, such as beach, dune, lagoon, and deltaic environments. The Watercourse Aquifer ranges in thickness from 0 to 200 feet and is hydraulically connected to the underlying Miocene-Pliocene Aquifer (Gillet et al. 2000). Most of the Island's surface lies very close to sea level, and thus its freshwater resources are vulnerable to storm surge during major hurricanes (O'Donnell and Associates, Inc. 2002). In a recent study, Adyasari et al. (2021) found that the local rivers had a more immediate hydrological response time than groundwater during the storm event, indicating a river-dominated environment.

Groundwater Quality

Dauphin Island's hydrologic situation is unique in the State of Alabama. Because it is an island isolated from the rest of Mobile County by the brackish water of the Mississippi Sound, its primary source of fresh water is a freshwater lens "floating" on top of denser saline water (GSA 2000b). As with all shallow aquifers in the coastal regions, these sands are subject to contamination by storm tides and surges. The deeper sands underlying the watercourse aquifer also tend to be high in salt. Because of salt-water encroachment, Dauphin Island installed a shallow well field on the Island to produce water from the shallow unconfined parts of the aquifer. Eight shallow wells, ranging from 30 to 40 feet in depth, were drilled. Two existing deep wells were left in service. In October 2021, the Dauphin Island Water and Sewer Authority noted there are now four wells serving the Island at varying depths and in differing aquifers. Due to lack of updated publicly available data, the specific locations of wells are unknown. **Figure 3-13** shows well locations from 2013.

SOURCE: MBNEP, Alabama Coastal Resources Comprehensive GIS Inventory

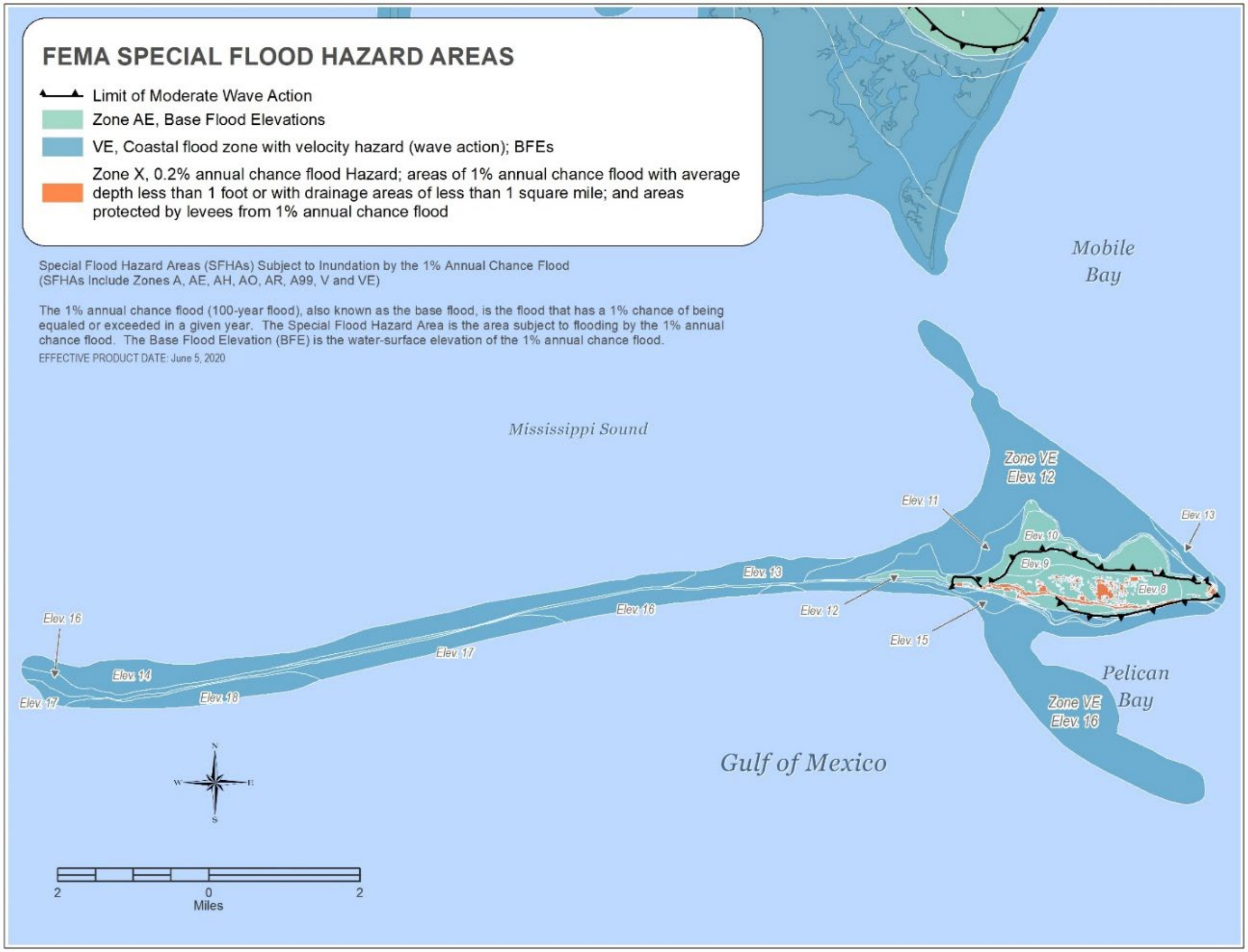
FIGURE 3-13 Public Groundwater Wells and Aquifer Recharge Areas

3.4 Floodplains and FEMA Flood Zones

Dauphin Island is a low-laying barrier island that is particularly vulnerable to flooding. The Federal Emergency Management Agency (FEMA) assigns levels of flood risk to geographic areas to determine flood zones indicating the severity and type of flooding that occurs in a geographic area. FEMA has identified three standard risk areas: moderate-to-low-risk areas, high-risk areas, and high-risk coastal areas. High-risk areas (non-coastal and coastal), also referred to as special flood hazard areas, also subject to federal floodplain management regulations and potential flood insurance recommendations. The National Flood Insurance Program (NFIP) was created by Congress in 1968 to protect lives and property and to reduce the financial burden of providing disaster assistance. The NFIP is administered by FEMA. Nationwide, over 20,200 communities participate in the NFIP, and nearly all of Alabama's flood-prone communities participate. The NFIP is based on a mutual agreement between the federal government and communities. Participating communities agree to regulate floodplain development according to certain criteria and standards. In partnership with FEMA, the State produces flood maps in accordance with FEMA standards. The maps are used by communities, insurance agents, and others.

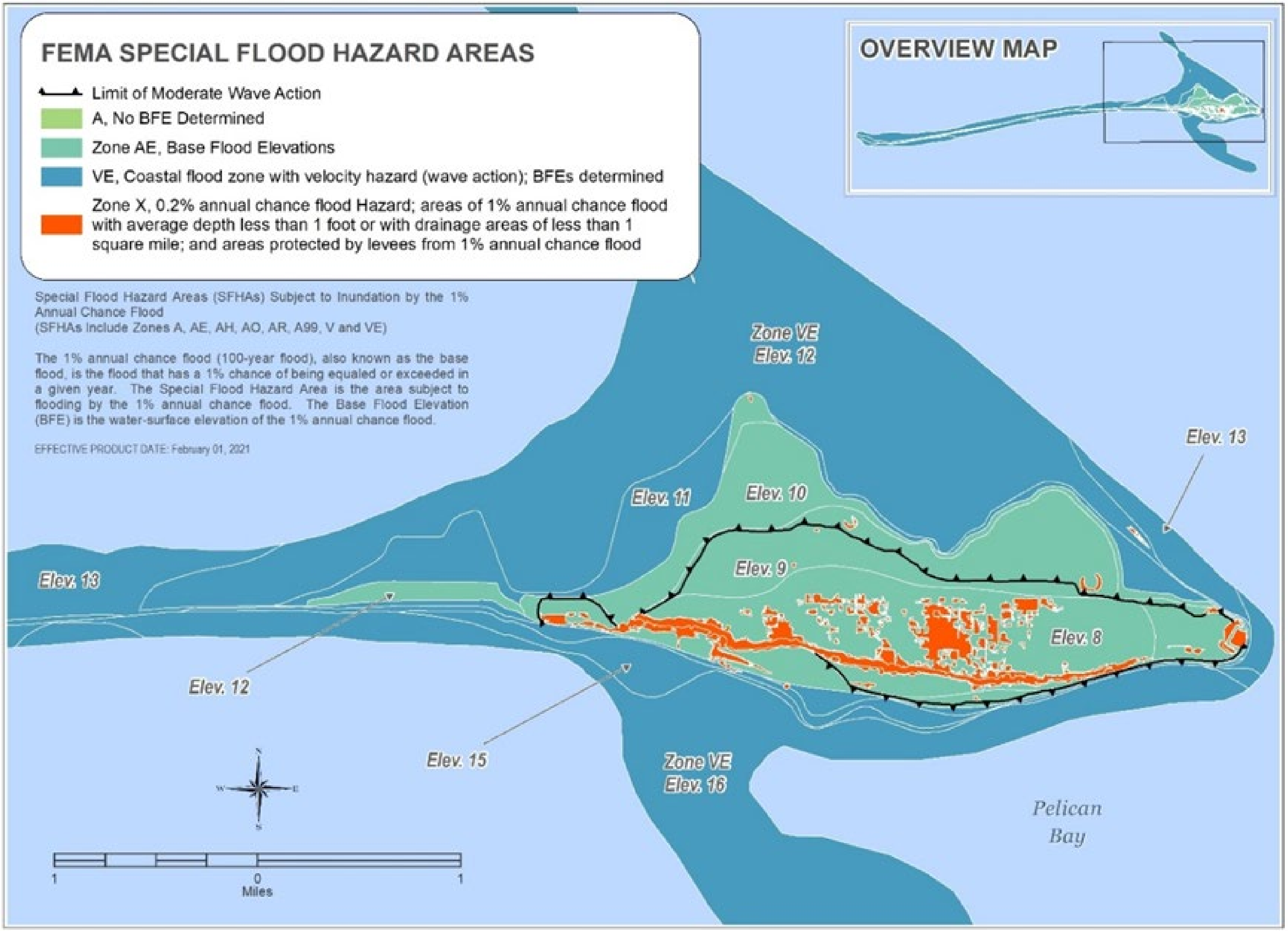
Dauphin Island's floodplains and their flood hazard area designations are depicted in **Figure 3-14A–C**. These include Zone AE (subject to inundation by the 1% annual-chance flood event with base flood elevation determined), Zone VE (subject to inundation by the 1% annual-chance flood event with additional hazards due to storm waves with base flood elevation determined) and Zone X (area between the limits of the base flood and the 0.2% annual-chance [or 500-year] flood). Base Flood Elevation is the elevation of surface water resulting from a flood that has a 1% chance of equaling or exceeding that level in any given year.

Coastal flood studies include storm surge with wave modeling, wave hazard analysis, and mapping. Hurricanes can cause storm surge, resulting in a rise in water level. Wave modeling determines the magnitude of the surge based on a number of parameters. These parameters include track and speed of the storm, atmospheric pressure, offshore water depths, and location of landfall. The results of the modeling are still water elevations, which are used to establish the special flood hazard areas along the coastline. The maps and studies may be found on the Alabama Department of Economic and Community Affairs (ADECA) website (http://adeca.alabama.gov/Divisions/owr/floodplain/Pages/default.aspx).



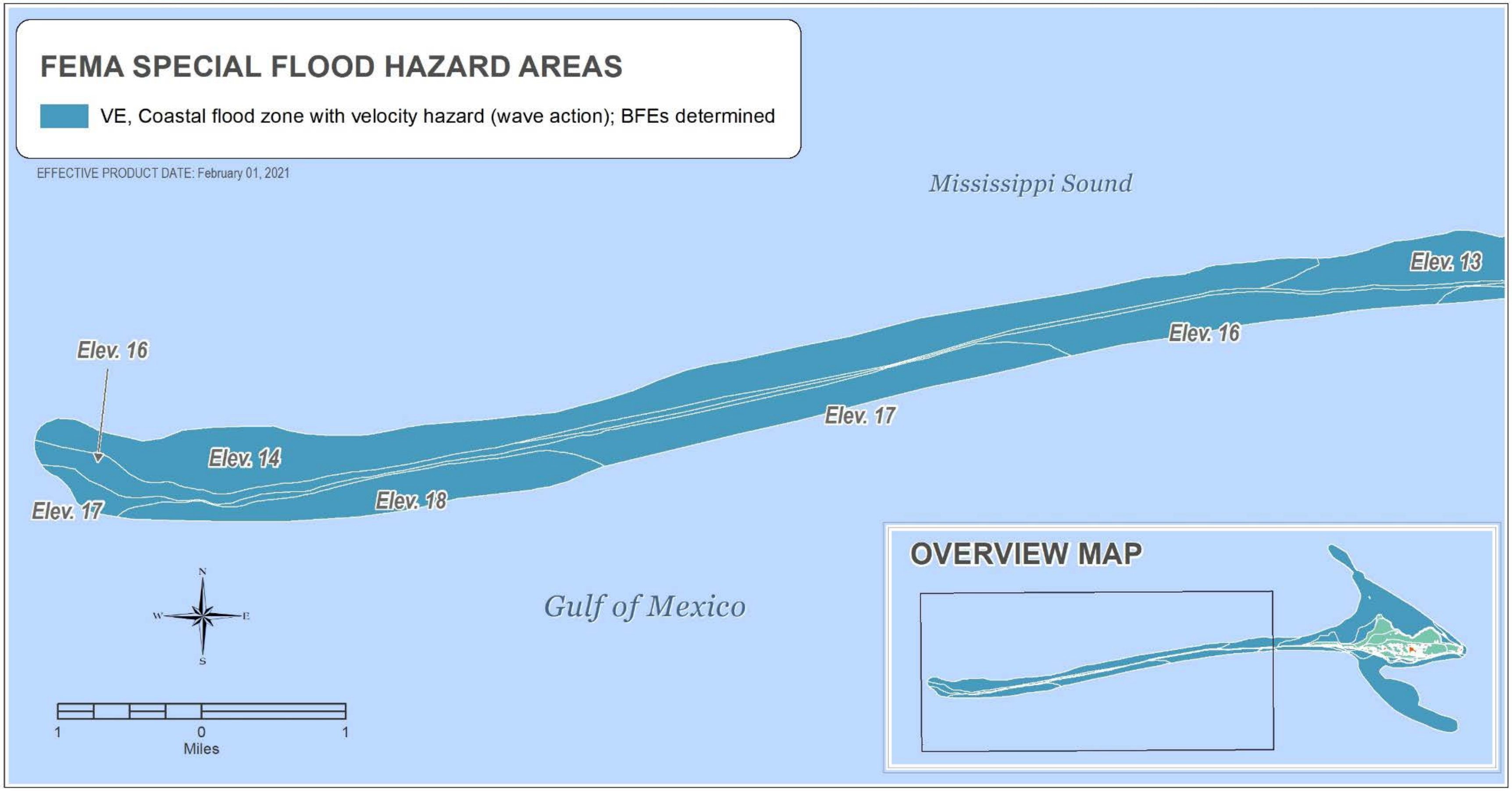
SOURCE: FEMA

FIGURE 3-14A Federal Emergency Management Agency Flood Zones within Dauphin Island Watershed



SOURCE: FEMA

FIGURE 3-14B Federal Emergency Management Agency Flood Zones within Dauphin Island Watershed – East End



SOURCE: FEMA

FIGURE 3-14C Federal Emergency Management Agency Flood Zones within Dauphin Island Watershed – West End

3.5 Biological Resources

3.5.1 INTRODUCTION

Dauphin Island lies in the Gulf Barrier Island and Coastal Marshes Level IV Ecoregion, part of the broad Southern Coastal Plain Level III Ecoregion (Griffith et al. 2001). Barrier islands are long and narrow offshore deposits of sand or sediments that parallel the coastline, typically separated from the mainland by a sound, bay, or lagoon. Sometimes referred to as a coastal strand, these systems are dynamic and ecologically diverse.

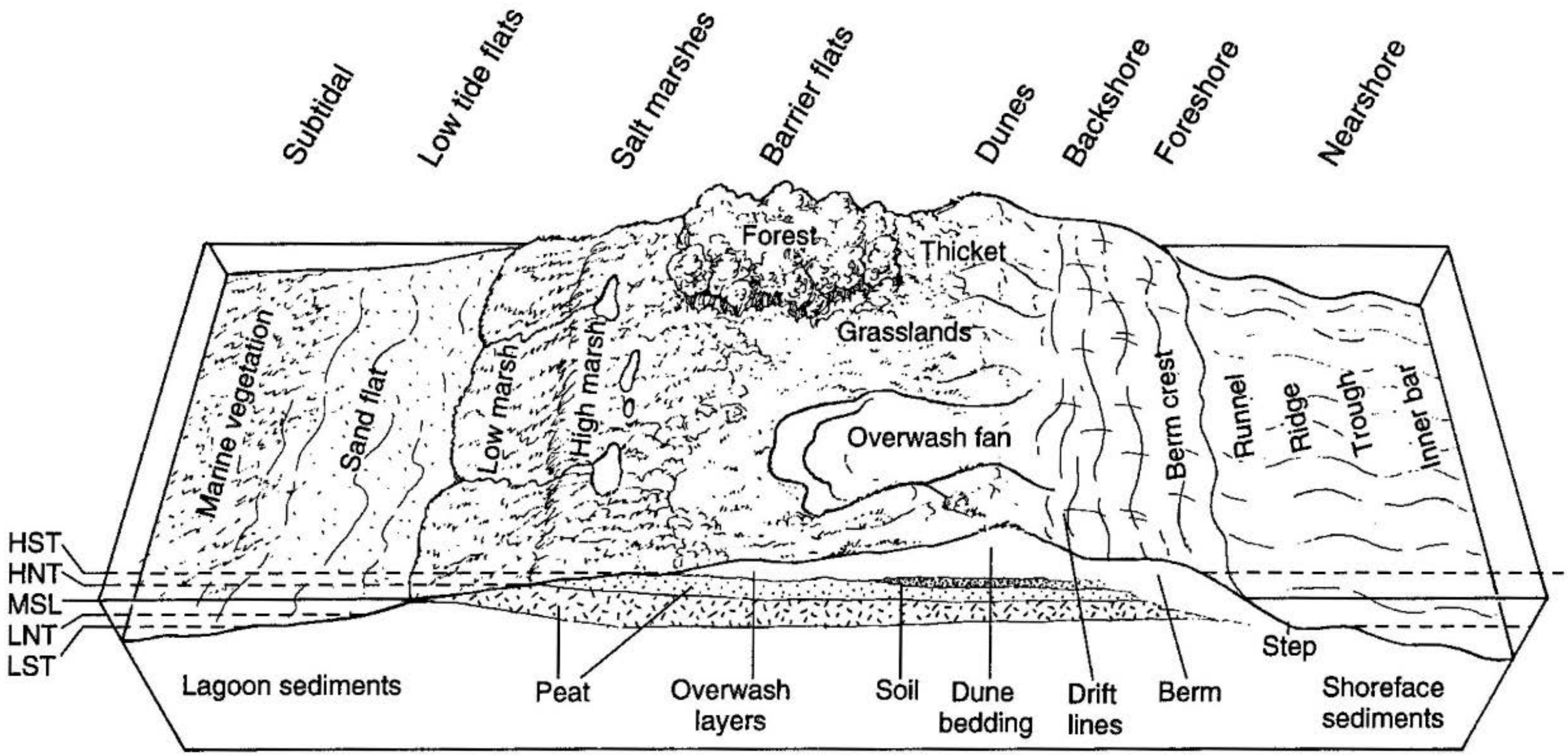
Situated on the Gulf of Mexico, Dauphin Island provides an important mainland buffer against tropical storms and hurricanes. Gulf waves expend their energy along the Island's south side. On the north side, Mississippi Sound is a lagoon system with a buffered environment, providing a more quiescent landscape. The Sound includes adjacent open bays, including Portersville Bay north of the Island, along with barrier-island passes; including Petit Bois Pass on the west and Mobile Pass to the east.

Surrounded by marine and estuarine waters, Dauphin Island has beaches and dunes, grassed meadows, xeric coastal strand and pine scrub vegetation, maritime forest, forested wetlands, and salt and brackish tidal marshes. These habitats provide important ecosystem services to the coastal region, including storm protection and erosion control; habitat for birds, fish, and wildlife; salinity regulation in estuaries; carbon sequestration in marshes; water catchment and purification; recreation; and tourism (Barbier et al. 2011). Cultural services and benefits include aesthetic, artistic, educational, and scientific values (Costanza et al. 1997).

3.5.2 ISLAND HABITATS

A generalized depiction of barrier island zonation is presented in **Figure 3-15** (Bellis and Keough 1995). Island structure on the Gulf of Mexico side has a beach of sand deposits constantly re-worked by wave action. The foreshore is defined as the beach area between the average high tide mark and the average low tide mark, generally the immediate shoreline. The beach backshore area lies between the average high-tide mark and sparsely vegetated areas affected by waves only during severe storm events.

Landward of the beach, a dune system is formed by sand carried and deposited by winds and stabilized naturally by plants. Water and wind are the primary environmental forces that shape the morphology and ecology of beach dunes. Storm waves may sometimes break through the dune, moving sand inland as an overwash fan, or barrier flat, which often become grassed meadows.



SOURCE: Bellis and Keough 1995

FIGURE 3-15 A Generalized Depiction of the Physiographic and Ecological Zonation of a Typical Barrier Island

Maritime forests are largely confined to barrier islands and Gulf-fringing sand dune systems, usually covering their more stable portions. Maritime flora and fauna are well adapted to survive the elevated salt content, limited availability of fresh water, soil erosion and dune migration, occasional seawater inundation, and wind damage associated with oceanic storms (Bellis and Keough 1995).

Freshwater wetlands occur within the barrier flats portions of Dauphin Island in dune swales or on the edges of relict dunes. Located generally landward of the main dune system, these wetlands are in many cases ephemeral or intermittently flooded.

Low-lying areas on the sound-side of barrier islands have high and low intertidal marshes. High marsh areas are irregularly flooded with the spring tides, whereas low marsh areas are flooded with daily high tide during the growing season.

The USGS recently mapped Dauphin Island habitats as part of the Alabama Barrier Island Restoration Assessment in collaboration with the U.S. Army Corps of Engineers and in cooperation with the State of Alabama (USGS 2017). Overall, the most abundant terrestrial habitats mapped were meadow (890 acres; 29.2 % of the total land cover), forest (722 acres; 23.7%), intertidal marsh (302 acres; 9.9%), herbaceous dune (269 acres; 8.8%), and unvegetated barrier flat (260 acres; 8.5%) (**Table 3-1**). The USGS habitat maps for Dauphin Island, Little Dauphin Island, and Pelican Island are presented in **Figure 3-16** and **Figure 3-17**.

Terrestrial habitats on the western, uninhabited half of Dauphin Island are dominated by meadow (271.4 acres), followed by herbaceous dune (108.8 acres), beach (96.8 acres), unvegetated barrier flat (70.1 acres), intertidal marsh (59.3 acres) and flat (49.1 acres), and intertidal beach (23.8 acres) (**Table 3-1**). Most of the Island's seagrass acreage (232.8 acres) is located along its northern shore, west of Katrina Cut (**Figure 3-16**).

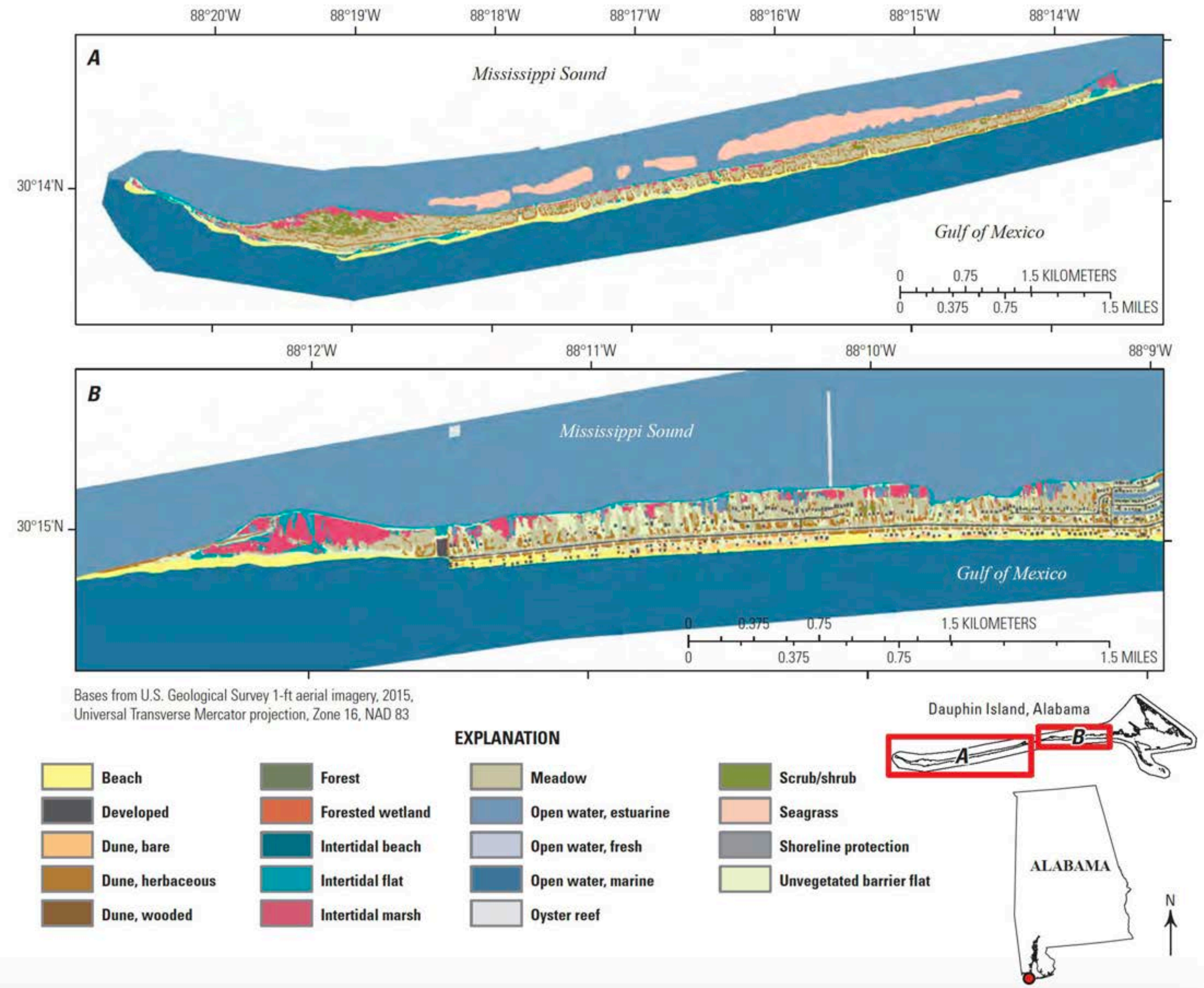
The middle portion of the Island (**Figure 3-16**) comprises meadow (111.8 acres), unvegetated barrier flat (85.1 acres), beach (55.5 acres), intertidal marsh (43.8 acres) and flat (26.7 acres), and herbaceous dune (40.7 acres). Much of the mapped herbaceous dune in this area of Dauphin Island is represented by roadside sand deposits south of Bienville Boulevard that are not natural features. There are 33.9 acres of developed land in the middle portion of Dauphin Island (**Table 3-1**).

TABLE 3-1 USGS 2015 Habitat Acreages, Corresponding to Figures 3.5-2 and 3.5-3

Habitat	Acreage		
	West	Middle	East
Dune, bare	0.0	8.8	14.9
Dune, herbaceous	108.8	40.7	119.6
Dune, wooded	0.0	0.0	54.9
Meadow	271.4	111.8	506.3
Unvegetated barrier flat	70.1	85.1	104.2
Scrub/shrub	34.6	1.0	79.6
Forest	0.0	0.0	720.5
Forested wetland	0.0	0.0	13.7
Intertidal beach	23.8	8.8	14.6
Beach	96.8	55.5	56.0
Intertidal flat	49.1	26.7	60.0
Intertidal marsh	59.3	43.8	198.6
Seagrass	232.8	0.0	2.0
Oyster reef	0.6	2.9	758.8
Shoreline Protection	0.6	3.2	3.6
Developed	0.0	33.9	266.6
Open water, fresh	0.0	1.3	11.8

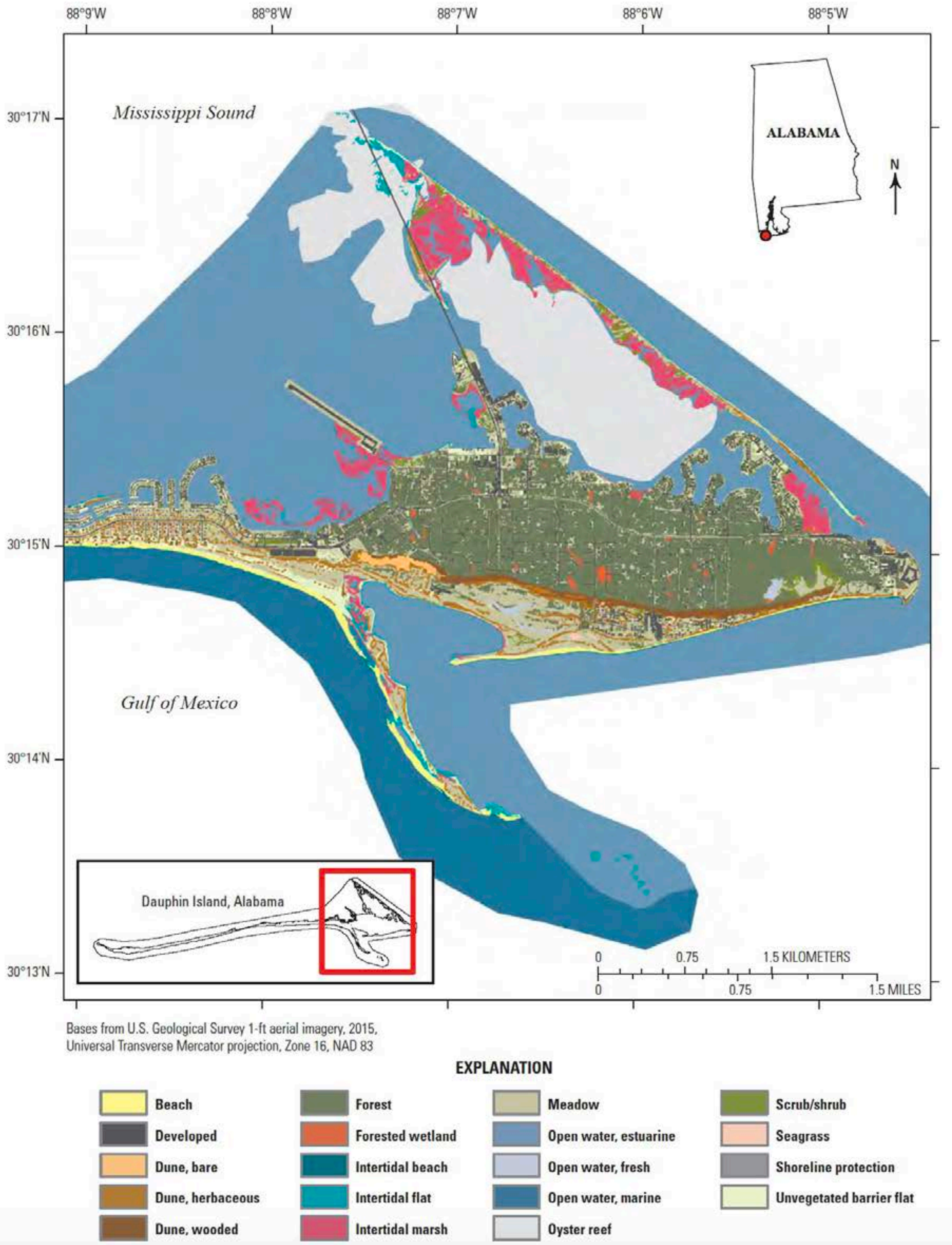
SOURCE: USGS 2017

Land cover on the eastern portion of Dauphin Island (**Figure 3-17**), including Little Dauphin Island and Pelican Island, is mostly forest (720.5 acres), meadow (506.3 acres), intertidal marsh (198.6 acres) and flats (60.0 acres), herbaceous dune (119.6 acres), unvegetated barrier flat (104.2 acres), scrub-shrub (79.6 acres), beach (56.0 acres), and wooded dune (54.9 acres). The eastern part of the Island is the Town's urban core, with 266.6 acres of developed land cover. There is a 758.8-acre area of oyster reef between Dauphin Island and Little Dauphin Island (**Figure 3-17**) that includes subtidal and intertidal areas mapped as oyster reef.



SOURCE: USGS 2017

FIGURE 3-16 2015 Habitat Map for the Western Two-Thirds of Dauphin Island



SOURCE: USGS 2017

FIGURE 3-17 2015 Habitat Map for Eastern Dauphin Island, Little Dauphin Island, and Pelican Island

3.5.3 HABITATS AND PLANT COMMUNITIES

Beaches

The dominant environmental factor on exposed sand beaches is wave action, which creates unstable, continually moving sediments. The beach zone is considered to be the unvegetated area of sand immediately fronting the Gulf of Mexico. This relatively flat portion of land contains the swash zone and extends inland to the highest drift line where vegetation begins to become established (FNAI 2010).

There are no large plants on exposed beaches, and coastal sandflats generally have low productivity (McLachlan 1996). The only primary producers on beaches are benthic diatoms and swash-zone phytoplankton, which are often patchy in distribution and can exhibit vertical migration within sediments. Sources of organic material, such as the macroalga *Sargassum* and estuarine plant detritus, provide episodic, localized enrichment. Early colonizing plants such as the annual sea rocket (*Cakile lanceolata*), beach morning glory (*Ipomoea imperati*), and crested saltbush (*Atriplex pentandra*) can be found above the highest drift line representing the upper beach (FNAI 2010).

There is typically a gradient of community organization on exposed sand beaches, reflecting the intensity and periodicity of wave action. Suspension feeders, deposit feeders, and scavengers dominate the beach invertebrate community. The surf zone has the greatest number of species. Organisms in the swash zone can either burrow deeper than impact of wave action or burrow very quickly between waves. Burrowing taxa include many polychaetes (Syllids, *Capitella*, *Paraonis*, *Leitoscoloplos*, *Nephtys*), crustaceans (Mysids, amphipods, mole crabs), and small clams like the coquina *Donax variabilis*. Ghost crabs (*Ocypode*) are often found on the highest areas of the beach.

Dunes

The Gulf-fronting dune system includes primary and secondary dunes (**Figure 3-18**). The primary dune system is a ridge or series of ridges or mounds of unconsolidated and usually mobile sands lying immediately landward of the upper limit of the Gulf beach and contiguous to mean high water. Secondary dunes include the dune field landward of the primary dunes. Primary dunes are low-elevation, typically less than about 10 feet relative to mean sea level (USGS 2017). Recent Mobile County elevation data (2015) show primary dune crests on the Island’s East End ranging from 4 to 10 feet above sea level.

Several distinctive plant communities comprise Dauphin Island’s beach dune habitats and coastal grasslands. Community associations generally change along elevation and hydrologic gradients, moving landward away from the shoreline (Deramus 1970). Plants on the primary dunes nearest the shoreline are regularly exposed to salt spray and sand burial from onshore winds blowing across salt water and open sandy beach. The plants of the beach dune community are adapted to either withstand these stresses or to rapidly recolonize from seed or vegetative parts following destruction (FNAI 2010).

SOURCE: Barry Vittor and Associates, Inc.

FIGURE 3-18 Natural Dunes and Adjacent Coastal Grassland Community

Primary dunes are typically built up due to the establishment of sea oats (*Uniola paniculata*), a perennial rhizomatous grass that traps and accumulates wind-blown sand. Sea oat growth keeps pace with sand burial (FNAI 2010). Other common plants on the primary dunes of Dauphin Island include bitter beachgrass (*Panicum amarum*), seacoast marsh elder (*Iva imbricata*), and dune sandspur (*Cenchrus tribuloides*). The Alabama Natural Heritage Program (ALNHP) tracks Gulf bluestem (*Schizachyrium maritimum*), a primary dune species considered to be critically imperiled due to its extreme rarity.

Secondary dunes comprise a ridge or series of ridges or mounds of unconsolidated sands landward of the primary dune system, formed through modification of the primary dunes by continued wind-driven processes. Secondary dunes are relatively immobile and may support sparse vegetation coverage, including shrubs. Coastal scrub is characterized by the absence of a tree canopy and areas of open sand dominated by low-growing shrubs and herbaceous plants. Common plants of Dauphin Island scrub dunes are presented in **Table 3-2**.

Dauphin Island's main dune system on its East End consists of large, stable secondary dunes, which provide inland protection from wind and storm surge. The crests of the main dune system range from approximately 15 to 40 feet above sea level (Mobile County LiDAR 2015).

TABLE 3-2 Common Dune Plants of Dauphin Island

Type	Common Name (Scientific Name)
Primary Dunes	Sea oat (*Uniola panicum*) Bitter beachgrass (*Panicum amarum*) Seacoast marsh elder (*Iva imbricata*) Dune sandspur (*Cenchrus tribuloides*) Camphorweed (*Heterotheca subaxillaris*)
Secondary Dunes (scrub)	Woody goldenrod (*Chrysoma pauciflosculosa*) Florida rosemary (*Ceratiola ericoides*) Dune prickly pear (*Opuntia drummondii*) Purple sandgrass (*Triplasis purpurea*) Seabeach evening primrose (*Oenothera humifusa*) Myrtle oak (*Quercus myrtifolia*) Pinebarren flatsedge (*Cyperus* cf. *retrosus*)
Secondary Dunes (forested)	Myrtle oak (*Quercus myrtifolia*) Pinebarren flatsedge (*Cyperus* cf. *retrosus*) Muscadine (*Muscadinia rotundifolia*) Slash pine (*Pinus elliottii*) Southern magnolia (*Magnolia grandiflora*) Live oak (*Quercus virginiana*).

Stable, vegetated dunes establish the critical ecological conditions to support the coastal climax forest dominated by pine and oak. Many scrub dune plants extend into the forested dunes, including myrtle oak (*Quercus myrtifolia*), pinebarren flatsedge (*Cyperus* cf. *retrosus*), and muscadine (*Muscadinia rotundifolia*). Common trees of forested dunes include slash pine (*Pinus elliottii*), southern magnolia (*Magnolia grandiflora*), and live oak (*Quercus virginiana*). Gulf coast frostweed (*Crocanthemum arenicola*) is a rare secondary dune species tracked by the ALNHP.

On the West End, roadside rights-of-way berms comprise relocated sand deposits, with many of these having fairly dense plant cover (**Figure 3-19**). The most abundant species on these "artificial dunes" are sea oats (*Uniola paniculata*) and Gulf bluestem (*Schizachyrium maritium*). Other common species include shell mound prickly pear cactus (*Optunia stricta*), camphor weed (*Heterotheca subaxillaris*), large-leaf pennywort (*Hydrocotyle bonariensis*), common reed (*Phragmites mauritianus*), and bladderpod (*Sesbania vesicaria*). Torpedo grass (*Panicum repens*), a highly invasive species, also occurs on the berms.

SOURCE: Barry Vittor and Associates, Inc.

FIGURE 3-19 Densely Vegetated Berm on South Side of Bienville Blvd

Maritime Forest

Maritime forest is present on barrier islands and near-coastal strands, including relatively stable coastal dunes. Vegetation structure and composition are influenced by salt spray, coastal winds, and extreme disturbance events, especially hurricanes. The flora and fauna of maritime forests typically consist of a distinctive subset of the regional biota that is particularly well adapted to survive frequently harsh coastal conditions (Bellis and Keough 1995).

Maritime forests are dominated by broadleaved evergreen trees and shrubs (**Figure 3-20**). Some of the common tree and shrub species in the maritime forest of Dauphin Island are presented in **Table 3-3**. Southern magnolia (*Magnolia grandiflora*) and live oak (*Quercus virginiana*) are characteristic species, along with wild olive (*Cartrema Americanum).* Dwarf live oak (*Quercus minima*) is a rare maritime forest species tracked by the ALNHP.

In addition to trees and shrubs, maritime forest supports a number of woody vines, including greenbrier (*Smilax* spp.), muscadine (*Muscadinia rotundifolia*), crossvine (*Bignonia capreolata*), and Virginia creeper (*Parthenocissus quinquefolia*), among others. The herbaceous plant community comprises numerous grasses, sedges, rushes, and forbs. Maritime forest typically grades into associated communities that include scrub and sandhill forest and freshwater swamps that are seasonally or intermittently flooded.

SOURCE: Barry Vittor and Associates, Inc.

FIGURE 3-20 Dauphin Island Maritime Forest

TABLE 3-3 Common Woody Plant Species in the Maritime Forest of Dauphin Island

Type	Common Name (Scientific Name)
Canopy Trees	Southern magnolia (*Magnolia grandiflora*) Live oak (*Quercus virginiana*) Slash pine (*Pinus elliottii*) Longleaf pine (*Pinus palustris*) Water oak (*Quercus nigra*)
Midstory (smaller trees and tall shrubs)	Wild olive (*Cartrema americanum*) Common persimmon (*Diospyros virginiana*) Yaupon (*Ilex vomitoria*) Myrtle oak (*Quercus myrtifolia*) Sassafras (*Sassafras albidum*)
Shrubs	Small-flower pawpaw (*Asimina parviflora*) American beautyberry (*Callicarpa americana*) St. Andrew's cross (*Hypericum hypericoides*) Saw palmetto (*Serenoa repens*) Deerberry (*Vaccinium stamineum*)

Wetlands

Wetland ecosystems share a number of features including extended periods of inundation or saturation, hydrophytic vegetation, and hydric soils (Cowardin et al. 1979). Wetlands are widely recognized as important and valuable ecosystems in terms of the services and benefits they provide (Costanza et al. 2006; Costanza et al. 2014), including significant ecosystem functions on Dauphin Island for flood water storage, groundwater re-charge, wildlife habitat, and biodiversity support.

The Island's interior has freshwater palustrine wetlands dominated by trees, shrubs, and emergent herbaceous plants. These primarily include forested gum swamps, typically saturated or inundated for extended periods, and ephemeral ponds. Tidally influenced marshes line Dauphin Island's north shoreline along Mississippi Sound and Mobile Bay, as well as Little Dauphin Island and Pelican Island.

FRESHWATER GUM SWAMPS

Forested depressions are topographically isolated and seasonally inundated by rainwater, primarily during late winter and early spring and again in the fall. When flooded, they are pond-like with standing water reaching two feet in depth (or more) that can persist for several weeks (**Figure 3-21**). Swamp tupelo (*Nyssa biflora*) typically dominates the upper canopy of these gum swamps. Woody shrub diversity is low in gum swamp habitats, particularly within the deeper water areas where buttonbush (*Cephalanthus occidentalis*) and myrtle-leaf holly (*Ilex myrtifolia*) are the only species present. Outside of the wetter center, slash pine (*Pinus elliottii*), red maple (*Acer rubrum*), sweet bay magnolia (*Magnolia virginiana*), sweetgum (*Liquidambar styraciflua*), water oak (*Quercus nigra*), live oak (*Q. virginiana*), and southern magnolia (*Magnolia grandiflora*) are frequently encountered.

The transition from freshwater wetlands into upland habitat is often fairly abrupt with a narrow ecotone forming over the elevational gradient as maritime forest species increase in abundance. The wetland-upland boundary is marked by a dense ring-like thicket of saw palmetto *(Serenoa repens*) in these areas, among other common shrubs (**Table 3-4**).

Similar to shrubs, the community's woody vines are more common along the wetland edge. Representative taxa include poison ivy (*Toxicodendron radicans*), cat brier (*Smilax glauca*), muscadine, peppervine (*Nekemias arborea*), virginia creeper, and trumpet creeper (*Campsis radicans*). When dry, the understory can become vegetated with numerous herbaceous species (**Table 3-4**).

SOURCE: Barry Vittor and Associates, Inc.

FIGURE 3-21 Forested Gum Swamp on Dauphin Island

TABLE 3-4 Common Plant Species in the Wetland-Upland Transition Zone

Type	Common Name (Scientific Name)
Shrubs	Saw palmetto (*Serenoa repens*)
	St. Andrew's cross (*Hypericum hypericoides*)
	Swamp bay (*Persea palustris*)
	Elliott's blueberry (*Vaccinium elliottii*)
	Yaupon (*Ilex vomitoria*)
	Downy sweet pepper bush (*Clethra tomentosa*)
	Wax myrtle (*Morella cerifera*)
Woody Vines	Poison ivy (*Toxicodendron radicans*)
	Cat brier (*Smilax glauca*)
	Muscadine (*Muscadinia rotundifolia*)
	Peppervine (*Nekemias arborea*)
	Virginia creeper
	Trumpet creeper (*Campsis radicans*)
Gum Pond Understory in Dry Conditions	Lizard's tail (*Saururus cernuus*)
	Virginia chain fern (*Anchistea virginica*)
	Southern waxy sedge (*Carex glaucescens*)
	Fascicled beaksedge (*Rhynchospora fasicularis*)
	White grass (*Leersia virginica*)
	American cupscale (*Sacciolepis striata*)
	Round-seed witch grass (*Dichanthelium sphaerocarpon*)
	Marsh seedbox (*Ludwigia palustris*)
	Virginia buttonweed (*Diodia virginiana*)

WET PINE FOREST

Wet pine forests on the Island naturally have a sparse or absent midstory and a dense groundcover of hydrophytic grasses, herbs, and low shrubs (**Figure 3-22**). The understory of moist pinelands may be very dense, especially if fire has been prevented, and consists largely of gallberry (*Ilex glabra*), wax myrtle, and saw palmetto. Herbs include grass-like plants, mostly of the sedge family (Cyperaceae), but also with true grasses (Poaceae), such as switch cane (*Arundinaria tecta*), rushes (Juncaceae), and yellow-eyed grasses (*Xyris* spp.).

SOURCE: Barry Vittor and Associates, Inc.

FIGURE 3-22 Wet Pine Forest on Dauphin Island

TIDAL MARSHES AND FLATS

Tidal marshes are primarily distributed along the northern shoreline of Dauphin Island and on the west side of Little Dauphin Island (see **Figure 3-16** and **Figure 3-17**). These areas are inundated mainly by daily tides with high marsh inundated mainly by wind-driven high tides. Tidal marshes provide important nursery habitat for shrimps, crabs, and fishes; baffle wave energy; prevent shoreline erosion; sequester nutrients; improve water quality; and provide habitat for a diverse wildlife community (**Figure 3-23**).

SOURCE: Barry Vittor and Associates, Inc.

FIGURE 3-23 Tidal Marsh on Pelican Island

Dominant marsh species include smooth cordgrass (*Spartina alterniflora*) in lower elevations, black needlerush (*Juncus roemarianus*) in areas where elevations range from +1 to +2 feet above mean sea level, and saltmeadow cordgrass (*Spartina patens*), which occurs in areas above +2 feet. Other species typical of tidal marshes include common cane (*Phragmites mauritianus*) and groundsel bush (*Baccharis halimifolia*), which generally occur at the upper margins of tidal marsh. Tidal wetlands are considered to be the most sensitive and essential types of coastal wetland and are afforded the highest level of regulatory protection.

Mud flats develop in sheltered areas of the intertidal zone, and are important as sedimentation areas, providing a rich source of organic material to the benthic invertebrate community. The numerically dominant infauna found on intertidal mud flats are the same as those on sand beaches, including polychaetes, bivalves, and crustaceans, but the specific taxa are different in response to adaptations necessary for life in a habitat with fine sediments and anaerobic pore water conditions.

Epifaunal organisms associated with intertidal flats are predominantly mobile predatory species like blue crabs (*Callinectes sapidus*), which consume small bivalves, polychaetes, and crustaceans. Other mud and sandy-mud-associated epifauna include brown shrimp (*Farfantepenaeus aztecus*), white shrimp (*Litopenaeus setiferus*), swimming crabs (*Portunus* spp.), and mantis shrimp (*Squilla empusa*). Intertidal flats provide migratory corridors for brown shrimp, white shrimp, and blue crabs, all of which feed on polychaete worms and other infauna as they move into subtidal waters (Franks et al. 1972).

RUDERAL WETLANDS: DITCHES, ROADSIDES, AND DISTURBED SETTINGS

Roadside drainage ditches and low adjoining rights-of-way (ROWs) represent an under-appreciated and often overlooked wetland community on Dauphin Island. On the East End of the Island, these open corridors are very diverse, supporting over 70% of the plant species recorded from the Island (Deramus 1970). There are many species including several rare taxa that are only known from the maintained ROWs. Graminoids (grasses and grass-like plants such as sedges and rushes) and forbs make up a large component of vegetation in the Island ROWs. Examples of native graminoid and forb species occurring in ruderal wetlands are presented in **Table 3-5**.

TABLE 3-5 Common native Plant Species in Ruderal Wetlands

Type	Common Name (Scientific Name)
Graminoids	Two-flowered rush (*Juncus biflorus*) Haspan flatsedge (*Cyperus haspan*) Tropical flatsedge (*Cyperus surinamensis*) Long's sedge (*Carex longii*) Southern umbrella sedge (*Fuirena scirpoidea*) Few-flowered beaksedge (*Rhynchospora rariflora*) Whitetop sedge (*Rhynchospora colorata*) Common carpet grass (*Axonopus fissifolius*) Florida paspalum (*Paspalum floridanum*) Velvety panic grass (*Dichanthelium scoparium*)
Forbs	Grassy arrowhead (*Sagittaria graminea*) Bull tongue arrowhead (*Sagittaria lancifolia*) Eastern blue-eyed grass (*Sisyrinchium atlanticum*) Mermaid weed (*Proserpinaca palustris* and *P. pectinata*) Primrose-leaf violet (*Viola primulifolia*) Mexican primrose willow (*Ludwigia octovalvis*) Maid Marian (*Rhexia nashii*) Large water starwort (*Callitriche heterophylla*) Herb of grace (*Bacopa monnieri*) Shade mudflower (*Micranthemum umbrosum*) Zig-zag bladderwort (*Utricularia subulata*) Rayless sunflower (*Helianthus radula*) Variable leaf sunflower (*Helianthus heterophyllus*)

On the Island's low-elevation West End, the diversity of plants in ditches and wet roadside ROWs is much lower than those in the eastern section. The plants here are subject to periodic overwash from storms and tend to be characteristic of brackish or saline marshes. Common species include three square (*Schoenoplectus pungens*), sturdy

Simmond's Aster

bulrush (*Bolboschoenus robustus*), lobe-head rush (*Juncus compositus*), Gulf bluestem (*Schizachyrium maritium*), and seashore paspalum (*Paspalum vaginatum*).

Rare plants found growing in the residential wetland ditches include night-flowering petunia (*Ruellia noctiflora*) and Simmond's aster (*Symphyotrichum simmondsii*), both classified as critically imperiled in the State by the Alabama Natural Heritage Program (ALNHP 2021). The State's only known populations of Simmond's aster occur entirely on Dauphin Island at Shell Mound Park and along the roadside ditch on the north side of Bienville Blvd. directly east of Key Street.

Another rare plant found in an altered wetland setting is the pond piedmont primrose willow (*Ludwigia arcuata*), classified as critically imperiled in Alabama (ALNHP 2021). The only extant population known in Alabama is at the Isle Dauphine Golf Course where the plants grow in a low wet swale that is regularly mown during routine maintenance of the course.

The ALNHP tracks species determined to be imperiled in the State due to rarity, using the Heritage ranking system developed by NatureServe (ALNHP 2021). Each rare species is assigned a rank representing its status in Alabama. Priority 1 (S1) taxa are considered critically imperiled in Alabama because of extreme rarity (five or fewer occurrences of very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation from Alabama. Priority 2 (S2) taxa are considered imperiled in the State if they exhibit three of four of the following criteria: rarity; very limited, disjunct, or peripheral distribution; decreasing population trend/population viability problems; or specialized habitat needs/habitat vulnerability. **Table 3-6** includes a list of ALNHP-tracked plants on Dauphin Island.

Piedmont Primrose Willow

TABLE 3-6 ALNHP-Tracked Plants on Dauphin Island

Common Name (Scientific Name)	State Rank	Notes and Records
Whisk fern (*Psilotum nudum*)	S1	All Dauphin Island records are considered introduced (occurring on non-native palms used in landscaping), and not native.
Golden canna (*Canna flaccida*)	S1	A small population occurs along the east margin of Alligator Lake in the Audubon Bird Sanctuary. The species should be considered in any management activities taking place in the sanctuary, especially the spraying of herbicide to treat invasive plants (e.g., *Triadica sebifera*).
Coastal plain beaksedge (*Rhynchospora stenophylla*)	S2	Last collected on Dauphin Island in 1966 (Keener et al. 2021; Deramus 1970). Surveys needed.
Narrowleaf bluestem (*Andropogon perangustatus*)	S1	Collected by Horne in 2018 at the Audubon Bird Sanctuary.
Gulf bluestem (*Schizachyrium maritium*)	S1	Abundantly common in dune grassland communities across the Island.
Munson grape (*Muscadinia rotundifolia*)	S1	Last collected in 1966 at the Audubon Bird Sanctuary (Keener et al. 2021; Deramus 1970). Updated surveys needed.
Small-flower mock buckthorn (*Sageretia minutiflora*)	S1	Common shrub at Shell Mound Park.
Dwarf live oak (*Quercus minima*)	S2	Collected by H. Horne in mesic maritime woods on East End of Island.
Summer spurge (*Euphorbia discoidalis*)	S2	Common in maritime forest habitats in the Audubon Bird Sanctuary.
Piedmont primrose willow (*Ludwigia arcuata*)	S1	Only known extant population in the state. Occurring in low wet swale of the Island's golf course.
Gulf coast frostweed (*Crocanthemum arenicola*)	S1	Common on beach dunes, especially on the East End of the Island.
Christmas berry (*Lycium carolinianum*)	S2	Associated with oyster shell beaches and shorelines. A small population is at Shell Mound Park at the northern mounds along the margin of Dauphin Island Bay.
Night-flowering petunia (*Ruellia noctiflora*)	S1	Uncommon in wet roadside ditches on Alabama Street west of the town's water tower. There is also one small population at POA Golf Course and possibly at the Audubon Bird Sanctuary.
Carolina grasswort (*Lilaeopsis carolinensis*)	S1	Small population in wet bowl/depression at Shell Mound Park. Sporadically appears following periods of extreme flooding of the bowl.
Simmon's aster (*Symphyotrichum simmondsii*)	S1	Only known occurrence in Alabama is on Dauphin Island at Shell Mound Park and along Bienville Blvd.
Water dawnflower (*Stylisma aquatica*)	S2	Collected by Deramus in 1965 on Hernando Street near Cadillac Square.

3.5.4 SUBTIDAL ECOSYSTEMS

In subtidal waters, submerged aquatic vegetation (SAV) and oyster reefs provide important nursery habitat for shrimps, crabs, and fishes, as well as attenuating wave energy, preventing erosion, enhancing water quality, and supporting regional biodiversity. In recent history these aquatic habitats have undergone a significant decline in distribution and extent worldwide, including coastal Alabama. SAV and oyster reefs function as habitat “engineers,” providing structural complexity that enriches faunal use and enhances biodiversity compared to bare sediment (Heck and Wetstone 1977; Summerson and Peterson 1984; Thompson et al. 1996; Tolley and Volety 2005).

Most SAV in the shallow subtidal areas along Dauphin Island is located on its northern side, west of Katrina Cut (see **Figure 3-16**). This 233-acre area contains numerous small patches of shoalgrass (*Halodule wrightii*) and has been increasing in extent since at least 2002, when the shoalgrass area covered 60 acres (Barry A. Vittor & Associates 2004). Ponded areas inside the northern shoreline of western Dauphin Island and a pond at the Alabama Department of Conservation and Natural Resources (ADCNR) Marine Resources Division (MRD) laboratory typically contain widgeongrass (*Ruppia maritima*). Widgeongrass has also become established in the moat surrounding Fort Gaines. Ponds at the Isle Dauphine Golf Course have Eurasian watermilfoil (*Myriophyllum spicatum*) and southern naiad (*Najas guadelupensis*). Small areas of SAV occur in sheltered locations of Little Dauphin Island (Barry A. Vittor & Associates 2016, 2020). In 2008, seven acres of shoalgrass were mapped on the east side of Pelican Island, in Pelican Bay, but the grass disappeared by the following summer (Barry A. Vittor & Associates, Inc. 2010).

Oyster reef habitat shown in **Figure 3-17** includes subtidal and intertidal estuarine areas in Dauphin Island Bay, on the west side of Little Dauphin Island. The entirety of this area of oyster reef was not included in 1968 survey data (May 1971), though it likely existed at the time. The complete area was first mapped as oyster reef in the subsequent ADCNR MRD survey (Tatum et al. 1995). There are scattered, harvestable oysters in the area, but it is not actively fished (Rigsby 2021).

3.5.5 FAUNA

Animal communities of the Coastal Barrier Ecoregion are diverse. Natural habitats supporting high biodiversity include upland forests, freshwater swamps, coastal scrub, tidal marshes, beaches, and the Mississippi Sound and Gulf of Mexico systems. **Table 3-7** lists some fauna common on Dauphin Island, including in urbanized areas.

TABLE 3-7 Common Fauna Reported from Dauphin Island

Fauna	Common Name (Scientific Name)
Frogs	Eastern spadefoot (*Scaphiopus holbrookii*) Green tree frog (*Hyla cinerea*) Squirrel treefrog (*Hyla squirella*) Southern toad (*Anaxyrus terrestri*)
Lizards	Brown anole (*Anolis sagrei*) Green anole (*Anolis carolinensis*) Ground skink (*Scincella lateralis*) Eastern glass lizard (*Ophisaurus ventralis*) Six-lined racerunner (*Aspidoscelis sexlineatus*)
Snakes	Cottonmouth (*Agkistrodon piscivorus*) North American racer (*Coluber constrictor*) Rat snake (*Pantherophis spiloides*)
Birds	Blue jay (*Cyanocitta cristata*) Eastern bluebird (*Sialia sialis*) Eastern towhee (*Pipilo erythrophthalmus*) House finch (*Haemorhous mexicanus*) Mourning dove (*Zenaida macroura*) Northern cardinal (*Cardinalis cardinalis*) Northern mockingbird (*Mimus polyglottos*) Brown thrasher (*Toxostoma rufum*)
Mammals	Common raccoon (*Procyon lotor*) Gray squirrel (*Sciurus carolinensis*) Virginia opossum (*Didelphis virginiana*)

SOURCE: iNaturalist 2021

Coastal waters provide foraging, nursery, migratory, and spawning habitat to numerous invertebrate and fish species. Abundant invertebrates and fishes of coastal Alabama have been collected by Swingle and Bland (1974), Shipp (1979), Rozas et al. (2013), among others. These species comprise important forage and fishery populations (Shipp 1979; Valentine et al. 2006) and are among the most abundant fishery species across the northern Gulf of Mexico.

Reddish Egret

Species such as adult spot (*Leiostomus xanthurus*), Atlantic croaker (*Micropogonias undulatus*), and striped mullet (*Mugil cephalus*) occupy the estuary seasonally. Strong seasonal patterns of assemblage composition are related to recruitment of juveniles to the estuary (Gorecki and Davis 2013; Rozas et al. 2013).

The National Audubon Society (NAS) administers the Important Bird Area (IBA) Program, with 13 IBAs designated across Alabama, including Dauphin Island. NAS IBAs are essential habitat for birds for breeding, wintering, and migrating. Various shorebirds, both seasonal visitors and year-round residents, use sandy beach areas and sand dunes. Brackish wetlands and coastal ponds are important foraging sites for egrets and herons, rails, and shorebirds. Maritime forest is important habitat for neotropical migrants. There are 378 bird species on the official Dauphin Island Bird Checklist, currently in preparation by Dauphin Island Bird Sanctuaries (DIBS).

Table 3-8 lists some important migratory bird species of high conservation concern likely to occur on Dauphin Island (USFWS 2021). Some of these species are uncommon-to-rare or accidental visitors. Many are resident breeders on Dauphin Island, including seaside sparrow (*Ammodramus maritimus*), willet (*Tringa semipalmata*), and Wilson's plover (*Charadrius wilsonia*).

Shorebirds

TABLE 3-8 Migratory Birds Occurring on Dauphin Island

Wintering Residents	Breeding Residents
Black Scoter (*Melanitta nigra*)	American Oystercatcher (*Haematopus palliates*)
Bonaparte's Gull (*Chroicocephalus philadelphia*)	Bald Eagle (*Haliaeetus leucocephalus*)
Nelson's Sparrow (*Ammospiza nelsoni*)	Black Skimmer (*Rynchops niger*)
Red-breasted Merganser (*Mergus serrator*)	Gull-billed Tern (*Gelochelidon nilotica*)
Common Loon (*Gavia immer*)	Red-headed Woodpecker (*Melanerpes erythrocephalus*)
Ring-billed Gull (*Larus delawarensis*)	Royal Tern (*Thalasseus maximus*)
Ruddy Turnstone (*Arenaria interpres morinella*)	Seaside Sparrow (*Ammodramus maritimus*)
Short-billed Dowitcher (*Limnodromus griseus*)	Sooty Tern (*Onychoprion fuscatus*)
Surf Scoter (*Melanitta perspicillata*)	Least Tern (*Sternula antillarum*)
White-winged Scoter (*Melanitta fusca*)	Common Tern (*Sterna hirundo*)
Bufflehead (*Bucephala albeola*)	Willet (*Tringa semipalmata*)
Canvasback (*Aythya valisineria*)	Wilson's Plover (*Charadrius wilsonia*)
Redhead (*Aythya americana*)	Mottled Duck (*Anas fulvigula*)
Ring-necked Duck (*Aythya collaris*)	Mallard (*Anas platyrhynchos*)
Greater Scaup (*Aythya marila*)	Rock Pigeon (*Columba livia*)
Lesser Scaup (*Aythya affinis*)	Eurasian Collared-Dove (*Streptopelia decaocto*)
Hooded Merganser (*Lophodytes cucullatus*)	Common Ground Dove (*Columbina passerina*)
Sora (*Porzana carolina*)	Mourning Dove (*Zenaida macroura*)
Sanderling (*Calidris alba*)	Common Nighthawk (*Chordeiles minor*)
Dunlin (*Calidris alpina*)	Chuck-will's-widow (*Antrostomus carolinensis*)
Least Sandpiper (*Calidris minutilla*)	Clapper Rail (*Rallus crepitans*)
Western Sandpiper (*Calidris mauri*)	Killdeer (*Charadrius vociferus*)
Willet (*Tringa semipalmata*)	Snowy Plover (*Charadrius nivosus*)
Greater Yellowlegs (*Tringa melanoleuca*)	Great Blue Heron (*Ardea herodias*)
Laughing Gull (*Leucophaeus atricilla*)	

TABLE 3-8 Migratory Birds Occurring on Dauphin Island

Wintering Residents	Breeding Residents
Herring Gull (*Larus argentatus*)	Green Heron (*Butorides virescens*)
Lesser Black-backed Gull (*Larus fuscus*)	Osprey (*Pandion haliaetus*)
Great Black-backed Gull (*Larus marinus*)	Great Horned Owl (*Bubo virginianus*)
Forster's Tern (*Sterna forsteri*)	Downy Woodpecker (*Dryobates pubescens*)
Royal Tern (*Thalasseus maximus*)	Red-bellied Woodpecker (*Melanerpes carolinus*)
Caspian Tern (*Hydroprogne caspia*)	Loggerhead Shrike (*Lanius ludovicianus*)
Double-crested Cormorant (*Nannopterum auritum*)	Eastern Kingbird (*Tyrannus tyrannus*)
	Gray Kingbird (*Tyrannus dominicensis*)
Brown Pelican (*Pelecanus occidentalis*)	Great-crested Flycatcher (*Myiarchus crinitus*)
Northern Harrier (*Circus hudsonius*)	Blue Jay (*Cyanocitta cristata*)
Sharp-shinned Hawk (*Accipiter striatus*)	Fish Crow (*Corvus ossifragus*)
Cooper's Hawk (*Accipiter cooperii*)	Purple Martin (*Progne subis*)
Red-tailed Hawk (*Buteo jamaicensis*)	Barn Swallow (*Hirundo rustica*)
Belted Kingfisher (*Megaceryle alcyon*)	Brown-headed Nuthatch (*Sitta pusilla*)
Yellow-bellied Sapsucker (*Sphyrapicus varius*)	Carolina Wren (*Thryothorus ludovicianus*)
Eastern Phoebe (*Sayornis phoebe*)	Brown Thrasher (*Toxostoma rufum*)
Blue-headed Vireo (*Vireo solitarius*)	Northern Mockingbird (*Mimus polyglottos*)
American Kestrel (*Falco sparverius*)	European Starling (*Sturnus vulgaris*)
Peregrine Falcon (*Falco peregrinus*)	Eastern Bluebird (*Sialia sialis*)
Ruby-crowned Kinglet (*Corthylio calendula*)	House Sparrow (*Passer domesticus*)
House Wren (*Troglodytes aedon*)	House Finch (*Haemorhous mexicanus*)
Marsh Wren (*Cistothorus palustris*)	Red-winged Blackbird (*Agelaius phoeniceus*)
Hermit Thrush (*Catharus guttatus*)	Brown-headed Cowbird (*Molothrus ater*)
White-crowned Sparrow (*Zonotrichia leucophrys*)	Common Grackle (*Quiscalus quiscula*)
White-throated Sparrow (*Zonotrichia albicollis*)	Pine Warbler (*Setophaga pinus*)
Nelson's Sparrow (*Ammospiza nelsoni*)	Northern Cardinal (*Cardinalis cardinalis*)
Savannah Sparrow (*Passerculus sandwichensis*)	
Song Sparrow (*Melospiza melodia*)	
Swamp Sparrow (*Melospiza georgiana*)	
Yellow-rumped Warbler (*Setophaga coronata*)	

Dauphin Island is a popular birding destination during spring migration. The Alabama Coastal Birding Trail has seven stops on the Island, part of the Trail's South Mobile County Loop. These sites from east to west include:

- Pelican Point
- Dauphin Island Bird Sanctuary
- Goat Trees Preserve
- Cadillac Square
- Shell Mound Park
- Dauphin Island Airport
- West End Dauphin Island

3.5.6 FEDERAL AND STATE PROTECTED SPECIES

The habitats and surrounding waters of Dauphin Island support many species of conservation concern. These include species listed under Section 7 of the federal Endangered Species Act (FESA) of 1973. The U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration National Marine Fisheries Service have jurisdiction over FESA species conservation, including their designated critical habitat.

A database search of the U.S. Fish and Wildlife Service Information for Planning and Conservation (IPaC) decision support system (USFWS 2021) was performed to generate a list of federally protected species for the Dauphin Island Watershed. The IPaC report identified 10 federally protected species (i.e., threatened, endangered, or candidate species) occurring on or within the general vicinity of the Island.

Alabama does not have a state law equivalent to the FESA, so species do not have regulatory protection as State-endangered or threatened species. However, some species do receive regulatory protection through the Alabama Regulations on Game Fish and Fur Bearing Animals that is published annually. These are the primary regulations affording State protection for some species in Alabama and are administered by the ADCNR.

In order to receive funds through the Wildlife Conservation and Restoration Program and the State Wildlife Grants Program, each state and territory was required by Congress to develop a wildlife action plan. These proactive plans, known technically as "comprehensive wildlife conservation strategies," assess the health of each state's wildlife and habitats, identify the problems they face, and outline the actions needed to conserve them over the long term. The wildlife action plans identify a variety of actions aimed at preventing wildlife from declining to the point of becoming endangered and outline the steps needed to conserve wildlife and habitat before they become rarer and more costly to protect. One component of the plan was to identify species of Greatest Conservation Need (GCN). Species were assigned a status based on the expert opinion of taxa committees.

The State Wildlife Action Plan (SWAP) for 2015–2025 was developed by the ADCNR and provides a strategy for wildlife conservation in the State supported through funding from the U.S. Fish and Wildlife Service's State Wildlife Grants (SWG) program. Species data obtained from the SWAP include species that are federally protected (listed endangered, threatened, or proposed threatened), State-protected, and or identified as requiring the greatest conservation need.

Table 3-9 lists federal and State-protected and conservation concern species occurring or with potential to occur on Dauphin Island or in its surrounding waters.

TABLE 3-9 Federal and State Protected Species Occurring on or with Potential to Occur on Dauphin Island or in its Surrounding Waters

Common Name	Scientific Name	Federal Status	State Status	SWAP Status
FISHES				
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	LT	SP	P2
Paddlefish	*Polyodon spathula*		CNGF, SP[1]	
Alligator Gar	*Atractosteus spatula*		CNGF	
Alabama shad	*Alosa alabamae*		SP	P1
Saltmarsh Topminnow	*Fundulus jenkinsi*	SC[2]		
AMPHIBIANS				
Eastern Tiger Salamander	*Ambystoma tigrinum*			P2
TERRESTRIAL REPTILES				
Coachwhip	*Coluber flagellum*		SP	
Eastern Kingsnake	*Lampropeltis getula*		SP	P2
Gulf Saltmarsh Watersnake	*Nerodia clarkii*		SP	P2
Pinewoods Littersnake	*Rhadinaea flavilata*			
Eastern Diamond-Backed Rattlesnake	*Crotalus adamanteus*	UR	SP	P2
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*		SP	P1
Alabama Red-Bellied Turtle	*Pseudemys alabamensis*	LE	SP	P1
Florida Softshell Turtle	*Apalone ferox*		RT	
SEA TURTLES				
Loggerhead Sea Turtle	*Caretta*	LT	SP	P1
Green Sea Turtle	*Chelonia mydas*	LT	SP	P1
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	LE	SP	P1
Leatherback Sea Turtle	*Dermochelys coriacea*	LE	SP	P1
MAMMALS				
Northern Yellow Bat	*Lasiurus intermedius*		SP	P2
Tricolored Bat	*Perimyotis subflavus*	UR	SP	P2
Rafinesque’s Big-eared Bat	*Corynorhinus rafinesquii*		SP	P1
Southeastern Myotis	*Myotis austroriparius*		SP	P1
American Black Bear	*Ursus americanus*		SP[3]	P1
MARINE MAMMALS				
West Indian Manatee	*Trichechus manatus*	LE	SP	P1
BIRDS				
American Black Duck	*Anas rubripes*		SP	P2
Mottled Duck	*Anas fulvigula*		SP	P2

TABLE 3-9 Federal and State Protected Species Occurring on or with Potential to Occur on Dauphin Island or in its Surrounding Waters

Common Name	Scientific Name	Federal Status	State Status	SWAP Status
Common Ground Dove	*Columbina passerina*		SP	
White-winged Dove	*Zenaida asiatica*		GB	
Black-billed Cuckoo	*Coccyzus erythropthalmus*		SP	
Groove-billed Ani	*Crotophaga sulcirostris*		SP	
Clapper Rail	*Rallus longirostris*	SC	GB	
King Rail	*Rallus elegans*	SC	GB	P2
Purple Gallinule	*Porphyrio martinicus*		GB	
Yellow Rail	*Coturnicops noveboracensis*		GB	P2
Eastern Black Rail	*Laterallus j. jamaicensis*	LT	GB	P2
American Oystercatcher	*Haematopus palliatus*		SP	P1
Piping Plover	*Charadrius melodus* [4]	LE, LT	SP	P1
Wilson's Plover	*Charadrius wilsonia*		SP	P1
Snowy Plover	*Charadrius nivosus*		SP	P1
Long-billed Curlew	*Numenius americanus*		SP	
Red Knot	*Calidris canutus* [5]	LT	SP	P2
American Woodcock	*Scolopax minor*		GB	
Willet	*Tringa semipalmata*		SP	
Least Tern	*Sternula antillarum*		SP	
Gull-billed Tern	*Gelochelidon nilotica*		SP	P2
Caspian Tern	*Hydroprogne caspia*		SP	
Common Tern	*Sterna hirundo*		SP	
Forster’s Tern	*Sterna forsteri*		SP	
Royal Tern	*Thalasseus maximus*		SP	
Sandwich Tern	*Thalasseus sandvicensis*		SP	
Black Skimmer	*Rynchops niger*		SP	
Wood Stork	*Mycteria americana*	LT[6]	SP	P2
American Bittern	*Botaurus lentiginosus*		SP	
Least Bittern	*Ixobrychus exilis*		SP	P2
Reddish Egret	*Egretta rufescens*		SP	P2
White Ibis	*Eudocimus albus*		SP	
Glossy Ibis	*Plegadis falcinellus*		SP	
Swallow-tailed Kite	*Elanoides forficatus*		SP	P2
Northern Harrier	*Circus hudsonius*		SP	
Burrowing Owl	*Athene cunicularia*		SP	

TABLE 3-9 Federal and State Protected Species Occurring on or with Potential to Occur on Dauphin Island or in its Surrounding Waters

Common Name	Scientific Name	Federal Status	State Status	SWAP Status
Short-eared Owl	*Asio flammeus*		SP	P2
American Kestrel	*Falco sparverius*		SP	P2[7]
Peregrine Falcon	*Falco peregrinus*		SP	
Gray Kingbird	*Tyrannus dominicensis*		SP	
Scissor-tailed Flycatcher	*Tyrannus forficatus*		SP	
Loggerhead Shrike	*Lanius ludovicianus*		SP	P2
Blue-headed Vireo	*Vireo solitarius*		SP	
Warbling Vireo	*Vireo gilvus*		SP	
Marsh Wren	*Cistothorus palustris*		SP	
Bewick's Wren	*Thryomanes bewickii*		SP	P1
Bachman's Sparrow	*Peucaea aestivalis*		SP	P2
LeConte's Sparrow	*Ammospiza leconteii*		SP	
Seaside Sparrow	*Ammospiza maritima*		SP	P2
Nelson's Sparrow	*Ammospiza nelsoni*		SP	P2
Henslow's Sparrow	*Centronyx henslowii*		SP	P1
Rusty Blackbird	*Euphagus carolinus*			P2
Cerulean Warbler	*Setophaga cerulea*		SP	P1
Yellow Warbler	*Setophaga petechia*		SP	
Painted Bunting	*Passerina ciris*		SP	

NOTES:

1 *Polyodon spathula* is not included in the list of protected species in the Nongame Species Regulation 220-2-.92, but is protected by Regulations 220-2-.94 Prohibition of Taking or Possessing Paddlefish (Spoonbill) and 220-2-43 Unlawful to Willfully Waste Paddlefish.

2 Listed as a species of concern by the National Marine Fisheries Service (Federal Register 69(73):19975–19979)

3 *Ursus americanus* is not included in the list of protected species in Nongame Species Regulation 220-2-.92, but is protected under Alabama Game, Fish and Wildlife Laws, Section 9-11-480-481, which makes it illegal to hunt, wound, injure, kill, trap, collect, or capture a black bear, or to attempt to engage in that conduct during the closed season for black bear. It is designated a game animal by Regulation 220-2-.06 of the Alabama Regulations on Game, Fish, and Fur Bearing Animals, but there is no open season for the species.

4 *Charadrius melodus*. LE, LT; Listed by U.S. Fish and Wildlife Service as Endangered in Great Lakes watersheds of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin; Listed as Threatened elsewhere, including Alabama. Portions of Dauphin Island are designated as Critical Habitat.

5 Subspecies *Canidis canutus rufa* listed as threatened. Proposed Critical Habitat includes all of Dauphin Island and Little Dauphin Island.

6 *Mycteria americana*. Listed by U.S. Fish and Wildlife Service as Endangered in Alabama, Florida, Georgia, Mississippi, North Carolina, and South Carolina. Populations originating from outside these six states are not protected.

7 The southern form, *Falco sparverius paulus*, is included on the species of greatest conservation need list but the northern form, *F. sparverius*, is not. The northern form is considered to be a species of moderate conservation concern (P3).

TABLE 3-9 Federal and State Protected Species Occurring on or with Potential to Occur on Dauphin Island or in its Surrounding Waters

Common Name	Scientific Name	Federal Status	State Status	SWAP Status

Federal Status Code Definition

LE: Listed Endangered. A species in danger of extinction throughout all or a significant portion of their range.
LT: Listed Threatened. A species likely to become endangered within the foreseeable future throughout all or a significant portion of their range.
UR: Under Review in the Candidate or Petition Process. A species under review in the candidate or petition process. A 90-day finding indicated that listing may be warranted, and a full status review has been initiated to determine if listing is warranted. (An unofficial status with no regulatory requirements.)
SC: Species of Concern. Species that have not been petitioned or been given Endangered, Threatened, or Candidate status, but have been identified as important to monitor. (An unofficial status with no regulatory requirements.)

State Status Code Definitions

SP: State Protected. Species protected by Regulation 220-2-.92 (Nongame Species Regulation), 220-2-.98 (Invertebrate Species Regulation), 220-2-.26(4) (Protection of Sturgeon), 220-2-.94 (Prohibition of Taking or Possessing Paddlefish), or 220-2-.97 (Alligator Protection Regulation).
RT: Regulated Turtle. Species for which the Turtle Catcher/Dealer/Farmer Regulation (Regulation 220-2-.142) imposes a limit on the number that can be possessed or size limits.
GB: Game Bird (Managed hunting regulations). GBNOS – Game Bird - No Open Season: Species designated a game bird by Regulation 220-2-.04, but for which there is no open season.
CNGF: Commercial or Non-Game Fish (Managed fishing regulations).

Alabama Department of Conservation and Natural Resources (ADCNR) State Wildlife Action Plan (SWAP) Status Code Definitions

P1: Priority 1/Highest Conservation Concern: taxa critically imperiled and at risk of extinction/extirpation because of extreme rarity, restricted distribution, decreasing population trend/population viability problems, and specialized habitat needs/habitat vulnerability due to natural/human-caused factors. Immediate research and/or conservation action required.
P2: Priority 2/High Conservation Concern: taxa imperiled because of three of four of the following: rarity, very limited, disjunct, or peripheral distribution, decreasing population trend/population viability problems, or specialized habitat needs/habitat vulnerability due to natural/human-caused factors. Timely research and/or conservation action needed.

Brief descriptions of some of the more important FESA-listed species known to occur in the Watershed are provided below.

GULF STURGEON (*ACIPENSER OXYRINCHUS DESOTOI*)
STATUS: THREATENED

Gulf sturgeon is an anadromous fish with reproduction occurring in fresh water. Sturgeons are thought to return to breed in the river system in which they hatched, and genetically distinct subunits of Gulf sturgeon have been identified throughout the Gulf of Mexico (Stabile et al. 1996; Dugo et al. 2004). There is a faunal break at Mobile Bay. In Mississippi, the Pascagoula and Pearl Rivers support a western group, distinct from the eastern assemblages of the Escambia, Yellow, Choctawhatchee, and Apalachicola River drainages (Dugo et al. 2004). The Mobile River Basin is not known to support a breeding sub-population.

Gulf Sturgeon

Sturgeons migrate from the estuaries, bays, and the Gulf of Mexico into coastal rivers in early spring (i.e., March through May) (Foster and Clugston 1997; Fox and Hightower 1998; Sulak and Clugston 1999; Fox et al. 2000). After spawning up-river, Gulf sturgeon reside in rivers, fasting until fall (Mason and Clugston 1993). Sturgeons initiate their migration out of fresh water from late-September to mid-October, coincident with shorter day length and falling water temperature (Heise et al. 2005). Most Gulf sturgeon feeding takes place in the Gulf and its estuaries, where active foraging replaces depleted energy reserves. Adult sturgeons over the age of five or six years overwinter in marine waters, especially near Gulf barrier islands (Rogillio et al. 2007; Ross et al. 2009). Juveniles may remain in the estuary during winter to feed (Fox and Hightower 1998).

There are both historical and recent records of Gulf sturgeon from Mobile Bay (Mettee et al. 2009). Recent telemetry studies detected eastern population fish (Escambia, Blackwater, Yellow, and Choctawhatchee Rivers) overwintering near Mobile Bay (Vick et al. 2018). Gulf Sturgeon critical habitat is designated in Mississippi Sound0 west of Point Aux Pins and encompassing the far-west tip of Dauphin Island.

LOGGERHEAD (*TRICHECHUS MANATUS*) AND GREEN (*CHELONIA MYDAS*) SEA TURTLES
STATUS: THREATENED

LEATHERBACK (*DERMOCHELYS CORIACEA*) AND KEMP'S RIDLEY (*LEPIDOCHELYS KEMPII*) SEA TURTLES
STATUS: ENDANGERED

Loggerhead Sea Turtle

Loggerheads are expected to be the most common sea turtle in the vicinity of Dauphin Island, as they are the most abundant turtle on the northern Gulf shelf (Lohoefener et al. 1990; Mullin and Hoggard 1998; Davis et al. 2000). Leatherbacks are abundant in the northern Gulf, but primarily in deep waters of the continental slope and beyond (Hansen et al. 1996; Mullin and Hoggard 1998); however, they also occur on the shelf in smaller numbers (Evens et al. 2021). Green and Kemp's ridley turtles are typically inshore species that occur in the project area, but little is known of their abundance in coastal Alabama and the broader northern Gulf.

Loggerhead, Kemps ridleys, and green sea turtles nest on Gulf-fronting beaches, including Dauphin Island. Dauphin Island documented a total of 20 nests and 28 false crawls on the Island during the 2021 nesting season (Share the Beach 2022). Eleven of these were spread across the undeveloped Far West End of the Island and nine were located across the remaining developed portions of the Island, mostly from Sand Island west.

Designated critical habitat for loggerheads includes Gulf-fronting beaches along Petit Bois Island and Horn Island in Mississippi and along the Ft. Morgan Peninsula in Baldwin County. No critical habitat has been designated for Kemp's ridley sea turtles. Green sea turtle critical habitat is designated in Puerto Rico.

WEST INDIAN MANATEE (*TRICHECHUS MANATUS*)
STATUS: THREATENED

The West Indian manatee is protected under both the FESA and the Marine Mammal Protection Act of 1972. Manatee sightings in Alabama have been increasing in recent years, as they expand their presence farther west of Florida during warmer months. Manatees are opportunistic herbivores, consuming SAV in marine, estuarine, and freshwater systems. No critical habitat has been designated for the species in Alabama. The Dauphin Island Sea Lab's Manatee Sighting Network online database (DISL 2021) was accessed on September 25, 2021, to gather information on the number of manatee observations reported from Dauphin Island for the period 2016 to 2020 (**Table 3-10**). The maximum number of individuals reported within the study area was a pod of four sighted along the Gulf shoreline in June 2018.

TABLE 3-10 Manatee Sightings Recorded from 2016 to 2020 at Dauphin Island

Year	Number of Sightings	Months
2020	3	June, Aug., Nov.
2019	4	June, July
2018	6	June, Sept., Dec.
2017	4	May, June, July, Aug.
2016	7	June, July, Sept.

SOURCE: Dauphin Island Sea Lab's Manatee Sighting Network 2021

EASTERN BLACK RAIL (*LATERALLUS JAMAICENSIS JAMAICENSIS*)
STATUS: THREATENED

Eastern Black Rail

The Eastern subspecies of black rail was designated as threatened on October 7, 2020. Black rail is considered rare in spring and occasional in other seasons in the Gulf Coast region. Black rails prefer damp soils in relatively drier areas of salt, brackish, and freshwater marshes and partially flooded fields and meadows. They often occur near marsh edges where thin-stemmed emergent vegetation such as rushes, cordgrasses, and sedges are present (Eddleman et al. 1994). States in the southeastern U.S., including Alabama, either do not have a history of supporting eastern black rails consistently or are considered to be on the peripheries of known breeding areas (USFWS 2020).

There are numerous reports of black rail from the Island Airport Marsh, particularly in spring, most likely migrants or over-wintering birds. Reports also come from the marsh east of the old Dauphin Island fishing pier on Pelican Island and from Little Dauphin Island. The West End marshes offer potential breeding habitat, but surveys have not been conducted there.

There is currently a multi-state research project underway studying black rail ecology across the northern Gulf Coast from Texas to Florida. The five-year project is funded through the Resources and Ecosystems Sustainability Tourist Opportunities, and Revived Economics Act (RESTORE Act 2012; Public Law 112-141, Section 1604). The project will conduct field surveys for black rails during the breeding and wintering seasons across the five-state study region to determine the species' distribution and abundance along the Gulf Coast. It will also map important marsh habitats for the species.

PIPING PLOVER (*CHARADRIUS MELODUS*)
STATUS: THREATENED

Piping Plover

The Piping plover is listed by the U.S. Fish and Wildlife Service as Endangered in Great Lakes watersheds of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin and listed as Threatened elsewhere, including Alabama. Critical wintering habitat units for piping plover are Little Dauphin Island, Pelican Island, and from Dauphin Island's East End, beginning approximately at the Bienville Boulevard two-lane section, to the

West End of the Island. Critical habitat also exists on Isle aux Herbes, in Portersville Bay.

Piping plovers commonly occur in the Watershed during winter and also spring and fall migration (starting in July). Foraging habitat consists of mudflats, beaches, and tidal wet sand areas. Occurrences are reported on exposed tidal flats on the northern end of Little Dauphin Island. On Pelican Island, piping plovers frequent the shoreline beach areas, tidal pools, wet swales, sandy margins of tidal creeks at shoreline, and exposed tidal flats on its south end. On Dauphin Island's West End, these same habitats are used. Since 1983, the annual Audubon Christmas Bird Count for Dauphin Island has recorded piping plovers every year except one (1990), with a high count of 76 in 1988 and an average of 19 birds per year (Cobb and Morpeth 2020).

RED KNOT (*CALIDRIS CANUTUS*)
STATUS: THREATENED

Suitable foraging habitat for red knot consists of mudflats, beaches, and tidal wet sand areas. Red knot occurs in the Watershed during fall and spring migrations but is considered an infrequent visitor to the Alabama coast (Cobb and Morpeth 2020). Red knot critical habitat was recently proposed and includes all of Dauphin Island and Little Dauphin Island. Most local records come from Little Dauphin Island, where they occur on exposed tidal flats at its north end, as well as Pelican Island and the West End. The Christmas Bird Count for Dauphin Island has recorded red knot about every other year on average since 1983, with a high count of 96 in 1986.

Red Knot

MARINE MAMMALS

Marine mammals are protected under the Federal Marine Mammal Protection Act. Up to 28 cetacean species occur in the northern Gulf of Mexico, including seven species of Mysticetes (baleen whales) and 21 species of Odontocetes (toothed whales) (Jefferson and Schiro 1997). Endangered Mysticetes are likely to be represented in the Gulf only by occasional strays (Jefferson and Schiro 1997). These large whales prefer deep waters well offshore of the continental shelf (Davis et al. 2000) and are unlikely to occur on the inner shelf of the northern Gulf of Mexico. Sperm whales are common in the northern Gulf and particularly favor an area just south of the Mississippi River mouth (Hansen et al. 1996; Mullin and Hoggard 1998). However, these large whales also prefer deep water habitats and would be unlikely to occur the vicinity of Dauphin Island. Other than bottlenose dolphins (*Tursiops truncatus*) and West Indian manatees, and to a lesser extent Atlantic spotted dolphins (*Stenella frontalis*), marine mammals do not typically occur in the waters around Dauphin Island.

3.6 Political Institutions

The Dauphin Island Watershed area of approximately 6.3 square miles (approximately 4,032 acres) falls under the management and control of two different local governmental entities: Mobile County and the municipality of the Town of Dauphin Island (Town). Policymaking and legislative authority for the Town are entrusted to a mayor and a five-member town council. They are responsible for considering local resolutions and ordinances, adopting an annual budget, and appointing members to local boards and committees. A planning commission assists the Mayor and Town Council in preparing, maintaining, and implementing plans, regulations, and ordinances. The Dauphin Island Water and Sewer Authority operates independently from the Town to provide water and sewer services.

At the onset of the development of this Watershed Management Plan, the Dauphin Island Park and Beach Board operated independently of the Town government and managed the Island's public parks, beaches, campgrounds, and other recreational facilities, including the Dauphin Island Bird Sanctuary. However, during the development of this Plan, the State passed Senate Bill 65 to merge the Park and Beach Board with the Town and is now the Town's Parks and Recreation Department.

A portion of Little Dauphin Island, known as the Little Dauphin Island Unit, is owned and managed by the Bon Secour National Wildlife Refuge (US Fish and Wildlife Service). Shell Mound Park is managed by the ADCNR MRD.

3.7 Demographics

3.7.1 POPULATION

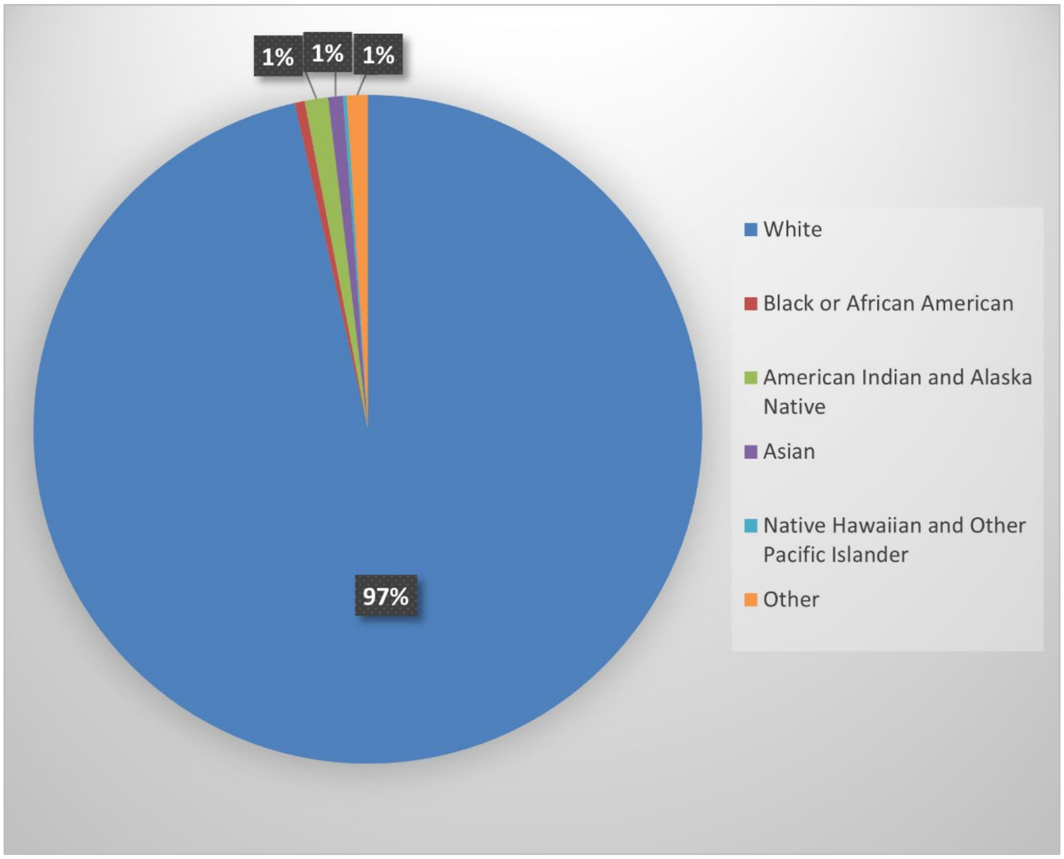
In assessing the population of the Dauphin Island Watershed, historic and projected population data have been evaluated (in context of the various sources considered) to gain an appreciation of existing and future population characteristics. The U.S. Census uses various geographic areas (or units) to aggregate and organize the information it collects. Aside from legal/administrative areas (e.g., states, counties, cities), it supplements these by aggregating data for statistical areas that are created in cooperation with state and local agencies. Most notably, counties are divided into census tracts, block groups, and blocks. The block is the smallest and most detailed geographic unit that the Census Bureau uses to tabulate decennial census data. The Dauphin Island Watershed is entirely in the Town of Dauphin Island census tract.

Mobile County, in southwest Alabama, has 11 municipalities including the Town of Dauphin Island. The County has a total area of 1,644 square miles (4,258 kilometers), of which 1,233 square miles (3,193 kilometers) is land and 410 square miles (1,064 kilometers) is water and includes several islands, including Dauphin Island. Dauphin Island is a low-lying barrier island with an approximate land area of 6.3 square miles located more than 20 miles south of the City of Mobile. The Island has two distinct types of residential populations—full-time residents residing year-round and tourists who visit the Island for shorter periods of time. It is important to note that during the tourist season and special events, the population of the Island can increase dramatically (Town of Dauphin Island 2013). While the number of tourists is important to local planning purposes, the majority of planning efforts are targeted at the resident population. Therefore, only residential population estimates will be evaluated. The total population of Dauphin Island in 2020 was 1,778, which is <1% of the total population of Mobile County (414,809).

Based on American Community Survey data, approximately 35.7% (472) of the Island's resident population is aged 65 or over compared to Mobile County's 5.5% (**Table 3-11**). The American Community Survey also estimated 2,043 housing units on Dauphin Island in 2020. Of this total number, about 844 are owner occupied year-round, and 1,199 or approximately 58.7% are primarily used as investment properties or vacation homes (Aloe Bay Town Center Master Plan 2021). The age composition and occupancy status numbers are typical of coastal tourist destinations where much of the resident population comprises a mature work force and retired individuals as opposed to young families with school age children (Town of Dauphin Island 2013). Census data also show that the population of Dauphin Island is not racially diverse and is significantly less diverse than Mobile County (**Figure 3-24** and **Figure 3-25**).

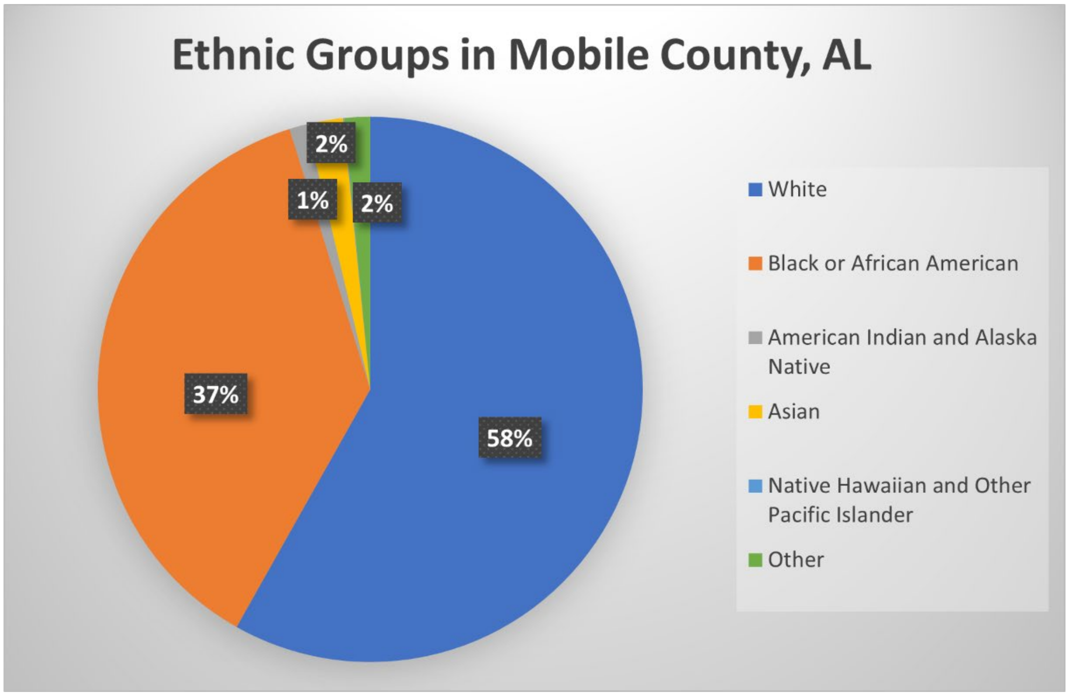
TABLE 3-11 U.S. Census Bureau American Community Survey Demographic numbers for 2020

Geographic Area	2020
Total Population	
Mobile County	413,210
Town of Dauphin Island	1,778
Age 65+	
Mobile County	5.50%
Town of Dauphin Island	35.70%
SOURCE: U.S. Census Bureau 2020	



SOURCE: U.S. Census Bureau

FIGURE 3-24 Ethnic Diversity of Dauphin Island

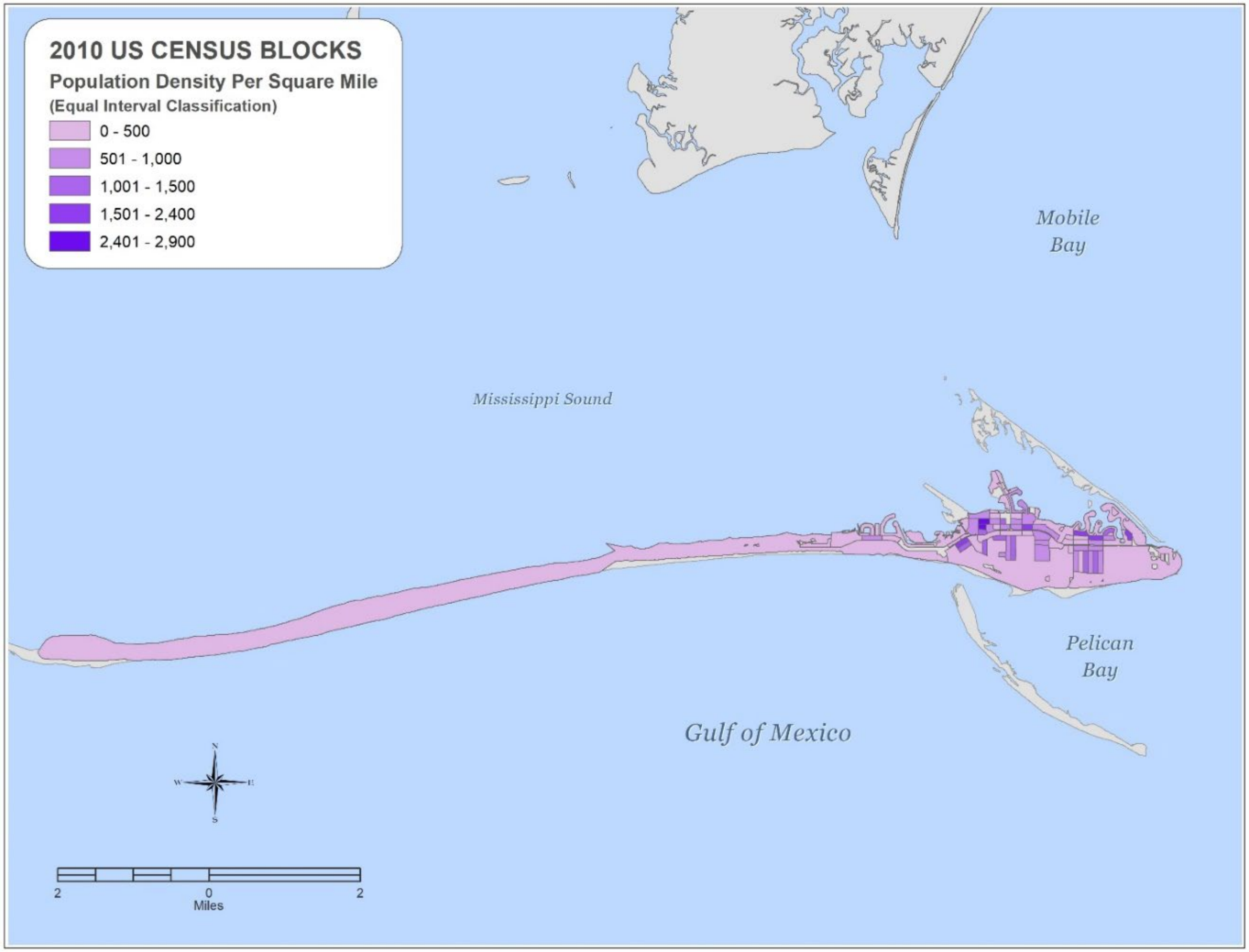


SOURCE: U.S. Census Bureau

FIGURE 3-25 Ethnic Diversity in Mobile County, AL

Historic Population Trends

From 2000 to 2010, Mobile County experienced an approximately 6.9% increase in population size (399,843 in 2000 to 412,992 in 2010) with an even smaller increase by 2020 to 4,940,253 (approximately 3%). Population estimates from 2010 to 2040 for Mobile County project another slight increase in population by approximately 11.3% (U.S. Census Bureau 2018). For Dauphin Island, specifically, the population decreased from 2000 to 2010 by 10%, declining from 1,371 in 2000 to 1,238 in 2010. However, from 2010 to 2020 the population of Dauphin Island increased by approximately 30% or 540 people (U.S. Census Bureau 2018). **Figure 3-26** shows the 2010 Census Data for Dauphin Island population density.



SOURCE: U.S. Census Bureau

FIGURE 3-26 2010 Population Density per Square Mile on Dauphin Island

Projected Future Population Growth

For population projections, various sources were evaluated to assist and guide estimates for 2040. For this study, The Town of Dauphin Island Comprehensive Plan – the 2030 Vision (2013) and The University of Alabama's Center for Business and Economic Research data from 2018 were utilized. For Mobile County, projections demonstrate a slight increase in population by 4.6% (431,909) (**Table 3-12**). In 2013, the Town drafted its Comprehensive Plan, which included growth projections through 2030. At that time, the Town used 1990 to 2000 and 2000 to 2010 historical decennial growth predictions to project a population of 2,097 by the year 2030. Since that Plan, new Census numbers have become available, and 2040 growth projections were calculated with the same methodology used in the 2013 Comprehensive Plan (**Table 3-12** and **Figure 3-27**) projecting a population of 2,290 (representing a 46% increase).

TABLE 3-12 Alabama Population 2000–2010 and Projections 2020–2040

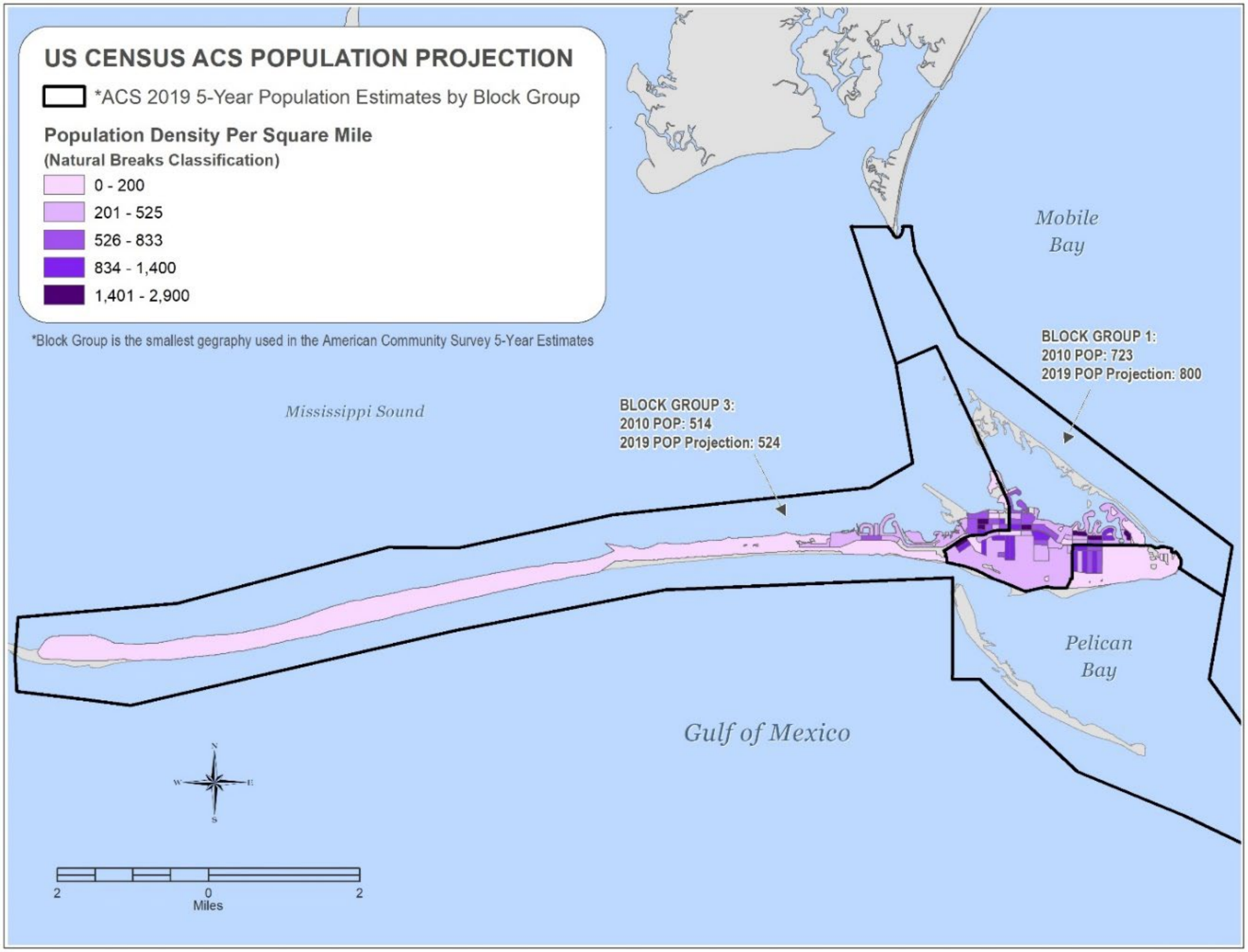
Area	Census 2000	Census 2010	2020	2040	Change 2010–2040 Number	Change 2010–2040 Percent
Mobile	399,843	412,992	416,420	431,909	18,917	4.6
Dauphin Island	1,371	1,238	1,778	2,290*	1,052	46

NOTE: *Growth prediction for 2040 was calculated by using the average of three decennial growth rates (1990–2000, 2000–2010, and 2010–2020).

SOURCES: U.S. Census Bureau and Center for Business and Economic Research; The University of Alabama, April 2018

3.7.2 ECONOMICS

Dauphin Island is a tourist destination with a large number of waterfront properties that have increased in property value over the past decade. This seems to be a common trend in coastal communities that are also tourist destinations. The higher property values on Dauphin Island are creating an older, married population, some of which are approaching retirement (Town of Dauphin Island 2013). As property values increase, incomes are expected to increase as well. In 2010, Dauphin Island's median household income was $56,731, which is considerably higher when compared to Mobile County at $40,996 and $40,474 for the State (Town of Dauphin Island 2013). These trends appear to be accurate as the median household income has since increased to $87,596 (U.S. Census Bureau 2019).



SOURCE: U.S. Census Bureau 2015–2019

FIGURE 3-27 Projected Population Growth for Dauphin Island

3.7.3 EDUCATION

Table 3-13 demonstrates the estimated number of individuals on Dauphin Island that do not have a high school diploma, have a high school diploma or higher, or have a bachelor's degree or higher broken out by age group. Approximately 62% of Island residents have obtained a high school degree or higher with 25% having a bachelor's degree or higher. High school graduates (or greater) between 45 and 64 years of age and 65 years and over (approximately 50% and approximately 22%, respectively) represent the largest part of the population (**Table 3-13**).

TABLE 3-13 Educational Attainment on Dauphin Island by Age Group

Age Range	Less than High School Graduate	High School Graduate or Higher	Bachelor's Degree or Higher
Population 18 to 24 years	5 (5.3%)	37 (38.9%)	14 (14.7%)
Population 25 to 34 years	—	70 (82.4%)	33 (38.8%)
Population 35 to 44 years	—	96 (100%)	36 (37.5%)
Population 45 to 64 years	—	432 (94.1%)	159 (34.6%)
Population 65 years and over	—	456 (96.6%)	230 (48.7%)

SOURCE: U.S. Census Bureau 2015–2019

3.8 History and Culture of the Watershed

In geologic time, Dauphin Island is relatively recently formed. Mobile Bay was a marsh-covered floodplain about 7,000 years ago (Hummel and Parker 1995a), with a deltaic system covering the southern bay and extending onto the present-day Gulf shelf (Hummel and Parker 1995a; Green et al. 2007). At the same time, Mississippi Sound was a marsh and forest-covered lowland, with the western half occupied by a lobe of the ancestral Escatawpa fluvial-deltaic system. By about 6,000 years ago, the Gulf had inundated almost 75% of Mobile Bay, and about 33% of Mississippi Sound. An open connection, Pass aux Herons, existed between the Sound and Bay as recently as 4,000 years ago (Hummel and Parker 1995b). Otvos (1979) determined that the Mississippi-Alabama barrier islands evolved through shoal-bar aggradation, or build up, likely initiated less than 4,500 years ago (Otvos and Giardino 2004).

Dauphin Island has a long record of human habitation, possibly as far back as 3000 B.C. when seas reached their current levels Archaeological excavations at the Dauphin Island Shell Mound (**Figure 3-28**) produced evidence of occupation from at least the Early Woodland Period (0 A.D. to 200 A.D.) through the Mississippian Period (1100 A.D. to 1550 A.D.). Furthermore, its circular configuration is typical of other Late Archaic (3000

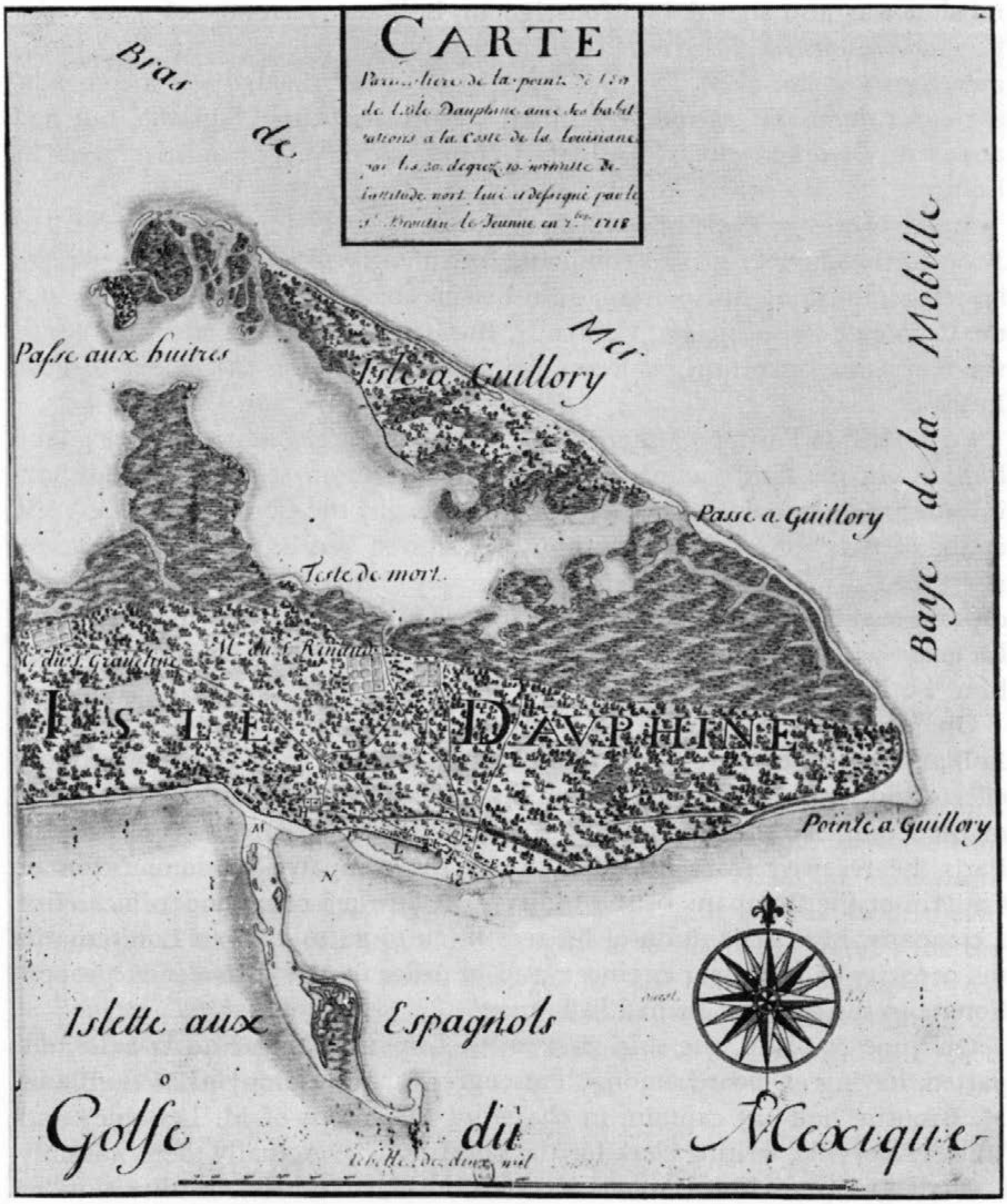
B.C. to 1200 B.C.) shell rings found on the Atlantic coast and the Gulf coast of Florida (Marquardt 2010), suggesting an initial occupation of the site and the Island at that time.

SOURCE: Photograph by Roland Harper 1940

FIGURE 3-28 Dauphin Island Shell Middens

The first large group of European settlers to make permanent homes in Alabama were French. Pierre Le Moyne, Sieur D'Iberville, explored coastal Alabama in 1699 in the name of Louis, King of France (Owen 1938; Summersell 1957). Le Moyne found many skulls and bones on Dauphin Island, leading him to initially name it Massacre Island. The Island is depicted in several maps produced in the French era, including a 1718 map by Broutin the Younger (**Figure 3-29**).

The main Island was the site of initial settlement by the French-Canadian colonists from 1699 to 1702, and for several years they maintained an extensive fort, warehouses, and a village site, much of which is still present archaeologically (Stowe 1977). There is also a War of 1812 component to the Island consisting of the remnants of encampments of British soldiers, and a very notable Civil War component is present in the form of Fort Gaines on the Island's eastern end.



1. "Detailed Map of the East Point of Dauphine Island with Its Habitations on the Coast of Louisiana at 30°, 10' North Latitude. Surveyed and Drawn by the Sr. Broutin the Younger in Sept. 1718." (Paris, Bibliothèque Nationale, Estampes.)

SOURCE: Paris Bibliotheque Nationale, Estampes

FIGURE 3-29 Eastern Portion of Dauphin Island as Surveyed and Drawn in the 1718 Map by Broutin the Younger

A post office was established on the Island in 1896 to service the small number of year-round residents (Maloney 2012). In the early 20th century, Harper (1913) found that very little of the Alabama coastal strand area was cultivated and the dune systems were mostly uninhabited “except for a few summer cottages.” He also noted that although there were no restrictions on the ranging of cattle, those present on the Islands were small herds dependent on the meager vegetation available as forage.

In 1929 the Alabama Deep Sea Fishing Rodeo was founded to bring additional tourism to the Island. Throughout the 1930s, large portions of the Island were purchased by a real estate company backed by Congressman Frank Boykin. In the 1940s, the Alabama State Armory Commission leased fifteen acres on the Island, including Fort Gaines, as a campsite for the State Guard (McWilliams 1954). During and since WWII, the U.S. Coast Guard has used the Island as a base of operation.

By 1955, Congressman Boykin had secured funds for construction of a bridge to the mainland (Maloney 2012). The Gordon Persons Bridge opened in July 1955. Island parcels were first platted around that time, in 1953, beginning the modern development era, which brought increased tourism and development. In 1979, Hurricane Frederic devastated the area and destroyed the only bridge to the Island, but throughout the 1980s the Island was built back, and full-time residency and seasonal visitors greatly increased. Recently, there has been a development boom on the Island, with the West End becoming almost built out. **Section 6.5.1** provides more information regarding population growth.

There have been 23 previous cultural resources surveys, representing approximately 3.8% of the 3,375-acre island (**Figure 3-30**). These previous surveys have documented 25 archaeological sites in addition to historic structures and one National Register of Historic Places property, the Isle Dauphine Club. Nearly half (12 sites) of the recorded archaeological sites on the Island are Woodland and Mississippi Period shell middens. These are present on the north shore of the Island as well as on Little Dauphin Island, and at several locations within the interior of both islands. Two prehistoric earthen mounds have been documented in the State Site Files, associated with the shell middens found around the Island. In addition, there are seven artifact scatter sites, as well as two sites of French colonial village origins and two Civil War sites.

One 19th century shipwreck was uncovered after Hurricane Ivan in 2004 and recorded in the site files. Its remnants are on display outside of Fort Gaines. Additional 19th and 20th century resources have been documented that include structures associated with the Coast Guard west of Fort Gaines, which are now either collapsed or in a state of collapse. Artifact scatters and a well have been documented in association with these structures.

SOURCE: Barry Vittor and Associates, Inc.

FIGURE 3-30 Documented Cultural Resource Surveys and Archaeological Sites

3.9 Public Access in the Watershed

Public access sites on Dauphin Island play an integral role in community health by providing outdoor recreational opportunities. In addition, these sites provide public education about coastal ecosystems and instill a sense of ownership. There are 15 public access sites located within the Watershed. The sites listed in **Table 3-14** include land-based parks and water-based sites allowing public access to waterbodies. These sites do not include the many privately owned boat ramps and access sites, County/Town parks, or recreation sports fields. **Figure 3-31A–B** shows the location of these public access facilities on the Island.

TABLE 3-14 Public Access Locations on Dauphin Island

Map Key	Park Name	Access
1	Aloe Bay Landing Park	Water
2	Audubon Bird Sanctuary	Water
3	Audubon Park	Water
4	Bayou Heron Park	Water
5	Billy Goat Hole	Water
6	Cadillac Square Park	None
7	Dauphin Island Campground	Beach
8	Dauphin Island Marina	Water
9	Dauphin Island Pedestrian/Bike Trail	None
10	Dauphin Island Public Beach and Pier	Water
11	The Dauphin Island Sea Lab and Estuarium Living Marsh Boardwalk	Beach
12	D'Olive Park	Beach
13	Goat Tree Reserve	None
14	Gorgas Swamp	None
15	Green Park	None
16	Historic Fort Gaines	Water
17	Indian Shell Mounds Park and Trail	Water
18	Isle Dauphine Golf Club	Water
19	Jeffries Park	Water
20	Lafitte Bay Park	Water
21	Little Billy Goat Hole	Water
22	Little Dauphin Island	Beach
23	Magnolia Park	Water
24	Penalver Park	Water
25	Pryor Park	Water views

TABLE 3-14 Public Access Locations on Dauphin Island

Map Key	Park Name	Access
26	Quarles Park	None
27	Salt Creek Park	None
28	Sandpiper Park	Beach
29	Sand Island Lighthouse	Viewable from water*
30	Saw Grass Point Salt Marsh	Water views
31	Steiner Property	None
32	Tupelo Gum Swamp	None
33	Water Tower Lawn/Calumet Park	None
34	West End Beach Park	Beach

NOTE:

* Direct access to the lighthouse is not possible due to dangerous conditions at the site location.

SOURCE: Thompson Engineering, Inc.

FIGURE 3-31A Public Access Locations on Dauphin Island

SOURCE: Thompson Engineering, Inc.

FIGURE 3-31B Public Access Locations on Dauphin Island

3.10 Land Use and Land Cover

Land use describes how people use the landscape (e.g., farming, forestry, residential development, commercial development), while land cover describes the landscape or surface of the land (e.g., water, wetlands, forest, impervious surfaces). Changes in land use and land cover (LULC) are used to assess and explain past, current, or future trends and consequences altered landscapes have on ecosystems at local, regional, or global scales. Understanding LULC changes at the watershed level are important as these can significantly impact local water resources, including sediment and pollutant loads of streams as well as stormwater runoff velocities, volumes, and timing (duration) within watersheds.

The following sections describe and evaluate LULC trends within the Dauphin Island Watershed to provide insight into the type, location, and extent of LULC changes over time.

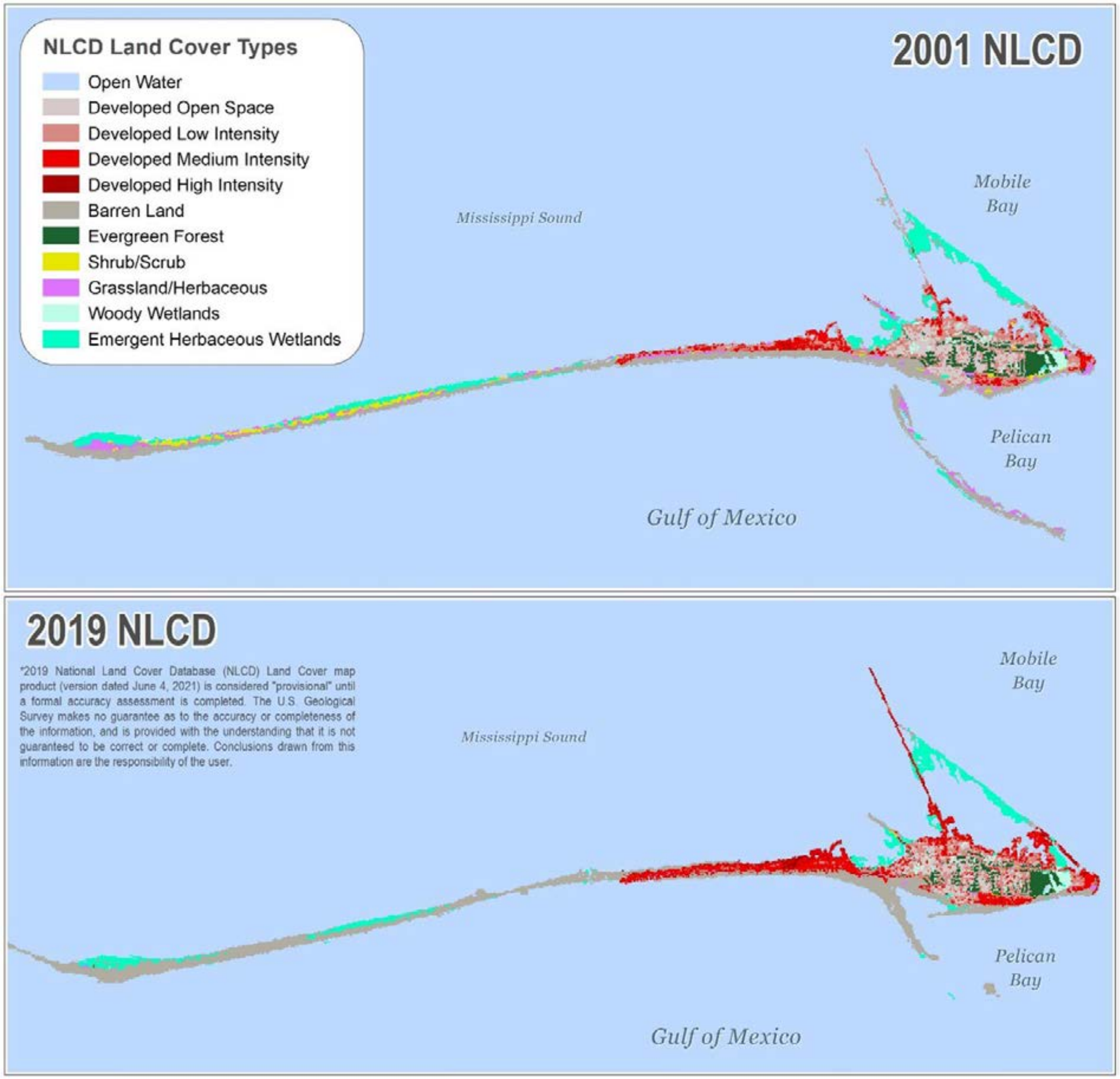
3.10.1 HISTORIC LAND USE/LAND COVER

The Multi-Resolution Land Characteristics Consortium (MRLC) coordinate and generate consistent and relevant land cover information. The National Land Cover Dataset (NLCD) is a complete, current, and consistent national land cover dataset that provides public and government entities land cover information to assess issues with ecosystems, modeling of various runoffs, understanding spatial patterns and assist in land use planning and land management policies. The NLCD provides land cover and land cover change at a 30-meter resolution. The NLCD datasets evaluated for Dauphin Island include the 2001, 2006, 2011, 2016, and 2019 datasets.

Being a barrier island, Dauphin Island has changed in its shape and size over the various NLCD epochs, which does not allow for an accurate or absolute calculation of change for undeveloped land cover types. However, some basic change characteristics can be discerned from the data. Land cover types identified on Dauphin Island are summarized in **Table 3.15** below and are quantified as a percentage of total land mass captured in the respective NLCD year (open water is not quantified). Due to the dynamic nature of the barrier island, comparison of land cover change between the years 2001 and 2019 are presented in **Figure 3-32**.

TABLE 3-15 Land Cover Types on Dauphin Island

Land Cover	2001 (%) Coverage	2006 (%) Coverage	2011 (%) Coverage	2016 (%) Coverage	2019 (%) Coverage
Open Water	-	-	-	-	-
Developed Open Space	11.1%	10.5%	11.2%	10.9%	8.7%
Developed Low Intensity	14.9%	14.4%	14.4%	15.3%	12.1%
Developed Medium Intensity	7.7%	7.9%	9.9%	10.2%	17.1%
Developed High Intensity	0.4%	0.8%	0.8%	1.0%	3.4%
Total Developed Land Covers	**34.1%**	**33.6%**	**36.3%**	**37.5%**	**41.3%**
Barren Land	31.3%	38.5%	37.6%	39.2%	37.6%
Evergreen Forest	6.4%	6.3%	6.9%	5.8%	5.3%
Shrub/Scrub	3.9%	0.9%	0.8%	0.3%	0.1%
Grassland/Herbaceous	6.2%	2.8%	1.7%	0.5%	0.4%
Woody Wetlands	2.2%	4.3%	4.2%	1.8%	1.9%
Emergent Herbaceous Wetlands	16.0%	13.7%	12.5%	15.0%	13.3%



SOURCE: NLCD Land Cover Change Index June 2021

FIGURE 3-32 Land Cover Change for Dauphin Island (2001–2019)

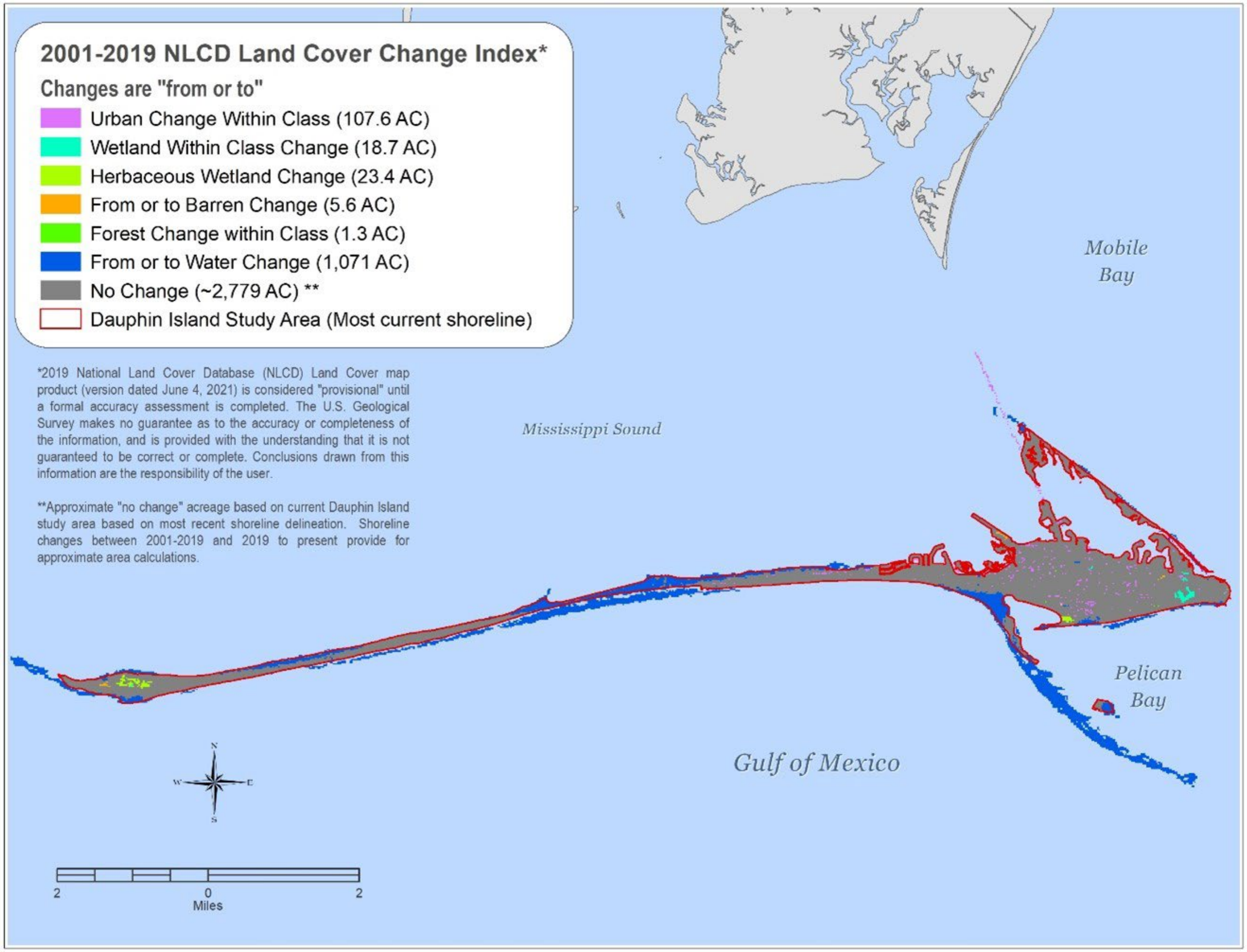
The largest land cover types on the Island are developed lands and barren lands, each comprising about 1/3 of the Island's land area. From 2001 to 2019 developed land covers shift from low intensity development to medium and higher intensity development with in-fill of urban uses where these already exist. Evergreen forest, which is limited to the urban East End of the Island, was reduced by 50 acres from 6% to 5%. Development may be the more likely the cause, although other factors including hurricanes and tropical storms also contribute to canopy losses.

Reduction in undeveloped land cover (such as barren lands, shrub/scrub, grasslands) on the Island may be due to some development but is largely due to being highly susceptible to the effects of tropical storms and land/shoreline loss by both location and constitution. Between the years of 2001 and 2009 the West End of the Island was greatly impacted by hurricanes that reduced its shape and land mass and also drastically shifted Pelican Island attaching it to Dauphin Island. Both these areas held a large portion of the non-developed land covers.

Barren Land for example, which constitutes 31% of the Island's land cover in 2001, increases by 180 acres (to 38%) by 2019. Barren Land has vegetation that accounts for less than 15% of total cover and is primarily located along the entire southern shore of Dauphin Island and most of Pelican Island. Most of this increase is due to loss of other non-developed land covers due to hurricanes and tropical storms whose impacts are predominantly along the west and southern shores of Dauphin Island.

Emergent Herbaceous Wetlands were reduced by 3% of total land mass but account for a loss of 127 acres primarily on the West End of the Island and Pelican Island. Grassland/Herbaceous areas, generally composed of greater than 80% of total vegetation, decreased from 6% total land mass to 0%—or from 239 acres to only 16 acres. These losses are also primarily visible on the western and southern shores of Dauphin Island and Pelican Island. Likewise, Shrub/Scrub, generally composed of greater than 20% of total vegetation were reduced form 152 acres to only 5 acres also along the West End of the Island.

Open water was not quantified above as the NLCD includes open water areas beyond the shorelines. However, the NLCD 2001–2019 Land Change Index provides for a measure of land loss, or change, that area qualified as "from or to" within the respective classifications. As shown in **Figure 3-33** below, there are approximately 1,071 acres that were either previously land and have been lost to "open water," or were "open water" and are now land classified within one of the land cover types discussed above. It is important to note that, while this dataset is "provisional" there are inconsistencies in the data, particularly where it was been discussed and shown in the 2001 NLCD that Shrub/Scrub, Grassland/Herbaceous, and Emergent Herbaceous Wetland land cover types were clearly "lost", however, not all to "open water". Some of the discrepancy may be due to a 30-meter resolution, satellite derived product. These products provide a baseline for understanding the changes occurring on the Island and to develop and expand on these through this WMP.



SOURCE: NLCD Land Cover Change Index June 2021

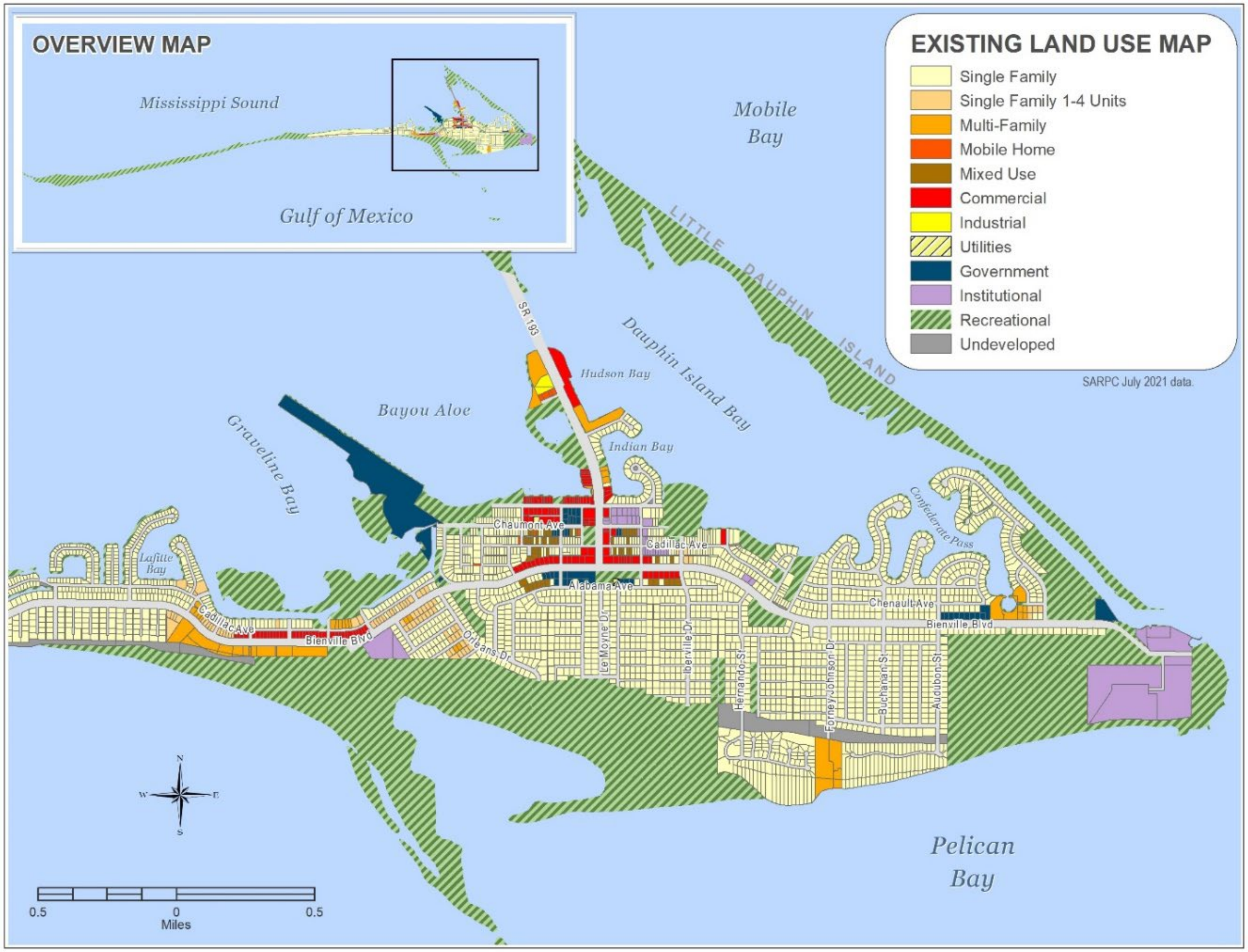
FIGURE 3-33 Land Cover Change Index for Dauphin Island (2001–2019)

3.10.2 CURRENT LAND USE AND LAND COVER

According to the 2013 Dauphin Island Comprehensive Land Use Plan, the largest land use category on the Island is parks and recreation land, totaling 838.5 acres, which accounts for 41.1% within the total municipal limits. Development on Dauphin Island is linear with the major roadway on the Island (Bienville Boulevard). Land uses are primarily devoted to residential and public or semi-public uses. The second largest land use category on Dauphin Island is undeveloped lands with a total of 513.4 acres, which accounts for 25.2% of total acreage. There are 1,540 undeveloped parcels identified on the Island with the average parcel size of 0.3 acres. Most of the undeveloped lots are located in residential neighborhoods. Some are not suitable for development due to wetlands present on the parcels. Single-family residential land use is the third largest category with 499.5 acres, or 24.5% of the total Island. Single family residences occur on 1,661 parcels with an average size of 0.3 acres. Commercial use is clustered where Highway 193 becomes Le Moyne Drive. Residential building has been scattered on the eastern end of the Island (**Figure 3-34**). However, the western end has been more fully developed and is more susceptible to loss through natural conditions (**Figure 3-35**).

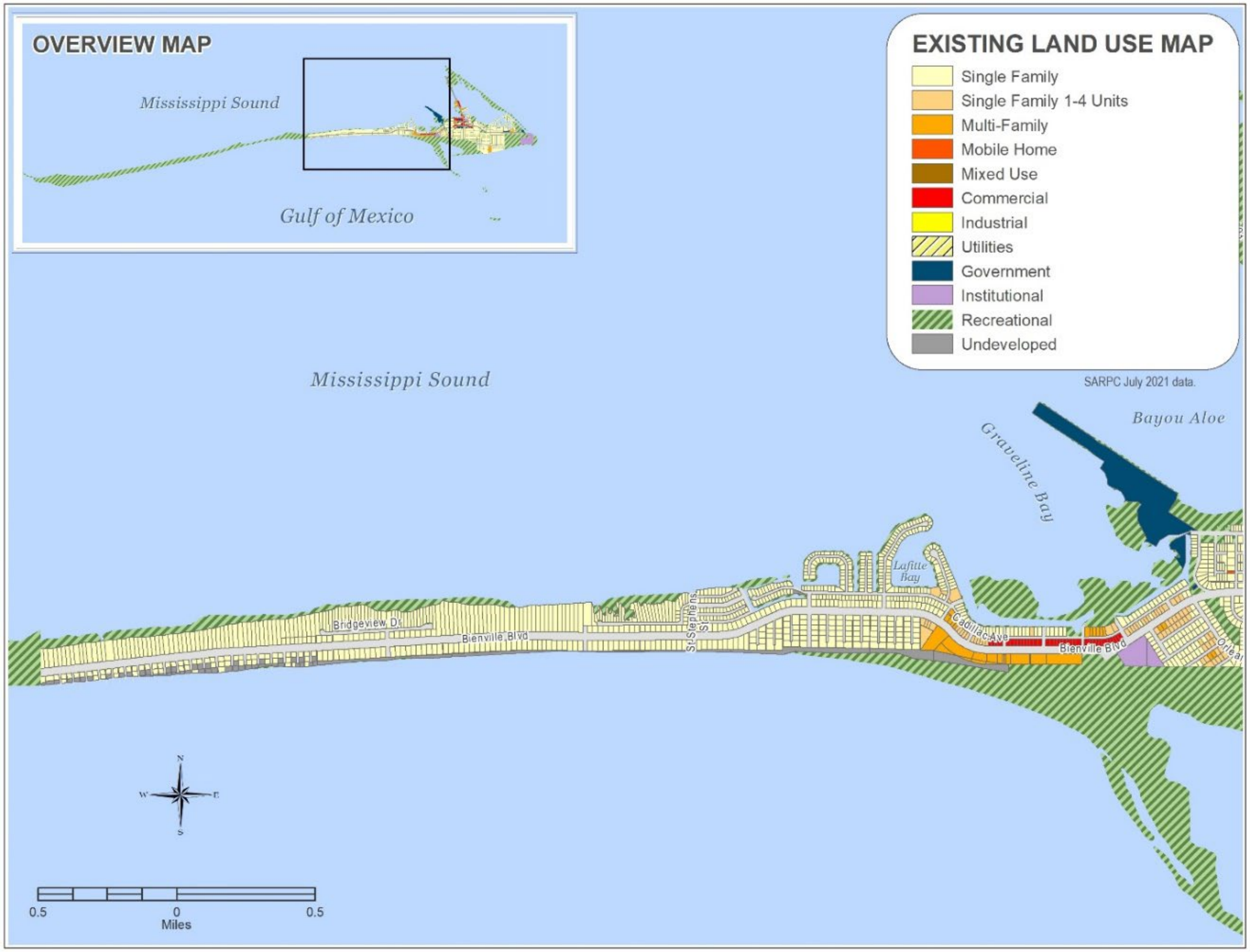
3.10.3 FUTURE LAND USE

In the 2013 Town of Dauphin Island's Comprehensive Plan, future land use acreage was projected based on current and historic growth trends and future land use requirements according to future population and housing projections from South Alabama Regional Planning Council (SARPC). **Figure 3-36** and **Figure 3-37** (Town of Dauphin Island 2013) illustrate the 2030 future land use development pattern based on a build out analysis formulated using existing land use inventory, historical and current land use growth patterns, the 2013 zoning map of the Town, and future population and housing projections. At the time of the Comprehensive Plan, the Town identified several additional land use categories that had not been designated historically, including mixed use, working waterfront, and tourist/resort. The Town also determined that due to natural resources such as wetlands, not all parcels are suitable for the development.



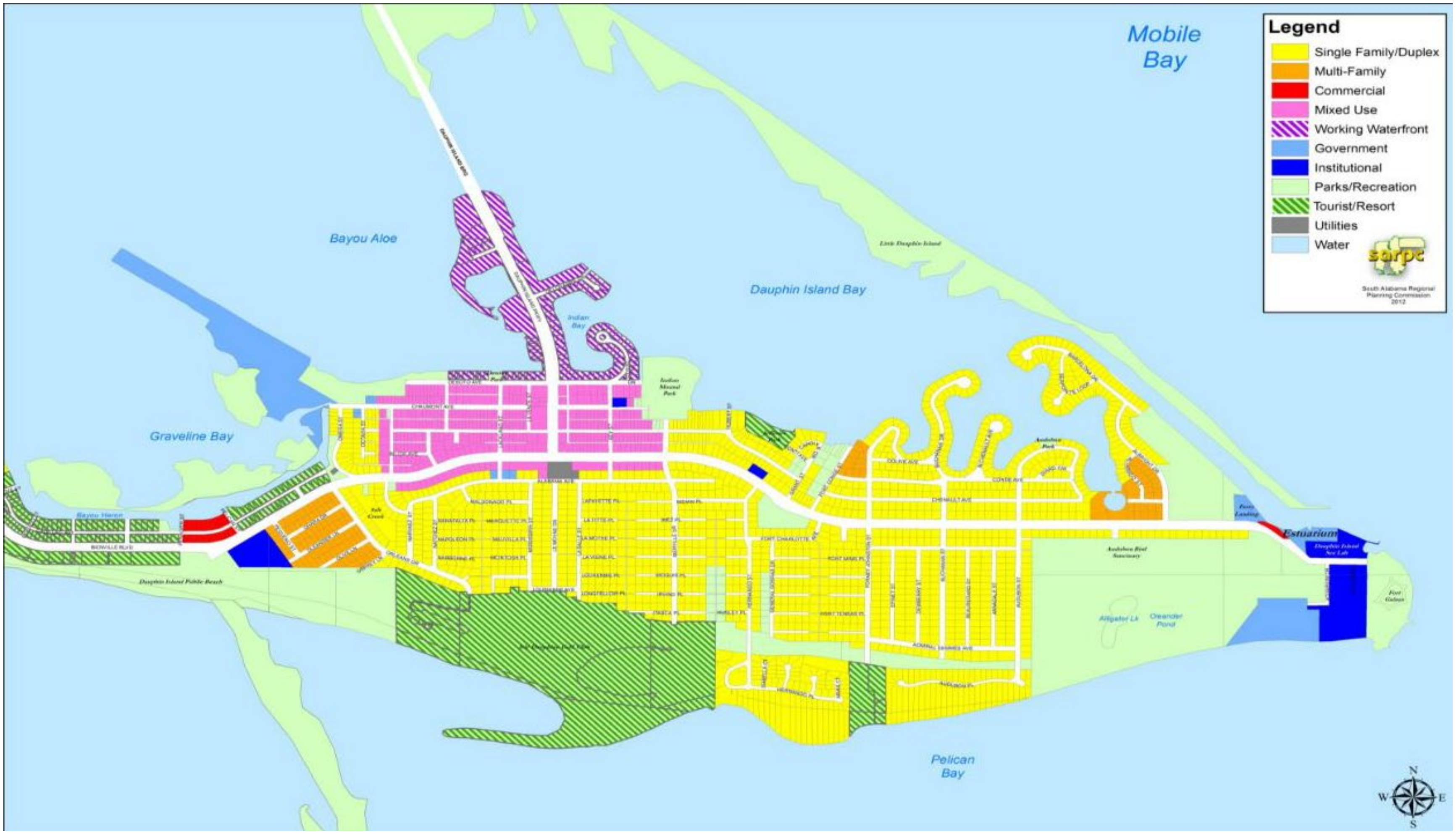
SOURCE: SARPC Post-Katrina Future Land Use 2005–2006

FIGURE 3-34 Existing Land Use on Eastern End of Dauphin Island



SOURCE: SARPC Post-Katrina Future Land Use 2005–2006

FIGURE 3-35 Existing Land Use on the West End of Dauphin Island



SOURCE: Town of Dauphin Island and South Alabama Regional Planning Commission 2013

FIGURE 3-36 Future Land Use for the Town of Dauphin Island – East End

SOURCE: Town of Dauphin Island and South Alabama Regional Planning Commission 2013

FIGURE 3-37 Future Land Use for the Town of Dauphin Island – West End

3.10.4 IMPERVIOUS COVER

Four principal factors influence stormwater runoff (quantity and quality): rainfall, soil characteristics, topography, and land cover. Of these, the most important factor we can control to manage stormwater is land cover. Land cover (in addition to topographic features and soil characteristics) is the variable most often influenced by man in developing landscapes. The potential for adverse effects on stormwater increases as natural vegetation is replaced with impervious cover in a developing watershed.

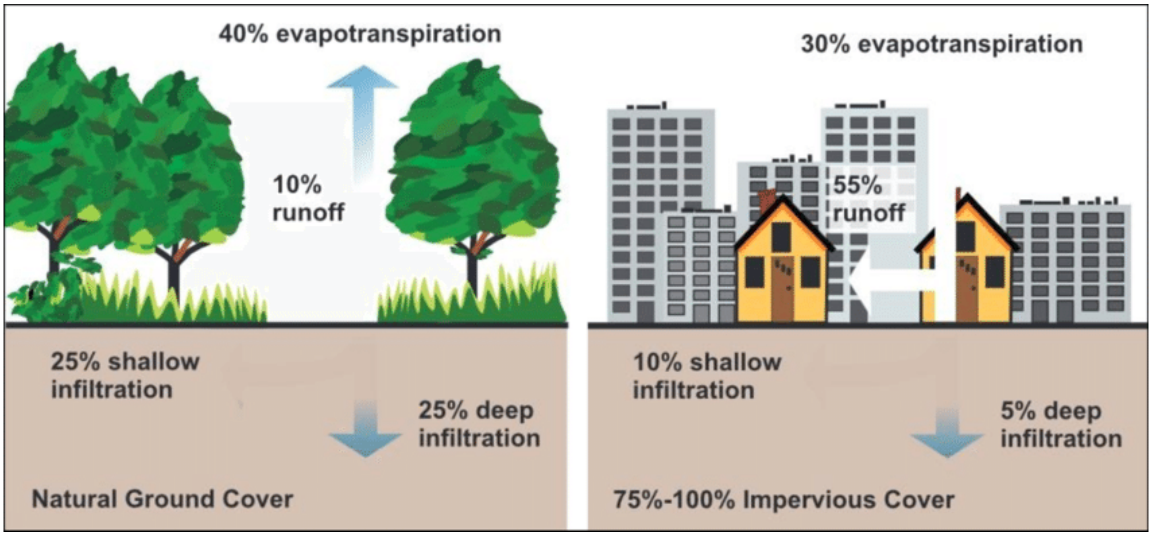
Impervious cover is a collective term used to describe all hard surfaces (e.g., rooftops, driveways, roads, parking lots, patios, and even compacted soils) that permit little or no water infiltration into the soil. Impervious cover fundamentally alters the hydrology of urban watersheds by generating increased stormwater runoff and reducing the amount of rainfall that soaks into the ground.

Background

Vegetative cover protects the soil from raindrop impact, reduces stormwater runoff velocities, increases infiltration of rainfall, and holds soil in place with root structures. Through the process of evapotranspiration, liquid water in the soil is absorbed by plant roots and released through stoma of the leaves as water vapor during normal metabolic processes.

As depicted in **Figure 3-38**, in the natural, undisturbed environment, rainfall is intercepted by trees and other vegetation and/or infiltrates into the soil. When permeable soils are present, runoff typically occurs only with significant precipitation events (USEPA 2009) or under saturated soil conditions.

Traditional urbanization of a watershed results in the removal of the native vegetation and replacement of large areas with impervious surfaces like roads, driveways, sidewalks, and buildings. Land cover changes also increase soil compaction and alter natural drainage patterns. These changes increase the imperviousness of a watershed so that runoff occurs even during small precipitation events that prior to development would have been absorbed by the soil and vegetation. Multiple studies have identified the negative impacts of poorly managed post-construction stormwater on our nation's waters. As landscapes become more urbanized, there is a corresponding increase in the area of impervious surfaces that limits the ability of stormwater to infiltrate into the ground.

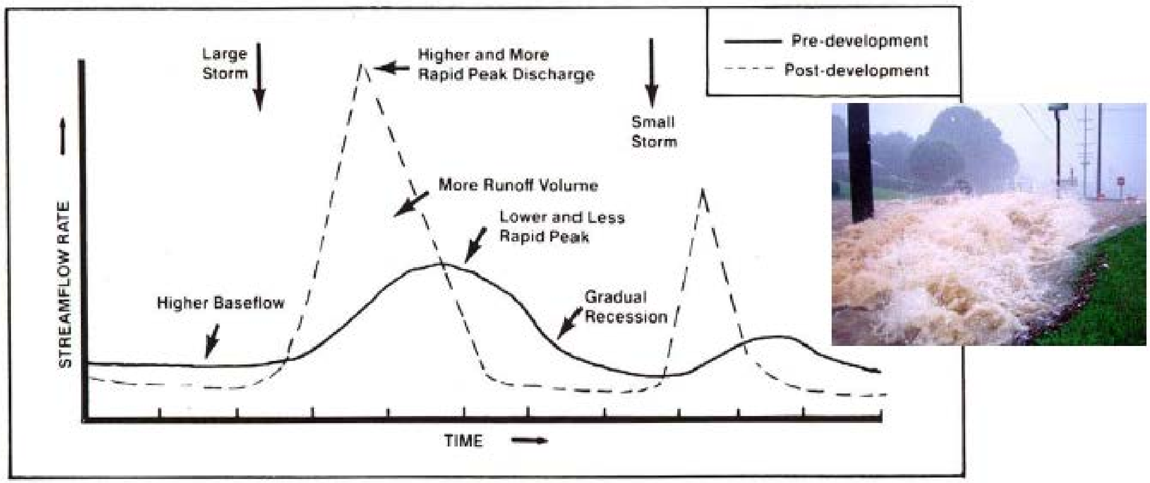


SOURCE: USEPA 2003

FIGURE 3-38 Relationship between Impervious Cover and Surface Runoff

The cumulative impacts of the LULC changes result in the natural hydrology of a site/watershed being altered, producing increased runoff volumes and peak runoff velocities. Development results in an increase in impervious surface area, a higher degree of connectivity between impervious areas, and loss of soils and vegetative cover that previously slowed or reduced runoff in the pre-developed condition. **Figure 3-39** illustrates the impacts of development on runoff volume and timing on the hydrograph of a receiving stream. Changes in watershed land cover result in greater discharge velocities, greater volumes, and shorter discharge periods. As shown in this figure, pre-development runoff velocities are lower than those on developed sites, and the discharges occur over a longer period. The pre-development peak discharge rate is also much lower than the post-development peak discharge rate due to attenuation and absorption by soils and vegetation. In addition, development shortens the time before runoff begins.

Impervious cover is the best indicator to measure the intensity of watershed development and to predict the severity of development impacts on the network of streams within a watershed. The extent of impervious cover in a watershed is closely linked to the specific land cover types that reflect the intensive LULC traditionally associated with urban growth. Typically, increases in impervious cover result in the fragmentation of natural area remnants, create interruptions in stream corridors, reflect encroachments into and expansion of developments within floodplains, and increase the density of stormwater hotspots.



SOURCE: Schueler n.d.

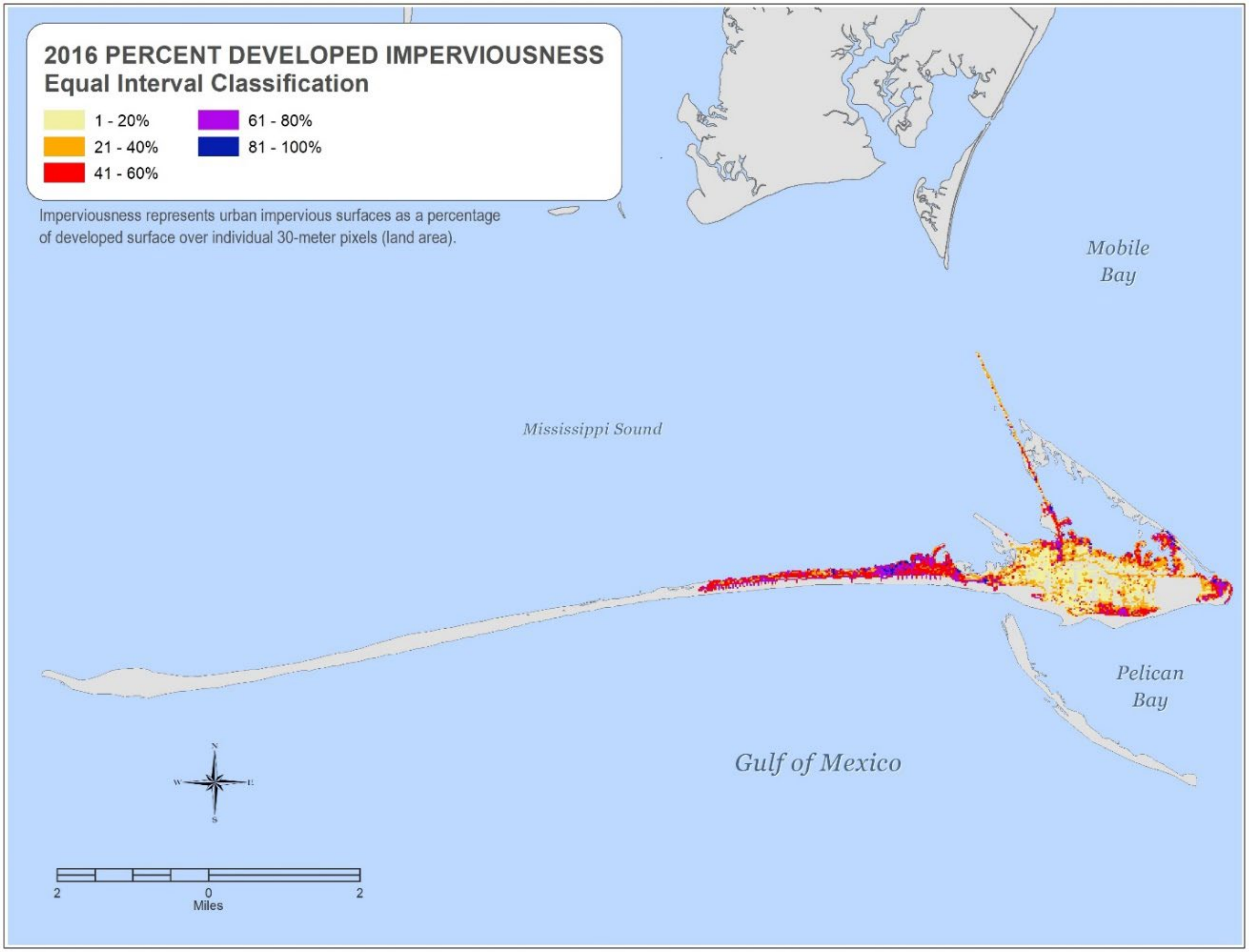
FIGURE 3-39 Comparison of Pre-Development and Post-Development Hydrographs

Current Impervious Cover on Dauphin Island

Impervious cover has unique properties that can be measured, tracked, forecasted, managed, regulated, and mitigated. The extent of impervious cover in a watershed can be accurately measured using either remote sensing or more detailed aerial photography. Impervious cover is usually reported as the percentage of impervious cover occurring within a specific area and at a specific time, which can range in size from an individual lot to an entire watershed. The NLCD 2016 and 2019 are the most current impervious cover datasets available and were used to analyze impervious surfaces on Dauphin Island. These datasets consist of 30-by-30-meter pixels, each with an assigned imperviousness value between 0 to 100, with zero representing no impervious area and 100 representing complete impervious surface coverage.

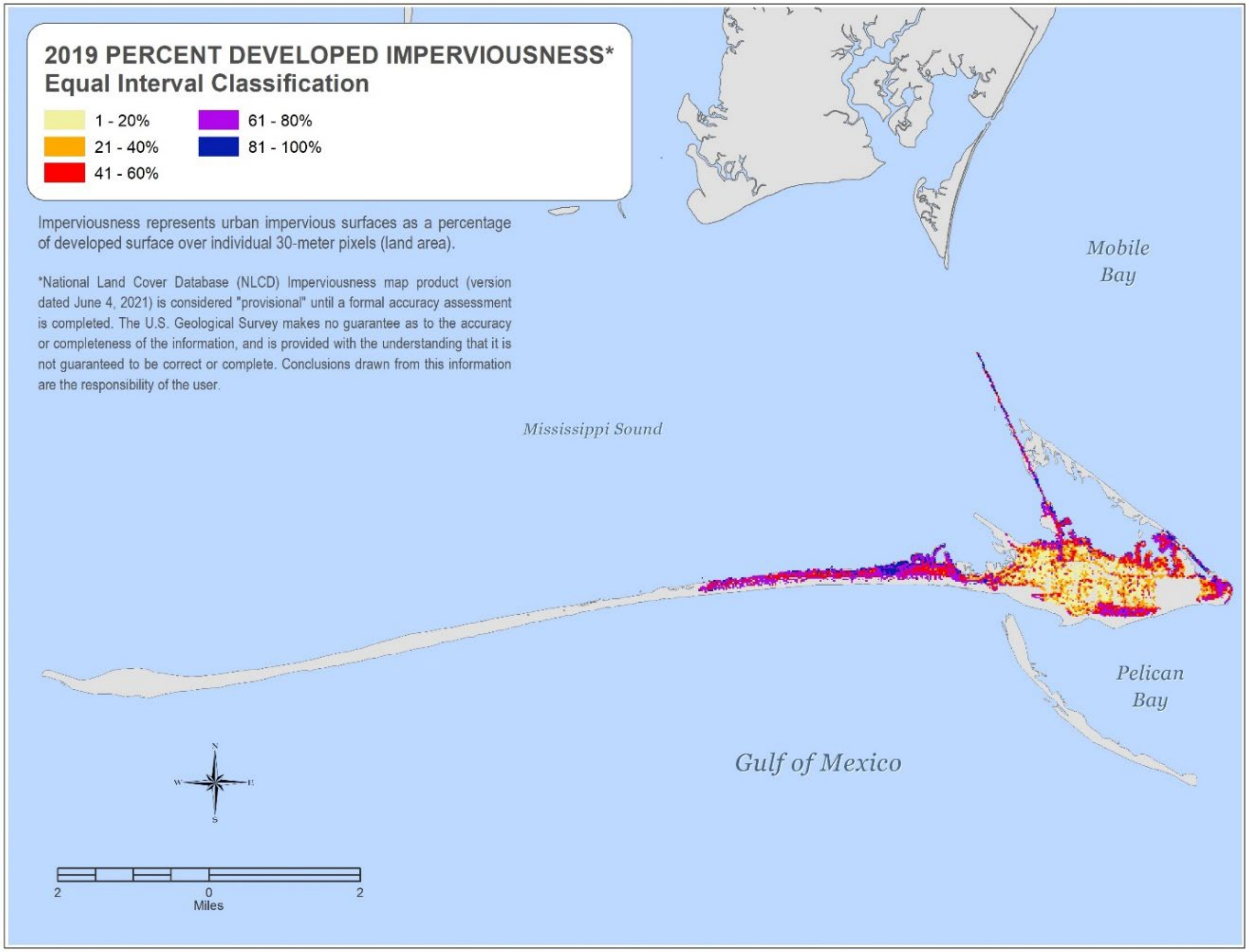
The percent developed imperviousness product contains two aerial increment measures: the impervious surface area (ISA), which calculates the fraction of impervious area in every 30-meter pixel, and the impervious effect area (IEA), which totals the number of 30-meter pixels that contain any impervious surface (>0%) (Xian et al. 2011).

Figure 3-40 and **Figure 3-41** demonstrate percent developed for 2016 and 2019, respectively and illustrate the IEA—the number of 30-meter grids—impervious surface area in 20% increments for Dauphin Island. The figures show a concentration of impervious surfaces on the West End of Dauphin Island where the percentage ranges from 41 to 100, and similar concentrations along the north and south coast of the Island (shoreline concentration).



SOURCE: NLCD

FIGURE 3-40 2016 Impervious Surface Area Dauphin Island



SOURCE: NLCD

FIGURE 3-41 2019 Impervious Surface Area of Dauphin Island

The West End of Dauphin Island has the highest percentage of impervious surfaces, as this is where the majority of the compact development is located. The areas of ISA and IEA are presented in 20% categories (1 to 20, 21 to 40, etc.) for Dauphin Island. Percentage of imperviousness did not increase dramatically from 2016 to 2019 (**Table 3-16**). This is likely due to limited availability of vacant lands and local building ordinances.

Quantitatively, impervious surface changes between 2016 and 2019 are represented in **Table 3.16** below in 20% increments as the figures, where ISA is the significant measure of actual impervious surface area. The IEA and ISA percent of total watershed are measured against the current delineated study area. All things being equal, it provides a direct proportion of areas identified as having impervious surfaces against the current extent of the Island. Also, these developed areas do not experience regular land loss or gain except during major catastrophic storms, which have not occurred between the years in question.

TABLE 3-16 Summary of IEA and ISA Factors in the Dauphin Island Watershed

IMPERVIOUS EFFECT AREA (IEA)		
	2016	2019
TOTAL WATERSHED AREA	**3,262**	**3,262**
1%–20%	434	335
21%–40%	387	300
41%–60%	399	387
61%–80%	172	391
81%–100%	35	117
IEA Area (acres)	**1,427**	**1,530**
IEA (% of total watershed)	**44%**	**47%**
IMPERVIOUS SURFACE AREA (ISA)		
	2016	**2019**
1%–20%	40	32
21%–40%	117	91
41%–60%	202	200
61%–80%	116	267
81%–100%	31	105
ISA Area (acres)	**506**	**695**
ISA (% of total watershed)	**16%**	**21%**
IEA/ISA Ratio (%)	**35%**	**45%**

From 2016 to 2019, there are an additional 103 acres with IEA with a total of 189 additional acres of impervious surfaces (ISA) with the higher increments in the range of 61% to 100% imperviousness. The increases appear contained to the currently developed areas. This may be due in part to the lack of available vacant lands and parcels, zoning and development measures, and the contained nature of the Island. As a percentage of the total study area, impervious surfaces on the Island have increased only 5%, from 16% to 21%.

CHAPTER 4 Watershed Conditions

Introduction

This section presents a narrative summary of existing conditions in the Dauphin Island Watershed from the review of available data. While Dauphin Island does not have any main tributaries, like more traditional watersheds, it does contain several unnamed tidal creeks and small water bodies including Salt Creek, Spring Bayou, Woods Bayou, Dauphin Island Bay, Colony Cove, Spanish Bay, Barcelona Bay, British Bay, Coronado Cove, Hudson Bay, Indian Bay, Aloe Bay, Graveline Bay, Lafitte Bay, Bayou Second, Quivera Bay, Pelican Cove, Pelican Bay, Gaillard Lake, and Oleander Pond (**Figure 4-1**).

SOURCE: Figure by Environmental Science Associates 2022

FIGURE 4-1 Dauphin Island Waterbodies

4.1 Water Quality Standards

The primary "regulatory drivers" governing discharges of pollutants to waterways and stormwater management within the Dauphin Island Watershed are the federal and state programs implemented pursuant to the Federal Water Pollution Control Act or Clean Water Act (CWA). These primarily include the CWA Section 303(d) Impaired Waters and TMDL program, and the Section 402 National Pollutant Discharge Elimination System (NPDES). The NPDES permitting program targets point source discharges from industrial and municipal sources (wastewater treatment plants), stormwater discharges from various industrial activities (i.e., manufacturing and construction activities), and the Municipal Separate Storm Sewer System (MS4) program. The Alabama Water Pollution Control Act (AWPCA) and Environmental Management Act provide the statutory basis for the State of Alabama to be delegated the authority to implement portions of the CWA related to water quality standards and NPDES permitting.

4.1.1 WATER-USE CLASSIFICATION AND WATER QUALITY CRITERIA

The CWA (Section 303) requires that states develop and describe water quality standards and criteria. Alabama's water quality criteria have been developed by the Alabama Department of Environmental Management (ADEM) and are based on a water use classification system for each waterbody. Use classifications and the general and specific narrative and numeric water quality criteria for each classification can be found in ADEM Admin. Code R. 335-6-10 and ADEM Admin. Code R. 335-6-11, respectively. The use classifications utilized by the State of Alabama are as follows:

- Outstanding Alabama Water (OAW)
- Public Water Supply (PWS)
- Swimming and Other Whole Body Water-Contact Sports (S)
- Shellfish Harvesting (SH)
- Fish and Wildlife (F&W)
- Limited Warmwater Fishery (LWF)
- Agricultural and Industrial Water Supply (A&I)

ADEM water use classifications for the Dauphin Island Watershed include S, F&W, and SH.

The water use classification system applies both narrative and numeric water quality criteria appropriate for the particular uses based on existing utilization, uses reasonably expected in the future, and those uses not now possible because of correctable pollution which could occur if the effects of pollution were controlled or eliminated. The water quality criteria are primarily used for assessment purposes (CWA Section 305[b]), setting water quality targets for impaired waters (TMDL program), and the permitting and regulation of discharges of pollutants to waters of the State of Alabama. However, they also provide an indication of expected ambient water quality conditions. Of necessity, the assignment of use classifications must take into consideration the physical capability of waters to meet certain uses. It should also be noted that under certain natural conditions or phenomena values may range outside the criteria for the parameters of pH, dissolved oxygen, and turbidity and not be considered a contravention of the standard (ADEM Administrative Code R. 335-6-10-.05[4]). In some instances, a waterbody may be assigned multiple classifications (e.g., S/F&W). A number of waterbodies throughout the State are specifically named in the ADEM regulations, and those not named are assigned the classification of F&W.

There are four waterbodies identified by ADEM that surround Dauphin Island (**Table 4-1**) and receive point and nonpoint source discharges from the Island. The primary numeric water quality criteria for the three water use classifications applicable to the Dauphin Island Watershed are provided in **Table 4-2.**

TABLE 4-1 Growth and Preservation Strategies

Waterbody	Classification
Mobile Bay	SH/F&W
Mississippi Sound	SH/S/F&W
Gulf of Mexico	SH/S/F&W
Pelican Bay	SH/S/F&W

NOTES: SH = Shellfish Harvesting; F&W = Fish and Wildlife; S = Swimming and Other Whole Body Water-Contact Sports.

TABLE 4-2 ADEM specific water quality criteria for relevant water used designated used classifications

Parameter	Water Use Designation: Shellfish Harvesting (SH)[5]	Swimming and Other Whole Body Water-Contact Sports (S)	Fish and Wildlife (F&W)
pH (s.u.)		6.0–8.5 (fresh)	
	6.5–8.5 (salt)		
Water Temperature (°F)	<90		
Dissolved Oxygen (mg/L)[1]	≥5.0		
Bacteria (colonies/100mL)[2]	126/235 E.coli		548/2,507 E.coli
			126/298 E.coli[3]
	35/104 entercocci		275 entercocci
			35/158 enterococci[3]
Turbidity (NTU)[4]	<50		

NOTES:
1 Dissolved oxygen shall be measured at a depth of 5 feet in waters 10 feet or greater in depth; and for those water less than 10 feet in depth, dissolved oxygen criteria will be applied at mid-depth. In estuaries and tidal tributaries, values may be less than 5.5mg/l in dystrophic waters due to natural phenomenon.
2 Bacteria criteria are shows as the geometric mean followed by single day maximum. E.coli is the designated metric for non-coastal waters and Enterococci for coastal waters.
3 Incidental water contact and whole body water-contact recreation during the months of May through October
4 Turbidity levels shall not exceed 50 NTU above background conditions
5 Not to exceed the limits specified in the National Shellfish Sanitation Program (NSSP) Guide for the Control of Molluscan Shellfish: 2015 Revision, published by the Food and Drug Administration, U.S. Department of Health and Human Services.

SOURCE: ADEM Administrative Code R. 335-6-10, February 3, 2017

4.1.2 CWA SECTION 303(D) IMPAIRED WATERS AND TMDL PROGRAM

Section 303(d) of the CWA requires that states develop lists of “impaired waters,” those waters that do not meet state water quality standards for their designated uses. These listings must be approved by the U.S. Environmental Protection Agency (EPA) and are published biannually. The CWA also requires that states establish priority rankings for waters on the 303(d) lists and develop a Total Maximum Daily Load (TMDL) for these waters. A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards. The TMDL calculates the maximum amount of a pollutant allowed to enter a waterbody (i.e., also known as the loading capacity) so that the waterbody will meet and continue to meet water quality standards for that particular pollutant. The TMDL then allocates the pollutant load to point sources (Wasteload Allocation or WLA) and nonpoint sources (Load Allocation or LA), which include both anthropogenic and natural background sources of the pollutant. Once a waterbody is placed on the 303(d) list, it can only be removed when the TMDL is completed or if new information indicates that water quality criteria are being met. At this time there are no federal or State-approved TMDLs within the Dauphin Island Watershed or surrounding receiving waters.

In the Dauphin Island Watershed, Pelican Bay was included on the 303(d) list as a low priority in 1998 and 2018. In addition, the surrounding receiving waters from Dauphin Island (i.e., Mississippi Sound, Mobile Bay, and the Gulf of Mexico) were each listed on the Draft 2022 303(d) list as a low priority. **Table 4-3** provides an overview.

TABLE 4-3 ADEM 2022 Draft 303(d) Listed Waterbodies in the Dauphin Island Watershed and Surrounding Receiving Waters

Waterbody	Parameter of Concern	Year Listed	Downstream/ Upstream Locations	Causes
Mobile Bay	Pathogens (Enterococcus)	1998	Mobile Bay south of a line extending east from East Fowl River to lighted beacon FL2 and then to lighted beacon FLG 4 and then northeast to Daphne, except out 1000 feet offshore from Mullet Point to Ragged Point	Urban runoff/storm sewers
Pelican Bay	Metals (Mercury)	1998	out to 1000 feet offshore from Dauphin Beach / out to 1000 feet offshore of Pelican Point	Atmospheric deposition
Pelican Bay	Pathogens (Enterococcus)	2018	out to 1000 feet offshore from Dauphin Beach / out to 1000 feet offshore of Pelican Point	Unknown source
Mississippi Sound	Metals (Thallium)	2010	Segment classified for shellfish harvesting	Industrial
Mississippi Sound	Pathogens (Enterococcus)	1998	Segment classified for shellfish harvesting	Urban runoff/storm sewers
Gulf of Mexico	Metals (Mercury)	1998	Mississippi / Florida	Atmospheric deposition

SOURCE: ADEM 2022

4.1.3 CWA SECTION 402 NPDES PERMITTING PROGRAM

Section 402 of the CWA sets forth the national permitting program for discharges of pollutants to waters of the United States. ADEM is authorized to implement the NPDES permitting program within Alabama. Facilities discharging pollutants are divided into a number of categories based on the type and/or size of the facility (e.g., major industrial, major municipal, minor industrial) and level of treatment required. Discharge limitations are generally similar within the classifications but may vary where the water quality of the waterbody receiving the discharge is a limiting factor. The larger facilities, such as sewage treatment plants and heavy industrial facilities, usually are authorized to discharge under an “Individual” NPDES permit. Smaller facilities of a similar nature (e.g., concrete plants, construction sites) are usually grouped under a “General Permit” developed to cover the specific industrial sector.

There are four NPDES permittees on Dauphin Island, with the most prominent being the Dauphin Island Water and Sewer Authority, NPDES Permit No. AL0075370. The subject permit regulates the discharge of treated effluent from the water treatment plant to the Mississippi Sound, classified as Swimming, Shellfish Harvesting, and Fish & Wildlife designated uses.

4.1.4 NPDES MS4 PROGRAM

Stormwater runoff in urbanized areas is also subject to NPDES permitting regulations pursuant to the MS4 program (40 CFR 122.32). Large municipalities and certain other MS4 operators (e.g., departments of transportation, universities) must obtain NPDES permit coverage and develop a stormwater management program. Currently the MS4 program is in Phase II, which began in 1999, and requires that cities or certain urban areas and counties with populations of 50,000 or more obtain NPDES permit coverage for their stormwater discharges. Each regulated MS4 is required to develop and implement a local stormwater management program to reduce the contamination of stormwater runoff and prohibit illicit discharges.

Due to its small size and population, Dauphin Island does not have a MS4 system. Like many small communities in coastal Alabama, a comprehensive stormwater management system was not created when the Town was platted and developed. The Town's drainage system is primarily made up of small open ditches and culverts that do not have the capacity to handle large rainfall events on the Island, which results in frequent flooding (**Figure 4-2**).

SOURCE: Photo by Environmental Science Associates 2022

FIGURE 4-2 Flooding North of Bienville Blvd. Observed During Rain Event on Feb. 17, 2021.

4.2 Potential Sources of Pollutants

In general, Dauphin Island is not a densely urbanized area, but it does include residential and commercial land uses with approximately 34% of the Island classified as "urban," as well as more intense land use areas like the Dauphin Island Sea Lab complex, Coast Guard Station, and ferry landing. Potential pollutant sources include a combination of point and nonpoint source dischargers. The major point source discharge is the Dauphin Island Water and Sewer Authority wastewater treatment plant (WWTP). Nonpoint source pollution on the Island is mainly from stormwater runoff.

4.2.1 REGULATED WASTE GENERATORS

Sites or facilities that generate regulated waste materials (e.g., hazardous chemicals, used oil) are potential sources of surface water or groundwater contamination due to leaks, spills, or improper disposal methods. A review of the EPA ECHO (2020) data indicates that there are nine registered generators of regulated waste in the Watershed, including the Dauphin Island Water and Sewer Authority WWTP and the U.S. Coast Guard Station. Four of the nine facilities have NPDES permits, and three of the nine facilities have had violations reported within the past three years. However, no facilities had significant violations or formal enforcement actions reported within the past five years (EPA ECHO 2020).

4.2.2 NONPOINT SOURCES

Other sources of pollution not originating from a discrete discharge location are generally lumped into the category of nonpoint sources (NPSs) and are generally not regulated under State or federal water pollution control acts. These NPSs of pollution can convey natural and anthropogenic pollutants into waterbodies. Nonpoint source pollution generally comes from runoff from overland flow, atmospheric deposition, and other diffuse sources. Many pollutants are grouped into the general term "gross pollutant," which is used to describe trash and organic debris like decaying branches, leaves, vegetation, and grass clippings. Gross pollutants are commonly observed throughout the Watershed. Gross pollutants can block drainage systems, resulting in decreased flows and localized flooding.

4.2.3 ON-SITE SEWAGE DISPOSAL SYSTEMS

On-Site Sewage Disposal Systems (septic tanks) can be a source of pollution when they fail to function properly due to improper siting, lack of maintenance, or failure of the disposal system (field lines). In areas where there is no centralized sanitary sewer collection service, septic tanks are the primary option for treatment and disposal of sewage. A permit from the Alabama Department of Public Health (ADPH) is required to install a septic tank.

Historically, most of Dauphin Island relied on septic tanks for wastewater disposal (Jordan, Jones, and Goulding, Inc. 1980). Many septic tanks and associated drainfields were located above ground due to the elevated water table and were susceptible to damage from major storm events. In subsequent years, a moratorium was placed for new septic tank construction (1976), and an additional regulation was developed related to septic tank repair for continued use (1979). In the early 1980s, Dauphin Island passed the first Well Head Protection Plan (to develop and utilize a shallow well aquifer system) in the State. All septic systems were banned, existing systems were eliminated and collapsed and buried in place, and all homes were placed on sanitary sewer. In 1982, Dauphin Island received a $9 million grant from the federal government for the construction of a municipal sewer plant to serve the West End of the Island (Gaul 2019). Currently, no septic tanks are used on the Island.

4.3 Water Quality

Characterization of current water quality can be broken down into general classes of water quality parameters. The cumulative assessment of these parameters can be used to determine the overall water quality of a particular water body with regard to its designated uses. Water quality in the Dauphin Island Watershed is characterized in the following sections with regard to the various classes of water quality parameters where ambient data are available (i.e., pathogens). The water quality parameters listed below are measures and/or indicators of different characteristics of the waterbody.

- **Physicochemical parameters** – These are measures of the general physical and chemical properties of a water body related to water column mixing and density stratification, in estuaries, including:
  - Temperature
  - Salinity
- **Geochemical parameters** – These are measures of geological inputs into a water body that affect water clarity and sedimentation, including:
  - Total suspended solids
  - Turbidity
  - Specific conductance
  - pH
- **Trophic parameters** – These are measures of primary production and levels of nutrients that can influence primary production, such as:
  - Chlorophyll-a
  - Dissolved oxygen
  - Nitrogen – both total and inorganic
  - Phosphorus – both total and inorganic
- **Pathogens** – These are bacterial constituents used as indicators of more noxious human pathogens associated with animal waste products (e.g., viruses, disease-causing bacteria), including:
  - Fecal coliform
  - *E. coli*
  - *Enterococci*

- **Contaminants** – These are chemical constituents potentially toxic to aquatic organisms and humans, including:
  - Heavy metals
  - Organics

Determination of water quality conditions was based on the following data sources:

- ADEM – Programmatic ambient monitoring and assessment data
- Pathogen data collection in the Dauphin Island Watershed during the period 2006–2021
- Ambient surface water monitoring
- Environmental Monitoring and Assessment Program (EMAP) – A discontinued program within EPA that collected data to monitor and assess status and trends of national ecological resources (1990–2006).
- National Aquatic Resource Survey – Current EPA monitoring program to monitor and assess national ecological resources (2006–ongoing).

Table 4-4 provides a summary of the surface water quality data available from the National Water Quality Monitoring Council, which provides data warehousing for state, federal, and local agencies including the U.S. Geological Survey (USGS), EPA, and the State of Alabama. In addition, more recent data available from ADEM's Beaches Environmental Assessment and Coastal Health (BEACH) Monitoring Program was retrieved from the ADEM website (http://adem.alabama.gov/programs/coastal/beachMonitoring.cnt).

All ambient surface water monitoring stations are located in the estuary and/or open waters (Gulf) adjacent to Dauphin Island. There are no monitoring sites within the confines of the land-ward extent of the Watershed. Long-term monitoring is available at limited stations and predominantly associated with bacterial monitoring for beach access. Water quality monitoring data directly associated with *Deepwater Horizon* oil spill response were removed from the evaluation and interpretation. Data collected as part of volunteer monitoring organizations, such as Mobile Baykeeper and Alabama Water Watch, were also reviewed to assist in describing existing water quality conditions in the Dauphin Island Watershed. Overall, minimal water quality data are available to characterize water quality conditions within the Watershed.

TABLE 4-4 Summary of Data Collection Adjacent to Dauphin Island as Available from the National Water Quality Monitoring Council Website

Sampling Entity	Site ID	Monitoring Type	First Sampling Date	Last Sampling Date
ADEM	CHANNEL-3	Estuary	3/21/2017	10/15/2020
EPA	Dauphin Island Bay	Estuary	7/18/2006	7/18/2006
ADEM/ADPH	DI_EAST	BEACH Program/Gulf	1/10/2006	9/13/2021*
ADEM/ADPH	DI_PIER	BEACH Program/Gulf	2/6/2006	9/13/2021*
ADEM	GMEX-2	Estuary	4/20/2004	10/18/2004
ADEM	MB-1	Estuary	3/19/1991	5/4/1993
ADEM	MB-1A	Estuary	4/20/2004	10/29/2019
EMAP	Mississippi Sound	Estuary	7/5/2000	7/18/2006
EMAP	Mobile Bay	Estuary	7/17/2000	7/24/2006

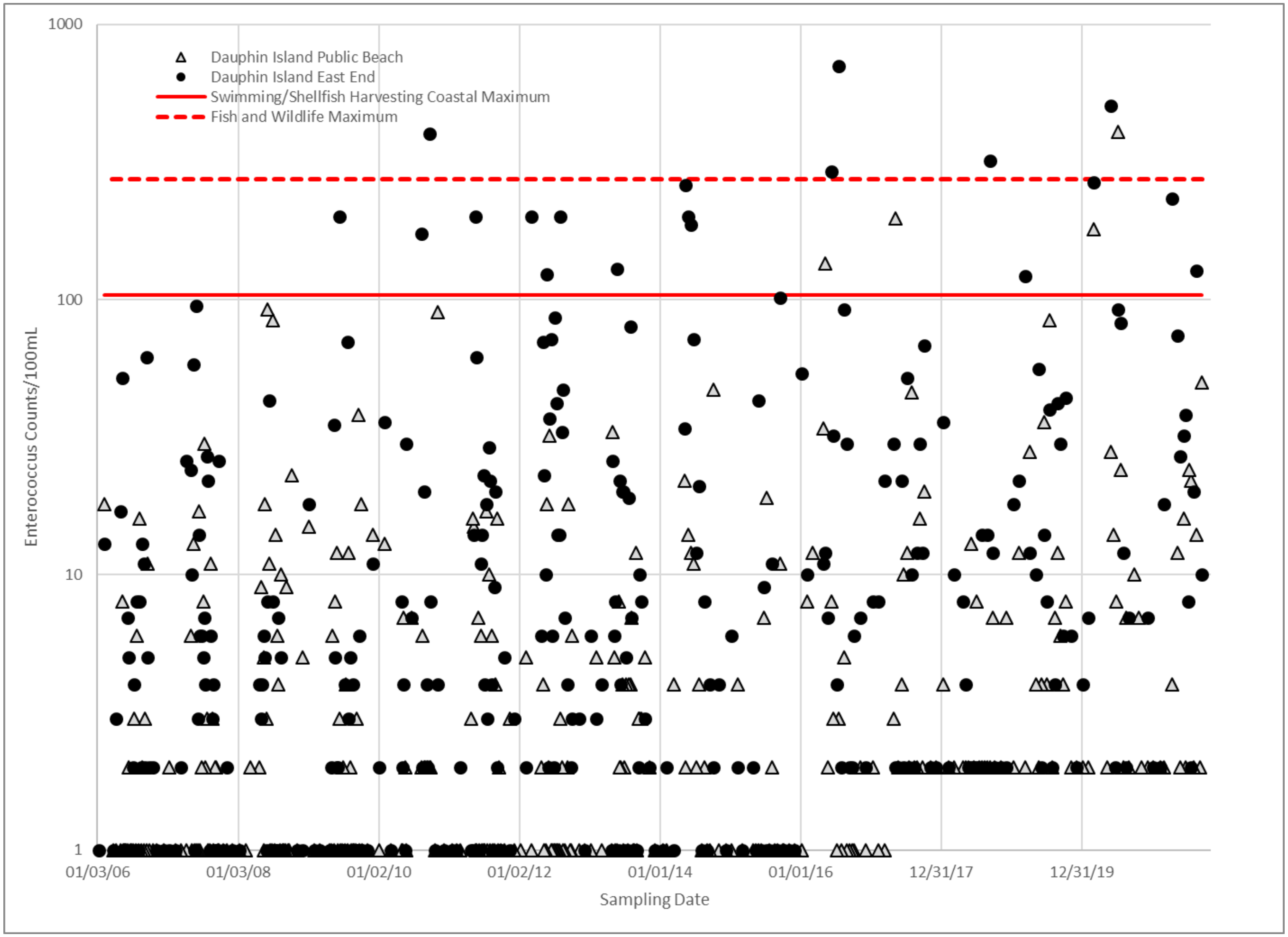
NOTE:
* supplemented by ADEM online data

4.3.1 PATHOGENS

Bacterial concentrations are used as indicators of the presence of fecal material in drinking and recreational waters, specifically *Escherichia coli* (*E. coli*) and *Enterococcus* sp. (common name, plural – *Enterococci*). Measured concentrations of either indicate the possible presence of other disease-causing bacteria, viruses, and protozoans. Such pathogens may pose health risks to people fishing and swimming in a waterbody. Sources of bacteria include improperly functioning wastewater treatment plants, leaking septic systems, storm water runoff, decaying animal remains, and runoff from animal manure and manure storage areas.

On October 10, 2000, the Beaches Environmental Assessment and Coastal Health Act (BEACH Act) was signed into law, amending the CWA. The BEACH Act require EPA to develop performance criteria for testing, monitoring, and notifying public users of possible coastal recreation water problems. In an effort to routinely monitor coastal bacterial concentrations, ADEM and ADPH implement a coastal beach monitoring program in response to the 2000 BEACH Act. There are two long-term bacterial monitoring sites in the Dauphin Island Watershed at the public beach and East End beach. If pathogens are present in waterbodies, they can cause adverse conditions such as cloudy water, unpleasant odors, and decreased levels of dissolved oxygen. *Enterococci* levels should be measured in marine and fresh waters, while *E. coli* should only be measured in fresh waters.

The bacterial surface water quality criteria are dependent on the respective designated use of the waterbody (see **Tables 4-1 and 4-2**). Instances in which enterococci values are above the whole body water contact standard (104 MPN/100mL) are denoted as having an elevated risk associated with swimming and a public health advisory is issued if elevated values persist. **Figure 4-3** displays *Enterococci* concentrations at the two BEACH monitoring stations during the period of record (2005–2020) compared to the regulatory criteria. Both BEACH monitoring sites have reported elevated *Enterococci* concentrations resulting in a potential health risk to the public; however, the East End monitoring location reports more frequent exceedances. It is important to note that the BEACH Monitoring Program provides data which are "biased" toward events which may result in a public health advisory as supplemental monitoring events are performed as a protective measure to adequately document elevated or recovered bacteria levels. In addition, chronic elevated bacterial concentrations can result in the closure of shellfish harvesting areas for the protection of human health. It is important to note that the BEACH monitoring sites have been reported above the criteria established for the protection of "Fish and Wildlife."



SOURCE: Figure by Environmental Science Associates 2022

NOTE: y-axis values are displayed on a Log_{10} scale.

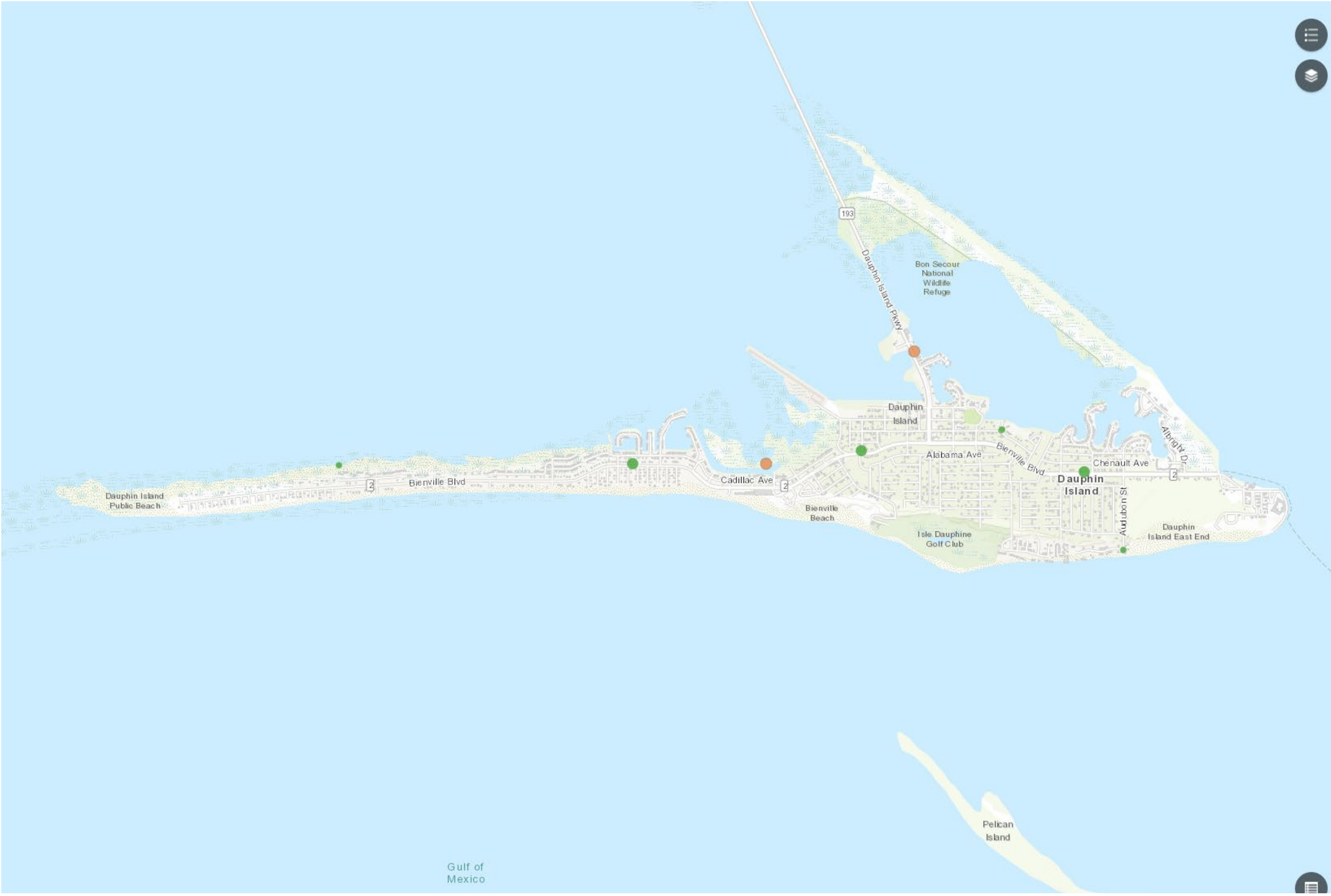
FIGURE 4-3 Public Beach and East End Beach *Enterococci* Concentrations in the Dauphin Island Watershed Over the Period of Record.

Sanitary sewer overflows (SSOs) have been documented and primarily occur during large rain events. This is a common problem among older urban sanitary sewer systems. It occurs during intense rain events that infiltrate and overtax the compromised sanitary sewer system, allowing sewage to escape the sanitary system to become a direct pollution source for creeks, bays, and the Gulf of Mexico. This process is referred to as “Infiltration and Inflow” or I & I. Infiltration and Inflow occurs when stormwater runoff and/or groundwater enter the sanitary sewer system through cracked pipes; leaky manholes; or improperly connected storm drains, down spouts, and sump pumps. The stormwater and groundwater combine with raw sewage, exceeding the design capacity of the sanitary sewer system, and cause SSOs. SSOs can increase pollutant loads, including oxygen-demanding substances, nutrients, and pathogens to surface waters. **Table 4-5** and **Figure 4-4** document Dauphin Island Watershed SSOs reported by the Mobile County Health Department in 2021.

TABLE 4-5 Sanitary Sewer Overflows on Dauphin Island

Date	Site(s)	Cause	Amount of spill (gallons)	Location Discharged to
4/5/2018	Dauphin Island WWTP	Faulty Breaker	2,000	Did not reach waters
9/2/2018	1601 Bienville	Grease	1,312	Did not reach waters
4/9/2021	300 Hubert Street.	Heavy rains	485	Dauphin Island Bay
4/14/2021	Hubert St. @ Cadillac Ave	Heavy rains	248	Dauphin Island Bay
4/14/2021	1200–1300 blocks of Bienville Blvd.	Heavy rains	1,780	Graveline Bay
4/15/2021	702 Bienville Blvd.	Heavy rains	4,620	Ground absorbed
5/12/2021	2600 block of Bridgeview Drive	Heavy rains and power failure	250	Mississippi Sound
6/29/2021	305 Audubon Place	Broken lateral on private property	625	Gulf of Mexico

SOURCE: Mobile Baykeeper 2021



SOURCE: Mobile Baykeeper 2021

NOTE: Pink dots are from 2018, Green dots from 2021.

FIGURE 4-4 Sanitary Sewer Overflows on Dauphin Island

4.3.2 CONTAMINANTS - HEAVY METALS (MERCURY)

Mercury (Hg) can occur both naturally in the environment (e.g., cinnabar) and from various anthropogenic sources (e.g., industrial processes, waste incineration, coal burning, aerial deposition). Once vaporized, Hg may persist in the atmosphere for days and up to a year (depending on species) and can be transported for great distances. Mercury persists in the environment and under certain conditions will transform to methylmercury, which is the form that is readily taken up by organisms and bio-accumulates. The natural water quality conditions present in coastal streams, primarily the amount of dissolved organic matter, higher temperature, low pH and, to a lesser degree, fluctuations in salinity (chlorides) and low dissolved oxygen, are thought to be particularly conducive to the methylation process. Bays and estuaries are thought to be “sinks” or “traps” for Hg and most coastal streams in the United States have Hg-related fish consumption advisories, as does the Gulf of Mexico, for long-lived top predator species.

The presence of Hg and other pollutants in fish tissues at certain levels triggers the issuance of a consumption advisory by the Alabama Department of Public Health (ADPH) and subsequent inclusion on the 303(d) list. These advisories are intended to provide information and guidance on the consumption of fish and shellfish to the public. The advisories apply mainly to “at-risk” groups, such as babies, children under the age of 14, and women who are nursing or pregnant or who plan on becoming pregnant.

Fish samples are routinely collected and analyzed by ADEM, and the results, along with information on the type and size of fish and sampling locations, are provided to the ADPH. Based on this information, ADPH may issue a consumption advisory for fishes caught from all or portions of a waterway. These advisories can include: “no consumption,” “one meal per week,” “one meal per month,” or “no restriction” and may relate to one or more species of fishes. A meal is considered one eight-ounce serving. Once issued, these advisories remain in effect until rescinded by ADPH.

The 2021 ADPH advisory lists the entire Gulf Coast, including the coastal areas of Mobile and Baldwin counties, for king mackerel. There are no restrictions for this species if under 39 inches in length, but king mackerel over 39 inches have a “Do Not Eat Any” advisory (ADPH 2021).

To learn more about fish consumption advisories, visit the Food and Drug Administration’s website (http://www.fda.gov/Food/ResourcesForYou/Consumers/ucm110591.htm) or the EPA website (www.epa.gov/ost/fish).

4.4 Habitat Conditions

Natural processes and human land use and development continue to shape and alter the environment of Dauphin Island. Highly vulnerable habitats on the Island include beaches and dunes, maritime forest, coastal scrub, and palustrine wetlands (ADCNR 2015).

4.4.1 BEACH AND DUNE

The Gulf-fronting east Dauphin Island shoreline has changed continuously in response to tropical cyclones and longshore drift since the first map was drawn in 1717 (Jones and Patterson 2006). Over the last 75 years, the Gulf shorelines along the Island have eroded continuously with rates ranging from 1.5 to 4 meters (5 to 13 feet) per year (Smith et al. 2018). The north side of the Island on Mississippi Sound also receded over the same period, so the width of the Island has decreased during the last 75 years.

Storm waters frequently overwash the western three-fourths of the Island because its elevations generally are less than 1.5 meters (4.9 feet) above sea level. The portion of Dauphin Island about 3.5 miles west of its eastern tip has been breached by hurricane and storm waters several times in recorded history. Maps and aerial photographs indicate breaches in this area separated the Island into two halves between 1909 and 1917 and in September 1948 (Smith 1984). Temporary breaches were experienced with hurricanes Frederic and Elena in 1979 and 1985, respectively (Stout et al. 1998). Most recently, Katrina Cut opened due to hurricanes Ivan (2004) and Katrina (2005). The Island is extremely sensitive to the effects of storms and hurricane events, and storm-induced, large-scale changes will likely continue as natural processes shape the Island in ways that are counter to existing human-maintained settings (Froede 2006).

The eastern end of Dauphin Island has high elevations associated with modern active sand dunes that were supplied by sand from the shoals of Pelican and Sand Islands. The high and wide Island core anchoring the eastern quarter of the Island has maintained a relatively stable position through recent time (Morton 2007). The western three-fourths of the Island is a low, narrow spit of recent sand deposits (Otvos 1979) with few natural dunes. Recent tropical storms caused significant changes in most of these dune systems. Many roadside berms and low dunes south of Bienville Boulevard were leveled with sand relocated to the north side of the Island. Subsequent sand removal operations have reestablished most of the roadside berms, but these areas lack vegetative cover and are susceptible to future erosion.

The Town of Dauphin Island has developed a Dune Protection Overlay District for the central and eastern portions of the Island's main dune system and enacted policies to ensure maintenance of dune functional values in protecting public and private infrastructures and the public investment in beaches and dunes. The Town is currently developing policies and procedures to address management and protection of sand deposits that occur from approximately Pirates Cove Street to the west end of Bienville Blvd. Also under consideration are policies concerning construction of bulkheads and seawalls on the Gulf-fronting side of the Island; these policies would address unintended consequences of installation of bulkheads along the Gulf shoreline, where bulkheads have caused severe erosion affecting adjoining properties. The Island's West End is susceptible to post-storm recovery activities, such as clearing of the Town's rights of way (ROWs), in addition to ongoing development.

4.4.2 MARITIME FOREST

Problems affecting Alabama maritime forest and coastal scrub habitats include their loss and fragmentation due to development, including clearing for roads and utilities (ADCNR 2015). Virtually all of Alabama's remaining maritime forest and coastal scrub habitats are highly fragmented. Most have been either lost to coastal development or interspersed with houses as on Dauphin Island. The lee side of the dune system and its maritime forest has relatively greater physical stability compared to the beachfront, and in recent years urban development has been intense in the Town core.

Bailey (2013) suggested that fire suppression and livestock exclusion over many decades in the Audubon Bird Sanctuary property has allowed the conversion of formerly sparse and open understory of the native maritime forest to a dense growth of yaupon (*Ilex vomitoria*), wax myrtle (*Morella cerifera*), southern magnolia (*Magnolia grandiflora*), various vines (especially *Smilax*), and other woody species. An August 2011 wildfire near the Island's campground burned over 80 acres in the bird sanctuary, opening up portions of the understory and allowing rapid colonization of loblolly pine (*Pinus taeda*), which now forms a nearly monotypic stand of dense trees. The former herbaceous groundcover, including saw palmetto (*Serenoa repens)* and a variety of grasses, has been greatly reduced in the unburned portion of the Sanctuary.

4.4.3 WETLANDS

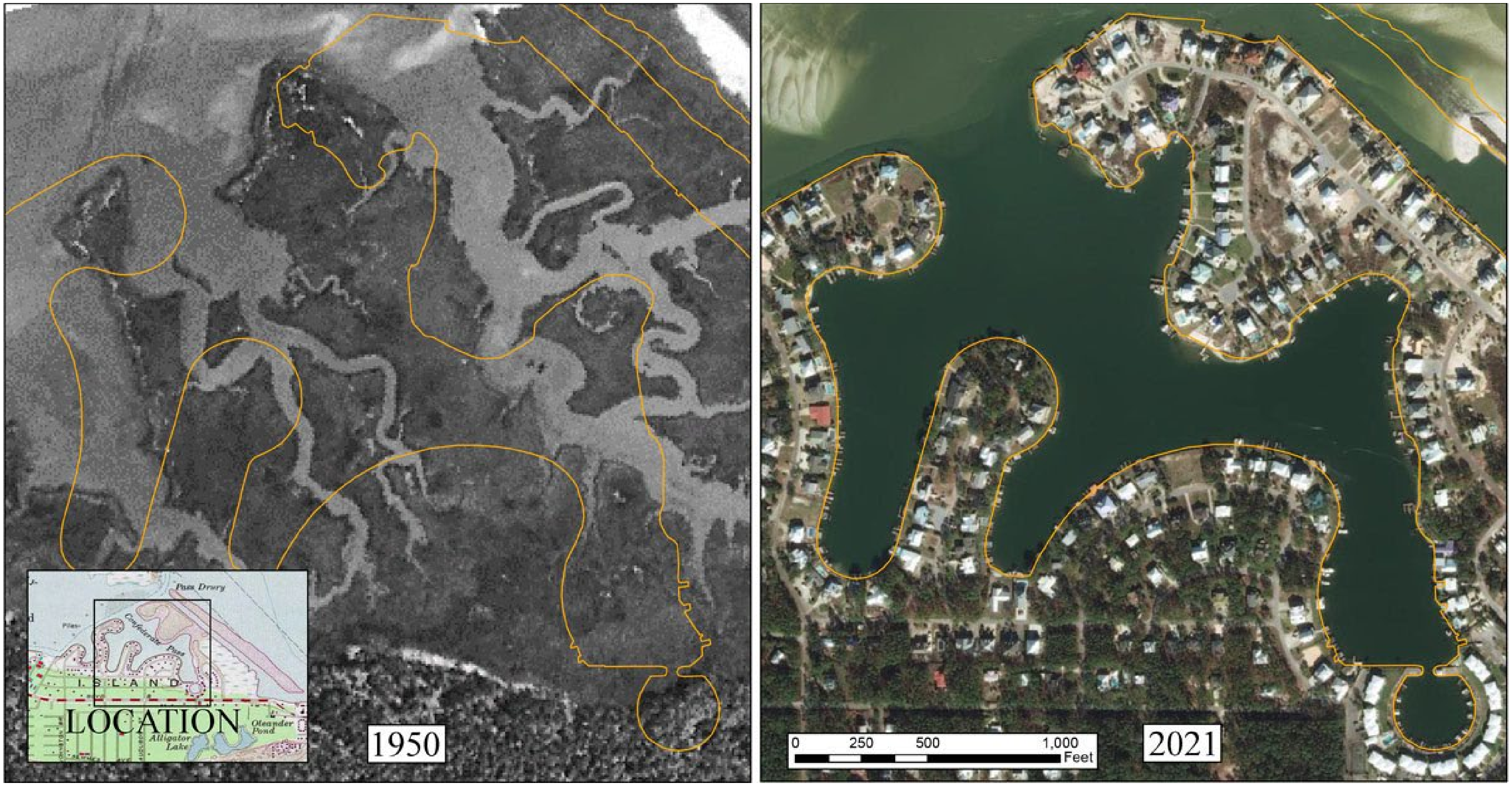
Dauphin Island wetlands are predominantly of three types: palustrine forested depressions, wet pinewoods, and tidally influenced estuarine marshes. All wetlands on the Island are classified as "coastal" wetlands, and all applications for wetland fill must be approved by ADEM before the U.S. Army Corps of Engineers (USACE) can issue a Section 404 (fill) permit.

Tidal wetlands (emergent marsh) have enhanced regulatory protection under the Alabama Coastal Area Management Plan (ACAMP) administered by ADEM. Filling or excavating tidal marshes is prohibited for residential or commercial developments and generally will only be authorized for projects that are water-dependent, such as marinas and harbor developments, or are uses of regional benefit, such as public roads.

Prior to the ACAMP, human modification eliminated large areas of the Island's tidal marsh habitat. Between 1952 and 1960, a large marsh platform wedged between the back-barrier regions of Little Dauphin Island and the area of Graveline Bay was exhumed and filled for development of residential communities and boat access (Smith et al. 2018). Large areas of open water and tidal marsh were also filled in the 1950s at Confederate Pass in southern Dauphin Island Bay (**Figure 4-5**).

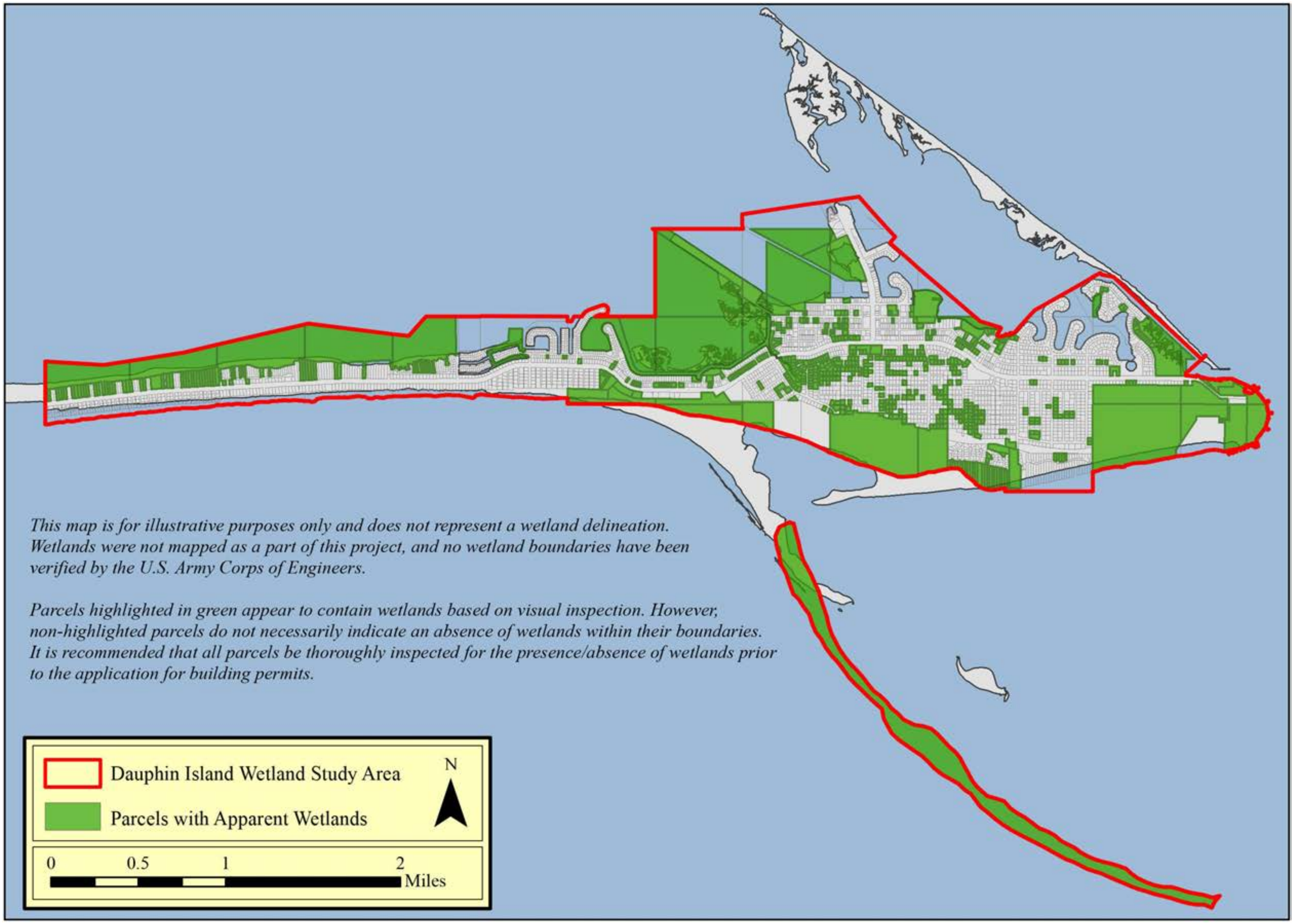
Palustrine wetland systems have come under the most pressure from modern development on Dauphin Island. Stout and Lelong (1981) and USGS (2017) identified areas of forested wetlands in the Town core, but the overall distribution has not been systematically mapped. Barry A. Vittor & Associates, Inc. (2021) recently identified locations of potential wetlands on the Island, based on visual observations of individual lots from public ROWs. Visual cues for identifying wetlands involved primarily plant community composition, ponding, and other evidence of wetland hydrology. The analysis found that forested wetlands are more extensive than previously mapped, with many locations in the urban core observed to have potential wetlands (**Figure 4-6**). A total of 630 Island parcels appear to contain wetlands, including tidal and non-tidal wetlands. This large number of parcels and the significant ecosystem functions of Dauphin Island's wetlands (e.g., flood water storage, groundwater re-charge, wildlife habitat) underscore the importance of future protection.

Tidal marshes are generally classified as high-quality wetlands throughout the Alabama coastal zone. From a regulatory standpoint, the Town classifies all Island wetlands as high quality. In terms of the important ecosystem services provided by the Island's non-tidal wetlands, forested depressions such as gum ponds and swamps are critical locations for stormwater attenuation and groundwater recharge, and are a high priority for preservation. The Town is in the process of updating its 2004 Wetland Ordinance to address ongoing loss of wetlands through filling for development.



SOURCE: Barry A. Vittor & Associates, Inc. 2021

FIGURE 4-5 Aerial Imagery Comparing the Pre-Development Condition of a Tidal Marsh Complex (1950) with the Present Day Developed Shoreline (2021) at Confederate Pass

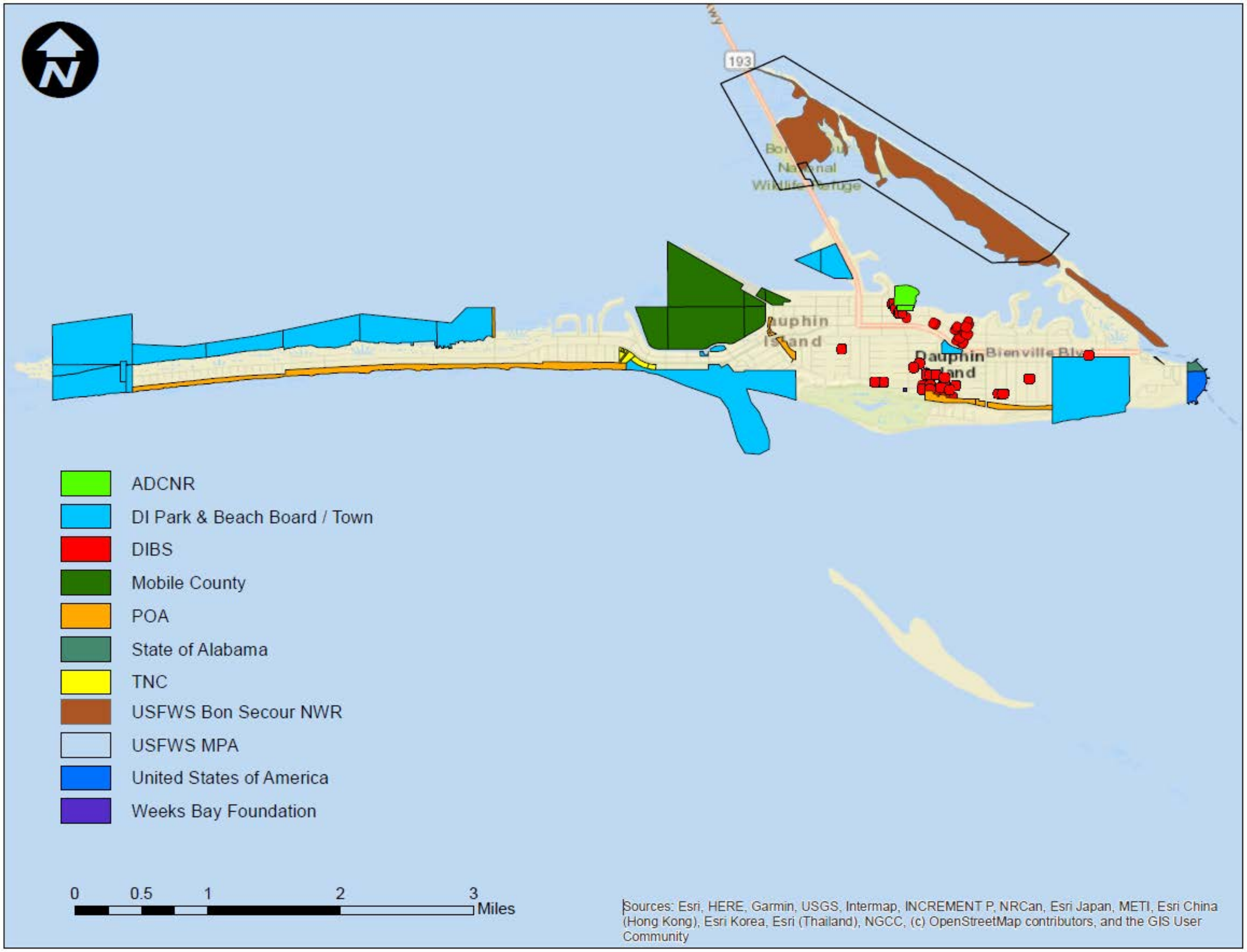


SOURCE: Barry A. Vittor & Associates, Inc. 2021

FIGURE 4-6 Dauphin Island Parcels with Documented or Potential Wetlands

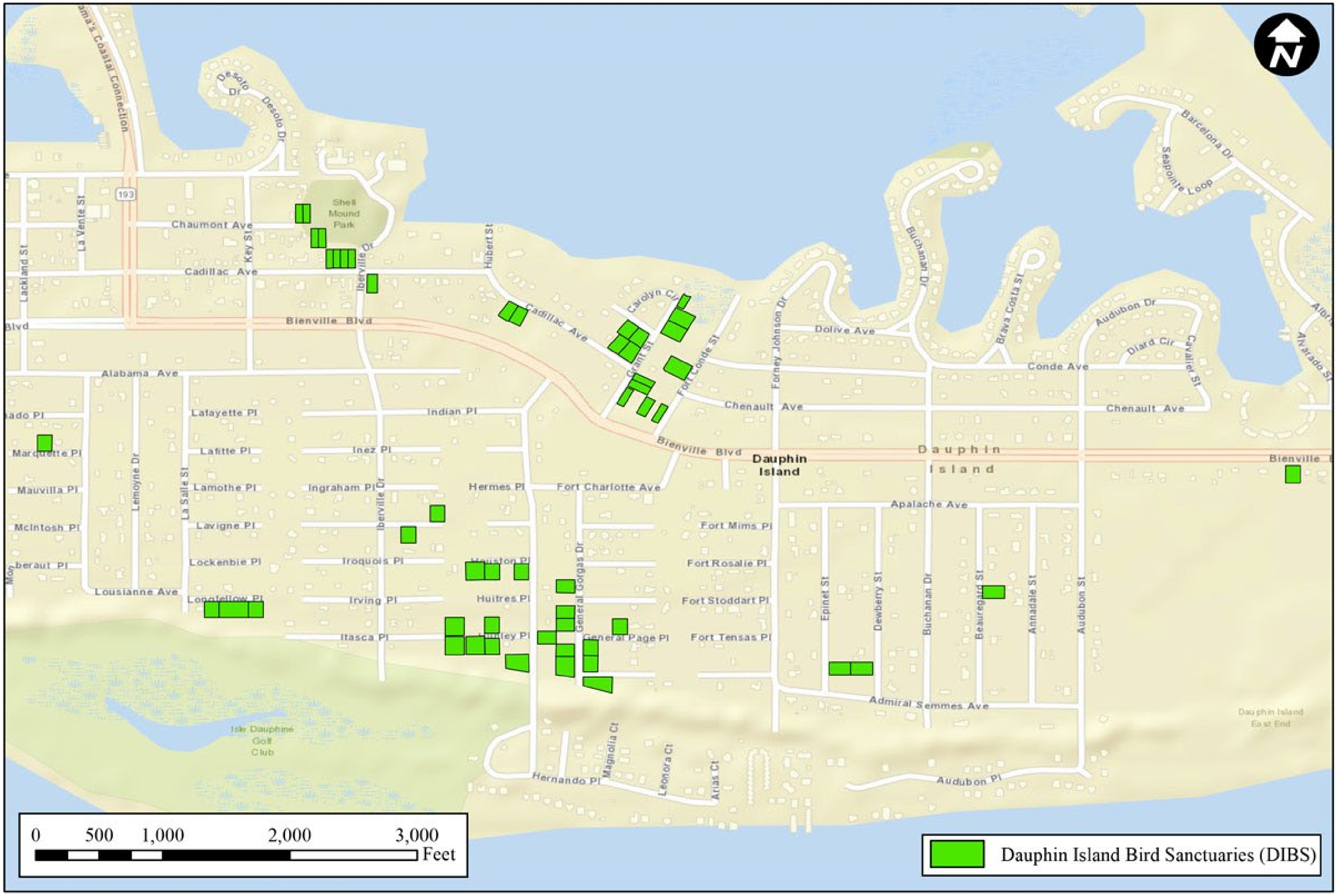
A strategy that protects and preserves natural lands, particularly priority habitats such as wetlands and maritime forest, yields many important ecosystem benefits including improved water quality, wildlife habitat, and protection of biodiversity. There are protected conservation lands in the Watershed, including Little Dauphin Island, both as part of the Bon Secour National Wildlife Refuge (USFWS) and a broader USFWS Marine Protected Area, and parcels owned by The Nature Conservancy and the Weeks Bay Foundation (**Figure 4-7**).

The Dauphin Island Bird Sanctuaries (DIBS) is a 501(c)(3) non-profit organization dedicated to the acquisition & preservation of ecologically important stopover habitat for neotropical migrant birds on the Island. The DIBS currently manages 53 undeveloped lots, permanently protecting 15.4 acres of native forested and wetland habitats from development through the use of conservation easements (**Figure 4-8**). Most of the DIBS parcels are identified as having verified or potential wetlands (BVA 2021). Properties owned by DIBS include portions of Shell Mound Park, the Goat Tree Reserve, and a number of wetland lots in the Gorgas Swamp Preserve and tupelo gum swamp areas of the Island. Non-protected parcels are still undergoing development, however, and valuable habitat continues to be lost and degraded.



SOURCE: Barry A. Vittor & Associates, Inc. 2021

FIGURE 4-7 Dauphin Island Protected Lands and Conservation Easements



SOURCE: Barry A. Vittor & Associates, Inc. 2021

FIGURE 4-8 Dauphin Island Bird Sanctuaries (DIBS) Parcels on East End of Dauphin Island

4.5 Biological Conditions

4.5.1 INVASIVE AND EXOTIC SPECIES

A chief management concern in coastal communities of Alabama is exotic plant control. The introduction of invasive exotic plants such as Chinese tallowtree (*Triadica sebifera*) and cogongrass (*Imperata cylindrica*) has resulted in changes to natural vegetative structure and plant species composition across virtually every type of upland and wetland habitat in coastal Alabama. These aggressive species can spread rapidly to outcompete native flora with consequent loss of biodiversity and habitat degradation. Invasive plants are prevalent in and near disturbed areas, especially maintained lands such as along roadsides and trails, farmland fringes, and urbanized areas generally.

Exotic species are a major conservation concern in the gum swamps on the Island. Many of these areas now possess a high cover of Chinese tallow tree, and in some locations this species has become the most dominant canopy tree. Numerous other exotic species are also spreading into these swamps, particularly around its more mesic fringes. Some of the most serious invaders are listed in **Table 4-6**. Torpedo grass (*Panicum repens*) is perhaps the most abundant and widespread invasive plant across the Island (H. Horne, personal observation).

TABLE 4-6 Common Invasive Exotic Plant Species in Dauphin Island Wetlands

Invasive Exotic Plants in Dauphin Island Gum Swamps
Bay Biscayne creeping-oxeye (*Sphagneticola trilobata*)
Camphor tree (*Camphora officinarum*)
Japanese cleyera (*Ternstroemia gymnanthera*)
Japanese yew (*Podocarpus macrophyllus*)
Coral ardisia (*Ardisia crenata*)
Chinese privet (*Ligustrum sinense*)
Japanese honeysuckle (*Lonicera japonica*)
Torpedo grass (*Panicum repens*)
Alligator weed (*Alternanthera philoxeroides*)
Japanese climbing fern (*Lygodium japonicum*)
Wild taro (*Colocasia esculenta*)

Bailey (2013) noted that the freshwater swamp and Gaillard Lake in the Audubon Bird Sanctuary has approximately 12 acres of intact freshwater marsh, largely open and herbaceous. Swamp tupelo (*Nyssa biflora*) was originally the dominant tree, but this wetland is being increasingly invaded by Chinese tallowtree despite previous attempts to control it. This highly invasive tree is widespread on the eastern end of the Island and has escaped from ornamental plantings.

Source: Barry Vittor & Associates Inc.
Cogongrass on Dauphin Island

Several non-native plants have intentionally been included in various dune revegetation and restoration projects on the Island, both on private and public properties. The ADCNR State Wildlife Action Plan (SWAP) (2015) cites cogongrass (*Imperata cylindrica*) as a primary invasive plant of maritime forest and coastal scrub habitats. Cogongrass is present in many areas of the Island, including along trails in the Audubon Bird Sanctuary, at the DI airport property, and within the grassed meadow near the Dauphin Island Pier. The DIBS is actively managing its parcels for exotics, including cogongrass.

Source: Barry Vittor & Associates Inc.
Beach Vitex

Beach vitex (*Vitex rotundifolia*) is native to islands in the Pacific Indo-Malaysia region and was introduced into the United States during the 1980s to stabilize dunes. Unfortunately, the species is highly invasive and forms long dense runners that can quickly cover 100% of dune surfaces, blocking out sunlight, killing native plant species, and also eliminating nesting habitat for federally protected sea turtles (Clemson Extension Home and Garden Information Center 2017). Beach vitex was first collected on Dauphin Island in 2003 on the West End, near the intersection of Port Royal Street and Cadillac Avenue (Keener et al. 2022). These plants are apparently no longer present, as recent searches have failed to detect the species in this general vicinity. It has also been observed in landscaping at the Dauphin Island Sea Lab on the Island's East End and on Little Dauphin Island (H. Horne, personal observation).

Another non-native species that is frequently planted locally in dune settings is slender muhly (*Muhlenbergia sericea*). The species is often sold as "purple muhly" in the horticultural trade and is promoted as an appropriate native species to plant in the State's maritime areas. Purple muhly is commonly used as a landscaping plant on Dauphin Island. Unfortunately, there is no documentation that the species ever occurred naturally in the State based on a lack of historic collections and its absence in the early literature, including Deramus (1970).

Plant taxonomy is an important, but often overlooked, component of revegetation and planting projects, and the correct identification of species needs to be considered when selecting both plants and vendors. Dune sunflower (*Helianthus debilis*) is a species widely available in the nursery trade and frequently used for planting in dune settings. The species is broadly distributed across both the Atlantic and Gulf coasts and comprises five genetically distinct subspecies. The nominate subspecies *H. debilis* subsp. *debilis* is endemic to just 12 counties along Florida's Atlantic Coast and does not occur naturally occur on the northern Gulf Coast. Unfortunately, the non-native Atlantic Coast subspecies was included in planting efforts to stabilize the sand berms along the Bienville Blvd. following Hurricane Katrina. Its use risks the potential introduction of foreign genetic stock into the local subspecies (*H. debilis* subsp. *tardiflorus*), resulting in the break-up of locally adapted gene complexes, out-breeding depression, and reduced fitness in the native population found on the Island.

4.5.2 INVASIVE EXOTIC PREDATORS

Domestic cats (Felis catus) and red foxes (Vulpes fulvus) are invasive exotic species that present a serious threat to native wildlife. Both species have been observed preying on Island fauna, including species of conservation concern.

Introduced and spread globally by humans, cats are considered to be among the world's worst 100 invasive species (Loss et al. 2013; Lowe et al. 2000). Feral and free-roaming cats are major predators on small mammals, birds, reptiles, and amphibians (Loss et al. 2013; Winter and Wallace 2006). Predation by cats has directly contributed to the extinction of 33 species, representing 14% of the 238 total global extinctions of birds, mammal, and reptiles (Medina et al. 2011). In a 2013 landmark study, Loss et al. (2013) estimated that free-ranging domestic cats kill between 1.3 and 4.0 billion birds and between 6.3 and 22.3 billion mammals annually in the contiguous United States, making cats the greatest single source of wildlife mortality.

Feral cats are a significant problem on Dauphin Island. The Island is designated as a Globally Important Bird Area (Donald et al. 2019, National Audubon Society 2021) and the control of stray cats is considered to be a high priority at these critical sites (Winter and Wallace 2006). Free-roaming cats are a recognized threat to numerous bird species of conservation concern found on Dauphin Island, including loggerhead shrike (*Lanius ludovicianus*), cerulean warbler (*Setophaga cerulea*), yellow warbler (*Setophaga petechia*), wood thrush (*Hylocichla mustelina*), Bewick's wren (*Thryomanes bewickii*), and painted bunting (*Passerina versicolor*) (ADCNR 2015; Alabama Natural Heritage Program 2021). Alabama's SWAP (2015) includes stray and free-roaming cats as one of several conservation problems that affect species occurring in maritime forest, coastal scrub, and beach dune habitats. The control of cats in these threatened communities is considered to be among the highest priority of conservation actions.

Perhaps no single wildlife conservation issue is more contentious than the management of free-ranging domestic cats. Populations of stray and feral cats are traditionally managed by live-trapping individuals for either adoption or euthanasia (Winter and Wallace 2006). The Dauphin Island Cat Association (2021) is a non-profit volunteer organization actively involved in efforts to humanely control the Island's population of stray cats through their trapping and spay/neuter program. However, despite these efforts, stray cats continue to be a threat to the Island's wildlife.

Though they are thought to primarily feed on small mammals, red foxes are also known to be opportunistic predators that consume insects, birds, and other small animals. Signs of red fox predation on sea turtle nests have recently been observed on the Island, west of Katrina Cut. Red foxes are also known to prey on Dauphin Island shorebird nests (Koczur et al. 2020).

Source: Photo by Environmental Science Associates

Fox Den on West End

4.6 Shoreline Assessment

The Dauphin Island barrier island complex consists of the beach face, beach berm, dunes, relic dunes, and back-bay marsh. Each element of this complex plays an important role in the evolution of the barrier island due to storm impacts and erosion.

4.6.1 SHORELINE TYPES

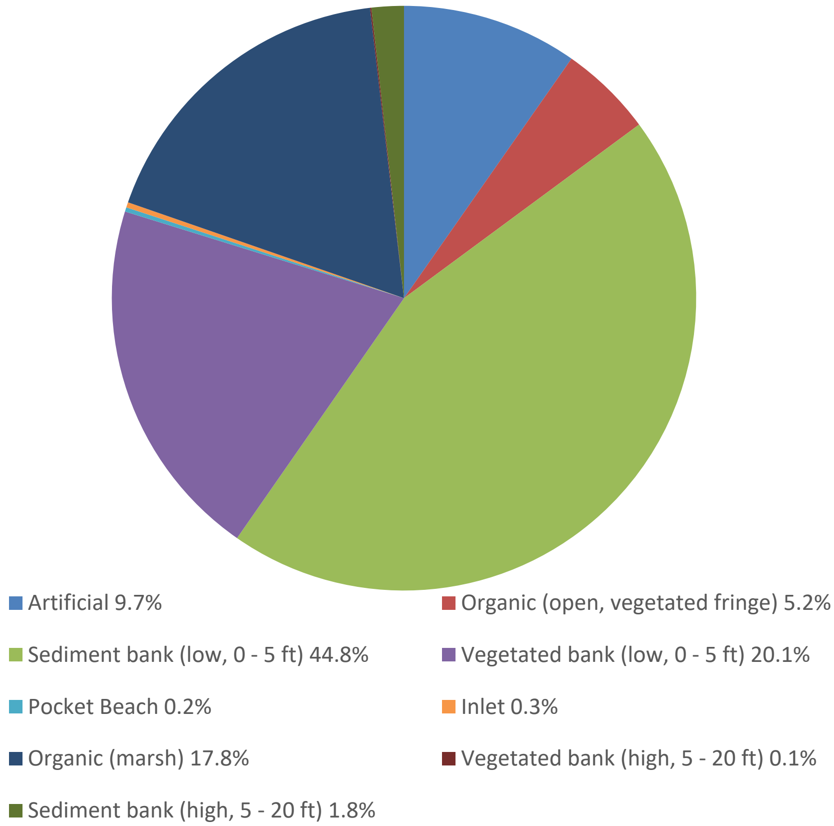
The Geologic Survey of Alabama mapped the types of existing shorelines along Dauphin Island's coast (Jones and Tidwell 2012). **Table 4-7** presents the seven classification categories they used to describe shoreline types found on Dauphin Island. Several subcategories were developed to better represent shoreline types and are mainly applied to vegetated bank, sediment bank, and organic categories.

TABLE 4-7 Applicable Shoreline Type Classifications, as Defined in the GSA Phase III Report

Shoreline Type	Description
Artificial Shorelines	Shorelines built in areas previously occupied by water. Typically built for industrial and commercial use; examples include causeways, infilling, and shoreline extensions.
Vegetated Bank Shorelines	
a. Bluff	Greater than 20 feet above the high tide line (within 50 yards of the shoreline).
b. High Bank	5-20 feet above the high tide line (within 50 yards of the shoreline).
c. Low Bank	0-5 feet above the high tide line (within 50 yards of the shoreline).
Organic Bank Shorelines	
a. Open Shoreline Vegetated Fringe	Occurs where water grasses flourish just in front of the shoreline in shallow water.
b. Swamp Forest	Typically occurs where periodically inundated low-lying forests meet the shoreline.
c. Marsh	Occurs where saltwater or freshwater marsh habitat adjoins open water.
Sediment Bank Shorelines	
a. Bluff	Greater than 20 feet above the high tide line (within 50 yards of the shoreline).
b. High Bank	5-20 feet above the high tide line (within 50 yards of the shoreline).
c. Low Bank	0-5 feet above the high tide line (within 50 yards of the shoreline).
Inlet	Where unnavigable tributaries meet the open water, at the farthest mapped upstream locations, and in shallow channels within marsh habitat.
Pocket Beach	Mainly located between two shoreline protections structures extending into the water.
Rock Bank (low)	Occurs where bedrock or rock layers are exposed at the shoreline.

Most of the Island (19.3 miles) is classified as sediment bank (i.e., sandy beach), with 9.5 miles classified as organic shoreline (mostly marsh with some open, vegetated fringe) and 8.4 miles classified as vegetated bank. The study also identified 11 inlets on Dauphin Island. **Figure 4.-9** illustrates the proportional breakdown of each shoreline type as a percentage of the entire shoreline. **Figure 4-10** depicts the geographic distribution of shoreline types, followed by **Figures 4-11, 4-12, 4-13**, and **4-14,** which depict the shoreline types in greater detail.

As a barrier island, Dauphin Island's shoreline are constantly changing. Due to these geomorphological changes over time, there are some mapping inconsistencies between the shoreline data available and aerial imagery presented throughout this section.



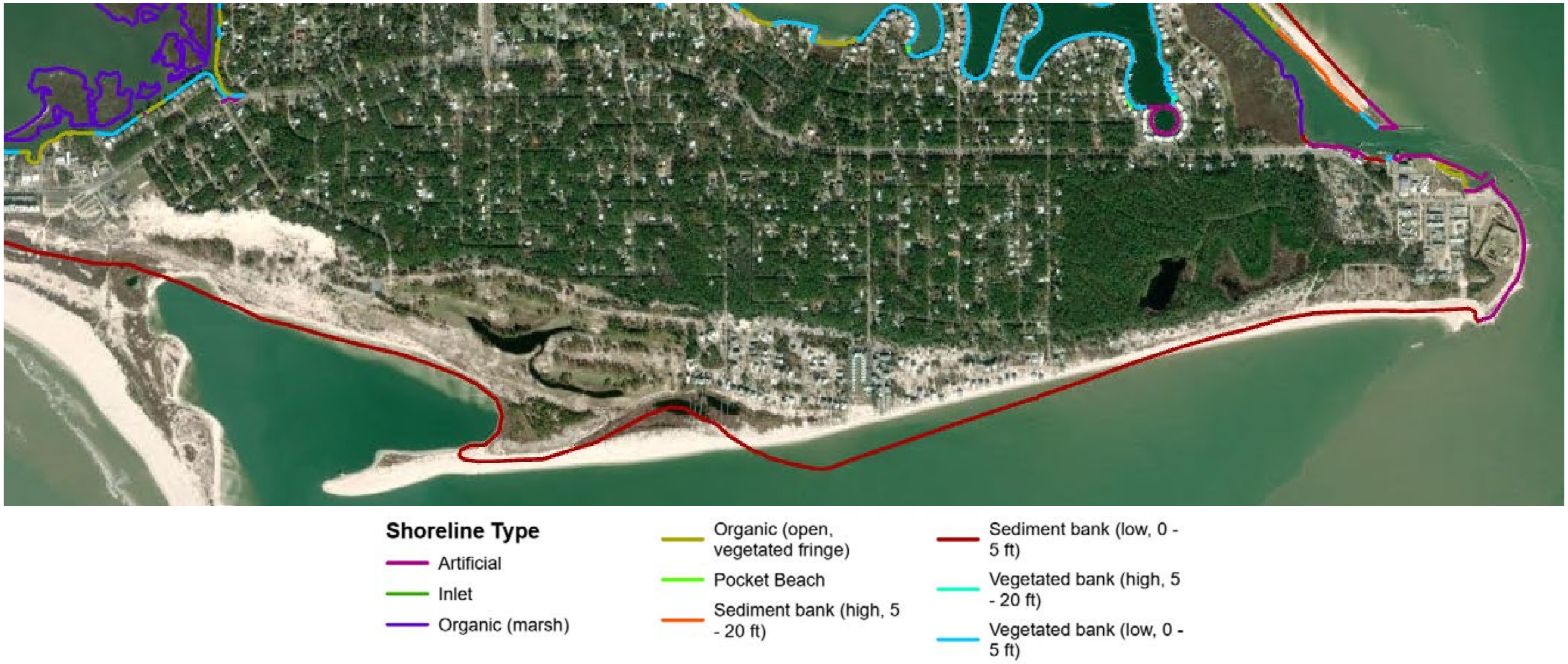
SOURCE: Jones and Tidwell 2012

FIGURE 4-9 Proportional Breakdown by Shoreline Type (Percent of Total)

SOURCE: Jones and Tidwell 2012

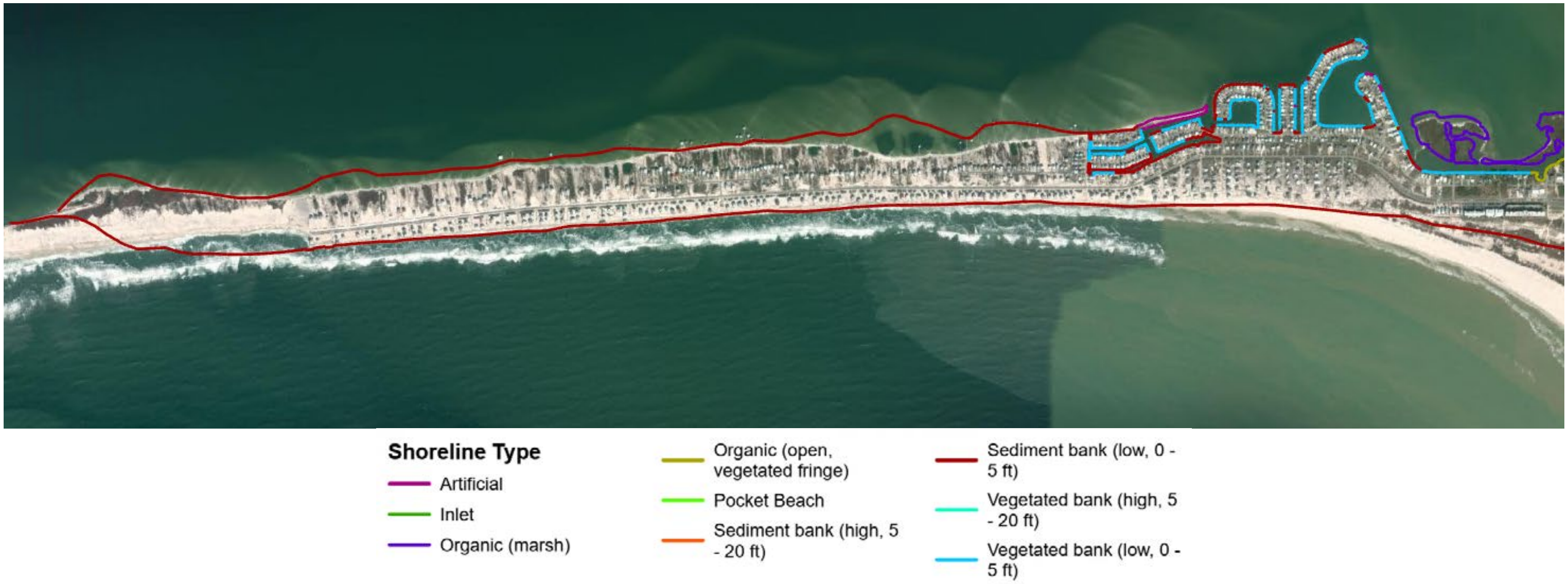
NOTE: The figure presented is prior to Pelican Island merging into the public beach shoreline. Figure 4-30 presents those changes over time.

FIGURE 4-10 Shoreline Types Along Dauphin Island



SOURCE: ESRI, Jones and Tidwell 2012

FIGURE 4-11 Distribution of Shoreline Types, Eastern Gulf Shore of Dauphin Island



SOURCE: ESRI, Jones and Tidwell 2012

FIGURE 4-12 Distribution of Shoreline Types, Western Gulf Shore of Dauphin Island

SOURCE: ESRI, Jones and Tidwell 2012

FIGURE 4-13 Distribution of Shoreline Types, Back-Barrier Marsh of Dauphin Island

SOURCE: ESRI, Jones and Tidwell 2012

FIGURE 4-14 Distribution of Shoreline Types, Little Dauphin Island

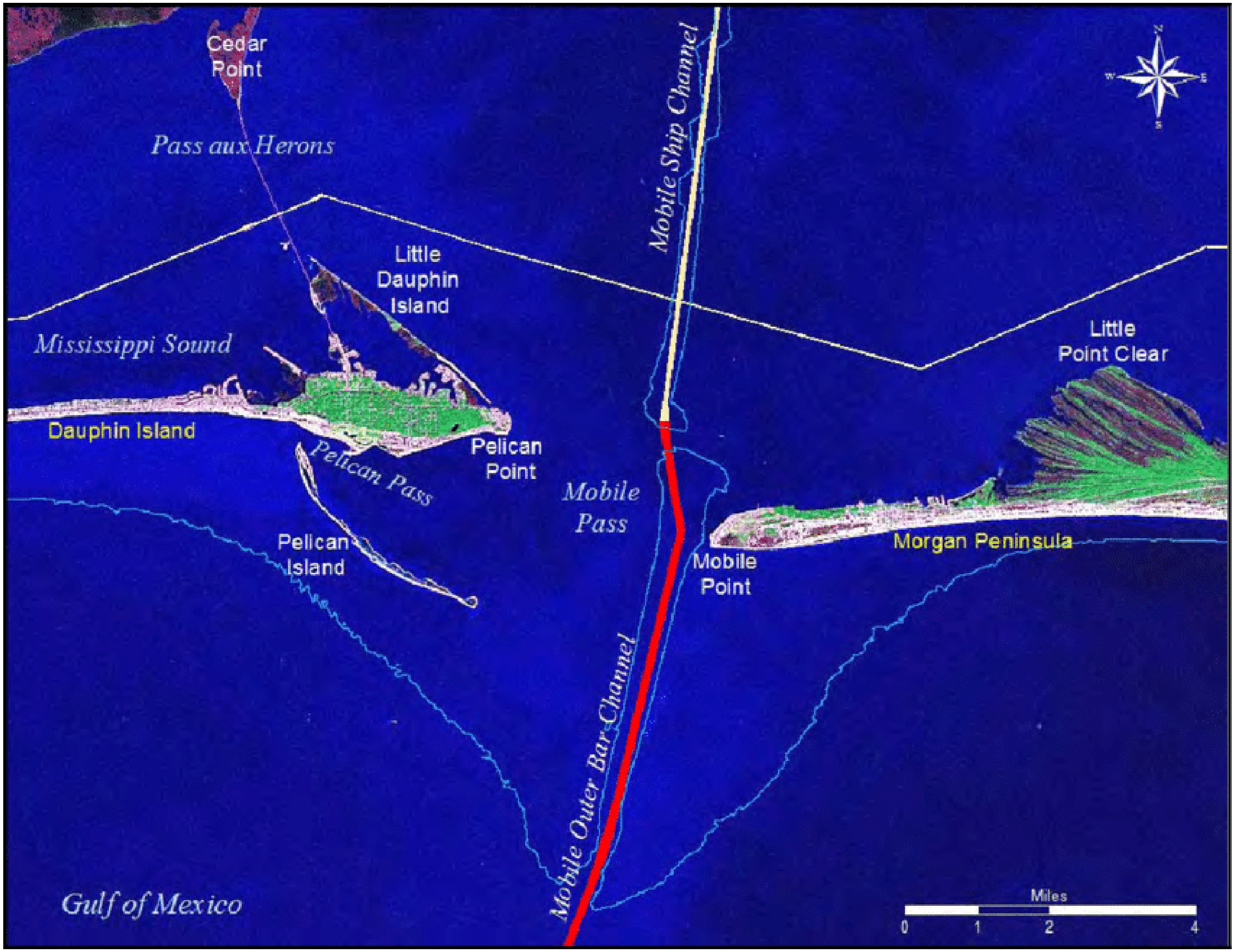
4.6.2 SEDIMENT TRANSPORT AND GEOMORPHOLOGY

As a barrier island, Dauphin Island shorelines are constantly changing due to hurricanes, storm surge, sea level rise, gradual coastal processes, and anthropogenic influences. The East End of Dauphin Island is adjacent to Mobile Pass, which is dredged to keep the Mobile Ship Channel navigable (**Figure 4-15**). **Figure 4-16** depicts the same area as **Figure 4-15** and shows how the shoreline of Dauphin Island has changed between 2010 and 2022, particularly along the southern shore.

For most of the year, southeast winds drive longshore currents and sediment transport to the west along the Mississippi-Alabama barrier island chain. On the east side of the Pass, sediment is transported from east to west from the Florida panhandle until it reaches the Pass. The littoral zone currents transport sediment that reaches the Pass out of Mobile Bay to an ebb shoal approximately 10 miles wide and including Pelican and Sand islands south of Dauphin Island (blue mounds in **Figure 4-17**; Alesce and FitzHarris 2012). Sand from the ebb shoal is then transported back to Dauphin Island through littoral processes (Byrnes et al. 2010).

Long-term trends show the Island is narrowing (-1.97 meters/year), but progradation has been greater during recent years, offsetting more dramatic ocean shoreline erosion (Smith et al. 2018). The land area of Dauphin Island has shrunk from around 5.5 square miles in 1852 to around 4.7 square miles after Hurricane Katrina, as shown in **Figure 4-18** (Morton 2008). **Figure 4-19** shows aerial photos taken from the east showing the development and changes in the shoreline between circa 1950 and 2022.

The following sections provide more detail on the unique shorelines that make up Dauphin Island. **Figure 4-20** shows a site map with place names for reference. **Figure 4-21** depicts the same area as **Figure 4-20**, showing the 2022 shoreline extent.

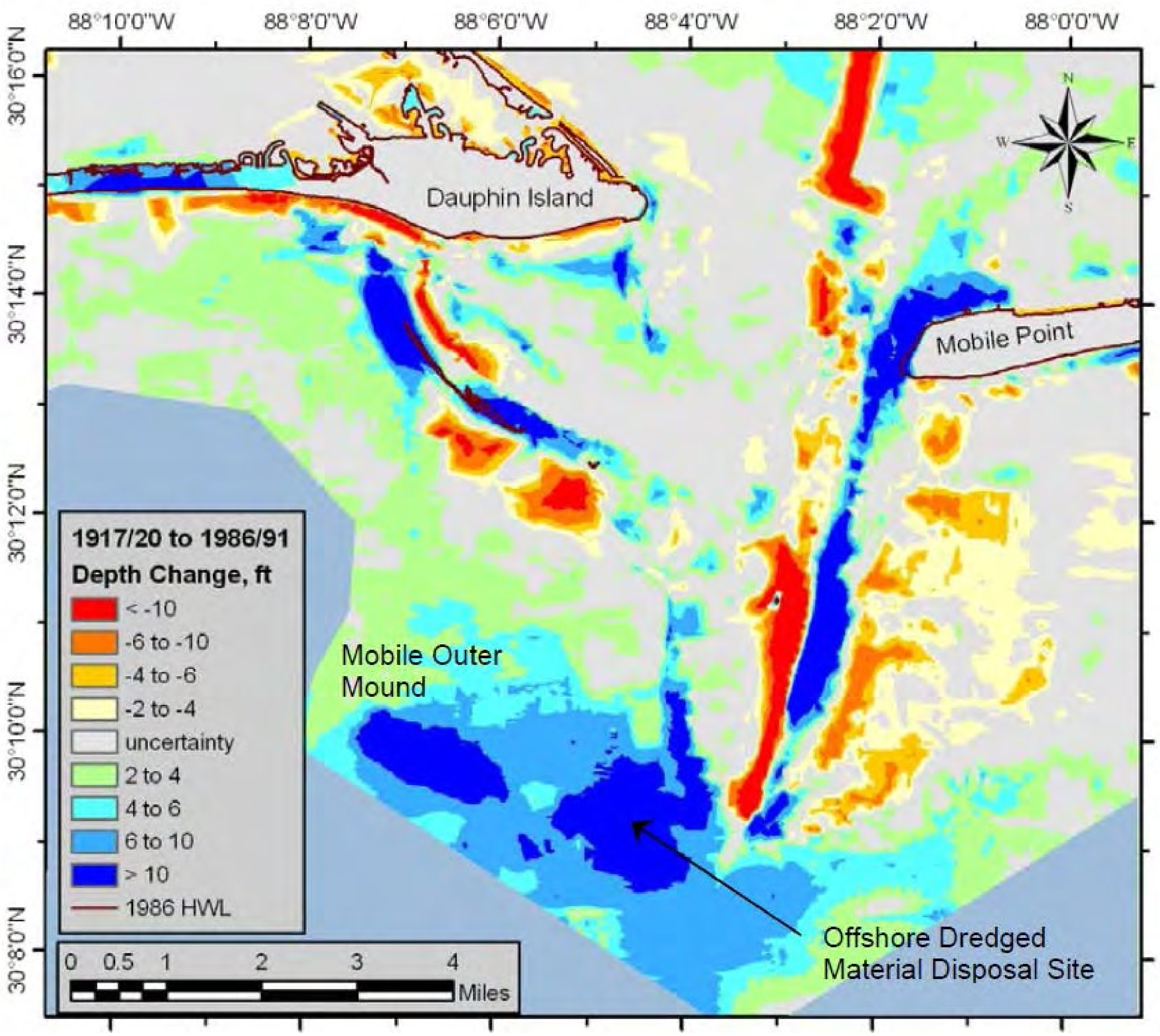


SOURCE: Byrnes et al. 2010

FIGURE 4-15 Mobile Pass and Ship Channel

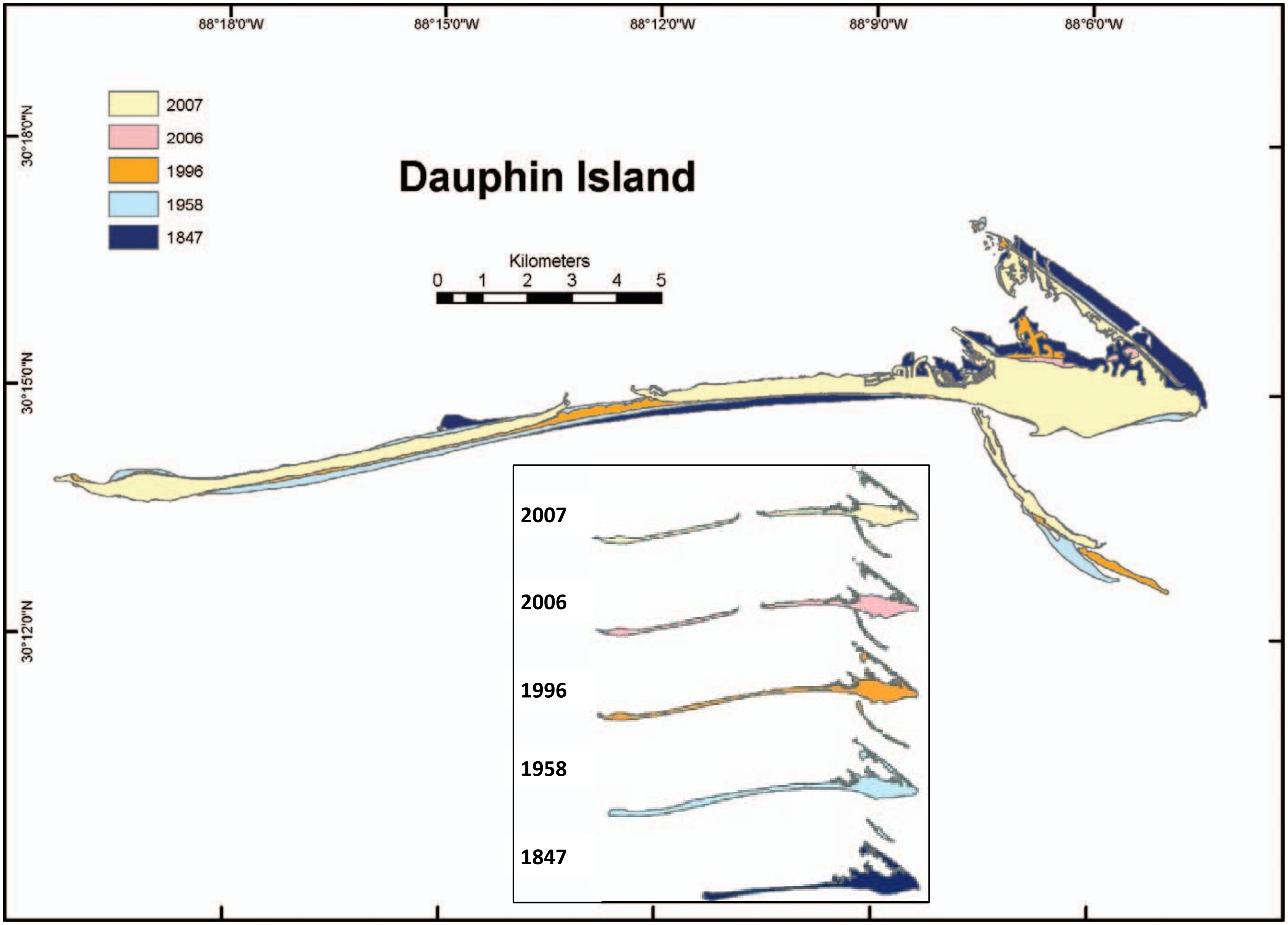
SOURCE: Google Earth 2022

FIGURE 4-16 2022 Aerial of Mobile Pass and Ship Channel



SOURCE: Byrnes et al. 2010

FIGURE 4-17 Erosion and Deposition Around Dauphin Island between 1917/20 and 1986/91

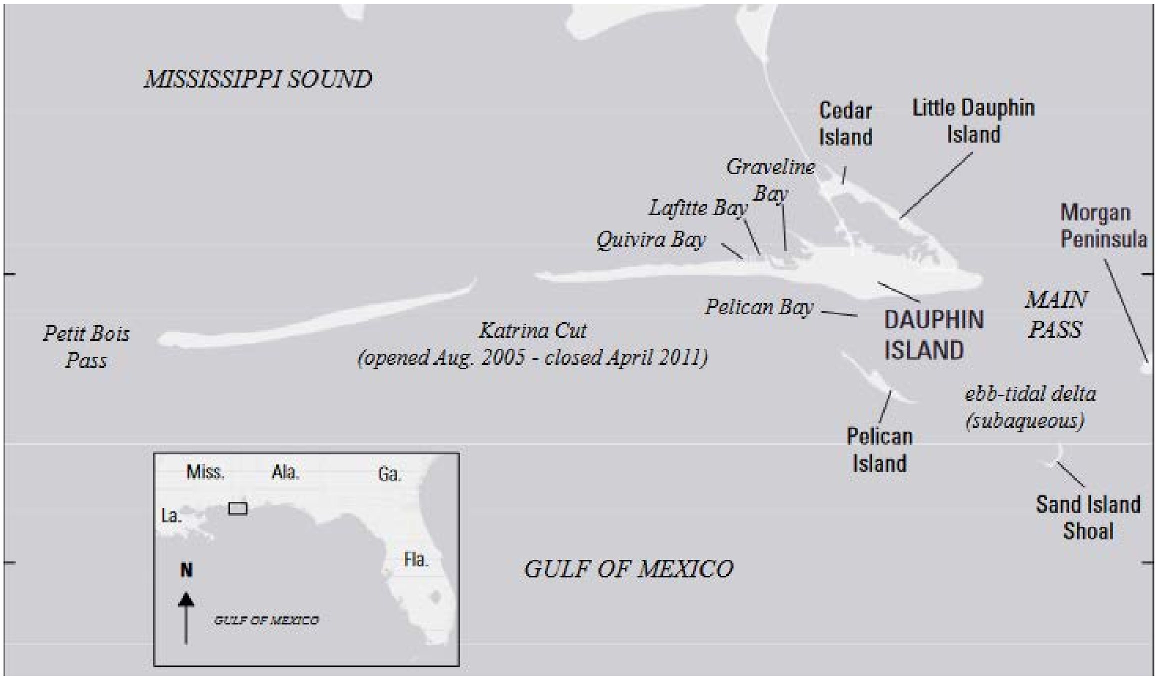


SOURCE: Morton 2008

FIGURE 4-18 Morphological and Spatial Changes in Dauphin Island

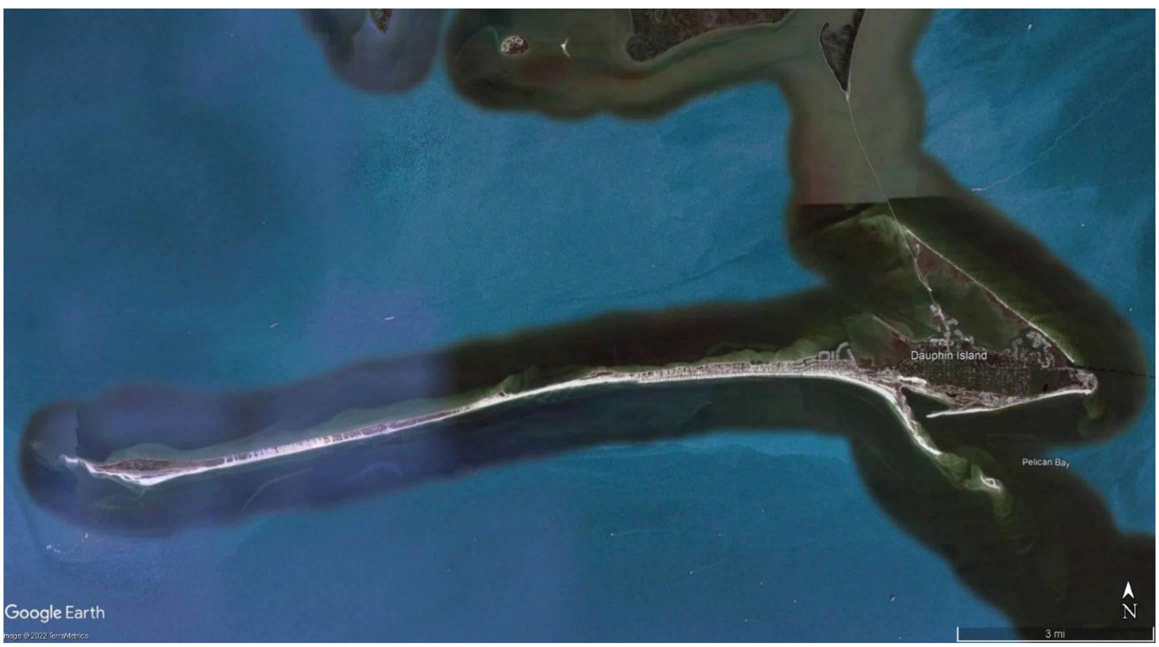
SOURCE: History Museum of Mobile 2022; Google Earth 2022

FIGURE 4-19 Aerials of Dauphin Island from the East, circa 1950 (top) and 2022 (bottom)



SOURCE: Smith et al. 2018

FIGURE 4-20 Site Map and Place Names



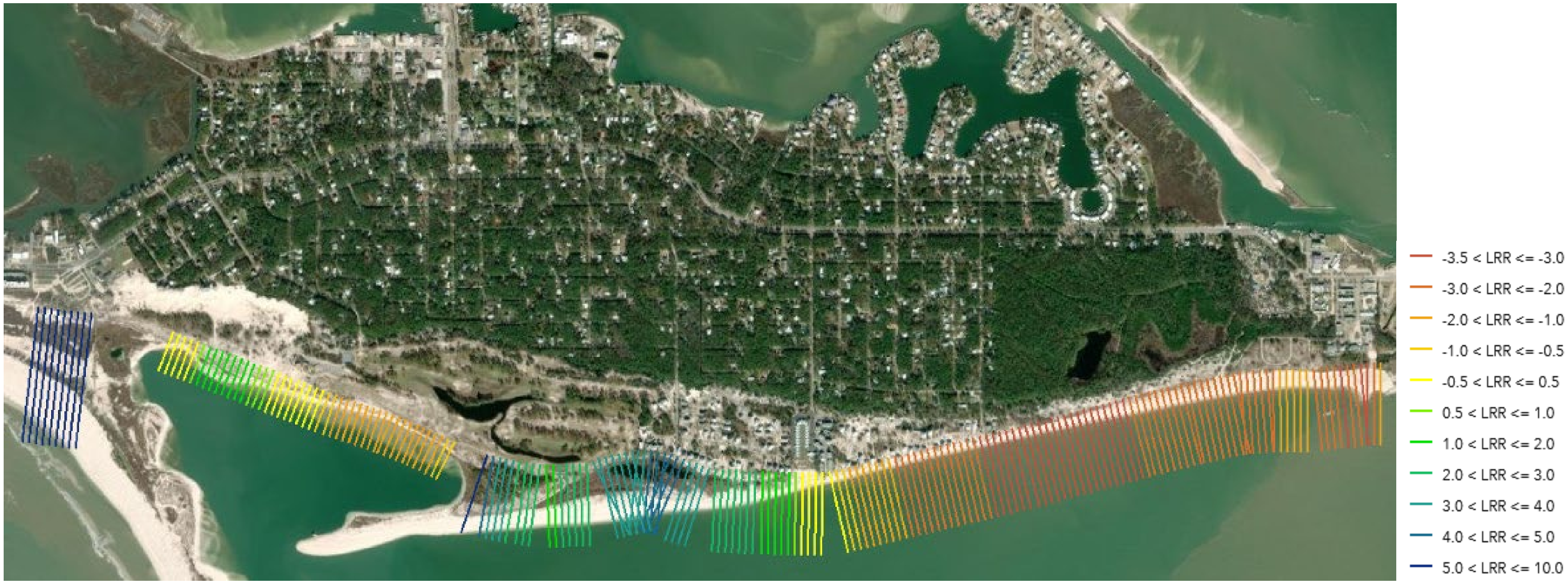
SOURCE: Smith et al. 2018

FIGURE 4-21 2022 Aerial of Site

Eastern Gulf Shore

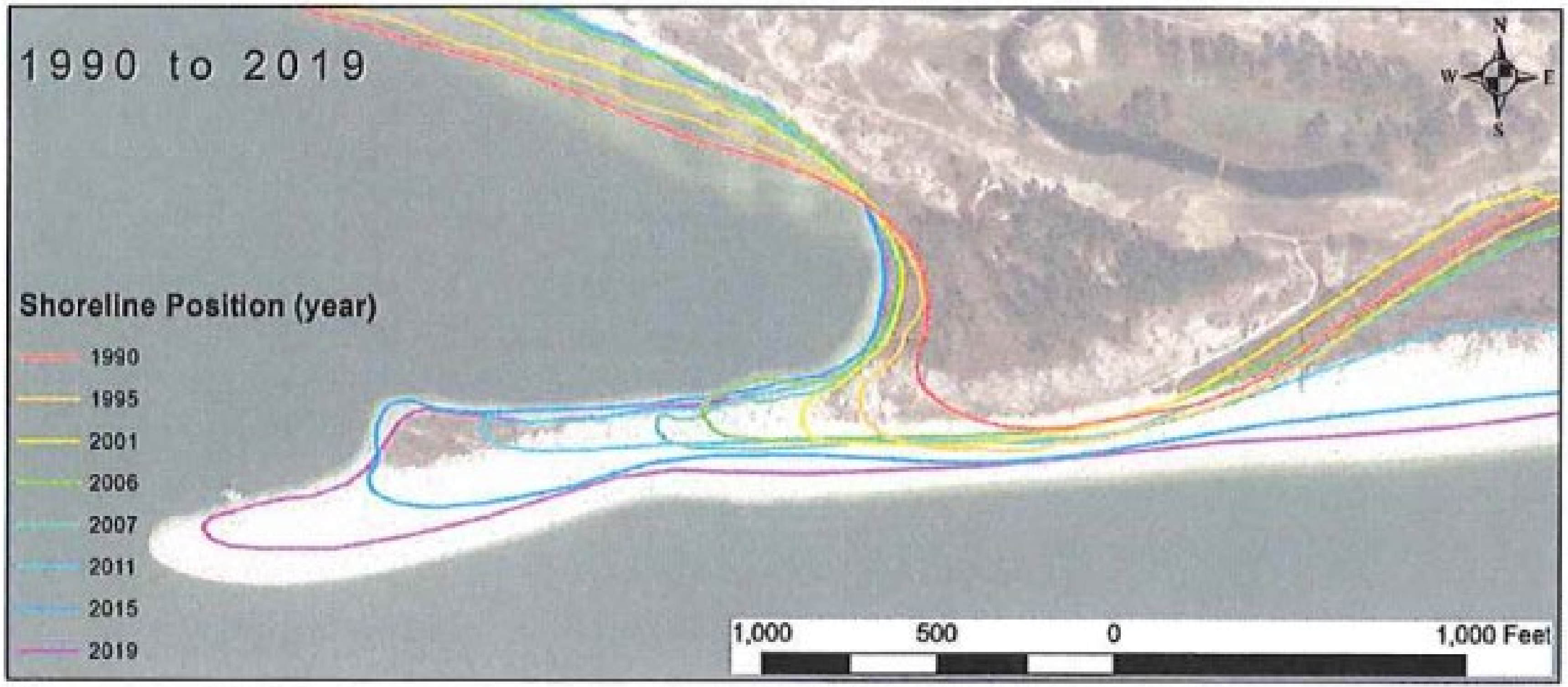
The eastern fifth of the Island is considered a composite barrier island, which is a tall and wide system underpinned by an older geologic unit. The Gulf side of the Island is largely sandy beach with dunes on the order of 10 feet high. In the past 20 years, the beaches at the East End have experienced some of the most dramatic shoreline recession seen in the United States (Douglas et al. 1994), as shown in **Figure 4-19** above. The USGS reviewed historic shoreline locations from 1975 to 2019 to evaluate erosion rates along the Island (Smith et al. 2018). **Figure 4-22** shows cross-shore transects color-coded based on the calculated long-term erosion rates, while **Figure 4-23** shows the growing sand spit south of Isle Dauphine Golf Club.

As part of the 2020 USACE and USGS Barrier Island Study, the USGS modeled several beach restoration scenarios to evaluate their performance in the future with sea level rise and extreme storm events (Mickey et al. 2020). One option considered nourishing the beaches east of Katrina Cut (on the western Gulf shore) and east of Pelican Island. The results showed that this option helped maintain the width of Dauphin Island and mitigated new cuts from forming during extreme storm events. However, with 0.3 feet of sea level rise and a medium storminess scenario, the study found that 25% to 50% of the sand placed would be lost over the 10-year modeling period. With high storminess and 3.1 feet of sea level rise, the model predicted 30% to 73% of the sand would be lost within 10 years.



SOURCE: Smith et al. 2018

FIGURE 4-22 Long-Term Erosion Rates (LRR in meters/year) Along the Eastern Gulf Shore



SOURCE: Douglass and Goecker 2001b

FIGURE 4-23 Growth of Sand Spit South of Isle Dauphine Golf Club

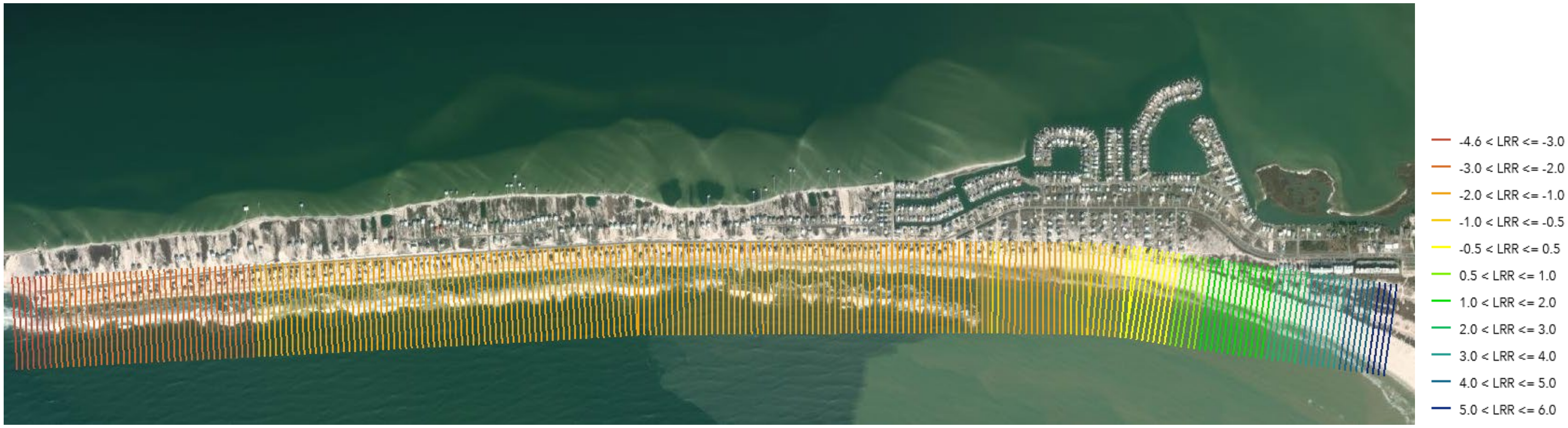
Western Gulf Shore

The western four-fifths of the Island are considered a simple barrier island, indicating a low and narrow sandy landform dominated by overwash and longshore transport. This part of the Island is highly susceptible to storm impacts due to its low elevation (around five feet above sea level), narrow width, lack of substantial dune features, and no shielding from Pelican Island or existence of maritime forest found naturally on the East End. For example, when Hurricane Katrina made landfall in August 2005, 450 of the 500 homes on the West End were damaged when the West End was completely covered with water (**Figure 4-24;** Gaul 2019).

SOURCE: NOAA NWS 2021b

FIGURE 4-24 Overwash of the West End during Hurricane Katrina

Based on the USGS's review of historic shoreline locations discussed in Section 4.6.2.1, **Figure 4-25** shows cross-shore transects color-coded based on the calculated long-term erosion rates between 1975 and 2019 (Smith et al. 2018). Almost the entire West End has experienced erosion greater than 3 feet/year (1 meter/year) since 1975.



SOURCE: Smith et al. 2018

FIGURE 4-25 Long-Term Erosion Rates (LRR in meters/year) Along the Western Gulf Shore

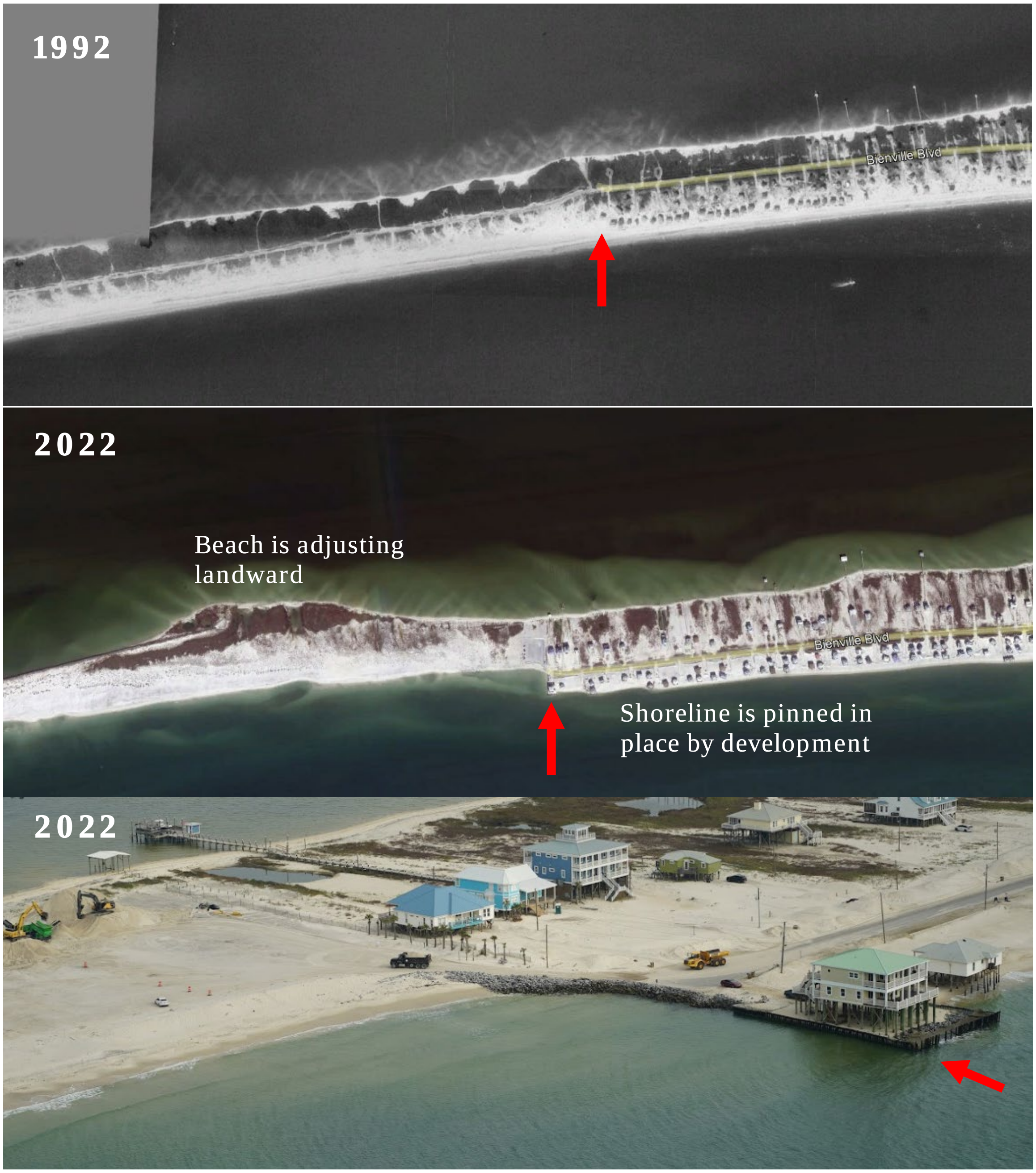
During extreme storm events, overwash transports sediment from the Gulf side of the Island to the back-barrier shorelines, which is an important process for sustaining barrier island width (Smith et al. 2018). This is called barrier island rollover and allows the Island to be maintained, but at a more landward location after major storm events. **Figure 4-26** shows how the overwash from Hurricanes Ivan (September 2004) and Katrina (August 2005) covered much of the West End in sand. However, human activities, such as the residential construction on the West End, have attempted to “pin” the Island in place. **Figure 4-27** shows the West End shoreline in 1992 and in 2022 and the bulkheaded western-most house, which is “attempting” to hold the shoreline in place. This pinning of the shoreline has resulted in loss of structures during extreme events as the Island tries to “adjust” out from under the development.

Some cross-barrier sediment deposition occurs after a storm passes, as high waters on the Island drain back towards the Gulf, moving sediment towards the Gulf shoreline. Passeri et al. (2018) found that sea level rise may alter Gulf-directed flows and durations after a storm, leading to increased cross-barrier sediment deposition on the Gulf side of the Island. In some cases, this may allow the Island to recover post-storm; alternatively, if sand is transported away from the Island, this process may contribute to increased erosion.

Several of the scenarios considered in the Barrier Island Study included sand nourishment east of Katrina Cut on the western shoreline (Mickey et al. 2020). Generally, the model results showed that such nourishment helped mitigate Island breaches. When dune features were considered in addition to nourishment, the model did not show a substantial added benefit. Similarly, buyouts of properties south of Bienville Blvd. did not show much benefit to the sand transport on the Island.

SOURCE: USGS 2021

FIGURE 4-26 Photos Showing the Overwash of Sand from Hurricanes Ivan and Katrina



SOURCE: Sam St. John and Google Earth 2022

FIGURE 4-27 Evolution of the West End Shoreline

Back-Barrier Marsh

The back-barrier side of Dauphin Island was historically made up of a marsh system, which has been largely filled in over time for housing and lined with hard armoring (see **Section 4.4.3** and **Figures 4-10, 4-12, and 4-13** above). In areas where the marsh remains, the shoreline is experiencing steady, long-term erosion with the occasional offset by progradation after large storm events with overwash (Ellis et al. 2018). Erosion rates at Graveline Bay marsh are an order of magnitude higher than the rest of the back-barrier system (Smith et al. 2018). In several areas, borrow pits were excavated to supply sand for the emergency barrier built along the Katrina Cut during the *Deepwater Horizon* oil spill (see Katrina Cut and West discussion below). These areas are morphologically vulnerable to breaching (Collini and Smallegan 2020).

However, frontal storms moving parallel to the Island have increased fetch, which can set up large waves in the Mississippi Sound and entrain and deposit estuarine sediments onto the marshes. Vegetated areas provide habitat and help build vertical elevation on the Island through sediment capture and stabilization. Marsh areas on Dauphin Island have been accreting vertically at 3.73 millimeters/year (Smith et al. 2018). However, USGS modeling as part of the Barrier Island Study showed that while intertidal marsh can keep pace with intermediate levels of sea level rise, higher scenarios of sea level rise may require nourishment to maintain the marsh (Enwright 2020).

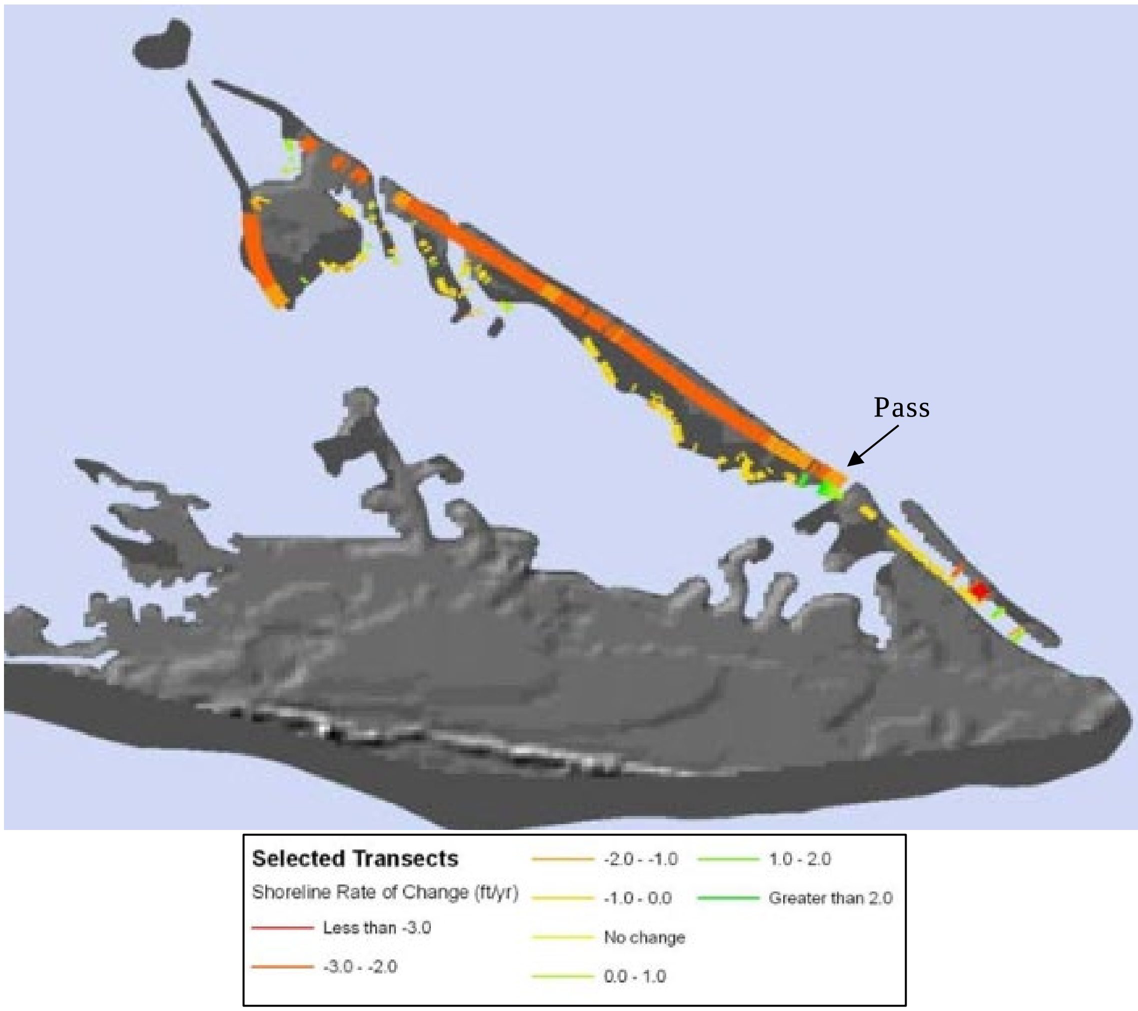
One of the scenarios considered in the USACE/USGS Barrier Island Study was re-filling the borrow pits along the back-barrier tidal flats and restoring back-bay marsh behind Katrina Cut and within Graveline and Aloe bays. The modeling results showed that the restoration did not result in much change compared to existing conditions, but the authors note that the model used was not designed to evaluate back-barrier evolution (Mickey et al. 2020). At the time of this writing, the Aloe Bay and Graveline Bay marsh restoration projects are moving forward, but the borrow pits restoration project was put on hold and the Katrina Cut marsh restoration project has not been planned yet.

The nourishment of the back-bay marsh is critically important to the health and resilience of the Island as a whole. When overwash from large storms occurs, if the back bay marsh has been lost or has lost elevation, then the overwash volume goes to fill those voids, instead of enhancing the marsh or building new beach/dune areas.

Little Dauphin Island

Little Dauphin Island is a composite barrier island like the eastern side of Dauphin Island and is underlain by the same geologic unit as the main Island. It is included in the Bon Secour National Wildlife Refuge (BSNWR) managed by USFWS and provides essential habitat for several coastal bird species, including the semipalmated sandpiper and piping plover. The BSNWR was established in 1980 with the acquisition of the Perdue Tract in Baldwin County and Little Dauphin Island in Mobile County.

The northeast side of Little Dauphin Island is sandy and relatively straight; the southwest side of the Island is a back-barrier marsh shoreline with complex landforms. Between 1996 and 2010, the Island eroded on average 3.7 feet/year, as shown in **Figure 4-28** (Jones and Tidwell 2012).



SOURCE: Smith et al. 2018

FIGURE 4-28 Shoreline Erosion on Little Dauphin Island

Just north of Barcelona Dr. on Dauphin Island is the historic Pass Drury. In the late 1950s, the Pass was closed off with dredge material, but it reopened during Hurricane Frederic in 1979 and was again closed with dredge material soon after (Douglass 1994). More recently, Little Dauphin Island was breached at the historic location of Pass Drury, and the Pass has remained open since. However, since the 1950s, development just inside the Pass has been extensive (**Figure 4-29**). At the time of this writing, the USACE is conducting the National Fish and Wildlife Foundation–funded Little Dauphin Island Restoration Assessment project, which is investigating restoration alternatives for Little Dauphin Island.

SOURCE: Sam St. John, December 2021

FIGURE 4-29 Photo of Pass Drury Adjacent to Homes

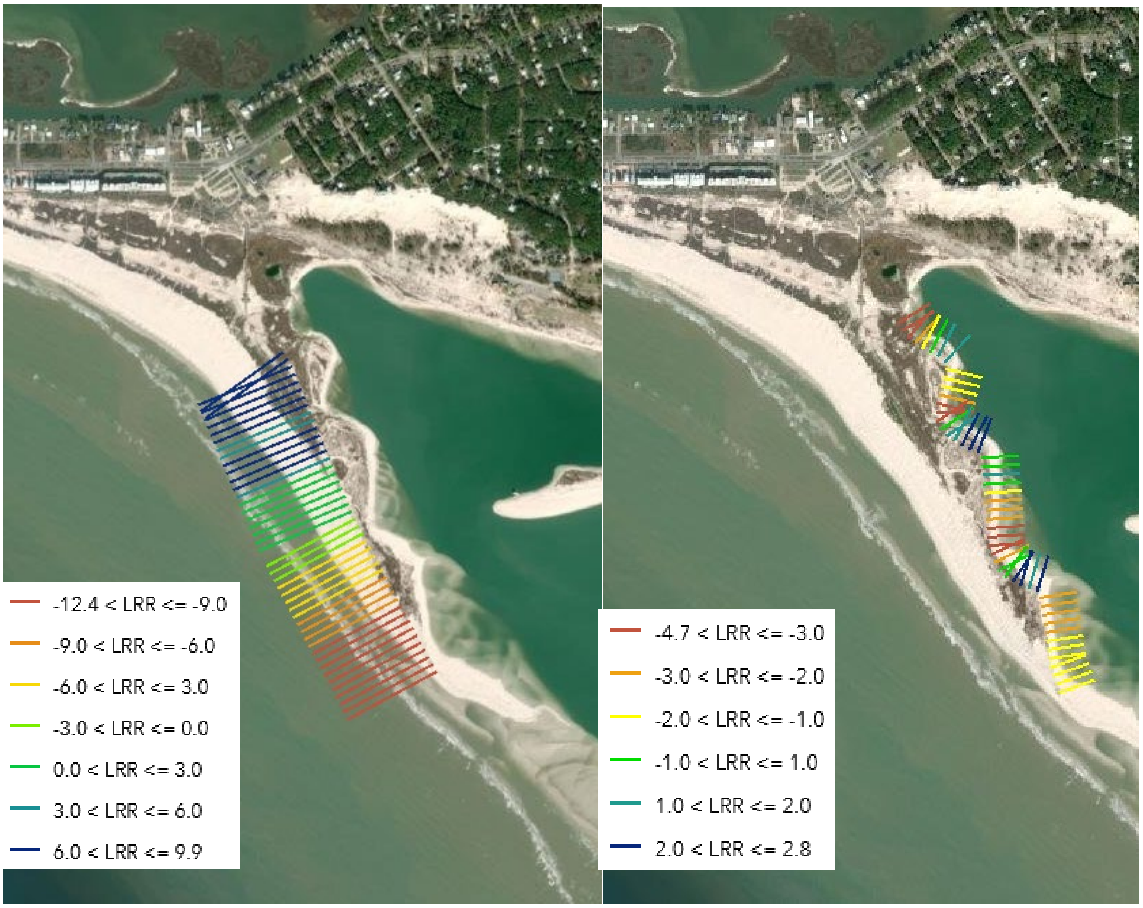
Pelican Island

Pelican Island or Peninsula, south of Dauphin Island, is very dynamic and has formed, merged, grown, and disappeared over the last century. In 2008, Pelican Island merged with Dauphin Island where the eastern and western shorelines meet, as shown in **Figure 4-30**. This connection of Pelican Island to Dauphin Island is the attachment of the ebb shoal fillet to the beach face. This is an indication that the ebb shoal complex is a very mature one, or that the ebb shoal is accreting volume. The ebb shoal complex will continue to accrete and erode sand seasonally, but this is a natural occurrence and provides an important buffer to the eastern portion of the Island. While there may be consideration to mine Pelican Island for sand to benefit other portions of Dauphin Island further west, due to its close proximity, it is important that the Island is not altered by anthropogenic means, as that could cause detrimental downdrift effects.

Based on the USGS's review of historic shoreline locations discussed in **Section 4.6.2**, **Figure 4-31** shows cross-shore transects which are color-coded based on the calculated short-term erosion rates between 2009 and 2019 (Smith et al. 2018). The figure shows beach growth in the blue and dark green colors on the northeast side of the peninsula, indicating that the beach is widening at the connection to Dauphin Island. The south end of the peninsula and the east side mostly show erosion in the yellow, orange, and red transects. This indicates that the peninsula is shortening and moving west.

SOURCE: Google Earth

FIGURE 4-30 Pelican Island Morphology Over Time



SOURCE: Smith et al. 2018

FIGURE 4-31 Short-Term (2009–2019) Erosion Rates (LRR in meters/year) Along Pelican Island

One of the scenarios considered in the Barrier Island Study was adding sand to the southern tip of Pelican Island. The modeling results showed that the nourishment helped maintain Pelican Island and reduced erosion for east Dauphin Island, but contributed to greater erosion on the north end of the peninsula (Mickey et al. 2020). The nourishment of the southeastern tip of Pelican Island may be accomplished by placing the sediment that does not meet requirements to be placed on the dry beach. Placing the material near shore allows wave action to sort the sediment and nourish the lower portion of the beach profile below mean low water.

Sand Island

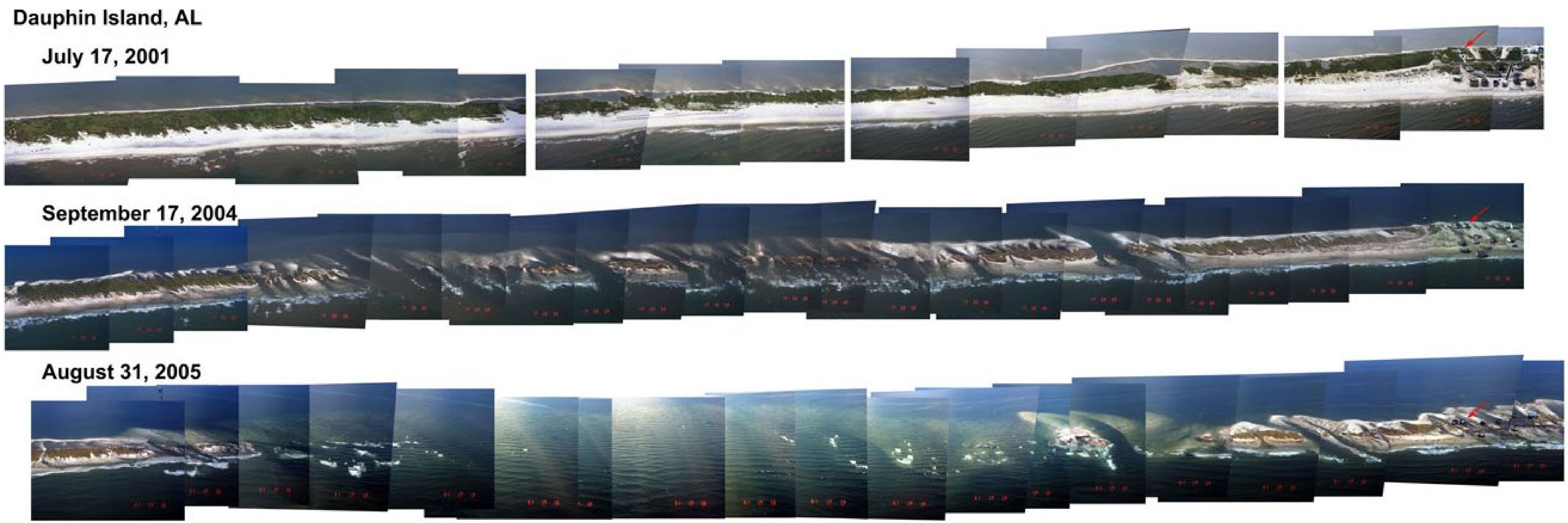
Sand Island, southeast of Dauphin Island and located approximately three miles offshore from the Mobile Bay Entrance, is very dynamic and has formed, merged, grown, and disappeared over the last century, similar to Pelican Island. The Sand Island platform is a remnant sand shoal of what is now Pelican Island that has been migrating toward Dauphin Island over the past century, as discussed in the previous section. Sand from the ebb shoal of Mobile Bay is transported to Dauphin Island through littoral processes between Sand Island and Pelican Island (Byrnes et al. 2010). Sand Island exceeded 400 acres in the 1800s, but is now less than one-acre in size. In 2011, the USACE placed dredged material around the Sand Island lighthouse to renourish the area, but Hurricane Isaac impacted the coast in 2012 and eroded the area. One of the scenarios considered in the USACE/USGS Barrier Island Study was adding sand to Sand Island every two years, however modeling showed this approach did not provide much benefit to Dauphin Island (Mickey et al. 2020).

Katrina Cut and West

In September 2004, Hurricane Ivan made landfall just west of Gulf Shores, Alabama, as a Category 3 hurricane and resulted in storm surge up to eight feet at the Dauphin Island tide gauge with winds up to 102 miles per hour (NOAA NWS 2021a). A buoy 70 miles south of Dauphin Island recorded a significant wave height of 52 feet (NOAA NWS 2021a). The hurricane breached the West End of the Island, as shown in **Figure 4-32**. Then in 2005, Hurricane Katrina made landfall in southeast Louisiana. The breach on the West End caused by Hurricane Ivan increased in size, as shown in **Figure 4-32**, and became known as Katrina Cut.

While the inlet resulted in back-barrier shoaling, which contributed to the Island width, the USACE issued an emergency permit to close the Katrina Cut with a rubble mound structure in April 2011 to protect against oil from the *Deepwater Horizon* oil spill getting into the Mississippi Sound (**Figure 4-33**). Additionally, the Cut led to concerns about additional saltwater entering the Sound and impacting oyster reefs (Enwright et al. 2020). In 2020, as part of the Barrier Island Study, the USACE developed a three-dimensional hydrodynamic and water quality model to evaluate the impacts of additional breaches on the Island (Bunch et al. 2020). Model results showed that breaches in Dauphin Island contribute to the exchange of water between the Gulf and the Sound, while breaches in Little Dauphin Island and Pelican Island only resulted in localized impacts. The USGS found that restoration to reduce breaches would affect oysters in Mississippi Sound positively (Enwright et al. 2020).

Based on USGS's review of historic shorelines, the Island area west of Katrina Cut is narrowing rapidly and steadily, while the area east of the cut has only recently started narrowing (Smith et al. 2018). One of the scenarios considered in the Barrier Island Study was replacing the Katrina Cut rubble mound with a sand berm. The USGS modeling found that with high storminess and 3.1 feet of sea level rise, the sand berm at the Cut would be totally eroded (Mickey et al. 2020). An additional scenario evaluated sand nourishment east and in front of the Katrina Cut rubble mound with construction of dune features to provide an additional source of sand, as well as habitat. The modeling showed that the nourishment and dunes helped mitigate Island breaches.



SOURCE: USGS 2021

FIGURE 4-32 Photos Showing the Breaching of Dauphin Island from Hurricanes Ivan and Katrina

SOURCE: Thompson Engineering 2012

FIGURE 4-33 Katrina Cut Before and After Construction of the Rubble Mound

4.6.3 SHORELINE VULNERABILITY

As discussed above, Dauphin Island is already experiencing erosion from long-term processes and extreme weather events. Sea level rise is projected to make the Island more susceptible to storm events, flooding, overtopping, and erosion. Because of the relatively low elevation of the Island, even a slight vertical increase in sea levels will result in significant movement of the shoreline. Additionally, projections suggest that climate change will result in increases in storm intensity, with more Category 4 and 5 hurricanes.

Passeri et al. (2020) modeled Dauphin Island shoreline evolution with varying levels of storminess and sea level rise. Their study suggests that barrier islands can keep pace with sea level rise by moving sand across the Island during storm events to maintain height and width. However, if storms are too intense or sea levels are too high, the Island will be unable to recover. The study found Dauphin Island exhibits the following five behaviors in response to storms and sea level rise:

1. Keeping pace by maintaining height and width
2. Losing width but maintaining height
3. losing height but maintaining width,
4. Losing height and width
5. Gaining height and width

Increasing amounts of sea level rise and storminess were correlated with more of the Island losing height and width, and breaching in some cases. Under the highest storminess scenario, the Island was unable to recover in between storms and drowned in just 10 years (Passeri et al. 2020).

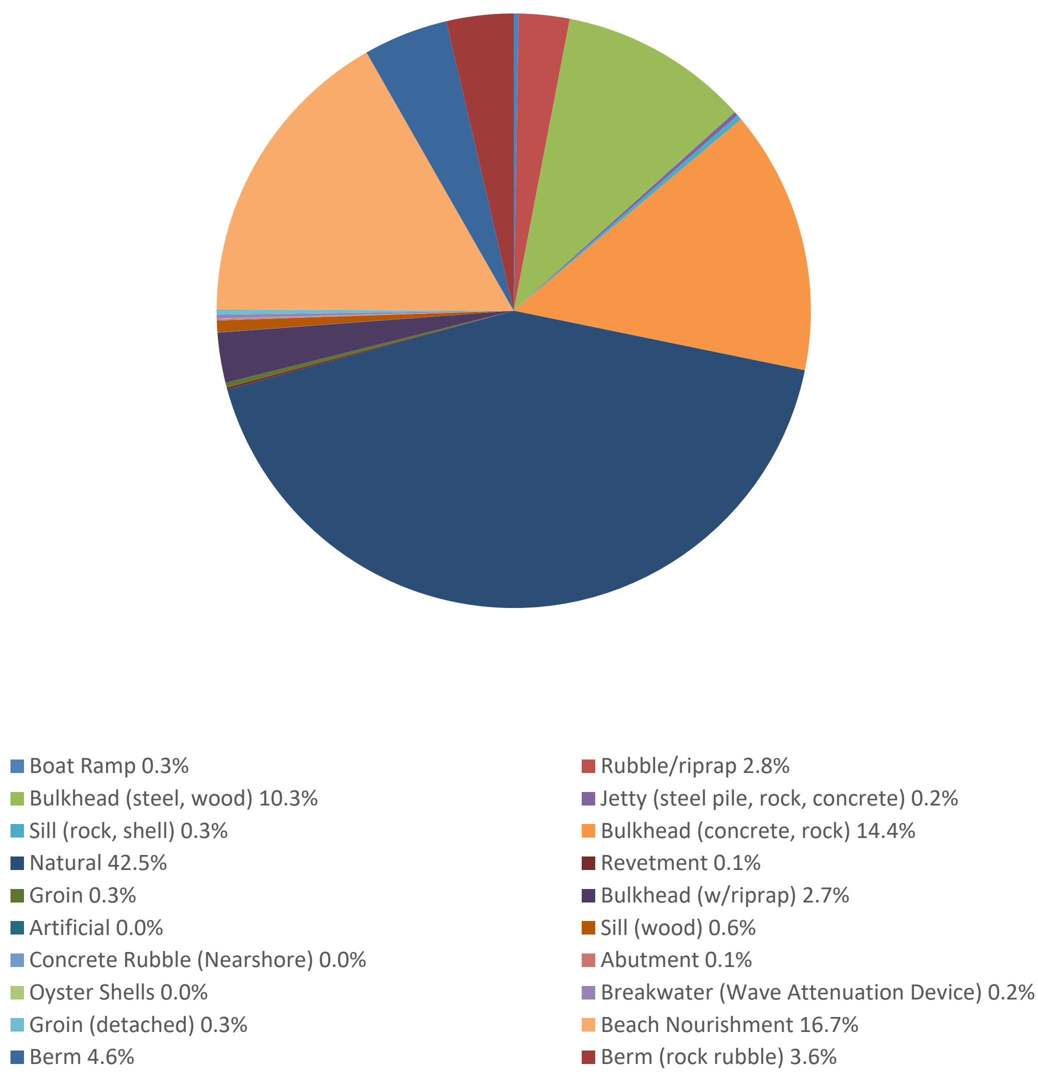
Existing Shore Protection

The Geologic Survey of Alabama mapped the types of existing shore protection along Dauphin Island's coast (Jones and Tidwell 2012). Twenty different shore protection classifications were mapped in Dauphin Island, including natural and anthropogenic shore protection types. Shore protection types are listed and described in **Table 4-8**.

TABLE 4-8 Applicable Shoreline Protection Type Classifications, as Defined in the GSA Phase III Report

Shoreline Type	Description
Natural	A natural setting with vegetation or sediment exposed and no apparent shoreline modification to protect the land behind it. The natural shore protection classification is commonly associated with wetland environments, undeveloped properties, and protected habitats.
Bulkhead	Bulkhead, the most common type of shore protection, is a broad category with numerous subtypes. Further modifiers or subdivisions represent the various construction materials (concrete, steel, wood) and convey additional shore protections placed seaward or landward of the bulkhead (groins, riprap, retaining walls).
Abutment	Concrete or wood abutments are found where bridges intersect most mapped waterways.
Breakwater	Typically used to dissipate wave energy where natural shoreline is desired. Breakwaters are constructed some minimal distance offshore. Breakwaters may be either fixed or floating, depending on the application.
Jetty (steel pile, rock, concrete)	Typically associated with an inlet and constructed normal to slightly oblique to the shoreline. Jetties are also commonly constructed around boat ramps and channels for either industrial or recreational traffic to flow through without running aground on shoals.
Revetment	Mainly cabled concrete mattresses or carefully placed rocks are installed as permanent sloping structures along sloping shorelines.
Rubble/riprap	Similar to a revetment except that its installation is not commonly engineered, but rather haphazardly placed by the property owner. Material can consist of rock, concrete and wood debris, and tires. Most have no aesthetic value and can take up much of the seaward shoreline.
Groin	Typically associated with bulkheads, but can be found isolated.
Artificial	Shorelines built in areas previously occupied by water. Typically built for industrial and commercial use; examples include causeways, infilling, and shoreline extensions.
Sill (wood)	Miniature versions of a breakwater designed to break wave action and allow sediment to fall out of suspension as wave energy dissipates.
Beach Nourishment	Typically associated with Gulf-fronting shorelines; small beach nourishment projects are located on private land and public parks.
Boat Ramp	Additional type of shoreline armoring constituting a very minor portion of the watershed's shoreline.

Bulkhead shore protection encompasses 12 miles of the Island, with beach nourishment encompassing 7.3 miles, berm shore protection 3.6 miles, and the remaining two miles armored through various methods. No apparent hard shoreline modification was found in 18.6 miles of the Island (Jones and Tidwell 2012; Alabama Department of Conservation & Natural Resources 2017). **Figure 4-34** illustrates the proportional breakdown of each shoreline protection type as a percentage of the entire shoreline. **Figure 4-35** depicts the geographic distribution of shore protection types, followed by **Figures 4-36, 4-37, 4-38**, and **4-39,** which depict the shore protection types in greater detail. Due to geomorphological changes, the mapping shows some inconsistencies between the shore protection type data and the aerial imagery.

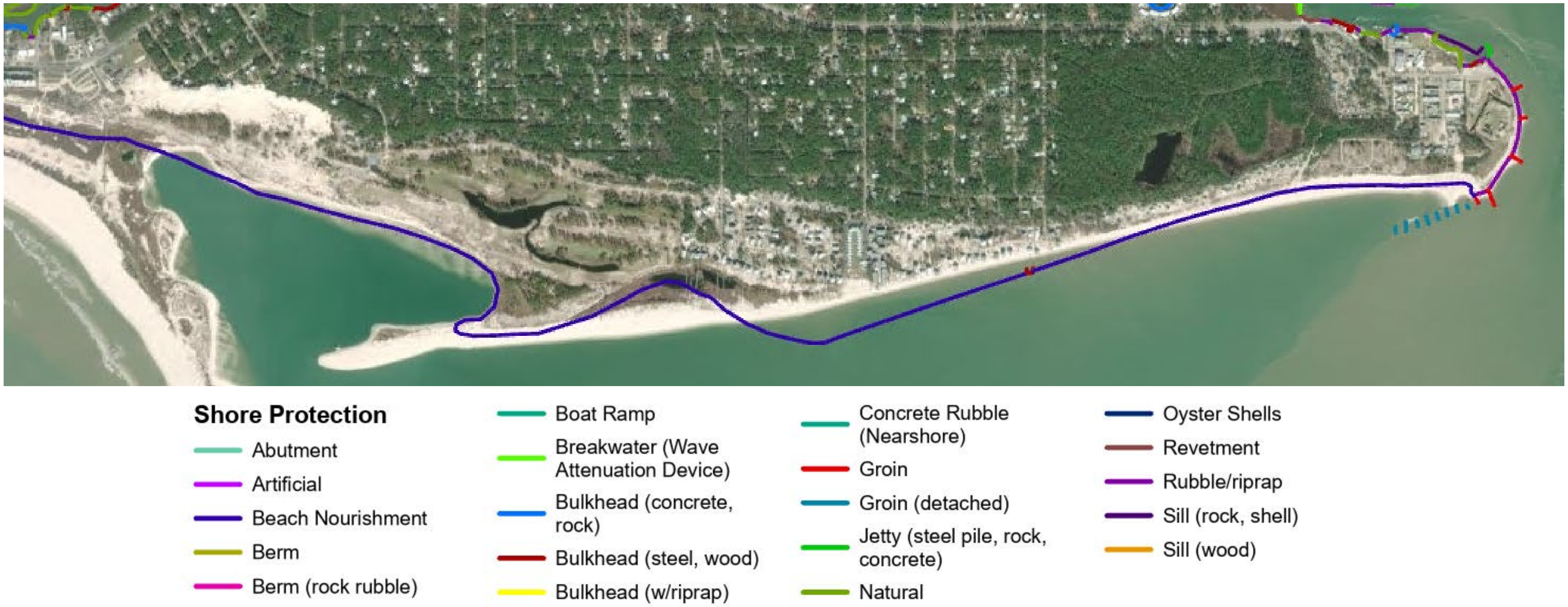


SOURCE: Jones and Tidwell 2012

FIGURE 4-34 Proportional Breakdown by Shoreline Protection Type (Percent of Total)

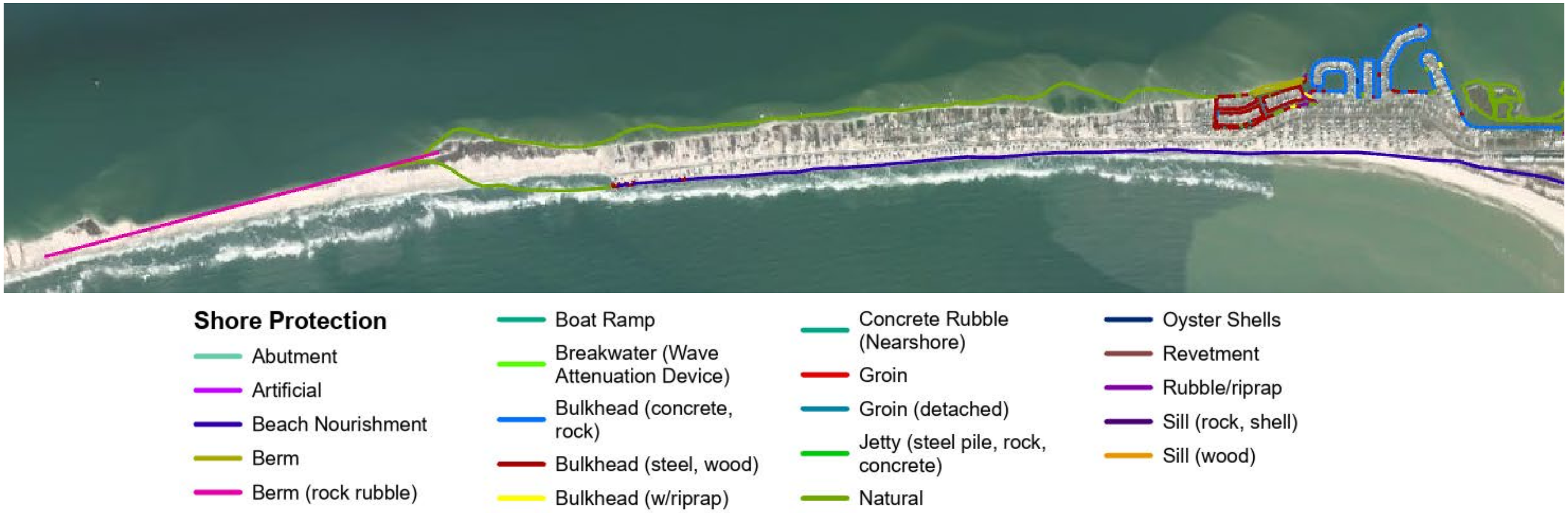
SOURCE: Jones and Tidwell 2012

FIGURE 4-35 Shore Protection Along Dauphin Island



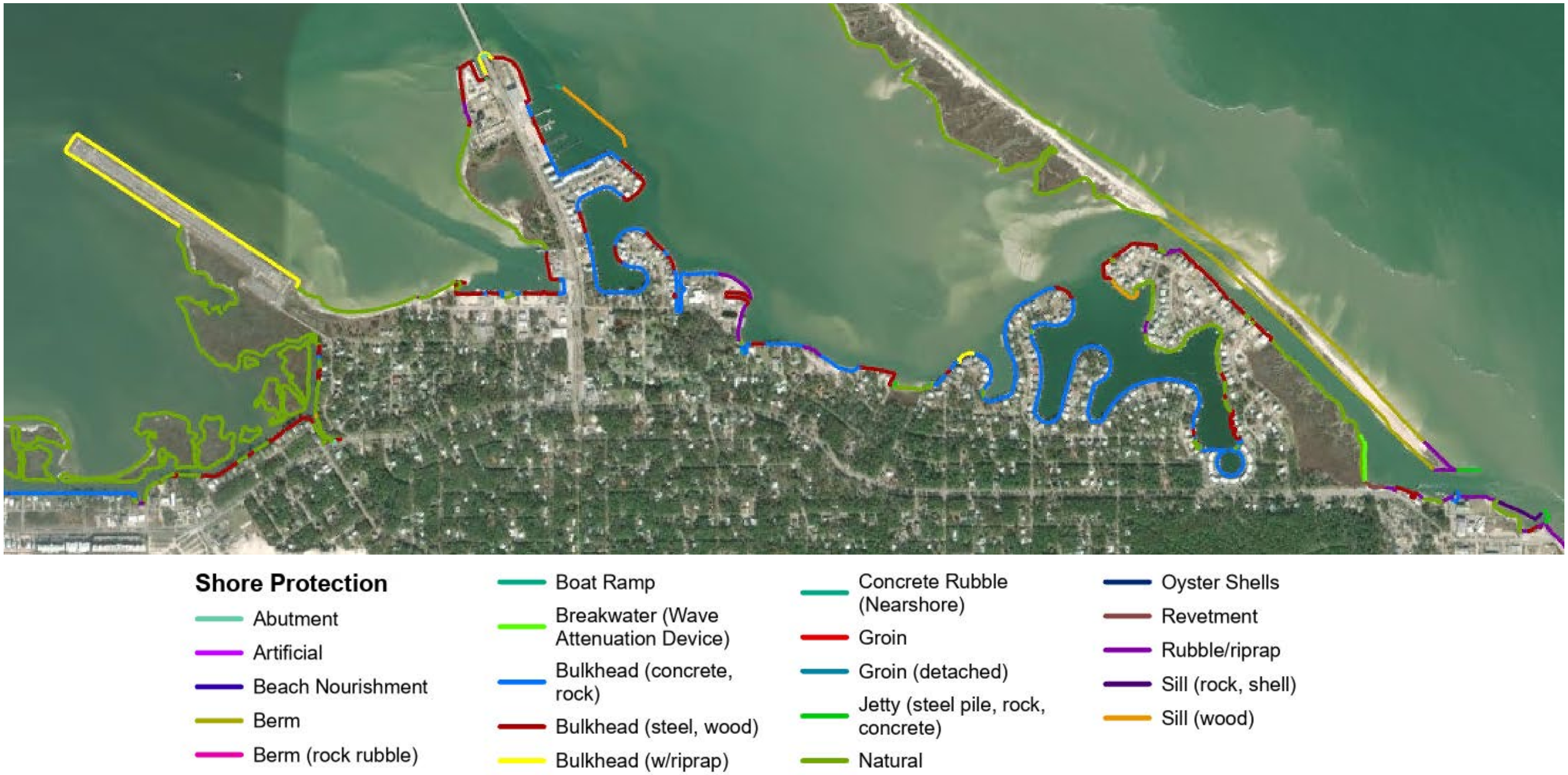
SOURCE: ESRI, Jones and Tidwell 2012

FIGURE 4-36 Distribution of Shore Protection, Eastern Gulf Shore of Dauphin Island



SOURCE: ESRI, Jones and Tidwell 2012

FIGURE 4-37 Distribution of Shore Protection, Western Gulf Shore of Dauphin Island



SOURCE: ESRI, Jones and Tidwell 2012

FIGURE 4-38 Distribution of Shore Protection, Back-Barrier Marsh on Dauphin Island

SOURCE: ESRI, Jones and Tidwell 2012

FIGURE 4-39 Distribution of Shore Protection, Little Dauphin Island

The eastern portion of the Island includes a groin field first built in 1894 to protect Fort Gaines. In 1897, a seawall was incorporated, and in 1909 additional groins were added along the shoreline southwest of the seawall. To mitigate for extensive erosion, eight of the western-most detached groins were reoriented in 2015 and 2016 into segmented breakwaters as a part of the Coastal Impact Assistance Program East End Shoreline Restoration Project (CIAP) (**Figure 4-40**).

SOURCE: Sam. St. John, July 15, 2019

FIGURE 4-40 Shoreline Stabilization at East End

Pelican Island is not currently protected by anthropogenic measures. Geotubes have been used on Little Dauphin Island during previous stabilization attempts (**Figure 4-41**). Sand Island is constantly shifting; however, the lighthouse is stabilized by a concrete base and rocks (**Figure 4-42**).

SOURCE: Sam. St. John, December 2021

FIGURE 4-41 Shoreline Stabilization at Little Dauphin Island

SOURCE: Sam. St. John, August 21, 2015

FIGURE 4-42 Sand Island Lighthouse

Future Beach Nourishment

While much of the sand placed as part of beach nourishment projects is generally lost within 10 years post-project (Mickey et al. 2020), beach nourishment can temporarily help reduce barrier island breaching and maintain Island height and width with increased storminess and sea level rise (Passeri et al. 2021).

At the time of this writing, the Town of Dauphin Island is using grant funds from National Fish and Wildlife Foundation to complete Phase 1 of the East End Beach and Dune Restoration project. The project includes engineering, design, and permitting to place an estimated 1.2 million cubic yards of sand along 4,800 feet of shoreline to restore 35 acres of beach and dune habitat (**Figure 4-43**).

The Town has also received grant funds from National Fish and Wildlife Foundation to complete engineering and 30% design of a beach nourishment project on the West End. The project will focus on the Gulf shore from approximately Mid-Island west to Katrina Cut (**Figure 4-44**).

SOURCE: USACE 2020

FIGURE 4-43 East End Beach and Dune Restoration Project

SOURCE: USACE 2020

FIGURE 4-44 West End Beach and Dune Restoration Project

Source: NOAA 2022

CHAPTER 5 Climate Change Vulnerability Assessment

Introduction

Human emissions of carbon dioxide and other greenhouse gas emissions are important drivers of global climate change. Greenhouse gases trap heat in the atmosphere, resulting in warming over time. This atmospheric warming can lead to other changes in the earth systems, including changing patterns of rainfall and snow, melting of glaciers and ice, and warming of oceans.

Climate change is projected to cause an increase in temperatures, a permanent rise in ocean water levels, and changes in weather patterns. Rising sea levels are already increasing physical risks to Dauphin Island, including exacerbated shoreline erosion and degradation, decreased beach widths, amplified storm surges, reduced stormwater drainage, and inundation during higher tides and windy days.

This chapter provides an overview of climate hazards and Dauphin Island's vulnerability to each. Additionally, further analysis and discussion of the potential effects of sea level rise is presented in **Section 5.2**.

A community's vulnerability depends on its potential exposure to hazards and the consequences of that exposure (higher exposure or consequences results in higher vulnerability), the sensitivity of the asset (higher sensitivity results in higher vulnerability), and the adaptive capacity of the asset (lower adaptive capacity results in higher vulnerability).

Exposure to hazard and the consequences are evaluated based on the type of hazard a community would potentially be subject to under future conditions and the timing at which this hazard is expected to potentially occur.

An example of low consequence would be infrequent storm flooding of a parking lot. An example of high consequence would be tidal inundation of an emergency response facility or hospital.

Sensitivity to hazard is defined as a community's level of impairment during a hazard. Highly sensitive assets would lose their primary function if exposed to any degree of flood or heat whatsoever. Assets with low sensitivity would not be majorly impacted by the hazard.

Adaptive Capacity is the community's ability to change and respond to a hazard. Low adaptive capacity communities would take a long time to be operational, once impacted. High adaptive capacity communities would bounce back more quickly.

An example of an asset with high adaptive capacity would be a road, which would return to providing access once flood waters recede. An example of an asset with low adaptive capacity would be a water treatment plant where flooding could cause damage that might require weeks or longer to repair.

5.1 Climate Hazards

This section provides an overview of the potential effects of climate change and the hazards that could affect Dauphin Island.

5.1.1 TEMPERATURE RISE AND EXTREME HEAT DAYS

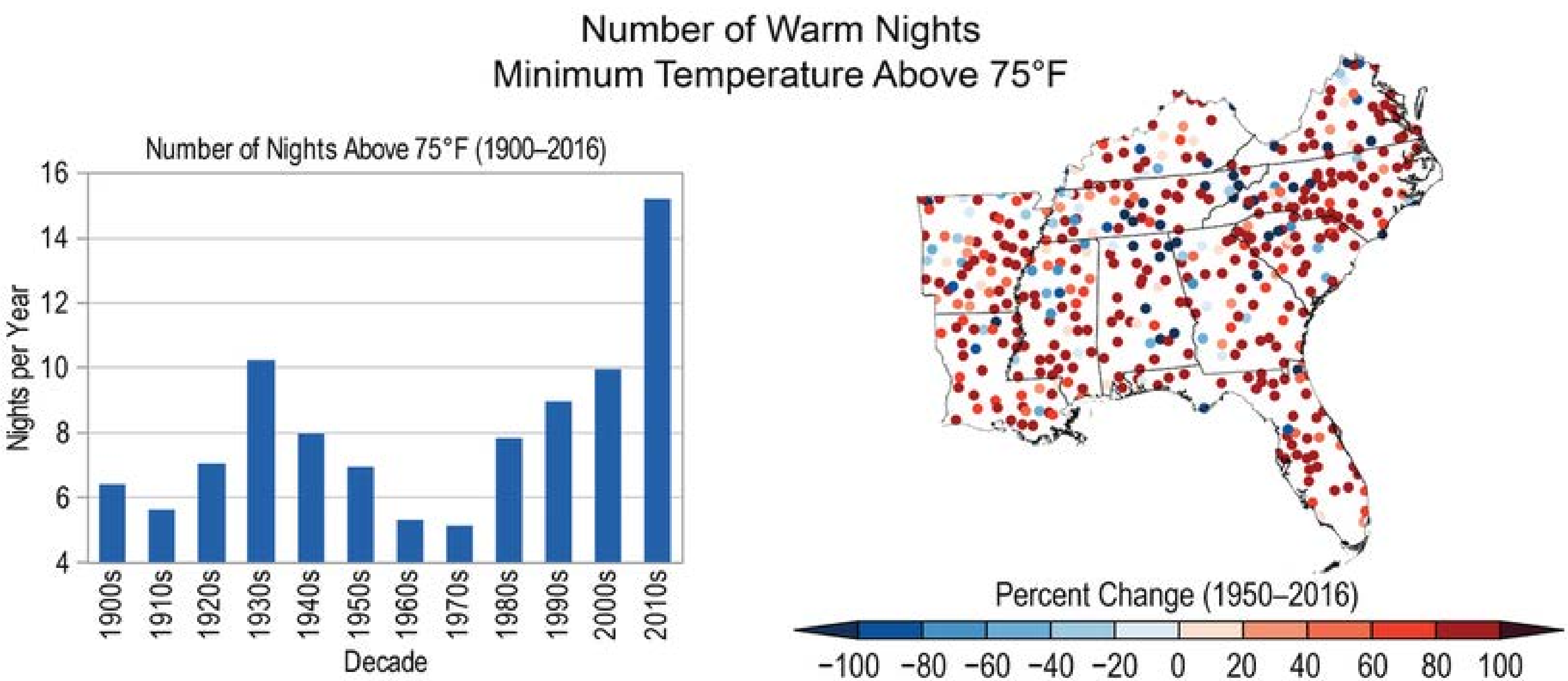
Annual average temperatures in the United States have increased by 1.8°F (1°C) compared to the beginning of the 1900s, with 1.2°F (0.7°C) of that occurring over the last few decades. Over the next few decades, the annual average temperature is expected to increase 2.5°F (1.4°C) above average temperatures since the early 1900s (1901–1960) regardless of future emissions. By the end of the century, increases ranging from 3°F to

12℉ (1.6℃ to 6.6℃) are expected depending on how the world acts to reduce emissions (USGCRP 2018).

The Southeast Region of the United States is one of the few regions in the world that has experienced little overall warming since 1900; however, since the 1960s, the Southeast has been warming at a similar rate as the rest of the United States. This is causing warmer winters and more hot days during the summer (EPA 2016).

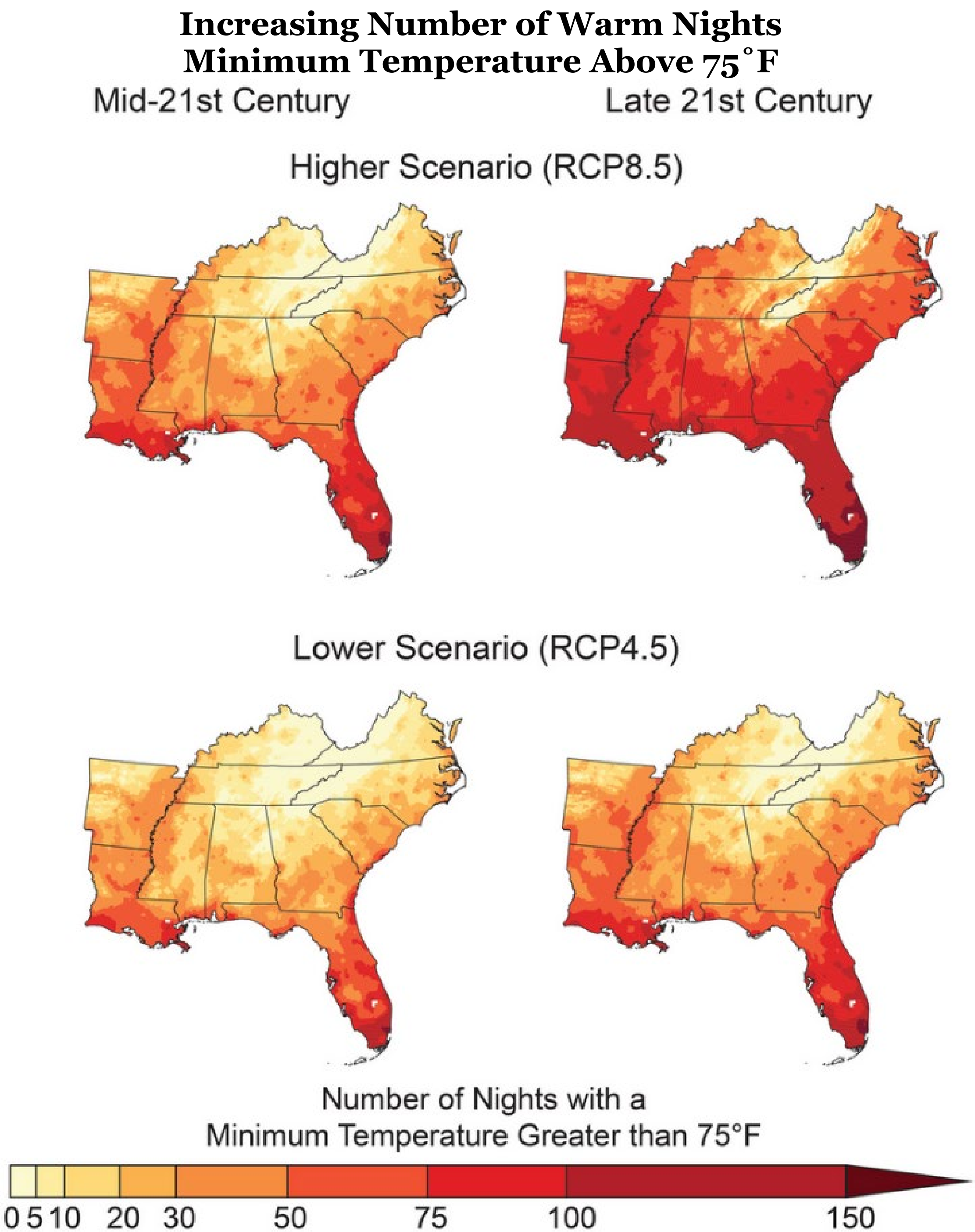
Alabama currently experiences about 15 extreme heat days per year, which are defined as days with temperatures above 95℉. By 2090, the state is expected to experience up to 30 to 60 days per year with extreme heat (EPA 2016). **Figure 5-1** shows how the number of warm nights with temperatures above 75˚F have increased since the 1970s, while **Figure 5-2** shows how the number of warm nights are expected to increase with climate change.

As discussed in **Section 3.3.1**, summer temperatures on Dauphin Island generally range from 80°F to 90°F, with 100°F not uncommon. For the most vulnerable populations such as low-income residents and chronically ill, an increase in extreme heat days can be dangerous, leading to serious illness or even death. In turn, this places additional stress on emergency services and health care systems. Extreme heat events can also strain the electrical grid and result in power outages, creating particularly dangerous conditions for individuals who rely on electricity for medical devices, air conditioning, or fans; and increasing costs to cool homes.



SOURCE: USGCRP 2018

FIGURE 5-1 Historic Number of Nights Above 75˚F



SOURCE: USGCRP 2018

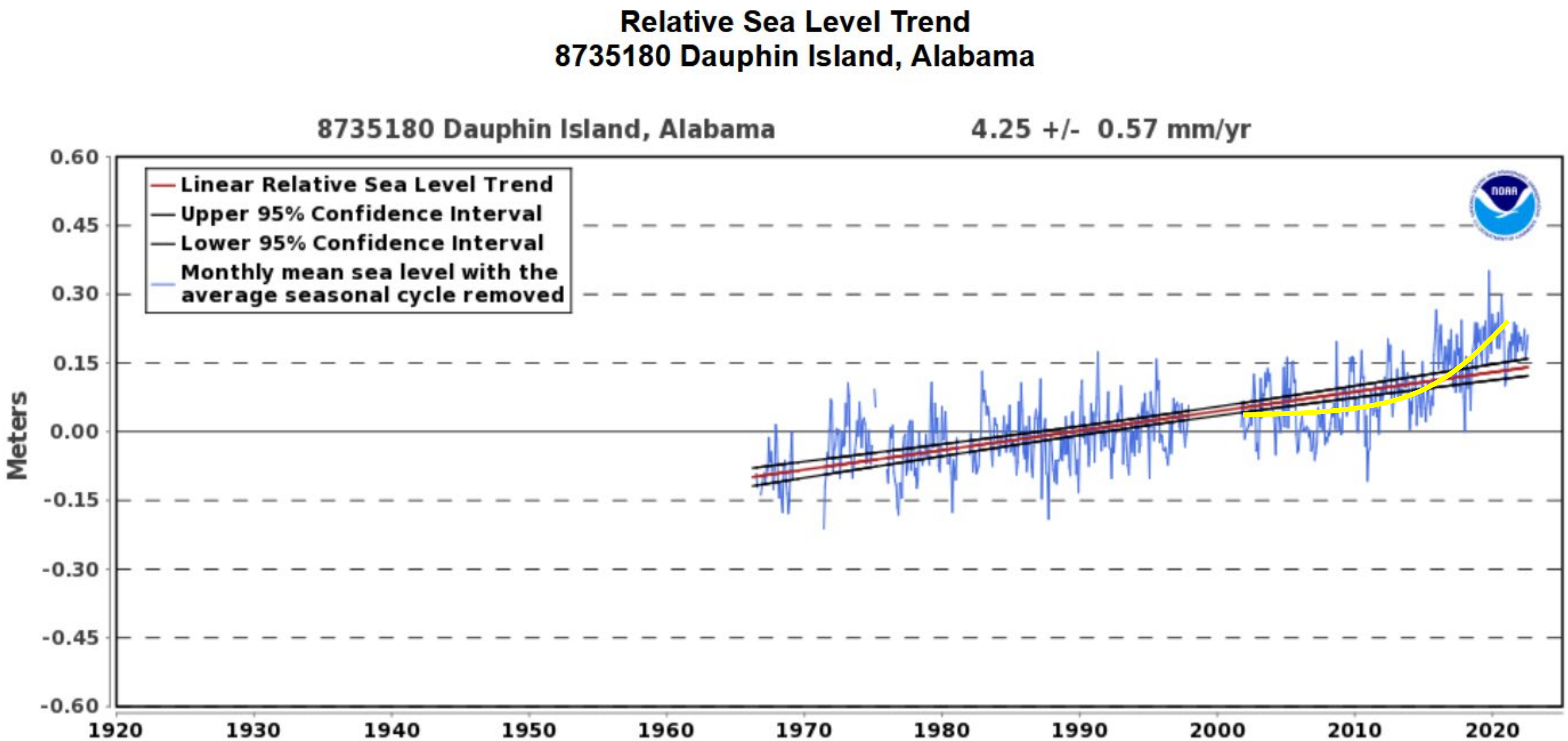
NOTE: The "Higher Scenario (RCP8.5)" is a higher emission (or business as usual) scenario where emissions continue to rise, along with population growth through 2050 and plateau around 2100. The "Lower Scenario (RCP4.5)" is a lower-emissions scenario where emissions peak around mid-century then decline.

FIGURE 5-2 Projected Number of Nights Above 75˚F with Climate Change

5.1.2 SEA LEVEL RISE

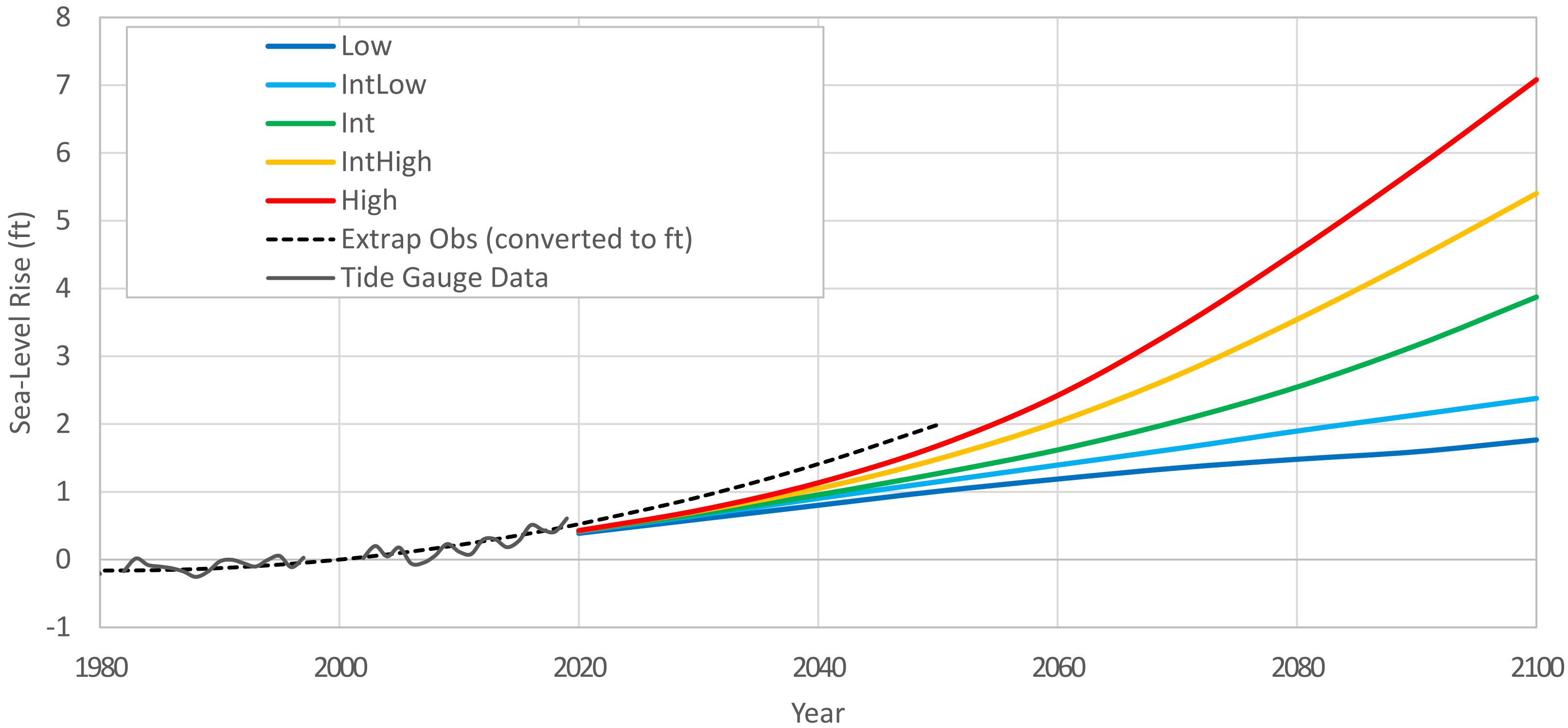
The global sea level has risen by about 7 to 8 inches since 1900 and is projected to rise another 1 to 4 feet by the end of the century. By 2100, a rise exceeding 8 feet is physically possible due to higher scenarios such as the Antarctic ice sheet instability (USGCRP 2018). However, some areas, such as coastal Alabama (including Dauphin Island), have seen greater amounts of relative sea level rise due to factors such as subsidence and changes in ocean dynamics (how water heats and moves; Collini et al. 2022). Sea levels at the National Oceanic and Atmospheric Administration's Dauphin Island tide gage are estimated to have increased by 1.35 feet in the last 100 years as shown in **Figure 5-3**. However, the rate of sea level rise is accelerating over time due to climate change and global warming (**Figure 5-4**).

Sea level rise not only increases typical tidal water levels, but it also raises storm water levels (**Figure 5-5**). The flood extent due to storm surge and waves is made worse by sea level rise and flooding can occur further inland. Additionally, higher sea levels combined with rain can increase flooding by reducing drainage, which would exacerbate flood conditions on Dauphin Island. Sea level rise is also expected to impact natural resources through inundation and drowning of marsh habitats and other important riparian systems, loss of inhabitable uplands, and increased stress of less resilient species of plants and animals.



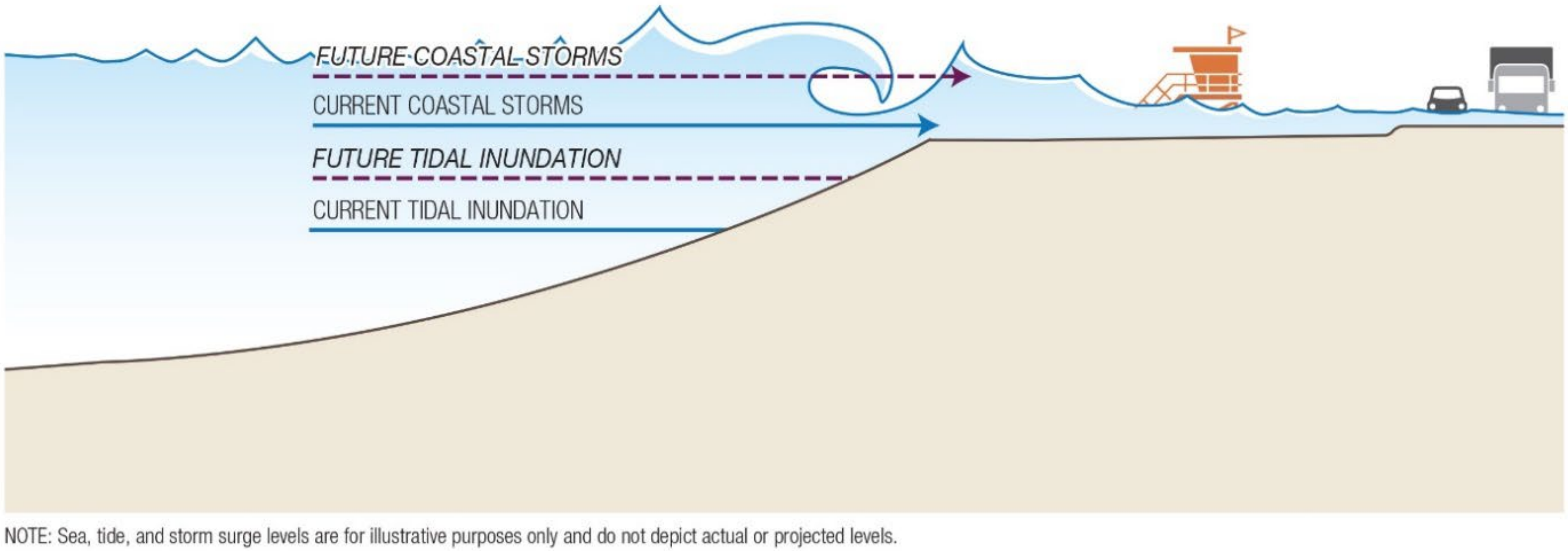
SOURCE: NOAA Tides and Currents

FIGURE 5-3 Relative Sea Level Trend at Dauphin Island Tide Gage Showing Accelerating Sea Level Rise in Yellow



SOURCE: Sweet et al. 2022

FIGURE 5-4 Relative Sea Level Change (RSLC) at Dauphin Island Tide Gage



SOURCE: Figure by Environmental Science Associates

FIGURE 5-5 Conceptual Shoreline Cross-Section Showing Tidal Inundation and Storm Surge Flood Hazards

5.1.3 CHANGES IN WEATHER PATTERNS AND OCCURRENCE OF EXTREME WEATHER

Across the nation, there have been changes in some types of extreme weather events over the last several decades. Whether it is an increase in the duration of droughts in the Western States, or an increase in heavy precipitation in most of the United States, it is causing significant changes. In general, heat waves have become more frequent and intense across the nation, while cold waves have become less frequent and less intense.

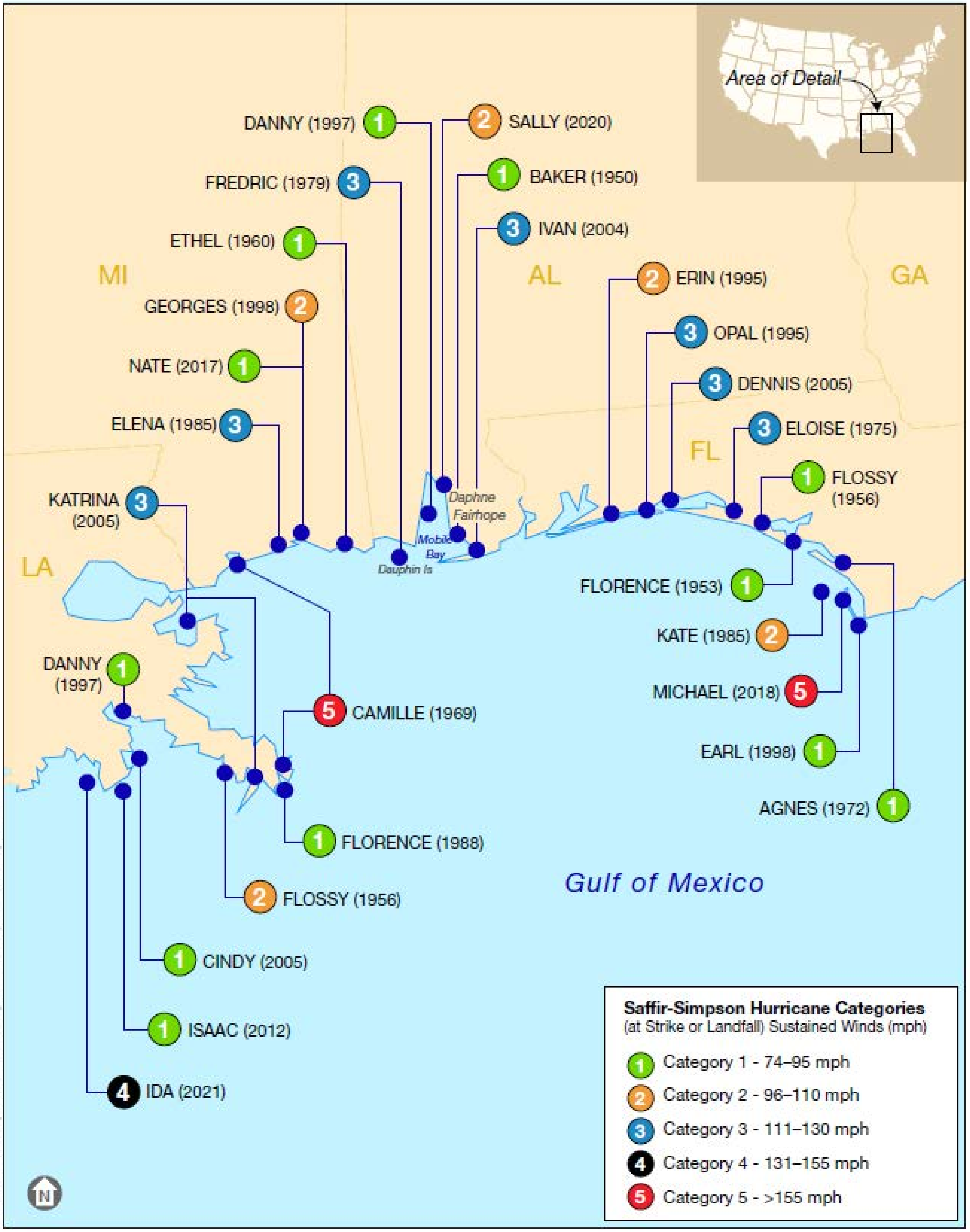
Longer and More Severe Droughts

In an index by States at Risk (SAR 2022), it was noted that Alabama's severity of widespread summer drought is average and ranks below half of the 36 states assessed for drought. However, with climate change, drought conditions are expected to become more common and could impact the natural ecosystems, industries such as agriculture, the community, and indirectly the infrastructure.

Hurricanes

As discussed in **Sections 3.3.1** and **4.6**, Dauphin Island residents have endured many severe storms throughout history (see **Figure 5-6**) and the 2020 hurricane season impacted local community with Hurricane Sally making landfall nearby in Gulf Shores. This storm made landfall in the same place and on the same day (September 16) as Hurricane Ivan did 16 years earlier in 2004. Some of Sally's impacts can be attributed to its slow speed—sometimes only moving 2 to 3 miles per hours, which brought sustained winds and dumped extensive amounts of rain across Dauphin Island. Many lost power for an extended time and homes on the sound side of the Island took the brunt of the damage with the sustained winds causing significant roof and siding damage.

With 2020 being an extremely active hurricane season with a record-breaking 30 named storms and 11 landfalling storms (NOAA 2022) in the continental United States, residents of Dauphin Island were still recovering from Hurricane Sally when Zeta arrived in the area. The two storms combined are reported to have caused billions of dollars in damages to Alabama with $3.4 million in damages to Dauphin Island alone (King and Jenkins 2022). On Dauphin Island, hundreds of homes on the West End were inaccessible by car after Zeta pushed 4 to 5 feet of sand over Bienville Blvd.



SOURCE: NOAA 2022

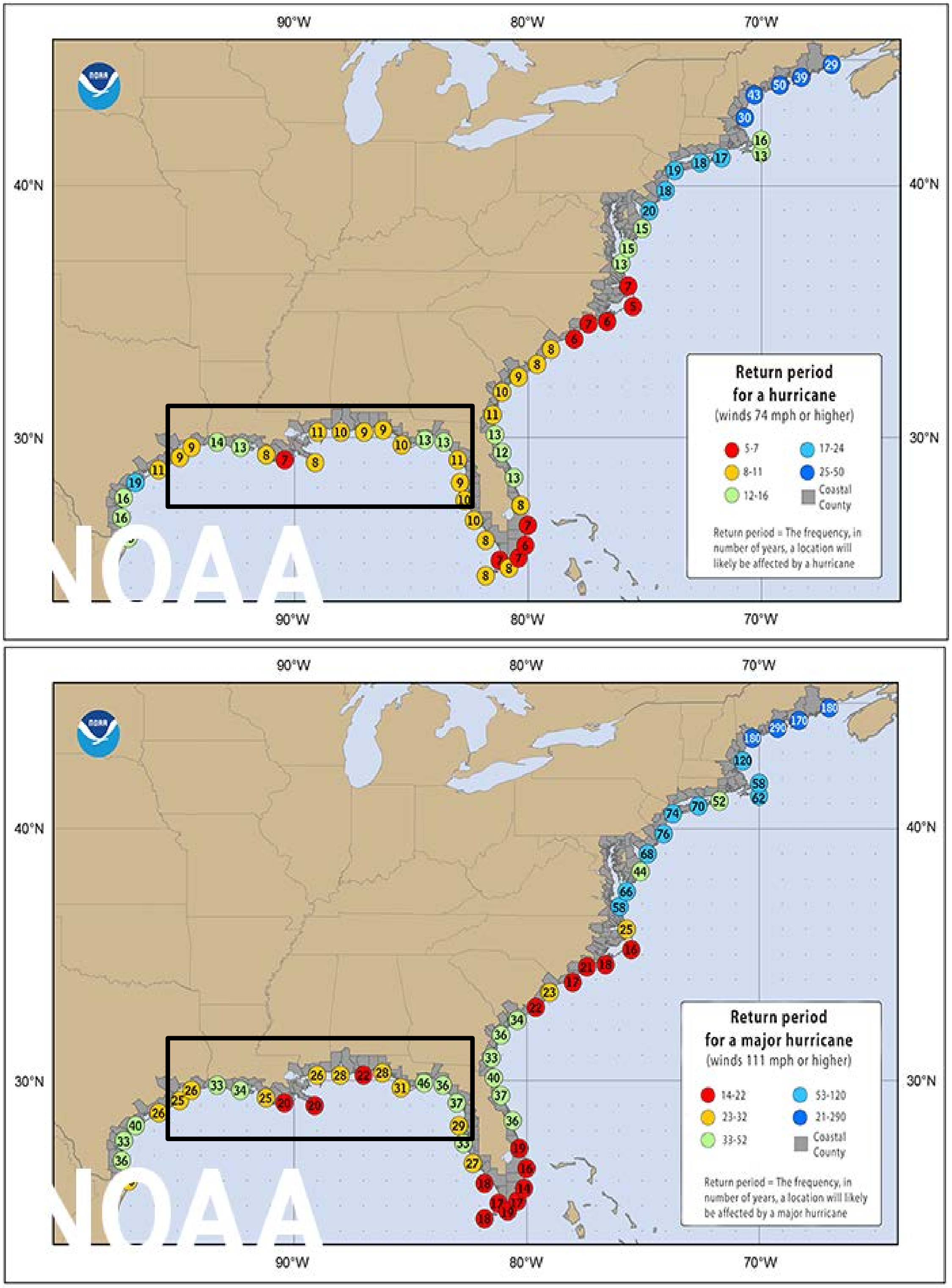
FIGURE 5-6 Gulf Coast Hurricane Strikes Between 1950 and 2021

The intensity, frequency, and duration of North Atlantic hurricanes, as well as the frequency of the strongest (Categories 4 and 5) hurricanes, have all increased since the early 1980s. As shown in **Figure 5-7**, the Mobile Bay area can expect a hurricane to make landfall approximately every 10 years and a major hurricane (winds 111 miles per hour or higher) to make landfall approximately every 28 years (NOAA 2018). By the late twenty-first century, scientists have projected an increase in the frequency of the strongest (Categories 4 and 5) hurricanes. For example, data collected during the 2017 Atlantic hurricane season showed two aspects as to why the warming climate is the cause of the severity of the storms: ability to rapidly reach and maintain very high intensity, and the intensity of the precipitation. Examples of the specific hurricanes demonstrating the effects of a warming climate are Hurricane Harvey, Irma, Jose, and Maria in 2017. All reached intense precipitation and maintained very high intensity. Therefore, Hurricane-associated storm intensity and rainfall rates are projected to increase as the climate continues to warm. (USGCRP 2018).

Severe Storms

Winter storms have increased in frequency and intensity since the 1950s, and their tracks have shifted northward over the United States. Other trends in severe storms, including the intensity and frequency of coastal waves, tornadoes, hail, and damaging thunderstorm winds, are uncertain and are being studied intensively. Modeling has been conducted to analyze the connection of these storms with climate change, however, the confidence in the model projections is low. (USGCRP 2018).

As discussed in **Section 4.6**, storms can erode huge quantities of sand from Dauphin Island's beaches and deposit the sand offshore. As a result, less intense seasonal storms could have a larger than expected impact on the Island as loss of land is occurring as well. As marshes, land, and trees are being lost, the Island becomes more susceptible to all levels of storms.



SOURCE: NOAA 2018

FIGURE 5-7 Return Periods for Minor and Major Hurricanes

Extreme Precipitation Events/Flooding

In the coming decades, winter storms are expected to become less frequent but more intense when they do arrive. There has already been a 27% increase in extreme precipitation since 1958 and by the late 21st century extreme precipitation is expected to increase by another 10%–20% (Scott 2019). Flash flooding events are expected to increase in frequency and intensity. The “atmospheric river” phenomenon, where massive streams of moisture deliver intense precipitation over several days, can result in damaging floods. These events are expected to exacerbate existing flooding on Dauphin Island (**Figure 5-8**), particularly in low-lying areas, and can impact important infrastructure. For example, on September 5, 2012, heavy rainfall and a partially blocked sewer main resulted in a sewage overflow into Salt Creek of around 2,360 gallons, causing the Mobile County Health Department to alert residents of contamination from untreated sewage (Janasie 2013). As discussed in **Section 4.3**, heavy rains in April 2021 also resulted in multiple sewer overflows.

Dauphin Island already experiences extreme precipitation, as the Alabama Gulf Coast is one of the wettest areas in the United States. As discussed in **Section 3.3.1**, Dauphin Island already experiences very intense rainfall based on NRCS rainfall distribution pattern categories. An increase in the number of flood events can impact homes and businesses in low-lying areas resulting in property damage, injuries, and displacement. Additionally, with higher sea levels, drainage to the ocean will be impeded, which will extend the duration for flood events. Vulnerable populations such as low-income households, senior citizens, or people living in ground level housing will face greater impacts of flooding as they have a reduced ability to respond to damage from flood events. Dauphin Island’s Comprehensive Plan (2013) noted that the population of Dauphin Island is aging with 23% of the population 65+, which is significantly higher than the percentages for Mobile County or Alabama. The Plan discusses that 34% of households have persons over 65 and almost 10% of households have someone 65 and older living alone. Additionally, many households will face difficulties in the event of evacuations due to street flooding and other access issues. Flooding may also impact emergency response facilities and other critical infrastructure that is below grade and can temporarily interrupt key access roads for emergency responders or evacuation routes.

SOURCE: Photos by Environmental Science Associates

FIGURE 5-8 Photos Showing Flooding on the Island after Heavy Rains in April 2021 (Top: East End; Bottom: West End)

Increased Air Pollution

Poor air quality can negatively impact human health through allergens and by causing respiratory diseases. Air pollution from the Southeast is largely from vehicle and power plant emissions, as well as wildfires and allergens. In the Southeast region, a warmer climate signifies more days with stagnant air masses, higher levels of fine particulate matter ($PM_{2.5}$),and higher ozone concentrations. Although, the levels of precipitation and wind trajectories are increasing, warmer weather is still projected to result in increased periods of ozone exposure.

5.2 Climate Vulnerability

5.2.1 INFRASTRUCTURE

In September 1979, Category 4 Hurricane Frederic passed over Dauphin Island with winds gusting from 100 to 145 miles per hour and 12- to 15-foot storm surge (NOAA NWS 2021). As shown in **Figure 5-9**, the storm toppled the only bridge to the Island and destroyed 140 houses (Gaul 2019). For the 34 months after the hurricane, those traveling to and from the Island had to use the ferry until the new bridge was opened.

SOURCE: USACE

FIGURE 5-9 Photo of the Remains of the Dauphin Island Bridge after Hurricane Frederic

The South Alabama Regional Planning Commission (2020) assessed the vulnerability of transportation in the Mobile area and determined a vulnerability score of 2.92 for the Dauphin Island Bridge and causeway, where 1 to 1.9 indicates low vulnerability, 2 to 2.9 indicates medium vulnerability and 3 to 4 indicates high vulnerability.

Sea level rise and flooding are likely to continue impacting transportation systems to and around Dauphin Island (**Figure 5-10**). Evacuation and re-entry during storms are particularly challenging since the causeway to the Island can become impassable (Janasie 2014). Additionally, storms often wash sand over Bienville Blvd., temporarily blocking access to the homes on the West End (**Figure 5-11**). Sea level rise may also cause impacts to docks and shoreline protections (e.g., sea walls), reducing access to the shorelines, which could affect water-based transportation to and from the Island (e.g., ferrying). Impacts to transportation have the additional impact of delaying utility and emergency workers, reducing the ability of the Island to adapt to hazards, individual and community emergencies, and other challenges.

SOURCE: Photos by Environmental Science Associates

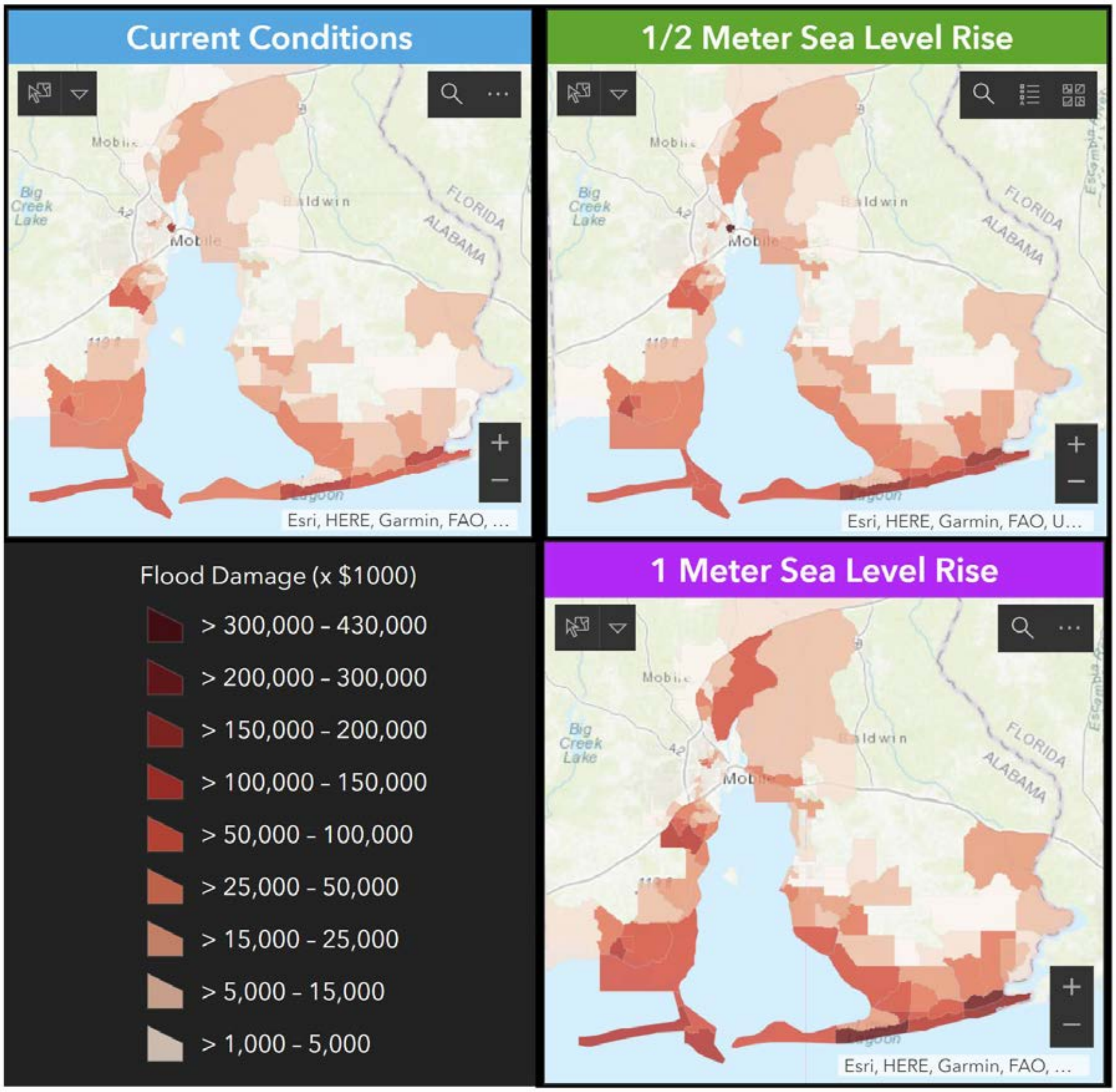
FIGURE 5-10 Photos of Flooding on Bienville Blvd. After Heavy Rains in April 2021 (Top: East End; Bottom: West End)

SOURCE: Barry Vittor and Associates, Inc.

FIGURE 5-11 Photo of Sand Berm Along Bienville Blvd. on the West End of the Island

The Dauphin Island Water and Sewer Authority, which is independent of the Town, is responsible for some of the more routine cleanup and storm related maintenance costs. Currently, the West End accounts for 60% of the Dauphin Island Water and Sewer Authority maintenance costs after a storm (King and Jenkins 2022). As sea level rise and increased storm intensity impact the Island, water and sewage maintenance is likely to increase.

Regional-scale evaluations of infrastructure risk under future sea level rise scenarios have been developed for the wider Mobile Bay area. The U.S. Army Corps of Engineers (USACE) modeled structural damage by census tract under current and future sea level rise scenarios for Mobile County, as part of the Alabama Coastal Comprehensive Plan (ACCP), which was commissioned by the State of Alabama's Department of Conservation and Natural Resources. The USACE led and completed the ACCP study through 2015. As part of the ACCP, an online web tool (Storyboard) was created so that stakeholders could view storm surge scenarios, structure risk, and habitat and climate resilience assessment outcomes for their areas of interest. The model results show structural damages for the 10-year, 50-year, and 100-year extreme event under existing conditions and 1.5 feet and 3.3 feet of future sea level rise (**Figure 5-12**). On Dauphin Island, 1,814 structures are predicted to be damaged under the 100-year storm surge and 3.3 feet of sea level rise.



SOURCE: ADCNR n.d.

FIGURE 5-12 Structural Damage by Census Tract for 100-Year Extreme Event and 0 Meter, 0.5 Meter, and 1.0 Meter of Sea Level Rise

5.2.2 LAND LOSS

As discussed in **Chapter 4**, Dauphin Island is already experiencing erosion from long-term processes and extreme weather events and has lost 16% of its area between 1958 and 2007 (Morton 2008). Recent tropical storms have eroded and flattened the roadside berms and low dunes south of Bienville Boulevard. Subsequent sand removal operations have reestablished most of the roadside berms, but these areas lack vegetative cover and are susceptible to future erosion (**Figure 5-11**).

Sea level rise is projected to make the Island even more susceptible to storm events, flooding, overtopping, and erosion. Because of the relatively low elevation of the Island, even a slight vertical increase in sea levels will result in significant movement of the shoreline. Additionally, projections suggest that climate change will result in an increase in storm intensity, with more Category 4 and 5 hurricanes.

Passeri et al. (2020) modeled Dauphin Island shoreline evolution with varying levels of storminess and sea level rise. Their study suggests that barrier islands can keep pace with sea level rise by moving sand across the Island during storm events to maintain height and width, however if storms are too intense or sea levels are too high, the Island is unable to recover. The study found Dauphin Island exhibits the following five behaviors in response to storms and sea level rise:

1. Keeping pace by maintaining height and width
2. Losing width but maintaining height
3. Losing height but maintaining width
4. Losing height and width
5. Gaining height and width

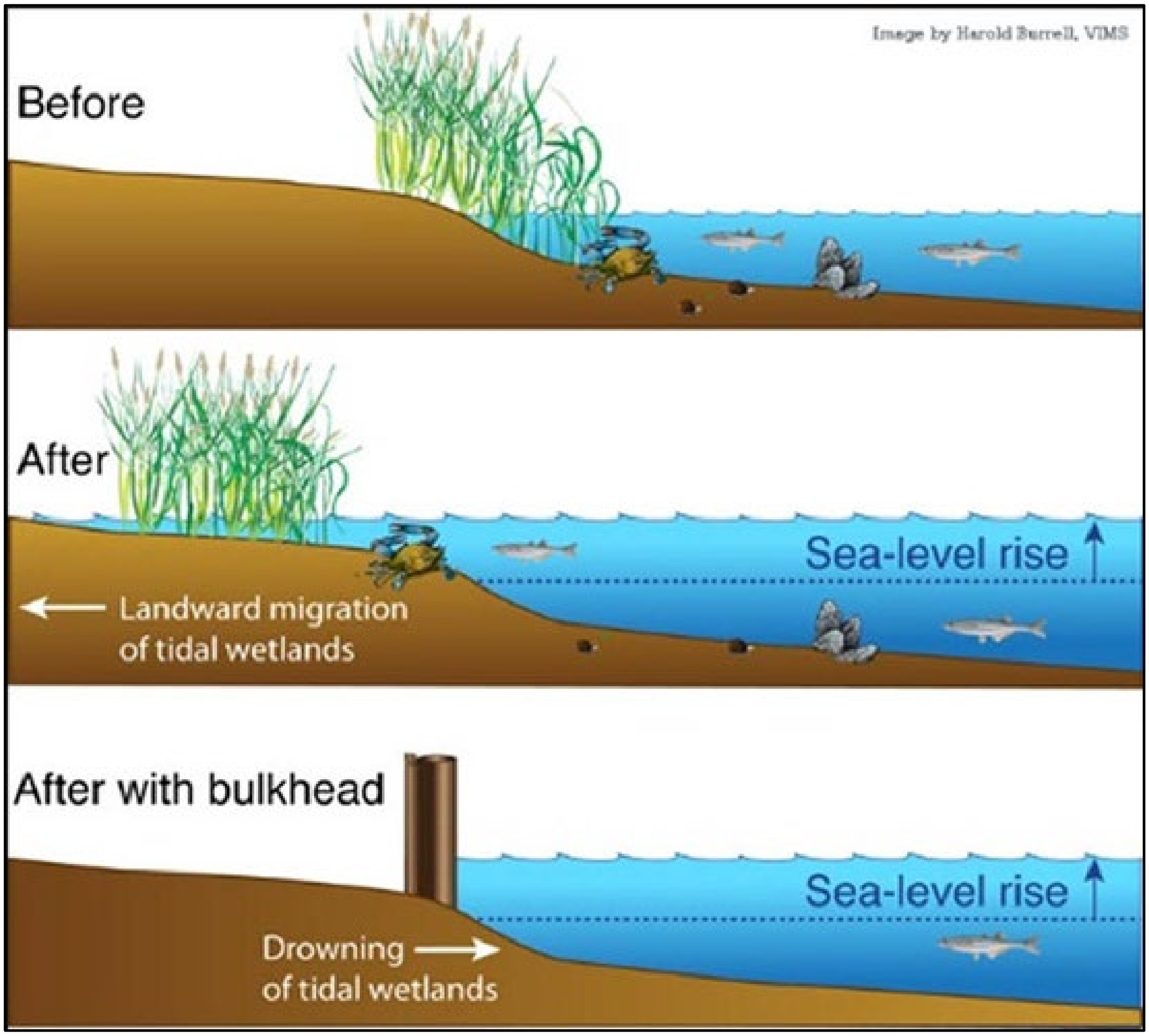
Increasing amounts of sea level rise and storminess were correlated with more of the Island losing height and width and breaching in some cases. USACE et al. (2020) found that with high sea level rise and a high level of storminess the Island was likely to experience significant breaches to the east and west of Katrina Cut and along Pelican Island and Little Dauphin Island. Under the highest storminess scenario, the Island was unable to recover in between storms and drowned in just 10 years (Passeri et al. 2020).

5.2.3 HABITAT IMPACTS

Sea level rise can shift salinity, which may lead to impacts to native species. After Hurricane Frederic in 1979, Dauphin Island tree species shifted as popcorn trees were introduced (Janasie 2013). Other climate stressors can also weaken trees, which can lead to other impacts, such as erosion and loss of bird habitat. For example, an August 2011 wildfire burned over 80 acres in the bird sanctuary, opening up portions of the understory and allowing rapid colonization of loblolly pine, which now forms a nearly monotypic stand of dense trees. Additionally, modern development has put pressure on the palustrine wetlands on the Island.

Coastal habitats, like salt marshes, change over the long-term in response to multiple processes, including tides, sediment accretion, freshwater inputs from the watershed, ecology, and sea level rise. Salt marsh and intertidal habitats establish within zones corresponding to tidal inundation. The elevation of an area determines the frequency of tidal inundation, which in turn determines soil moisture and salinity. These factors affect the type of vegetation that can establish and persist. If the landscape changes due to accretion (or restoration/grading), the habitat types change in response. Additionally, habitats will evolve when the tides rise due to sea level rise.

Given sufficient space, marshes will migrate inland to higher elevations over time. However, in many areas, development limits the areas marshes can migrate to and these habitats can be "pinched-out" and drowned with sea level rise. **Figure 5-13** demonstrates this "pinch-out" effect.



SOURCE: NOAA 2021 from Harold Barrell, VIMS

FIGURE 5-13 Sea Level Rise "Pinch-Out" Effect

Wetland Evolution

Previous modeling by Warren Pinnacle Consulting (WPC 2015) looked at wetland evolution across the entire Gulf Coast. They used the Sea Levels Affecting Marshes

Model (SLAMM) to analyze habitat changes under 1.6, 3.3, 3.9, 4.9, and 6.6 feet (0.5, 1.0, 1.2, 1.5, and 2.0 meters) of sea level rise and assumed habitats were allowed to migrate into developed areas. **Table 5-1** shows the habitat change for Dauphin Island with 4.9 feet (1.5 meters) of sea level rise by 2100.

TABLE 5-1 Habitat Acreage on Dauphin Island from WPC SLAMM Analysis

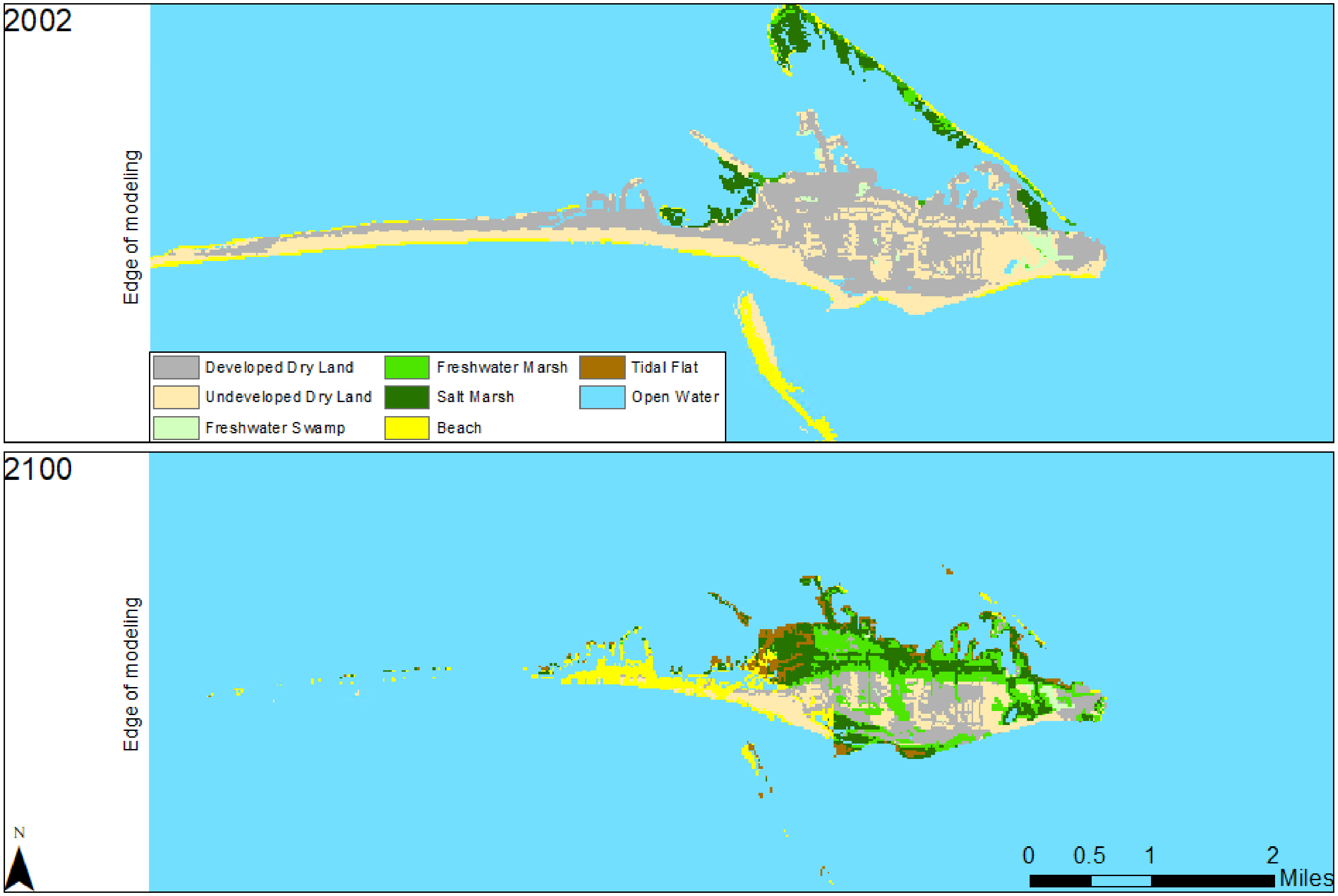
Habitats[1]	2002	2100	Change
Developed Dry Land	1,195	304	-891
Undeveloped Dry Land	908	248	-660
Freshwater Swamp	51	16	-34
Freshwater Marsh	22	343	321
Salt Marsh	233	347	114
Beach	393	220	-174
Tidal Flat		124	124
Open Water	11	1,211	1,200
Total	**2,813**	**2,813**	

[1] SLAMM habitats have been combined into simplified categories.

With 4.9 feet (1.5 meters) of sea level rise at the higher end of projections, most of the West End, Pelican Island, and Little Dauphin Island would convert to open water (**Figure 5-14**). Most of the middle of the Island would convert to beach and the marsh habitat in Graveline Bay would drown out. If habitat is allowed to migrate into developed areas, about one third of the East End would convert to salt and freshwater marsh. About 70% of the existing freshwater swamp habitat would convert to marsh.

Developed areas on the West End would likely be lost with 4.9 feet (1.5 meters) of sea level rise. While much of the developed area on the East End would be above tidal water levels, the loss of Little Dauphin Island would expose the area to more and higher waves and storm surge.

In The Nature Conservancy's *Resilient Coastal Sites for Conservation in the Gulf of Mexico* report (Anderson and Barnett 2019), they ranked the resilience of the West End beach and the south end of Little Dauphin Island as "average," Graveline Bay marshes as "slightly below average," and the north part of Little Dauphin Island and Aloe Bay marshes as "below average." This indicates that the habitats are less able to support biological diversity and ecological functions in response to sea level rise, when compared to other areas in the Gulf of Mexico.



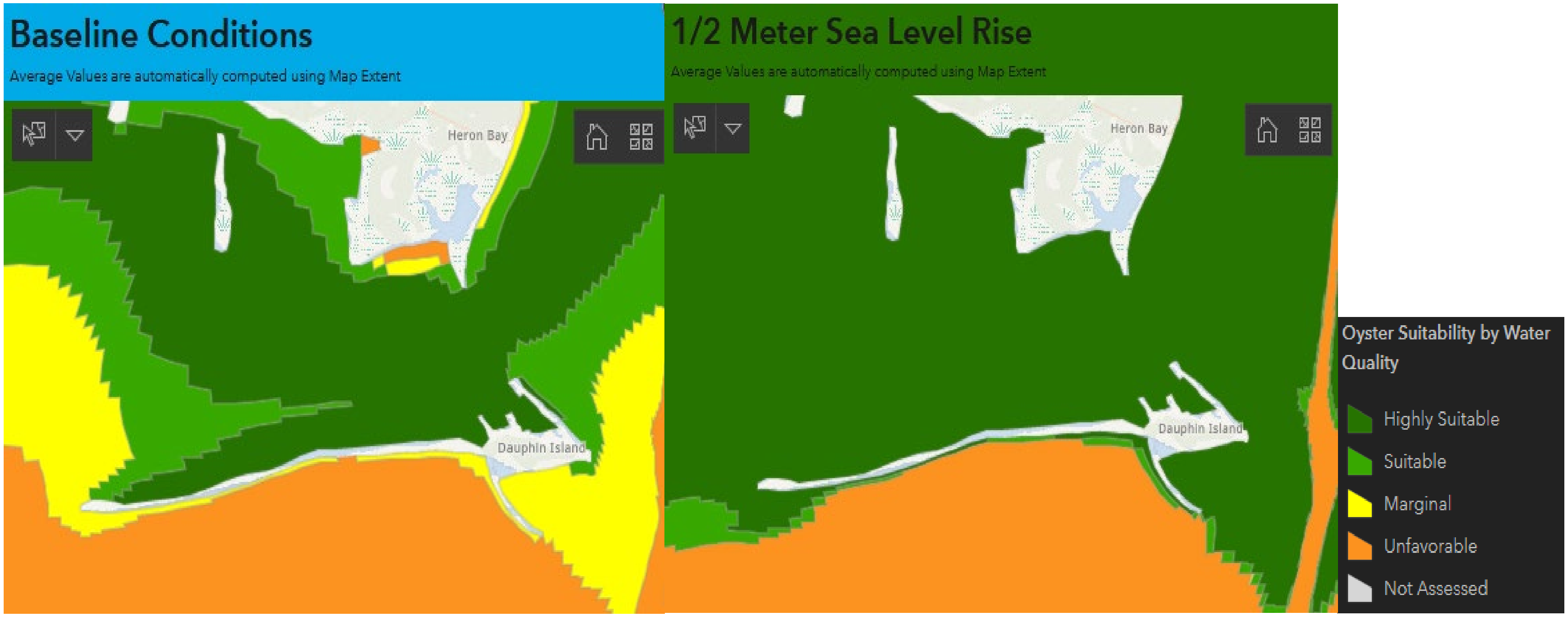
SOURCE: WPC 2015

FIGURE 5-14 Wetland Evolution on Dauphin Island with 1.5 meters of Sea Level Rise

Oyster Habitat Evolution

Oyster habitat suitability under existing and future conditions (1.6 feet or 0.5 meter of sea level rise) were evaluated and mapped for the eastern Mississippi Sound and Mobile Bay by the U.S. Geological Survey National Fish and Wildlife Foundation Alabama Barrier Island Restoration Assessment Study (Enwright et al. 2019). Key water quality parameters for oyster growth and survival, such as salinity, temperature, dissolved oxygen (DO), local water depth, and total suspended solids (TSS), from existing hydrodynamic and water quality modeling efforts were assessed in the region and used to create rankings of habitat quality from Highly Suitable to Unfavorable.

Presently, the Gulf side of Dauphin Island is considered to be unfavorable for oyster recruitment, while the Sound side is considered highly suitable, and some oyster aquaculture is currently occurring. Under 1.6 feet of sea level rise, the suitability of the region improves and is predicted to be more hospitable for oyster growth (**Figure 5-15**).



SOURCE: ADCNR n.d.

FIGURE 5-15 Oyster Habitat Suitability by Water Quality in Eastern Shore Watershed Study Area

5.2.4 FISCAL IMPACTS

King and Jenkins (2022) (**Appendix A**) prepared a fiscal impact assessment that examined the relative costs and benefits generated by the West End of Dauphin Island. West End properties are largely second homes and rental properties and, even without hurricanes and major storms, cost the Town a significant amount to maintain.

For the purposes of this analysis, Dauphin Island was divided into the following areas:

- **The West End:** defined as the area west of Pirate's Cove Street. Primarily built on less solid ground and at lower elevations. Some residents have defined it as the point where homes are built on fill.
- **The Middle:** the area west of Salt Creek and east of Pirate's Cove Street. The area houses the large condominium blocks comprising approximately 300 units, with an estimated 50% of those units serving as short-term rentals (STR)s. This area generates a considerable amount of economic activity heavily related to tourism. It is much less vulnerable than the West End, with less risk of erosion and flooding, and overall, less storm exposure.
- **The East End:** The area east of Salt Creek (Omega Street). This is the portion of the Island built on the most solid land and with the oldest structures. It is commonly thought of as more "local," with most full-time residents residing here.

With this dataset, summary statistics for the Island were developed, and a variety of tests were run to determine the fiscal impact of each region in terms of property tax generation for the Town. The impact of ownership (on-Island, State of Alabama, or out-of-state) and *classification* on revenues was also examined.

To calculate the potential fiscal impact of future storm damage, researchers from the Harte Research Institute for Gulf of Mexico Studies at Texas A&M and the National Centers for Coastal Ocean Science/National Oceanic and Atmospheric Administration National Ocean Service supplied modeling results of storm impacts in the Northern Gulf of Mexico. Impact damages were modeled under for two storm conditions—100-year and 500-year—and five sea level rise scenarios. The researchers projected the number of buildings exposed to damage, the number of "substantially damaged residential buildings[1]", and the percentage of buildings damaged, among other results. From these estimates, the expected replacement cost was determined using the average developed parcel value for each census block.

The results of the fiscal analysis showed that with storm damage the Town will lose between \$19,000 and \$142,000 in property tax revenues and \$114,000 in lodging tax

[1] Defined as greater than 50% damage, such that the structure would likely be replaced.

revenues at current sea levels, and up to $189,000 and $985,000 at higher sea levels. The majority of lost lodging tax revenue, as estimated, comes from impacts on the West End. Based on the analysis, Dauphin Island cannot offset the cost of major storm damages. The Town, however, can shift its economic base from the more vulnerable lowest lying areas to less vulnerable properties and development. In doing so, they can offset the coming losses with new revenue sources.

5.3 Conclusions

Dauphin Island is vulnerable to multiple climate hazards, especially sea level rise and changes in weather patterns that may result in increased flooding and erosion. With anticipated sea level rise, Dauphin Island's current vulnerabilities to coastal flooding and erosion are projected to increase in frequency, intensity, and extent. As discussed in **Section 5.1.3**, hurricanes have caused significant damage along Dauphin Island's coastline, even without significant amounts of sea level rise. Future sea level rise is projected to create a permanent rise in ocean water levels that will increase erosion of beaches and result in more damaging coastal storm events. Dauphin Island cannot afford to continue building as it has, placing high value homes in the path of hurricanes. Higher water levels at the coast and increased rainfall may also impact stormwater drainage during extreme rainfall events by backing up water on the Island and delaying drainage until low tide. The findings of this vulnerability assessment can be used to identify adaptation strategies that will address the impacts of climate hazards and reduce Dauphin Island's vulnerabilities, expanding on results of the Adaptation Pathways Project (Patch and Collini 2022).

CHAPTER 6 Identification of Critical Issues and Areas

Introduction

This section presents a narrative summary of the critical issues and areas in the Dauphin Island Watershed identified from public outreach and stakeholder engagement activities including Steering Committee input; interviews with local leaders and experts; direct input from citizens and visitors to the watersheds via public workshops, polls, and surveys (see **Chapter 2**); and a thorough review and characterization of Watershed conditions (see **Chapters 3 and 4**). The critical issues and areas presented below are organized by the Mobile Bay National Estuary Program Comprehensive Conservation and Management Plan Six Values with an additional category for administrative issues.

6.1 Water

6.1.1 FLOODING

The entirety of Dauphin Island is susceptible to flooding due to its low elevation, limited stormwater storage capacity, and drainage system. The West End of the Island is a vulnerable area that regularly experiences flooding during storm events that produce heavy rainfall, including but not limited to tropical systems. In addition, flooding pressures exerted by rainfall are worsened by storm surge impacts to varying degrees during tropical events. The East End of the Island also experiences flooding due to both rainfall and groundwater inundation.

Source: Photo by Environmental Science Associates

West End Flooding

The Water Table Aquifer located beneath Dauphin Island contributes to Island flooding. The top of the aquifer is visible at ground level and is recharged directly by precipitation falling on the Island. Under normal conditions, as rain enters the aquifer, it discharges to area water bodies such as Mississippi Sound to the north and the Gulf of Mexico to the south. However, when the precipitation rate exceeds the discharge rate, the aquifer's potentiometric surface (water table) rises above ground level in low-lying areas giving the appearance of flooding. This phenomenon is known as groundwater flooding. Groundwater flooding takes longer to dissipate than surface water flooding because groundwater moves much more slowly than surface water and will take time to flow away underground. As the aquifer slowly discharges to the surrounding water bodies, the water table drops and the

Source: Photo by Environmental Science Associates

East End Flooding

"flooding" recedes (see **Appendix C**). As sea levels rise, this issue may be compounded as presented in **Section 5.1.2.**

Groundwater and rainwater flooding is exacerbated on the East End as more land is converted from wetland to developed. Wetlands are natural water storage and treatment areas and as each parcel is developed and converted from pervious to impervious surface, there is less water storage available on the Island and flooding potential increases. Additionally, as lots are developed and trees cut down, this removes the water uptake capacity from this natural system. Some trees have the ability to transpire more than 10,000 gallons of water a year, providing natural flood attenuation.

Flooding issues can also be compounded when unknowing residents open their sewer cleanouts or a manhole thinking it will drain the water, not realizing this is a wastewater treatment system and not a stormwater conveyance system. This situation can overwhelm the wastewater treatment facility and can lead to sanitary sewer overflows (**see Sections 4.3.1 and 6.1.3**). Additionally, it has been noted that some residents are deepening ditches along their property, thinking that the water is from rainfall and this deepening would help speed up drainage. However, this proposed solution does little to alleviate the flooding if the water is coming from the aquifer below.

6.1.2 WATER SUPPLY

Dauphin Island Water and Sewer Authority (DIWSA) initially utilized eight shallow drinking water wells in the Water Table Aquifer. Over the years, production from the shallow wells decreased while water quality issues increased, resulting in the wells being taken out of service and abandoned. DIWSA currently operates three wells completed in the brackish sands of the Shallow Sand Aquifer. The water produced by these three wells requires various treatment methods prior to distribution (see **Appendix C**). DIWSA also operates one well completed in the brackish water sand of the Deep Sand Aquifer. The aquifer's water is treated by reverse osmosis to remove chlorides prior to distribution.

Due to the lack of a continuous and sustainable fresh drinking water supply, DIWSA invested in reverse osmosis as the primary treatment method to render the brackish water contained in sands of the Shallow and Deep Sand Aquifers potable. This treatment method is very expensive when compared to that required for aquifers containing fresh water that typically require little or no significant post-production treatment. To help protect the current treatable chloride levels in the aquifers with the existing reverse osmosis infrastructure, the Town of Dauphin Island should implement a total ban on all non-DIWSA operated public supply wells (i.e., private wells) drilled below a depth of 40 feet. In doing so, the Dauphin Island community would be opened to developing freshwater wells in the Water Table Aquifer and provide needed local protection to the brackish water aquifers currently serving citizens and visitors to Dauphin Island (**Appendix C**).

6.1.3 WATER QUALITY ISSUES

Stormwater Runoff

Developed areas typically experience greater magnitudes of stormwater runoff than more rural areas due to the higher percentage of impervious area. As lots are cleared, imperviousness is increased with driveways and structures such as roofs. Without the ability to readily infiltrate, runoff from developed areas transports pollutants to waterbodies. Stormwater runoff has the potential to carry trash, pollutants, and sediments into surface waters of the Watershed. Further, during periods of high rainfall, deficient stormwater management systems may be overburdened, and localized flooding and erosion may occur. Currently, Dauphin Island lacks a formal stormwater management system. Without a comprehensive planned and designed water storage and conveyance system, the Island is impacted by flooding and stormwater runoff issues. These seemingly separate critical issues become interconnected when considering appropriate stormwater BMPs and infrastructure for a given watershed.

Changes in watershed land uses and land cover characteristics, including the conversion of natural habitats to development and losses of wetlands and other natural systems, also affect the behavior of historic overland flows and discharge patterns to natural surface water features and resources. During severe storm events, runoff volumes and velocities are often amplified. When increased runoff volumes discharge into natural surface water features this may increase erosion and land loss, and increase pollutant loads to receiving waters.

Sanitary Sewer Overflows

As presented in **Section 4.3.1**, sanitary sewer overflows have been documented on Dauphin Island and primarily occur during large rain events. These occur during intense rain events that infiltrate and overtax the compromised sanitary sewer system, allowing sewage to escape the sanitary system to become a direct pollution source to receiving waters. This process is referred to as "Infiltration and Inflow" or I & I. Infiltration and Inflow occurs when stormwater runoff and/or groundwater enter the sanitary sewer system through cracked pipes; leaky manholes; or improperly connected storm drains, down spouts, and sump pumps. The stormwater and groundwater combine with raw sewage, exceeding the design capacity of the sanitary sewer system, and cause sanitary sewer overflows. DIWSA is in the process of making system-wide improvements to address sanitary sewer overflows and effluent treatment and discharge as presented in **Section 7-1-1.**

6.2 Coastlines

Source: Photo by Environmental Science Associates
West End bulkhead

As a barrier island, Dauphin Island shorelines are constantly changing due to hurricanes, storm surge, sea level rise, gradual coastal processes, and anthropogenic influences (see **Section 4.6**). Long-term trends show the Island is narrowing (-1.97 meters/year) and the land area of Dauphin Island has shrunk from around 5.5 square miles in 1852 to around 4.7 square miles after Hurricane Katrina in 2005 (Smith et al. 2018; Morton 2008). Pelican Island peninsula is shortening and moving west, and Little Dauphin Island has eroded on average 3.7 feet/year (Jones and Tidwell 2012). In areas of the back-barrier side of Dauphin Island where the marsh remains, the shoreline is experiencing steady, long-term erosion with erosion rates at Graveline Bay marsh an order of magnitude higher than the rest of the back-barrier system (Smith et al. 2018).

Development in vulnerable locations has contributed to the risks people on the Island face. Residential construction on the West End has attempted to “pin” the Island in place, leading to loss of structures during extreme events as overwash transports sediment from the Gulf side of the Island to the back-barrier and the shorelines “adjust” out from under the development.

Source: Photo by Environmental Science Associates
Pass Drury

While Pass Drury is an historic breach of Little Dauphin Island, the development that has occurred just inside the Pass, which was protected from waves when the pass was closed, is now at risk from waves and erosion during large storm events.

Source: NOAA NWS 2021b

Hurricane Katrina Overwash

Dauphin Island has been breached by hurricanes and storm waters several times in recorded history. In September 2004, Hurricane Ivan breached the West End of the Island and in 2005 Hurricane Katrina widened the breach, which then became known as Katrina Cut. After the *Deepwater Horizon* oil spill, the U.S. Army Corps of Engineers issued an emergency permit to close the Katrina Cut with a rubble mound structure to protect against oil getting into the Mississippi Sound. The Island is susceptible to additional breaches during extreme storm events and the risk of breaching is expected to increase with sea level rise.

Additionally, sea level rise is projected to make the Island more susceptible to storm events, flooding, overtopping, and erosion. Because of the relatively low elevation of the Island, even a slight vertical increase in sea levels will result in significant movement of the shoreline. Sea level rise is expected to alter Gulf-directed flows and durations after a storm, leading to increased cross-barrier sediment deposition on the Gulf-side of the West End (Passeri et al. 2018). In some cases, this may allow the Island to recover post-storm; alternatively, if sand is transported away from the Island, this process may contribute to increased erosion. While intertidal marsh in the back-barrier side of the Island is expected to keep pace with intermediate levels of sea level rise, higher sea level rise may require nourishment to maintain the marsh (Enwright 2020).

6.3 Access

6.3.1 PUBLIC ACCESS

General issues related to access as identified during the public outreach and stakeholder engagement program (see **Chapter 2**) are summarized below.

PARKING

The Town of Dauphin Island Comprehensive Plan 2030 (Town of Dauphin Island and SARPC 2013) identified the lack of adequate public parking as a concern and this issue persists today as the Island attracts more visitors, especially during Island events and peak tourist season. The development of Aloe Bay has the potential to attract even more visitors to the Island, and while the Aloe Bay Master Plan will address parking for that area, a broader Island-wide comprehensive parking strategy may be needed to integrate with the Aloe Bay Master Plan.

TRANSPORTATION

The transportation network on the Island consists of private vehicles, golf carts, bicycles, and a public ferry that connects the Island with the Fort Morgan area. With unprecedented growth occurring on the Island with new residents, and the influx of increased visitation, the Town may want to consider developing a comprehensive transportation strategy to effectively manage connectivity to the Island, accessibility on the Island, and evacuation during extreme events.

BOAT RAMPS AND KAYAK LAUNCHES

The need for more ramps, launches, and parking at these areas was identified as a need in Dauphin Island's Strategic Plan (Five E's Unlimited 2007) and also during the Watershed plan's outreach efforts. The Aloe Bay Master Plan addresses some of these concerns and during the development of the WMP the Town initiated projects to improve ramps, launches, and parking at these areas.

BEACH ACCESS

Access to beaches was also identified as an area of concern in Dauphin Island's Strategic Plan (Five E's Unlimited 2007) and during WMP outreach efforts; and the need for an Island-wide comprehensive beach access plan was identified in both the Strategic Plan (Five E's Unlimited 2007) and the Comprehensive Plan 2030 (Town of Dauphin Island and SARPC 2013). During the development of this WMP, the Town made significant improvements to the East End Beach parking area and West End Beach access.

LIMITED DINING OPTIONS

Lack of dining options was also identified as an area of concern in Dauphin Island's Strategic Plan (Five E's Unlimited 2007) and during WMP outreach efforts. The Aloe Bay Master Plan addresses this issue, and food trucks have also been used on the Island to augment existing services.

LODGING

Lodging provides a source of tax revenue to the Town and with increased visitation to the Island, there continues to be a need to accommodate visitors in a sustainable way. While there has been an increase in the building of rental homes on the Island's West End, this is not a sustainable area for growth due to its vulnerability as evidenced during the mass destruction of homes during hurricane Katrina. The Aloe Bay Master Plan will address some of the need for more accommodations, but more lodging options are needed across the Island. Additionally, during the Aloe Bay Master Plan development the need for meeting and conference space was analyzed.

At the time of this writing, the Town was in the process of updating its Zoning Ordinance, which effects both the East and West End rental markets. An overall strategy of providing lodging in recognition of issues outlined in this chapter (e.g., sea level rise, flooding, coastal erosion, preservation of culture and heritage) is needed to plan for sustainable lodging accommodations and the Town may look at what options there are for development in the Mid-Island and far East End areas (see **Section 7.6.3**).

6.3.2 TOURISM

One of the main economic drivers on Dauphin Island is tourism. Driven both by sales taxes and real estate taxes on properties where tourists stay while vacationing on the Island (see **Appendix A**). While both the Dauphin Island Strategic Plan (Five E's Unlimited 2007) and the Comprehensive Plan 2030 (Town of Dauphin Island and SARPC 2013) emphasized the importance of tourism to the Island's economy, both expressed concern about the potential to overburden the Island's resources (natural, cultural, historical, etc.) upon which the tourism industry is based. This concern was also heard by the Watershed planning team during public outreach and stakeholder engagement activities. The Aloe Bay project is of particular concern to residents due to the project's scope and size. While many Islanders are in overall support of the project, they are concerned about its potential to draw a significantly increased number of tourists to the Island.

The recent Alabama Tourism Industry Economic Impact Report (Alabama Tourism Department 2021), reports that Alabama tourism has almost doubled in revenue in the past 10 years. While the State saw a revenue drop from tourism in 2020 due to the

COVID-19 pandemic, that loss equated to just 20% of its revenue compared to the national tourism industry, which dropped 45% during 2020. The State quickly rebounded in 2021 with 26% more tourists visiting Alabama than the previous year. Alabama has risen from 30th place two years ago to fourth place as the most searched state on Google for travel information as reported by the U.S. Travel Association in the State's report.

While this boon in tourism may be beneficial to the Town's operating budget, the unintended consequences of increased tourism can impact the community's heritage and culture and the overall quality of life for its residents (see **Section 6.5**).

6.4 Fish and Wildlife

6.4.1 HABITAT CONSERVATION

In 2009 the Mobile Bay National Estuary Program, National Oceanic and Atmospheric Administration Coastal Services Center, and The Nature Conservancy developed a list of priority habitats to update local habitat conservation and restoration priorities (TNC 2009). The partnership worked with over 60 state and local representatives concerned with habitat protection in coastal Alabama to focus on developing criteria for prioritizing habitat patches for conservation and restoration in Mobile and Baldwin counties. The effort developed criteria for conservation to guide and inform the efforts of these organizations. Priority habitats on Dauphin Island include estuarine and marine waters, oyster reefs, SAV, beaches and dunes, tidal marshes and flats, freshwater wetlands, and maritime forest.

Estuaries, wetlands, and forests are among the most valuable ecosystems in terms of the level of services and benefits they provide (Costanza et al. 2006; Costanza et al. 2014). A strategy that protects and preserves natural lands, particularly priority habitats including beaches and dunes, wetlands, and maritime forest, supports the provision of important ecosystem services. There are significant protected conservation lands in the Watershed, but non-protected parcels are still

Source: Barry Vittor & Assoc.

East End dune meadow fronting maritime forest undergoing, or have potential for future development, and valuable habitat continues to be fragmented, degraded, and lost, emphasizing the importance of future protection.

Priority habitats on the Island are under pressure from modern development and natural phenomena. Important ecosystem services provided by freshwater wetlands, including floodwater storage and groundwater re-charge, are being degraded or lost. The Town of Dauphin Island has enacted policies to ensure maintenance of sand dune functional values in protecting public and private infrastructures and the public investment in beaches and dunes, but frequent storms and Island development continue to result in losses of habitat and sand resources. And like virtually all of Alabama's remaining maritime forest and coastal scrub habitat, these habitats on the Island are increasingly fragmented and eliminated by development. To help manage ongoing protection of sensitive Island habitats, an up-to-date inventory is needed to establish their status and provide a baseline for future trends.

Enhanced protection and management of high-quality habitats are accomplished through fee simple land acquisition and conservation easements. Fee simple acquisition is the direct purchase of a land parcel, including all the rights to it, with the goal of its preservation. Conservation easements offer an alternative to acquisition that can also be ecologically effective, and in some cases more financially feasible. An easement is a non-possessory interest in a portion of real property, where ownership remains with the landowner. There is typically a permanent restriction on the use of land within the designated easement. There are potential opportunities to provide incentives and information to landowners for long-term conservation, through enhanced coordination with the Dauphin Island Bird Sanctuaries, South Alabama Land Trust, Alabama Department of Conservation and Natural Resources, U.S. Fish & Wildlife Service, and other partners to develop a coordinated plan and identify opportunities for parcel acquisition and easements.

6.4.2 HABITAT RESTORATION

In its Alabama Comprehensive Wildlife Conservation Strategy, State Wildlife Action Plan, the Alabama Department of Conservation and Natural Resources (2015) identified past and ongoing threats to conservation priority habitats, including alteration and fragmentation due to agriculture, roads, and development. Ditching, draining, and filling wetlands have changed the natural flood regime of many swamps, marshes, and bogs. Land use change, habitat destruction and fragmentation, dredging and filling, and sedimentation have been identified by the Mobile Bay National Estuary Program's Science Advisory Committee as having the most impact on the natural condition of Alabama's estuaries (Barry A. Vittor & Associates, Inc. 2014).

There are opportunities on the Island for habitat restoration and enhancement through invasive plant management. Invasive species causing habitat degradation include Chinese tallowtree (*Triadica sebifera*), cogon grass (*Imperata cylindrica*), and Japanese climbing fern (*Lygodium japonicum*), and all three species are on the Alabama Department of Conservation and Natural Resources State Wildlife Action Plan (2015) list of top 10 invasive plants for the state of Alabama. Many of the gum swamps on the Island possess a high cover of tallow tree, and numerous other exotic species are also spreading into these swamps and adjacent areas. Cogongrass infestation occurs at several Island locations, and torpedo grass (*Panicum repens*) is abundant and widespread. In addition, non-native plants have intentionally been included in dune revegetation and restoration projects and landscaping on the Island, such as beach vitex (*Vitex rotundifolia*), on both private and public property.

Fire suppression and livestock exclusion over many decades in the Audubon Bird Sanctuary have allowed the conversion of an open understory of the native maritime forest to become dense forest with thick midstory shrubs. Bailey (2013) recommended a prescribed burning program to restore the native habitat, along with chemical or mechanical thinning of young and dense pine trees in some areas of the sanctuary, but little if any of the management has occurred.

Source: Barry Vittor & Assoc.

Dense loblolly pine in the Audubon Bird Sanctuary

There is also a need to manage the Island's sand resources. Sand is frequently redistributed from beaches and adjacent areas to public rights-of-way and private properties by storms. The Town needs improvements to long-term sand management, balanced between socioeconomic and ecological needs.

6.4.3 WILDLIFE MANAGEMENT

Habitat alteration and destruction and other human activities have adverse effects on wildlife populations dependent on natural areas for foraging and breeding. Island habitats support the local and regional biodiversity of Alabama's coast, including many species of conservation concern. As an Important Bird Area administered by the National Audubon Society, the shorelines, wetlands, and forests of Dauphin Island are considered essential bird habitat for breeding, wintering, and migrating.

Alabama's State Wildlife Action Plan (2015) includes stray and free-roaming cats as one of several conservation problems that affect species occurring in maritime forests, coastal scrub, and beach dune habitats. The control of cats in these threatened communities is considered to be among the highest priority of conservation actions. Predation by free ranging and feral cats, as well as red foxes, are an ongoing threat to Island wildlife.

6.5 Heritage and Culture

The heritage and culture of Dauphin Island is integral to the Island's identity and one of main reasons both tourists and residents are attracted to this special place (see **Section 3.8**). Some Island families can trace their heritage back to 18th century settlers with French and Spanish lineages. This connectivity to the Island's heritage has fostered a deep sense of ownership of the Island's culture among long-time residents. For over 120 years, the economy of much of the Watershed was traditionally supported by the harvesting of seafood. However, the Island's culture was forever changed in the 1950s when the Island was platted by a group of Mobile businessmen and a bridge was built.

The Island's rich history and laid back "island-time" lifestyle distinguishes it from other coastal areas. However, the culture and heritage of the Island has changed over time as increased pressure from both tourism and development has slowly impacted these important elements of the Island's identity. To further compound this issue, as long-time residents have either passed away or moved off the Island, their traditional knowledge has left with them.

While many new residents and visitors are drawn to Dauphin Island because of its small town, family-friendly charm, this attention can have consequences in that those drawn to the area can inevitably change the character of the place they find so special. More visitors and new residents mean more growth and often small communities are not able to assimilate the influx of people, and the desire to accommodate both new residents and visitors can be impact the heritage and culture of the area.

While some change to a community's culture and heritage is inevitable, there are opportunities to try and preserve what elements remain and seek ways to celebrate the past. The Town is making great strides in this direction with the Aloe Bay project, which seeks to celebrate the Island's culture and heritage of making a living from the sea by promoting local commercial fishing and seafood. And long-running events like the Alabama Deep See Fishing Rodeo established in 1929 still maintain the Island's deep connection to the sea.

6.5.1 POPULATION GROWTH

Dauphin Island’s Strategic Plan developed in 2007 (Five E’s Unlimited 2007) highlighted residents’ concern for uncontrolled growth that could degrade the Island’s resources and quality of life. The Island’s Comprehensive Plan 2030 (Town of Dauphin Island and SARPC 2013) highlighted similar issues. This statement from the Strategic Plan 2030 still holds true today and the Town works diligently to maintain a delicate balance of needs:

> *Dauphin Island is also challenged with determining how to effectively and equitably accommodate and encourage growth without compromising the character and natural resources unique to Dauphin Island.*

Additionally, the Strategic Plan 2030 laid out this goal:

> *Develop strategies to maintain and enhance the small town feel of the Island to protect against over-development. The goal is compatible, controlled, and guided economic development and growth that does not compromise the small-town character of the Island or its natural resources.*

Both of these sentiments were echoed frequently during public outreach conducted during the watershed planning process (see **Chapter 2**).

An analysis of population conducted during the watershed planning process presented in **Chapter 3** shows an increasing trend of population growth on the Island (see **Table 3-12**). The growth from the time both plans described above (approximately 2010 to 2020) presents an approximate 30% increase in population; and extending that to the projected 2040 population represents an approximate 46% increase from 2010 to 2040.

According to data from the Town, there has been a recent building surge on the Island, with an average of 61 new homes permitted each year (**Appendix A**). While the total population of Dauphin Island is extremely small compared to most areas, the population growth has been significant when compared to Mobile County, which showed negligible growth from 2010 to 2020 (see **Section 3.7**).

The Dauphin Island Fiscal Impact Analysis (**Appendix A**) reported that most property on the Island is (1) not owned by Island residents, and (2) not owned for personal use. This is especially apparent on the Island’s West End. With so many new residents and off-Island property owners building in such a small community, it can be difficult to assimilate new residents and owners into Island culture; and can present conflicts of interest between the two groups in defining the most pressing issues on the Island and potential solutions. This not only impacts the Island's heritage and culture; it also affects the Island's overall environmental health and resilience, which is discussed in **Section 6.6**.

6.5.2 WORKFORCE HOUSING

Dauphin Island's Strategic Plan (Five E's Unlimited 2007) also presented Islanders' concerns over maintaining housing affordability, and the Comprehensive Plan 2030 (Town of Dauphin Island and SARPC 2013) listed the need to explore workforce housing options on the Island as a goal. This issue is even more relevant today, as housing prices have increased exponentially from 2000 to 2022. Reatlor.com (2022) reports the median home price on Dauphin Island as of April 2022 is $539,800.00, representing a 54.3% increase year-over-year. Additionally, as presented in **Appendix A**, a large majority of homes on Dauphin Island are vacation rentals, which command a high price during tourist season—when the Island would need workers to support that tourism—leaving few options for short- and long-term workforce housing on the Island.

One of the goals outlined in both the 2007 and 2013 Plans was to honor the Island's cultural heritage by restoring and preserving a working waterfront for commercial fishing, and this has carried though to today with the recently completed Aloe Bay Master Plan. As the Aloe Bay Project moves forward, the Town will need to address workforce housing and has already started to look at some of these needs with the current update to its Zoning Ordinance, which was underway at the time of the writing of this WMP (**see Section 7.5.1**).

6.6 Resilience

6.6.1 CLIMATE VULNERABILITY AND ADAPTATION

Climate change is projected to cause an increase in temperatures, a permanent rise in ocean water levels, and changes in weather patterns. Rising sea levels and increased storm intensity and frequency present increased physical risks to Dauphin Island, including increases in shoreline erosion and degradation, decreased beach widths, amplified storm surges, and inundation.

Source: Photo by Environmental Science Associates

West End flooding

Even without accelerated sea level rise, flooding is already causing significant impacts to transportations systems to and around Dauphin Island during storm events, making evacuation and re-entry during storms particularly challenging and reducing the adaptive capacity of the Island. Additionally, storms are expected to continue washing sand over Bienville Blvd., temporarily blocking access to the homes on the West End. As sea level rise and increased storm intensity impacts the Island, water and sewage maintenance, 60% of which is already due to the West End (**Appendix A**), is likely to increase. Based on U.S. Army Corps of Engineers modeling, 1.0 meter of sea level rise combined with the 100-year storm surge is predicted to result in damage to 1,814 structures.

Critical Facilities

As a barrier island, the entirety of Dauphin Island is susceptible to impacts from storm surge including the Island's critical facilities. These are facilities that are critical or essential to normal daily operations following a disaster event and include emergency services such as police, fire, and EMS; government offices and facilities such as Town Hall and Public Works; educational facilities; wastewater treatment operations; and potable water supplies. **Table 6-1** below was adapted from Mobile County's Hazard Mitigation Plan (2016) and present facilities that are susceptible to hurricane storm surges.

TABLE 6-1 Dauphin Island Critical Facilities

Facility	Storm Surge Category
Dauphin Island Elementary School	Category 2
Dauphin Island Fire & Rescue Department	Category 2
Dauphin Island Police Department	Category 2
Dauphin Island Water and Sewer Authority	Category 1
Dauphin Island Sea Lab	Category 2
Dauphin Island Town Hall	Category 1

Habitat Migration and Adaptation

Sea level rise can shift salinity, which may lead to impacts to native species. Modern development has already put pressure on the palustrine wetlands on the Island through fill placement. Given sufficient space, coastal marshes will migrate inland to higher elevations over time. However, in many areas, development limits the areas marshes can migrate to and these habitats can be "pinched-out" and drowned with sea level rise (**see Section 5.2.3**). With 4.9 feet (1.5 meters) of sea level rise, most of the West End, Pelican Island, and Little Dauphin Island would convert to open water, while most of the middle of the Island would convert to beach and the marsh habitat in Graveline Bay would convert to mudflat and open water without further action (WPC 2015). While these projections present the higher range of estimates, they demonstrate the importance of ongoing restoration projects being implemented by the Town and Watershed stakeholders (**see Table 7-3**).

The topic of resilience related to the redevelopment of the West End after Hurricane Katrina accounted for 25% of all responses to major issues of concern for Dauphin Island stakeholders during the development of the Dauphin Island Strategic Plan (Five E's Unlimited 2007). The concerns were directly related to the risk to rebuilding the West End beach area as it had been in the past, due to both frequency of major storm events and rising sea levels.

6.6.2 ECONOMIC RESILIENCE

The fiscal impact of potential storm damage on the Island is expected to be between $19,000 and $142,000 in property tax revenues at current sea levels, and up to $189,000 at higher sea levels due to the loss of homes. For a 100-year storm event, 83% of homes lost are expected to be on the West End under existing conditions. While sea level rise will increase the impacts to homes in the middle of the Island and the East End, the West End is expected to account for 28%–51% of the losses with projected sea level rise. With the average developed parcel value of the West End exceeding those of the Middle and East End, the loss of West End homes is expected to have an outweighed impact on the Town's resources. The 100-year storm would also have an impact on lodging tax revenues, with between $115,000 (existing conditions) and $893,000 (with 6.6 feet of sea level rise) in lost annual revenue. The majority of lost lodging tax revenue comes from impacts on the West End. While the West End generates significant revenues including most of the lodging tax revenues, this does not offset the cost of maintaining the West End area and providing public services to the properties after an extreme storm event (**Appendix A**).

Additionally, most property on the Island is not owned by Island residents, and not owned for personal use, especially on the West End. As a result, a significant portion of the Town's expenditures benefit property owned by off-Island and out-of-state residents. While these properties generate revenues for the Town, most of the revenue they generate goes to owners and management companies outside of the local community.

The guidelines and risk rating system of Federal Emergency Management Agency's (FEMA's) National Flood Insurance Program were recently updated in acknowledgement of climate change and its impact on flooding risk. Beginning in April 2022, these changes are expected to lead to an up to 18% annual increase in premiums per year for the next 20 years. The new system, Risk Rating 2.0, is meant not only to reflect costs more accurately, but also to discourage building and rebuilding in hazard zones. The Individual and Households Program, for which many homeowners on Dauphin Island have applied in the aftermath of previous storms, will be extremely overburdened in the coming years, as climate-related disasters worsen and increase in frequency. It is possible FEMA may begin to look at the cost effectiveness of the program and discontinue the practice of funding rebuilding efforts where homes are unlikely to last.

There were 1,709 active National Flood Insurance Program policies on Dauphin Island as reported in Mobile County's Hazard Mitigation Plan (2016) with a total insurance valuation of $377,639,900. There were 838 repetitive loss (RL) structures and 68 severe repetitive loss (SRL) structures in the Watershed. A RL property is a building that has had two flood insurance claims within a 10-year period, and an SRL property is a building that has had four or more insurance claims with at least two occurring in a ten-year period with the total claims exceeding $20,000. There were 2,703 total RL claims with total RL losses of $93,492,000 and 426 SRL claims $14,199,499. With the significant increase in property values occurring during the development of this Plan, future losses would be substantially higher in cost.

Another challenge for coastal communities is that FEMA's assistance only comes with federally declared storm events. When a storm is not declared a federal emergency, it is considered a "non-event" and the Town bears the full cost of damages. Non-events range in severity from routine wind and wave uprush to coastal storms that are severe but not severe enough to reach federal emergency status. These all involve costs such as cleanup (e.g., debris removal, road clearing, sand removal), emergency services including the presence of police and fire, road repair, and the impact storms have on water and sewage systems.

As presented in **Appendix A**, when a federal disaster is declared, the federal government—through FEMA—covers 85% of the repair and cleanup costs. In instances of a severe storm that is *not* declared a federal emergency, the Town is entirely responsible for these costs. One such event in 2021 resulted in $2.5 million in sand removal costs exclusively on the West End. Because of the lack of federal assistance, these storms are of greater concern for the Town's fiscal situation than declared disasters.

Based on the fiscal analysis, the West End either costs the Town more to maintain than it generates in revenues or, at best, generates a very small net revenue (tax dollars generated minus costs) for the Town. Importantly, this revenue would not offset the cost of either a "non-event" storm, or even a federally declared disaster. While the results presented in **Appendix A** are based on best available data at the time, they indicate that the West End has an overall net negative impact on the Town's fiscal situation. Some coastal communities can face insolvency when costs of addressing the impacts of climate related issues outweigh the economic benefit that their tax base provides.

6.6.3 FINANCIAL MANAGEMENT SYSTEMS

In the development of the Fiscal Impact Analysis (**Appendix A**) it was noted that current fiscal record keeping, reporting, and the accuracy of local tax data creates limitations for the community in planning and preparing for future storms. These data are vital for assessing how communities can grow and adapt in the face of these changes. Community resilience requires financial resilience, and financial resilience requires transparency in fiscal accounting. This analysis revealed specific policies that could be implemented on Dauphin Island in the near future (1–10 years) to improve the Town's understanding of its own fiscal health. Accounting and monitoring of expenditures (and where they occur) would not only assist the Town and affiliated agencies in resource allocation, but also help make the public aware of the Island's financial sustainability.

6.7 Administrative

6.7.1 INTERGOVERNMENTAL COORDINATION

Governance through collaboration among all entities was identified as a major concern in the Dauphin Island's Strategic Plan (Five E's Unlimited 2007) with recommendations and action strategies outlined for a more effective and cooperative governance structure to provide guidance for controlling growth on the Island and to oversee the Island's movement to a more sustainable community over the next 20 years. The Town has made progress in this direction with the Parks and Beach Board being dissolved and brought under Town management. Future efforts may look at more alignment and integration with DIWSA in pre- and post-storm planning and cleanup.

Overall, since the development of that Strategic Plan, local, regional, state, and federal agencies have shown a sustained and dedicated commitment to the betterment of

Dauphin Island as evidenced through the numerous plans, studies, and projects that have focused on the Island (see **Section 1.2.1**). However, a more coordinated and formalized intergovernmental group may be needed to move actions and projects identified in this WMP forward in securing funding and implementing any regulatory changes needed for successful implantation of this plan (see **Section 7.7.1**).

Source: Krewe of Kindness

CHAPTER 7 Management Measures

Introduction

This chapter presents the management measures identified to address critical issues and areas discussed in **Chapter 6**. Management measures are defined as the potential opportunities or actions that can be implemented to target critical issues and mitigate their impact to the overall health of the Dauphin Island Watershed. These management measures were developed with input from the Steering Committee and through public outreach and stakeholder engagement activities. The management measures presented below have been categorized into the Mobile Bay National Estuary Program (MBNEP)

Comprehensive Conservation and Management Plan Six Values for ease of presentation with an additional category for administrative measures. However, many of these management measures address more than one of the six values.

As presented in **Section 1.2.1,** at the onset of the development of this watershed management plan (WMP), the Team documented over 50 projects categorized as proposed, planned, ongoing, or recently completed. The following sections list projects that were funded, initiated, or completed during the development of this WMP, followed by the management measures proposed by the WMP Team for implementation of this WMP.

7.1 Water

The following section lists Water projects that were funded, initiated, or completed during the development of this Plan, followed by the potential management measures proposed by the WMP Team for implementation of this WMP.

7.1.1 FUNDED, INITIATED, OR COMPLETED WATER MANAGEMENT MEASURES

Recently funded, initiated, or completed management measures related to the Water category include wastewater management facility and infrastructure upgrades and stormwater master planning. These types of management measures are important to the environmental health of Dauphin Island and maintaining water quality in the Watershed.

Table 7-1 presents the Water projects that were funded, initiated, or completed during the development of this Plan.

TABLE 7-1 Funded, Initiated, or Completed Water (FICW) Management Measures

ID#	Management Measure	Description	Photo
FICW -1	Aloe Bay/Mississippi Sound Water Quality Enhancement Project	RESTORE Act funding of $11,845,000 for the design and construction of a new Biological Nutrient Removal (BNR) water reclamation facility to replace the existing facility and enhance water quality discharge into Aloe Bay. Incorporating the latest technologies, the facility will improve water quality, conserving the health, diversity, and resilience of coastal, estuarine, and marine habitats. Focusing on long term sustainability, enhanced BNR & solids removal, improved disinfection techniques, removing suspended particulate through filtration and innovation in capacity improvements, this facility will serve the Island's needs for wastewater treatment. The facility will reduce existing pollutant loads and prevent an increase in future pollutant loads to Aloe Bay and Mississippi Sound. (Restore Alabama n.d.)	 Source: Google Earth
FICW-3	Dauphin Island Water and Sewer Authority (DIWSA) Collection System Improvements	This project was awarded under the Coastal Alabama Regional Water Quality Program, which was approved for funding in 2021 by the federal Gulf Coast Ecosystem Restoration Council as part of its Funded Priorities List 3B. The DIWSA provides vital sewage service to the Town of Dauphin Island and consists of sewage collection, conveyance, and treatment. Implementation of this project would greatly improve and enhance the collection, transport, and treatment of the Island's wastewater, improve water quality, reduce sewage pipe leakage, and prevent unplanned sewer discharges into the Island's waterways and groundwater.	 Source: Google Earth

TABLE 7-1 Funded, Initiated, or Completed Water (FICW) Management Measures

ID#	Management Measure	Description	Photo
FICW-2	Dauphin Island Stormwater Master Plan and Drainage Improvements	This project was awarded under the Coastal Alabama Regional Water Quality Program, which was approved for funding in 2021 by the federal Gulf Coast Ecosystem Restoration Council as part of its Funded Priorities List 3B. Implementation of this project would improve the quality of the stormwater runoff. This project would identify stormwater drainage improvements on the Island with goal of improving water quality and enhanced resilience on the Island. The project would seek to reduce stormwater discharge into the sound, reducing sediment and litter transport. The plan would make recommendations for updating and improving existing infrastructure, rerouting stormwater to centralized wetland treatment areas, and retention/detention areas.	 Source: ESA

7.1.2 POTENTIAL WATER MANAGEMENT MEASURES

Flooding and Infrastructure Management

The West End of Dauphin Island is a vulnerable area that regularly sees saltwater flooding during storm events that produce heavy rainfall, including but not limited to tropical systems. In addition, flooding pressures exerted by rainfall are exacerbated by storm surge impacts to varying degrees during tropical events. Below we explore a number of management measures that will help address and mitigate flooding and its unique impacts to infrastructure.

HOMEOWNER EDUCATION PROGRAM

Educational Signage is an effective way to instruct and remind local residents and business owners how to reduce the impacts of flooding on their property and throughout the Island (include signage on cleanouts and manholes). In addition to signage, the Town of Dauphin Island, Dauphin Island Water and Sewer Authority (DIWSA), and local realtors might provide an avenue to distribute educational materials to new home and property owners. In some instances, new owners from non-coastal areas can have a fundamental lack of understanding regarding coastal infrastructure and the particular vulnerabilities of coastal areas to flooding.

REGULATORY

Net Zero Stormwater Policy for New Development

This policy recommendation is targeted at all new residential and commercial development on Dauphin Island for all stormwater runoff to be managed on-site before a building permit is issued. Rather than allowing stormwater impacts to flow downstream, this policy is intended to minimize impacts to neighboring properties and areas. Each property owner would be required to evaluate their property's water footprint and develop their own on-site stormwater management. The Town would need to investigate the feasibility of implementing this policy and synching it with the Low Impact Development (LID) Code, Wetland Protection Ordinance, and Landscape Requirements discussed below.

LID Code Revisions

When codes are well written, it is easier for a community to implement its vision. Often, a disconnect exists between the development code and LID. Local codes are ever evolving and often times complicated. Performing a careful and comprehensive code review can help local government staff identify the code's top LID obstacles and modify them to allow for more extensive use and implementation of LIDs. For example, LID barriers often exist in the local development code's landscaping, open space, perimeter screening, street, parking, and lot setback requirements. (Revising Local Codes to Facilitate Low Impact Development, EPA, June 2021.)

Strengthen and Enforce Wetland Protection Ordinance

Given the limited number of wetlands left on the Island and their importance in the mitigation and storage of stormwater, construction in wetlands should be minimized to the most practicable extent possible simplistic. There is limited capacity on the Island to create stormwater retention and detention areas, an option that would still require setting aside properties exclusively for the use of stormwater. A permanent moratorium on construction in wetlands would be a more simplistic and direct approach to address this issue, but considering the implications of trying to enact a permanent ban, the Net-Zero Stormwater Policy presented above may provide incentive for property owners to limit development of wetlands since retaining them would help with on-site stormwater management.

Increase Residential and Commercial Landscape Requirements

Any areas of the Island that are developed moving forward should, at a minimum, have an increased green space requirement. Pervious surfaces, in particular those that are vegetated, allow more stormwater to percolate into soils. In already saturated soils, vegetation acts as a pump, pushing water into the atmosphere through evapotranspiration.

DEVELOP A COMPREHENSIVE, ISLAND-WIDE STORMWATER MASTER PLAN

Existing protected wetland areas should be evaluated to receive additional stormwater from the Island. Considerations of the evaluation should include existing and potential physical connectivity to parcels with higher impervious surfaces and higher runoff volumes. Care should be taken to implement measures to prevent influx of deleterious materials via stormwater into these ecologically sensitive areas.

Constructed Wetlands

The U.S. Environmental Protection Agency (EPA) publication, Guiding Principles for Constructed Treatment Wetlands (October 2000) defines a constructed wetland as engineered wetland that utilizes natural processes involving wetland vegetation, soils, and their associated microbial assemblages to assist, at least partially, in treating an effluent or other water source. In general, these systems should be engineered and constructed in uplands and outside waters of the U.S., unless the source water can be used to restore a degraded or former wetland. Thus, existing protected wetlands should not be modified unless such a modification would improve their habitat viability from an impaired state.

Acquire Additional Easements for Drainage Features and Associated Outfalls

There may be privately owned drainage features for which the Town of Dauphin Island could acquire additional easements. These include but are not limited to ditches, swales, and outfalls that are perpendicular to roadside ditches. Acquiring easements to these features would allow the Town of Dauphin Island to execute a more comprehensive approach on an Island-wide scale for maintenance and retrofit.

Drainage and Storage in Public Rights-of-Way and Easements

There is already an existing system of ditches and drainage features throughout the Island. Opportunities to increase the capacity of the existing ditches and drainage features should be assessed and utilized to the maximum extent practicable.

Stormwater Ponds

Both residential and commercial developments can utilize stormwater ponds to improve water quality and control water quantities. While traditionally designed ponds are an excellent option when space is no issue, Dauphin Island has a short supply of vacant lots and available footprint for such a design. Options for subsurface detention structures should be explored as part of the stormwater design for new construction on the Island. These designs may consist of any combination of corrugated metal pipes, plastic pipes, and/or concrete box design. Due to the nature of the high ground water table on Dauphin Island, any subsurface storage will need to be impervious to surrounding soil moisture/groundwater with inlets that receive water directly from the surface. Any subsurface storage should be designed with outlets sized to meet a slow-release requirement. Appropriate maintenance and inspection frequency should be determined by the Engineer of Record.

Culverts

Driveway culvert pipes are utilized in areas that have high water crossing concerns and/or to allow the free movement of water along the drainage ditch near the roadway. At a minimum, properties on Dauphin Island should have these installed if they aren't already present. In addition to traditional culvert pipes, it may be beneficial to raise driveways such that cross drains can be placed beneath the driveways allowing property owners access to their homes and adjacent roadways without driving through floodwaters.

Raised Driveways

Flooding of roadways and driveways due to a multitude of factors including stormwater, tidal flooding, and storm surge has occurred more and more frequently in the past few decades. Raising driveways and roadways may prevent water pooling on drivable surfaces, provided adequate cross drains and culverts are installed. The effect of raising the driveways along Bienville Boulevard on the West End were modeled as part of the Adaptation Pathways project (2022). The modeling showed a positive benefit to raising the driveways as assessed during tropical storm events with the main factors considered being storm surge and sea level rise. Rainfall and associated stormwater runoff were not considered as a factor in this modeling.

Green Infrastructure

Green infrastructure (GI) uses vegetation, soils, and natural processes to manage stormwater and create healthier built environments with fewer negative impacts on surrounding green spaces and wildlife habitats. At the scale of a large city or region, GI refers to the overall network of natural areas that provide habitat, flood protection, and cleaner air and water. At the scale of a neighborhood or property parcel, GI refers to stormwater management systems that mimic nature by absorbing, storing, and infiltrating stormwater close to its source. Referred to on a site-specific scale as low impact development (LID) techniques, GI includes sustainable stormwater management utilizing natural hydrologic cycles through multiple non-traditional measures. LID systems and practices use or mimic natural processes that result in the infiltration, evapotranspiration, or use of stormwater in order to protect water quality and associated aquatic habitat (EPA 2022). LID practices preserving and re-creating natural landscape features, minimizing impervious surfaces, and incorporating stormwater as an on-site resource rather than a waste product include:

- Green roofs
- Rain barrels and cisterns
- Permeable pavements
- Bioretention areas Vegetated swales/dry swales
- Curb and gutter eliminations
- Vegetated filter strips
- Sand and organic filters
- Constructed wetlands
- Riparian buffer

Older LID structures should be evaluated for maintenance and incorporation of LID design should continue to be a priority for new construction areas.

SOIL SUITABILITY

Analysis

The USDA-NRCS Web Soil Survey (2022) was used as a preliminary tool to explore areas suitable for infiltration-based GI. This analysis included identifying depth to water table and hydrologic soil group for each soil series and establish ratings for each based on typical GI design guidance. Hydrologic soil group is a characteristic that describes runoff potential for a soil, and subsequently infiltration potential. A hydrologic soil group of an “A” has the highest infiltration potential and “D” has the lowest. When the hydrologic soil group rating ends in “D”, this indicates that the depth to the water table is often less than 1 foot (**Table 7-2**).

TABLE 7-2 Factors Influencing GI Suitability by Soil Type

Soil Type	Map Unit	Water Table Depth Range (in)	Water Table Suitability	Hydrologic Soil Group (HSG)	Infiltration Suitability
Axis and Handsboro Soils	AH	0-6	Poor	C/D	Poor
Beaches	BcC	39-47	Good	None	Fair
Fripp-Newhan Complex	FnE	>80	Excellent	A	Excellent
Newhan-Duckston Complex	NdC	>80	Excellent	A	Excellent
Osier Loamy Sand	OsA	0-12	Poor	A/D	Poor
Pactolus Loamy Sand	PcA	22-41	Good	A	Fair
Urban Land	UbA	N/A	Unknown	N/A	Unknown
Urban Land Duckston Newhan Complex	UdC	0	Poor	A/D	Poor

As shown in **Table 7-2**, eight soil types were identified within the Dauphin Island Watershed. These types are as follows:

- Axis and Handsboro Soils (AH)
- Beaches (BcC), Fripp-Newhan Complex (FnE)
- Newhan-Duckson Complex (NdC)
- Osier Loamy Sand (OsA)
- Pactolus Loamy Sand (PcA)
- Urban Land (UbA)
- Urban Land Duckson Newhan Complex (UdC)

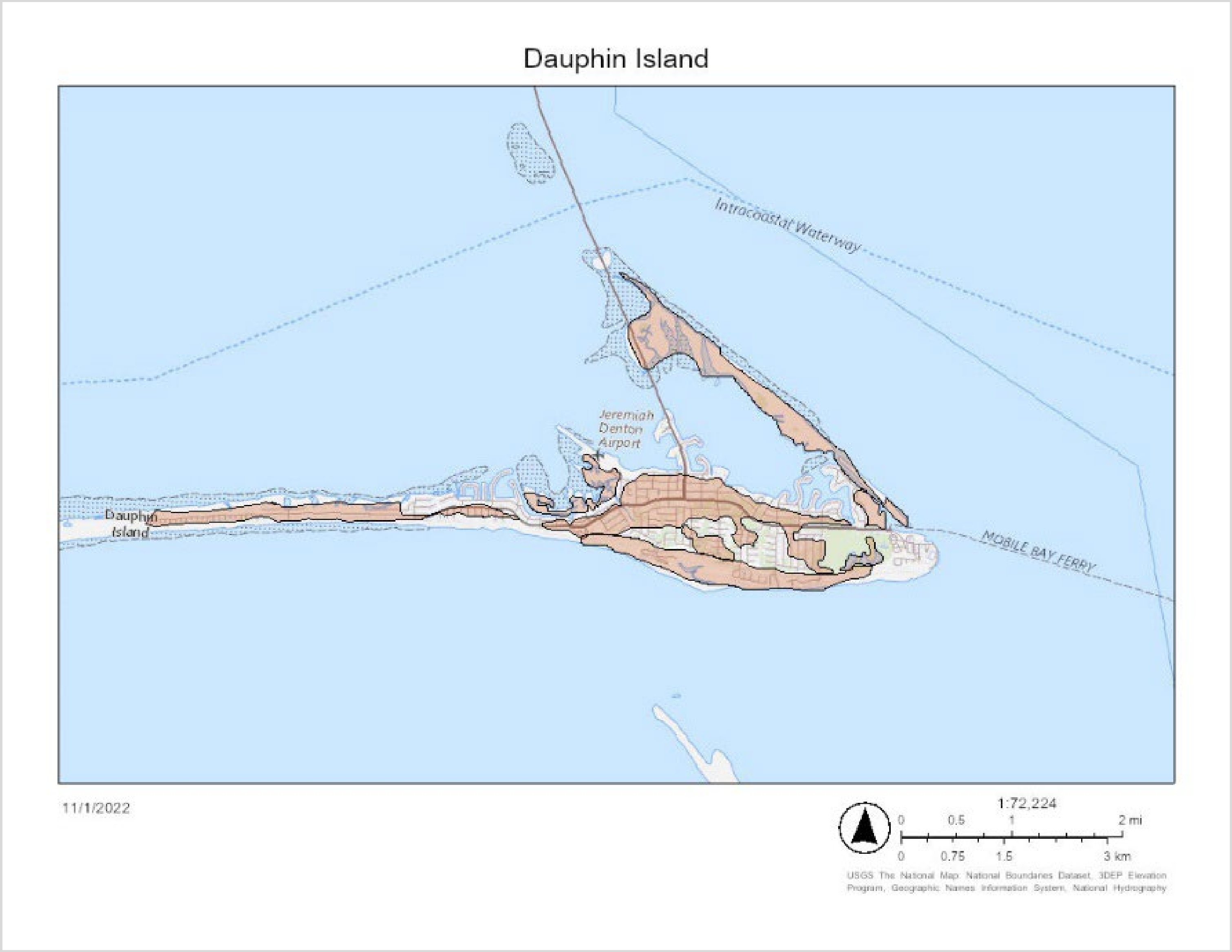
Some of these soils consist of complexes that consist of "two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous aeras are somewhat similar in all areas" (USDA 2022).

Three hydric soil types were identified during the analysis. These soils consist of the AH, OsA, and UdC. Hydric soils typically have a poor infiltration suitability and poor water table suitability. These soils have the ability to become flooded and are associated with wetlands. As such, they are not suitable for construction activities; 55% (approximately 58,166.46 acres) of the Island consists of these poor-quality soils (**Figure 7-1**).

Two soil types have been classified as fair soils. They have a good water table suitability and have a water table depth range of 25 to 50 inches. These soil types, BcC and PcA, are moderately well drained soils and have a moderately high to very high capacity to transmit water making them rarely flooded. These soils comprise 493.85 acres of the Island, which is approximately 1% of the soils present (**Figure 7-2**).

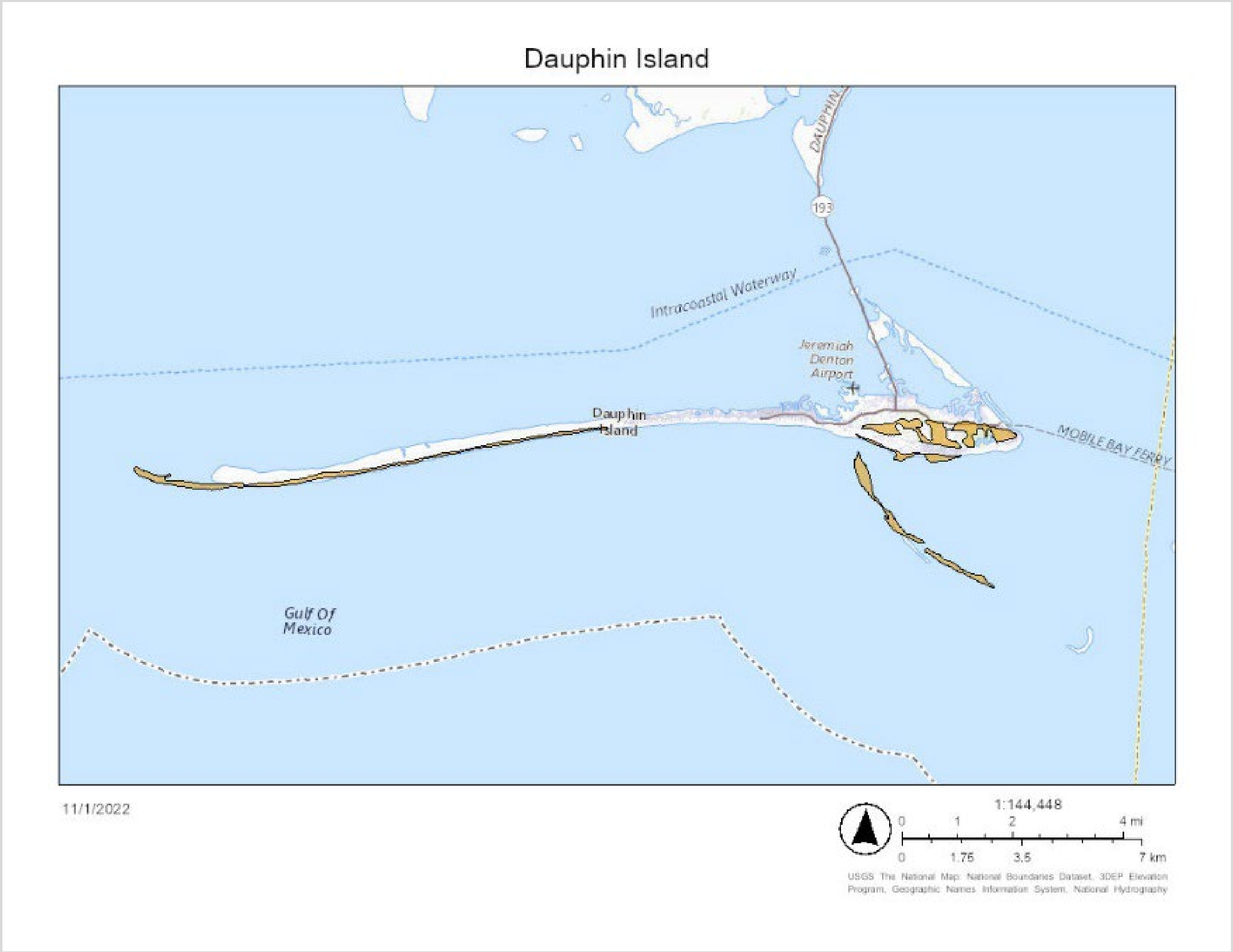
Two soil groups were identified that have an excellent classification. These soils, FnE and NdC, have an excellent water table suitability and has a water table depth range greater than 80 inches. These soils have a moderately high to very high capacity to transmit water and are rarely flooded because they are excessively drained. The location of these soils may be problematic since they are typically found on dunes and foredunes. Ordinance Number 66-A prohibits pedestrian and vehicle use of the sand berms located at designated places on the Island to preserve the berms. These soils are approximately 584.89 acres in size and make up roughly 1% of the soils present on the Island (**Figure 7-3**).

Urban Land (UbA) soils have been identified during this analysis. These soils do not have a hydrologic soil group rating because they have been disturbed. Therefore, the suitability of these soils for GI are "unknown" and will require a site-specific soil survey to verify depth to water table, soil texture, and infiltration potential.



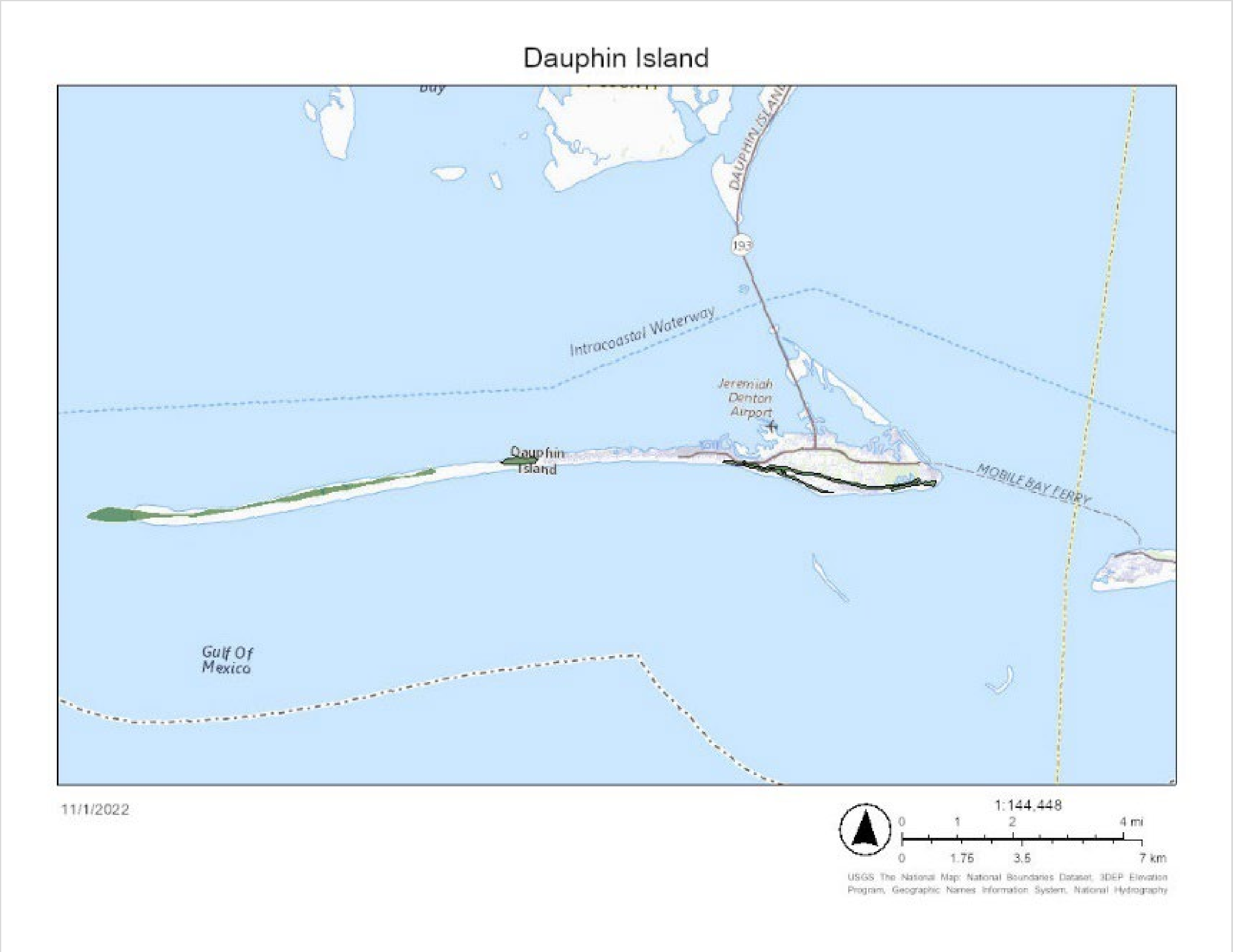
SOURCE: Ephriam Environmental

FIGURE 7-1 Hydric Soils (AH, OsA, and UdC) on Dauphin Island



SOURCE: Ephriam Environmental

FIGURE 7-2 Fair Infiltration Soil Types (BcC and PcA) on Dauphin Island



SOURCE: Ephriam Environmental

FIGURE 7-3 Excellent Infiltration Soil Types (FnE and NdC) on Dauphin Island

Soils

Axis and Handsboro Soils (AH)

Axis soils are loamy with a mixture of highly decomposed organic matter estuarine deposits and/or coarse-loamy estuarine deposits that form on tidal marshes, and salt marshes. As such, these soils have a moderately low to moderately high capacity of transmit water and are very frequently flooded. These soils are considered hydric and are associated with the presence of wetlands.

Handsboro soils are a component of this group. Handsboro soils are mucky silt loam that is derived from highly decomposed herbaceous material and thin mineral layer and/or highly decomposed herbaceous material stratified within thin loamy estuarine deposits. They are formed on tidal marshes and have a moderately low to moderately high capacity to transmit water. Because they are poorly drained, these soils are hydric in nature and are associated with wetlands.

Beaches (BcC)

Beaches soils are sandy and consist of a sandy marine deposits that form on beaches. There is a high to very high capacity to transmit water, which causes them to rarely flood because they are excessively drained. These are non-hydric soils and not associated with the presence of wetlands.

Fripp-Newhan Complex (FnE)

Fripp soils consist of fine sand and are formed from eolian sands. They can be found on foredunes. FnE has a moderately high to very high capacity to transmit water, as such, they are excessively drained and non-hydric in nature. They are not associated with the presence of wetlands.

Newhan soils are a component of this complex. These soils consist of fine sand that are formed from eolian sands and are found on foredunes. Fripp has a moderately high to very high capacity to transmit water, as such, they are excessively drained and rarely flood. They are non-hydric and not associated with wetlands.

Newhan-Duckston Complex (NdC)

Newhan soils primary component is a fine sandy soil that are from eolian sands. They form on shoulder, backslopes and have a moderately high to very high capacity to transmit water. Because of this, they are excessively drained and non-hydric in nature.

Duckston soils are a component of this complex. These soils consist of sand and are derived from sandy marine deposits. They typically form in depressions; however, they have a moderately high to very high capacity to transmit water. As such, these soils are poorly drained and are considered hydric in nature. Because of the hydric soil rating, these soils are associated with the presence of wetlands.

Osier Loamy Sand (OsA)

Osier soils are loamy sand that are derived from sandy alluvium and are formed on flood-plain steps. They have a moderately high to very high capacity to transmit water, as such, they are poorly drained soils that are hydric in nature. They are associated with wetlands. Two minor components are also associated with these soils, the Smithton and Johnston soils. Both of these minor components are also hydric in nature and are associated with wetlands.

Pactolus Loamy Sand (PcA)

Pactolus soils are a loamy sand that are derived from sandy fluviomarine deposits derived from sedimentary rock. These soils are found on fluviomarine terraces and have a moderately high to very high capacity to transmit water. Because of this ability, they are rarely flooded and not considered hydric. There are three minor components to this soil, however, that are hydric. They are the Smithton, Osier, and Pamlico soils.

Urban Land (UbA)

Urban Land are soils that have been disturbed. Their features are unknown and typically need to be mapped to be more accurate. According to the USDA Soil Survey, this component is formed on hillslopes and have a very high runoff class. They also have a very low to low capacity to transmit water.

Urban Land Duckston-Newhan Complex (UdC)

Urban Land Duckston-Newhan Complex soils are formed from loamy fluviomarine deposits derived from sedimentary rock and have a very high runoff class since they are disturbed soils.

Newhan soils secondary component is a fine sandy soil that are from eolian sands. They form on shoulder, backslopes and have a moderately high to very high capacity to transmit water. Because of this, they are excessively drained and non-hydric in nature.

Duckston soils are a tertiary component of this complex. These soils consist of sand and are derived from sandy marine deposits. They typically form in depressions; however, they have a moderately high to very high capacity to transmit water. As such, these soils are poorly drained and are considered hydric in nature. Because of the hydric soil rating, these soils are associated with the presence of wetlands.

POTENTIAL LOCATIONS FOR GI AND LID

Based upon the soil suitability analysis, poor quality soils make up approximately 55% of the soils identified on the Island. GI and LID stormwater practices should be utilized where possible to effectively store, infiltrate, or spread-out stormwater across the Island. These controls should be utilized to manage stormwater volumes, control stormwater runoff, and reduce pollutant loads. Site selection was based upon the quality of soils available on the Island as well as the urbanization of certain areas on the Island.

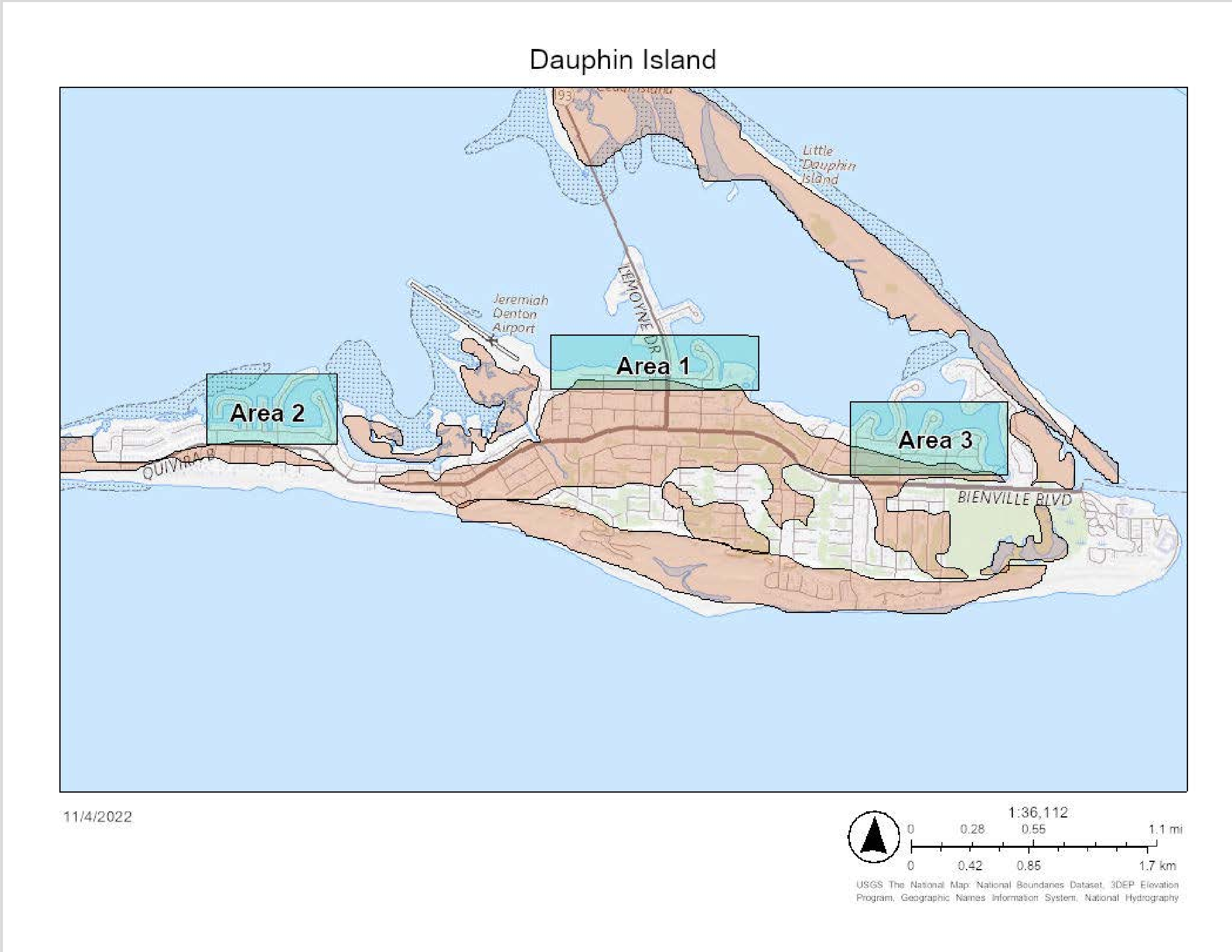
Area 1

Area 1 was selected because of the current project occurring in that area to revitalize Aloe Bay (**Figure 7-4**). Since a portion of this project will involve greenspace, it is suggested that vegetation, plant size, plant establishment and plant spacing is properly selected to help minimize the high runoff resulting from the presence of urbanization. Furthermore, by reducing the runoff, pollution and potential sedimentation will not enter into the poorly drained soils to the south causing less flooding.

A part of the revitalization of this area will include roadway improvements and the installation of a roundabout. Since these are traditionally impermeable surfaces, it is suggested to install permeable pavement, which will provide a volume reduction of stormwater runoff through temporary storage. This can help reduce peak flows and promote stormwater infiltration causing less flooding in the poorly drained soils to the south. Common permeable pavement alternatives include pervious concrete, porous asphalt, permeable interlocking concrete pavers, concrete grid pavers, and plastic reinforcement grids.

Areas 2 and 3

Areas 2 and 3 are grouped together because they have the same layout along the shoreline (**Figure 7-4**). These areas are residential and located on the water and are located on Urban Soils that have high runoff rates; therefore, they can be problematic during flooding events such as hurricanes and tropical storms. Further hydrological impacts occur in these areas through the installation of bulkheads or other habitat-degrading armoring. Atypical erosion control methods should be utilized in this area to facilitate the reduction in flooding during storm events, erosion control, and sediment transport to other areas of the Island. Living shorelines should be utilized as much as possible to provide erosional control and sediment transport. For areas that need repair such as streets and driveways, permeable pavement should be considered to repair or replace these areas to reduce stormwater by temporarily storing it in a gravel base layer. Grass swales, infiltration swales, and wet swales should also be considered for these residential areas because swales can reduce infrastructure costs by eliminating the need for curb and gutter and traditional stormwater piping. When paired with other methods like permeable pavement, pollutant load reductions will be increased.



SOURCE: Ephriam Environmental

FIGURE 7-4 Potential Locations for GI and LID on Dauphin Island

WATER SUPPLY

As presented in **Section 6.1.2**, DIWSA uses reverse osmosis as the primary treatment method to render the brackish water contained in the Shallow and Deep Sand Aquifers potable. This treatment method is very expensive and to help protect the current treatable chloride levels in the aquifers with the existing reverse osmosis infrastructure, the Town should implement a ban on all non-DIWSA operated public supply wells (i.e., private wells) drilled below a depth of 40 feet. In doing so, the Island would be opened to developing freshwater wells in the Water Table Aquifer and provide needed local protection to the brackish water aquifers. (**Appendix C**).

Water Quality Management Measures

PERFORM I&I STUDY ON WASTEWATER LINES TO ELIMINATE SSOS

Stormwater inflow and infiltration have long been recognized as the primary hydraulic problem in urban wastewater collection systems, which can cause problems such as sewer overloading, sewer overflows, and a reduction in the efficiency of treatment facilities (Zhang et al. 2018). Inflow and infiltration should be calculated for rainfall events of differing severities. Soil characteristics, rainfall intensities, and tidal influences vary greatly within location and regions, but the challenges of urbanization and resulting pressures on sewer infrastructure can be seen in cities all over the world. A study in Wuxi City, East China, Wang et al. (2019) found there were significant differences between stormwater inflow and infiltration between medium events (between approximately 1 and 3 inches) and heavy events (greater than 3 inches). During small events (less than 1 inch), the ratio of inflow and infiltration rates was variable due to conditions such as initial soil moisture and precipitation area distributions. The hydraulic conditions in sewer pipes were stable during medium rainfall events. Most of the water flows were dammed water in the sewer pipes. Backflow and overflow seldom occurred. During heavy rainfall events, the hydraulic conditions in sewer systems were complicated. The flow exceeded the pumps' capacity. Backflow and overflow also occurred at some areas due to the high-water depth in the pipes. The results of this study show the importance of evaluating the wastewater infrastructure during varying storm conditions. This should include light and heavy rainfall events and tropical events that create a surge (with adequate safety precautions).

UPGRADE AGING WATER AND SEWER INFRASTRUCTURE (E.G., PUMP STATIONS)

Any upgrades should be made only after a full assessment is conducted of the current infrastructure, including an inflow and infiltration study as noted above. Also under consideration, should be other influences such as sea level rise and increased population and commercialization of the Island that will both place additional strains on the system in the future.

Table 7-3 presents the potential Water management measures proposed by the WMP Team for implementation of this WMP.

TABLE 7-3 Potential Water Management Measures

ID#	Management Measure	Description	Cost
W-1	Upgrade Water and Sewer Infrastructure	Any upgrades should be made only after a full assessment is conducted of the current infrastructure, including an inflow and infiltration study as noted above. Also under consideration, should be other influences such as sea level rise and increased population and commercialization of the Island that will both place additional strains on the system in the future. This may be accomplished through FICW-3 depending on final scope of that project.	See Note 2
W-2	I&I Study	Perform I&I study on wastewater lines to help eliminate SSOs. This may be accomplished through FICW-3 depending on final scope of that project.	See Note 2
W-3	Comprehensive Island-wide Stormwater Master Plan	Planning document that looks at the Island in a holistic frame in consideration of flooding, storm, surge, and other stormwater management elements to determine what management measures may be implemented without unintended consequences to other Island-wide systems. This may be accomplished through FICW-2 depending on final scope of that project.	See Note 2
W-4	Water Supply	The Town should implement a total ban on all non-DIWSA operated public supply wells (i.e., private wells) drilled below a depth of 40-feet. In doing so, the Dauphin Island community would be opened to developing freshwater wells in the Water Table Aquifer and provide needed local protection to the brackish water aquifers. (**Appendix C**).	TBD
W-5	Net-Zero Stormwater Policy for New Development	This policy recommendation is targeted at all new residential and commercial development on Dauphin Island for all stormwater runoff to be managed on-site before a building permit is issued.	See Note 1
W-6	LID Code Revisions	Comprehensive code to identify top LID obstacles and modify them to allow for more extensive use and implementation of LIDs.	See Note 1
W-7	Wetland Ordinance Strengthening	Given the limited amount of wetlands left on the Island and their importance in the mitigation and storage of stormwater, construction in wetlands should be minimized to the most practicable extent possible.	See Note 1
W-8	Increase Residential and Commercial Landscape Requirements	Any areas of the Island that are developed moving forward should, at a minimum, have an increased green space requirement.	See Note 1
W-9	Long-term WQ Monitoring Program	A comprehensive, long-term water quality monitoring program is recommended to document the overall health of the Dauphin Island Watershed and to track changes in Watershed conditions over time. This will also help with assessing the performance of management measures and may determine where additional resources may be needed. **Chapter 11** provides additional information.	Initial Plan – $85,000 Program – $125,000/yr.

TABLE 7-3 Potential Water Management Measures

ID#	Management Measure	Description	Cost
W-10	Dauphin Island Restoration and Management Support System	Provides for basic maintenance and replacement of the existing sensor packages at each site, so the existing data utilized to develop the current project models continues to be available. These upgrades will allow the network to add the measurements of chlorophyll-a, a proxy for primary production. The second year will consist of upgrading the offshore site to be in real-time. Currently, those data are housed in a publicly accessible, online repository, but enhancements to real-time will integrate offshore surface data into adaptive management practices. The third year will focus on maintaining the data from the sites around the Island and developing new web-based applications for these data. The estimated costs for this project are based on the three phases. This initial effort will help make necessary upgrades and covered maintenance for a time; however, the system does not have a consistent funding base despite its critical role across a number of sectors including public health and safety, coastal resilience, and shipping and fishing industry. This monitoring program should be integrated into the long-standing, Alabama Real-Time Coastal Observing System (ARCOS). To ensure continued support of these stations, partnerships to ensure the stations' longevity should be explored.	Phase 1 (Year 1) – $266,041 Phase 2 (Year 2) – $303,145 Phase 3 (Year 3) – $278,518
W-11	Litter Management Program	Combating litter requires a multifaceted approach that includes the expansion of existing programs, increased regulatory control and enforcement, and an education component for both residents and tourists. Management measures may include installing catch mechanisms in the surface water drainage network, regulatory changes and enforcement, and educational and outreach activities. This program may be integrated with other management measure recommendations in this chapter and overall cost of the program will vary depending on what elements are implemented.	$100,000 – $250,000
W-12	Stormwater Homeowner Education Program	Primarily focused on public education regarding flooding, stormwater management, and water quality issues. May be integrated with other public education programs.	Initial Plan – $50,000 Program – See Note 1
W-13	Clean Water Future Program	This program provides resources and assistance to communities for promoting BMPs to protect waterways.	See Note 1
W-14	Clean Marina Program	This program is a voluntary certification program by Mississippi-Alabama Sea Grant consisting of a partnership of private marina owners, local government facilities, and yacht clubs that provides guidance in BMPs for the boating community in order to protect state coastal and inland waters. While some marinas have sewage pump-out stations, there are no Dauphin Island marinas listed on their website at the time of this writing (Mississippi-Alabama Sea Grant Consortium 2022).	See Note 1
W-15	Alabama Smart Yards (ASY) Program	The ASY program's mission is to introduce environmental consciousness to homeowners and neighborhoods. The ASY provides an extensive handbook that contains a host of information including recycling lawn waste, reducing stormwater runoff, managing yard pests responsibly, efficient irrigation practices, etc.	See Note 1

Note 1: Cost to be absorbed by internal administrative costs of participating organizations, municipalities, county, and agencies.

Note 2: Cost to be determined based on funding and scope for similar FICW projects presented in Table 7-1.

7.2 Coastlines

As a barrier island, Dauphin Island shorelines are constantly changing due to hurricanes, storm surge, sea level rise, gradual coastal processes, and anthropogenic influences. The following section presents Coastline projects that were funded, initiated, or completed during the development of this Plan, followed by the management measures proposed by the WMP Team for implementation of this WMP.

7.2.1 FUNDED, INITIATED, OR COMPLETED COASTLINE MANAGEMENT MEASURES

Recently funded, initiated, or completed management measures related to the Coastline category include beach and dune restoration, shoreline restoration, and marsh restoration projects. These types of management measures are important for protecting coastlines, enhancing and preserving habitat, and to the overall environmental health and resilience of the Dauphin Island Watershed.

Table 7-4 presents the Coastline projects that were funded, initiated, or completed during the development of this Plan.

TABLE 7-4 Funded, Initiated, or Completed Coastline (FICC) Management Measures

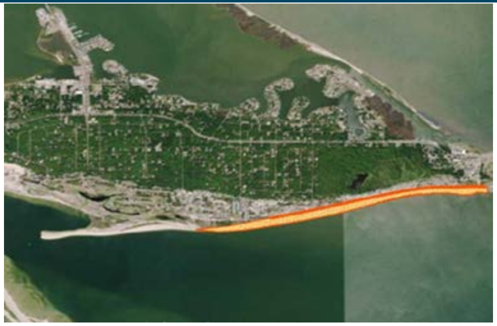
ID#	Management Measure	Description	Photo
FICC-1	Dauphin Island East End Beach and Dune Restoration Project	The Town of Dauphin Island is using a National Fish and Wildlife Foundation (NFWF) grant funds from to complete Phase 1 of the East End Beach and Dune Restoration project. The project includes engineering, design, and permitting to place an estimated 1.2 million cubic yards of sand along 4,800 feet of shoreline from the eastern tip of the Island to about parallel with Magnolia Court to restore 35 acres of beach and dune habitat. The project would also include planting and sand fencing to assist in retaining sand on the beach and dune system. (NFWF 2020a)	 Source: USACE/USGS 2020
FICC-2	Dauphin Island West End Beach and Dune Restoration Project	The Town has also received $1,143,000 in grant funds from NFWF to conduct field investigations and project design. Engineering and design tasks will include technical analysis, modeling, and 30% design drawings and preliminary 30% engineering and design activities as Phase I of a multiphase restoration effort to restore beach and dune habitats located along the western end of Dauphin Island. The project will focus on the Gulf shore from approximately Mid-Island west to Katrina Cut. Once constructed, the restored area would be naturally nourished as sand migrates westward from the East End of the Island. (NFWF 2021a)	 Source: USACE/USGS 2020

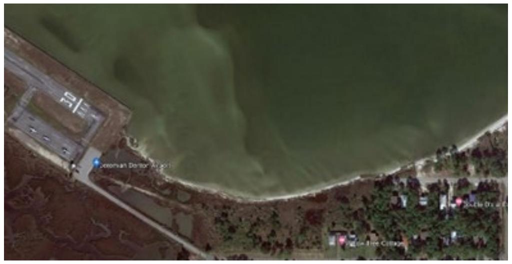
TABLE 7-4 Funded, Initiated, or Completed Coastline (FICC) Management Measures

ID#	Management Measure	Description	Photo
FICC-3	Dauphin Island Causeway Shoreline Restoration Project	This project will fund the engineering design and construction of breakwaters to enhance, protect, and improve resilience of marsh and oyster habitat adjacent to the Dauphin Island Causeway. The goal of the project is to stabilize the shoreline along the Bay side of the Dauphin Island Causeway and to create/enhance wetland and coastal habitat. This effort will create and protect critical coastal marsh habitat, enable natural processes to maintain nearshore habitats, and reduce the force of wave energy to the shoreline. This project is not in the Dauphin Island Watershed, but its proximity warrants its inclusion in the WMP as it is the only evacuation route of Dauphin Island. (NFWF 2020b, 2020c)	 Source: Mobile County Commission
FICC-4	Graveline Bay Marsh Restoration Project	The Town of Dauphin Island received $6,437,000 in NFWF funds to restore approximately 80 acres of back-barrier intertidal marsh habitat in Graveline Bay. This project will restore tidal wetland habitat, a natural first line of defense against storm surge and rising sea levels in Graveline Bay on Dauphin Island's north shore. The project is restoring tidal wetlands to provide habitat for coastal birds and other wildlife and create needed nursery habitat for fish and shellfish. Additionally, this project will enhance the resilience of Dauphin Island to future coastal storms and hazards. The second phase of the project includes the construction and monitoring activities. (NFWF 2021b)	 Source: Environmental Science Associates

TABLE 7-4 Funded, Initiated, or Completed Coastline (FICC) Management Measures

ID#	Management Measure	Description	Photo
FICC-5	Little Dauphin Island Restoration Assessment	USACE is conducting the NFWF funded Little Dauphin Island Restoration Assessment project, which is investigating restoration alternatives to help stabilize the Island. This project will provide funding to study both nearshore and onshore restoration options for a future project to enhance and protect Little Dauphin Island. Included in the Bon Secour National Wildlife Refuge managed by the U.S. Fish and Wildlife Service (USFWS). Little Dauphin Island is an important nesting and foraging area for several coastal bird species, including several imperiled shorebird species. Habitat quality has deteriorated in recent years due to loss of beach habitat through erosion. (NFWF 2020d)	 Source: Sam St. John
FICC-6	Aloe Bay Living Shoreline – 1	In October 2021, the Town was awarded $2,211,700 in Gulf of Mexico Energy Security Act (GOMESA) funds to design, permit, and construct a living shoreline in Aloe Bay, adjacent to the wastewater treatment facility and future eco-tourism site. The project is anticipated to include a 1,000-foot-long segmented breakwater, 2.5 acres of marsh and beach habitat creation, 200-300 feet of boardwalk, and an ADA beach access mat. This will be complemented by other public access amenities funded under a separate project that will include a parking lot and pathways on the upland area.	 Source: Google Earth

TABLE 7-4 Funded, Initiated, or Completed Coastline (FICC) Management Measures

ID#	Management Measure	Description	Photo
FICC-7	Aloe Bay Living Shoreline – 2	An additional $2,993,500 in NFWF Emergency Coastal Resilience Funds (ECRF) were awarded to the Town in June 2022 to design, permit, and construct a second living shoreline in Aloe Bay between the airport and the new DeSoto boat ramp site. The living shoreline will be up to 1,900 linear feet, create up to 6 acres of marsh, tidal creeks, and lagoons and 0.25 acres of oyster reef habitat. These projects will improve the Island's overall estuarine productivity and protect critical infrastructure.	 Source: Google Earth

7.2.2 COASTLINE AND SEDIMENT MANAGEMENT

The Town should consider developing a comprehensive shoreline management plan to link technical studies and engineering design, with the permitting and funding needs to implement a long-term strategy for sediment, beach, shoreline, and back-bay management. A Dauphin Island Watershed Alliance (DIWA) led by the Town and including local, regional, state, and federal agency representatives (see **Section 7.7**) could meet quarterly to develop the plan and then biennially to update the plan for the first decade from completion. The plan can then be updated on a 5–10-year basis.

The USACE/USGS Barrier Island Study (2020) provides a good basis for the technical approach to the current sediment transport and bypassing regime on the Island. However, further development is needed to update project and operations and maintenance (O&M) costs. Using information provided in **Chapters 8, 9, and 10** of this WMP and **Appendix A,** and with input from their respective staff and consultant teams, the DIWA would determine implementation and funding strategies.

The USGS/USACE Barrier Island Study (2020) suggests that Dauphin Island is an energy-starved system and not a sediment-starved one. Currently most of the sediment from dredging projects is placed in near-shore bars, with the intention that natural processes will sort the fine and coarse materials with the coarse fraction ultimately ending up on the beach. While this is beneficial to the beach in the area of immediate placement, the wave energy and longshore transport is not sufficient to move this sand higher onto the dry beach (above MHW) or move the sediment down the beach from east to west in short timeframes. Therefore, there is a need for enhanced coordination between the stakeholders to sediment placement. The sediment dredged from Mobile Harbor Bar Channel and other maintenance dredging projects around the Island could be optimized to beneficially use the sediment. The Town could also engage with the regulatory agencies and secure the permits that allow for multiple options for sediment placement. This would allow the Town to determine the placement location based on the different types of sediment generated by the dredging operations. Multiple permitted sediment placement options would also allow the Town the flexibility to work with USACE and other stakeholders to effectively cost share in the beneficial use of the material in the areas of greatest need, whether that is in the East End, West End, nearshore, beach berm, dune, or back bay areas.

The barrier island system that extends from Dauphin Island, Pelican Island, Sand Island, and the Mobile Bar to Fort Morgan is a mature, ebb shoal complex where sand moves alongshore in a balanced manner, losing some sediment to offshore bars and shoals, and some to channels and sinks. The USGS/USACE Barrier Island Study (2020) identifies the large volume of sand (ebb shoal complex) between Dauphin Island, Pelican Island, Sand Island, and the Mobile Bar as a potential source of sediment for beach nourishment and back bay nourishment projects for decades to come. However, outside of the sand generated by the maintenance of the Mobile Bar Channel, care should be taken if other portions of the ebb shoal complex are used as sources of sediment – avoiding any significant disruption to the ebb shoal complex, sediment transport processes, and its geomorphology. Further modeling and monitoring should be considered to avoid negative long-term impacts.

7.2.3 KATRINA CUT

Source: Thompson Engineering

Katrina Cut Repair, June 2011

Katrina Cut Background

Katrina Cut started as a 300-foot breach in the barrier island caused by Hurricane Ivan in 2004. This breach was widened by Hurricane Katrina in 2005 to over 6,500 feet and then to approximately 8,000 feet by Hurricane Gustav in 2010. In response to concerns of oil from the Deepwater Horizon oil spill reaching the marshes of Mississippi Sound and Portersville Bay, the Alabama Department of Environmental Management (ADEM) executed a contract to design, permit and construct a coastal structure to close Katrina Cut as an “emergency repair”. The gap was closed in October of 2010 and the structure completed in April 2011.

The repair measured 8,400 linear feet and involved 250,000 cubic yards of fill material. The structure was initially permitted as temporary and to be removed after one year, but the benefits to the marshes and oyster reefs, the navigation of the Gulf Intracoastal Waterway (GIWW), and potential foundation for future restoration projects outweighed the benefits of removal of the structure.

Katrina Cut Discussion

Over time, the structure has suffered damage in some locations. A survey commissioned in 2016 by USACE Mobile District revealed multiple areas where the crest elevation had been lowered from the design elevation.

The structure has breached on the East End and West End flanks after Hurricane Isaac in 2012, but those breaches healed naturally. Katrina Cut continues to be susceptible to breaches on the east and west flank, but modeling studies have shown that the breaches may occur whether the structure was left intact, modified, or removed. (Thompson Engineering 2013)

In April 2020, USACE Mobile District published a paper titled the Alabama Barrier Island Restoration Assessment Life-Cycle Structure Response Modeling (Gonzalez et.al. April 2000). A Monte Carlo life cycle structure response assessment of the Katrina Cut rubble mound structure was performed as part of this study by the USACE Engineer Research and Development Center (ERDC), Coast and Hydraulics Laboratory. Damage, wave transmission, and reliability were computed within the context of the decadal barrier evolution analysis performed by the USGS for various storm events and relative sea level change scenarios. The presence of a beach in front of the structure plays an important role in its protection. Since construction, morphological changes near the structure have been characterized by the steady accumulation of sand and the formation of a broad beach on the seaside of the rubble mound structure.

Source: Photo by Environmental Science Associates

Katrina Cut Structure

Thompson Engineering's Alternatives Analysis recommended leaving the structure in place, performing periodic maintenance to the Alabama Department of Transportation (ALDOT) Class V armor stone, and addressing flank breaches as they develop. In 2013, Thompson Engineering estimated the maintenance cost for the rip rap at $50,000 per year.

Katrina Cut Management Measures

The 2020 Alabama Barrier Island Restorations Assessment Report (USACE/USGS) identified three potential projects at Katrina Cut. The first project proposed a beach berm and dune nourishment on the Gulf side of the structure. The 2020 cost for the beach and dune nourishment in the area adjacent to Katrina Cut was approximately $60 million, with another $25 million in 20 years as O&M. The utility score for this project was highest at 231.1.

Source: Photo by Environmental Science Associates

Katrina Cut Dune Area

The second project proposed marsh restoration of the back-bay platform on the north side of the structure. The project would pump approximately 1.1 million cubic yards of sand in the areas immediately north of the structure and create up to 75 acres of habitat for wildlife. The cost for the project was estimated in 2020 dollars to cost $35 million with no future O&M costs. The utility score for this project ranked among the highest for marsh restoration at 224.8. This score equaled Aloe Bay but would create over 12 times the habitat acreage.

The third project proposed removal of the existing structure at Katrina Cut and allowing winds and waves to displace the existing sediment into the back-bay. The 2020 cost for removal of the Katrina Cut armor stone was $8 million and received a utility score of 195.9.

Source: Photo by Environmental Science Associates

Far West End Potential Overwash Area

The WMP Team recommends the marsh restoration of the back-bay platform, but without removal of the Katrina Cut structure and beach nourishment. Sand has already naturally migrated and formed dunes on the Gulf-side of the Katrina Cut structure; and longshore transport will continue to bring sand from the West End and from sandbars immediately offshore. Adding more sand to the gulf side beaches and dunes would be beneficial. The beach plays an important protective role by dissipating wave energy through wave breaking due to depth limitation. An initial assessment of the effect of the beach on the reliability of the structure showed that the absence of the beach can reduce its reliability more than 50%. Purposefully establishing and maintaining a beach long-term on the Gulf side of the rubble mound appears to be a viable option to extend the life and resilience of what was initially installed as a temporary structure. However, this can be costly to construct and maintain in the long-term. There is the potential for a lower cost, dune only project that would help to connect some of the existing dunes and eliminate lower elevation sections that are more prone to overwash or breach.

The loss of barrier islands in Louisiana is attributed to an inadequate sediment supply and insufficient back barrier marsh platform upon which barrier islands can migrate landward in response to storms and sea level rise (McBride and Byrnes 1997). Nourishing the back barrier marsh platform north of Katrina Cut not only creates habitat, but also captures any overwash sand from storms and allows the barrier island to recover.

Bathymetry varies from east to west across the bay bottom immediately north of the structure where the back barrier marsh platform would be constructed. The USACE shows the entire area filled as a uniform block. ESA recommends that the fill be designed to work in concert with the existing bathymetry and leave some of the deeper areas with no fill placed or they are filled to lower elevations. This will accomplish two goals, 1) diversity in the ecologic communities and 2) preserve recreational fishing opportunities. There are several locations that visitors to the area like to fish directly from the structure. Also, the incorporation of tidal creeks in the back barrier marsh platform will be critical. Tyler and Zieman (1999) states that tidal creeks are an important component of any marsh restoration effort, and increased creek-edge within the marsh increases the rate at which marshes mature.

Morris et al. (2002) concluded that as long as relative sea level rise does not exceed 3 to 20 mm/year, high marsh areas can sustain their elevation relative to water level while low marsh areas maintain or increase in elevation relative to water level. Estimates of sea level rise at National Oceanic and Atmospheric Administration (NOAA) tide station 8735180, show the relative rate of SLC was approximately 3.61 millimeters per year. These data were used in conjunction the USACE SLC curve calculator (version 2017.55) for low, intermediate, and high curves to develop projections for the relative rise in sea level at Dauphin Island over the next 50 years. The projected relative rise in sea level by 2070 varies from 0.3 meters in 2070 (using the current low rate) to 1 m in 2070 (USACE 2020).

The costs presented in this document are primarily from the USACE/USGS 2020 Barrier Island Assessment Report or the 2013 Thompson Report. In order to put those costs into 2022 values we refer to the Engineering News Record (ENR) Annual Average Construction Cost Index and to escalate costs from 2013 the factor is 1.35 and to escalate costs from 2020 the factor is 1.13. The ENR Cost Index is based on the average cost of materials, equipment, and labor across 20 U.S Cities.

7.2.4 POTENTIAL COASTLINE MANAGEMENT MEASURES

Table 7-5 presents the potential Coastline management measures proposed by the WMP Team for implementation of this WMP.

TABLE 7-5 Potential Coastline Management Measures

ID#	Management Measure	Description	Cost
C-1	Develop Beach/Shoreline Management Plan to include Back Bay	The Town needs to have a Comprehensive Beach Management Plan (CBMP) that combines the projects currently underway and proposed for future implementation by Federal, State and Local entities. Compiling the existing modeling data, sand specifications for nearshore, beach front, dune and back-bay projects as well as ensuring proper permits are in place for beach nourishment, will allow the Town to capitalize on sand dredged from the Mobile Harbor Bar Channel maintenance projects and collaborate effectively with other stakeholders. A CBMP will also identify funding needs, develop a dedicated funding structure for beach nourishment and maximize grant potential and FEMA support. The plan will need updates on 5- to 10-year intervals.	Initial Plan: $500,000–$1M Plan Updates: $200,000–$500,000
C-2	Katrina Cut Back Bay Restoration	Proposed marsh restoration of the back-bay platform on the north side of the structure. The project would pump approximately 1.1 million cubic yards of sand in the areas immediately north of the structure and create up to 75 acres of habitat for wildlife. The cost for the project was estimated in 2020 dollars to cost $35 million with no future O&M costs. The utility score for this project ranked among the highest for marsh restoration at 224.8.	$35M See Note 2
C-3	Sand Bypass System	One of the scenarios considered in the Barrier Island Restoration Assessment Report (USACE and USGS 2020) was adding sand to Sand Island every two years. The Sand Island Platform Nourishment and Sand Bypassing measure would serve to build up the shoal system around the Sand Island Lighthouse and supply sediment to the nearshore littoral system along regions of the submerged ephemeral sand deposits of Pelican and Sand Islands. The nourishment of the Sand Island Platform and the southeast portion of Pelican Island continues to reinforce the shoal in this area and create a more stable ebb shoal complex. The measure provides an estimated 127 acres of submerged offshore sand deposits along the ebb tidal shoal system, and a direct source of sediment to the Pelican Island and Sand Island submerged ephemeral sand deposits. There is also historical/cultural significance to consider for the Sand Island Lighthouse.	Initial Construction: $82M–$103M 2-yr. Renourishments: $10.4M–$29.7M (20–50 yr.) Monitoring: $2.5M–$3.1M See Note 2
C-4	Back Bay Marsh Restoration	While marsh areas on Dauphin Island have been vertically accreting (Smith et al. 2018), USGS modeling as part of the Barrier Island Study showed that higher scenarios of sea level rise may require nourishment to maintain the marsh (Enwright 2020). Additional thin layer sediment placement could help increase marshplain elevations without burying existing vegetation. Coordination with USACE dredging cycles would bring efficiency and cost-effectiveness to this approach.	$5M–$40M/project
C-5	Borrow Pits Restoration	NFWF withdrew its support for the proposed filling of numerous borrow pits along the north shore of the Island's West End due to lack of property owner buy-in and support. These holes were dug post-oil spill to construct a protective berm parallel to the south side of Bienville Boulevard. All of the pits are located on private property and permission from the individual owners was required for construction to occur. The project was designed to create additional critical habitat along the north shoreline while strengthening a portion of the Island that some coastal engineers suggested could be susceptible to breaching. Should landowner approval be secured in the future, this project should be prioritized for implementation if funding can be secured. (NFWF n.d.a)	Design: $329,000–$500,000 Construction: $5.1–$6.4M See Note 2

TABLE 7-5 Potential Coastline Management Measures

ID#	Management Measure	Description	Cost
C-6	Seawall Softening and Natural Enhancement or Removal	As seawalls and other hardened coastal structures reach the end of their lifespan, or are subject to damage from storms, the overall design and purpose should be re-evaluated. The Town could promote replacement of the seawall with softer, greener infrastructure where possible to address resilience while also creating and enhancing habitat.	\$500–\$1,000/linear ft.

Note 1: Cost to be absorbed by internal administrative costs of participating organizations, municipalities, county, and agencies.

Note 2: The costs presented are primarily from the USACE/USGS Barrier Island Assessment Report (2020), NFWF project funding sheets, or the Thompson Katrina Cut Report (2013). In order to put the costs presented into 2022 values the estimates would need to use the Engineering News Record (ENR) Annual Average Construction Cost Index to escalate costs. From 2013 the factor is 1.35; and to escalate costs from 2020 the factor is 1.13. The ENR Cost Index is based on the average cost of materials, equipment, and labor across 20 U.S Cities.

7.3 Access

The following section presents Access projects that were funded, initiated, or completed during the development of this Plan, followed by the management measures proposed by the WMP Team for implementation of this WMP

7.3.1 FUNDED, INITIATED, OR COMPLETED ACCESS MANAGEMENT MEASURES

Recently funded, initiated, or completed management measures related to the Access category include Town master planning, and community amenities and recreational enhancements. These types of management measures are important for protecting improving the quality of life for Island residents and visitors.

Table 7-6 presents the Access projects that were funded, initiated, or completed during the development of this Plan.

TABLE 7-6 Funded, Initiated, or Completed Access (FICA) Management Measures

ID#	Management Measure	Description	Photo
FICA-1	Aloe Bay Harbor Town Master Plan	The Aloe Bay Harbor Town Phase I project objective is to develop a "town center" master plan and urban design that will direct future infrastructure development. This phase of the Aloe Bay Harbour Town project includes a feasibility study, environmental and geophysical reports, an appraisal report, and a master plan for a town center, which aims to support economic development, tourism, and recreational fishing. The Master Plan document is a written catalogue that presents the vision, objectives, tools, and recommendations for the Dauphin Island community and town leaders to create an attractive and vibrant Town Center. (aloebay.org n.d.)	 Source: aloebay.org
FICA-2	West End Beach Wheelchair-accessible Beach Mat	The Town of Dauphin Island, MBNEP, and the Krewe of Kindness installed two extensive ADA/wheelchair compliant beach mats on the north and south sides of the West End Beach.	 Source: MBNEP
FICA-3	Cedar Point Pier Acquisition and Upgrades	Mobile County purchased the pier in December 2021 using a $2.2M GOMESA grant and initiated repairs and renovations. Repairs and renovations to the Pier over the winter closure include removal of unstable, worn structures, temporary stabilization around the bulkhead, grading of the parking area, and the completion of necessary electrical work. The work performed was designed to enhance the safety and stability of the Pier and the safety of visitors enjoying the property. This project is not in the Dauphin Island Watershed, but its proximity warrants its inclusion in the WMP as Cedar Point Pier, has long been considered the "*Welcome Mat to Dauphin Island*," because of its location on AL 193 just north of the bridge to Dauphin Island.	 Source: Mobile County

TABLE 7-6 Funded, Initiated, or Completed Access (FICA) Management Measures

ID#	Management Measure	Description	Photo
FICA-4	West End Land Acquisition and Bird Conservation and Management Plan	While the main goal of this project is for increasing bird populations and enhancing their habitat, this acquisition does provide for increased public access. This project is also presented as part of FICFW-1 presented in Section 7.4 With funding provided by the Deepwater Horizon oil spill settlement through the Alabama Trustee Implementation Group Restoration Plan III and the Alabama Department of Conservation and Natural Resources (ADCNR), the acquisition of approximately 838 acres of privately owned beach and dune habitat was deed transferred to the Town of Dauphin Island. The Town of Dauphin and Mobile County, in partnership with the Department of the Interior and ADCNR, are developing this plan to guide future implementation of management activities with the goal of increasing nesting bird populations and enhancing habitat quality and availability. Several species including birds and sea turtles use the area for nesting and the diverse habitats provide a prime resting spot for migratory bird species. (Gulf Spill Restoration n.d.)	 Source: Photo by Environmental Science Associates
FICA-5	Dauphin Island Community Center	The Dauphin Island Foundation, in partnership with the Town is planning the construction of this new facility. The building will hold nearly 13,000 ft2 and include a stage, kitchen, restroom facilities and two meeting rooms with seating for 100 and 350, respectively.	 Source: Google Earth

TABLE 7-6 Funded, Initiated, or Completed Access (FICA) Management Measures

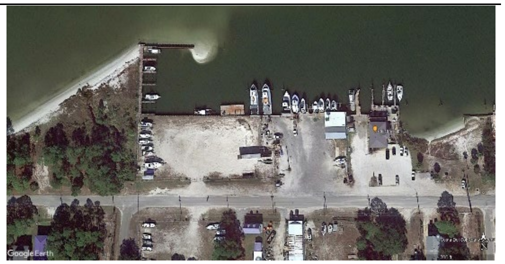
ID#	Management Measure	Description	Photo
FICA-6	Little Billy Goat Hole and East End Beach Access Improvements	The Town initiated improvements to the Little Billy Goat Hole Boat Ramp area and East End Beach access area. The project was funded by GOMESA and USFWS Sport Fish funds. At Little Billy Goat Hole, activities include maintenance dredging of the boat basin; repair of the rock/riprap jetty; upgrades to existing timber boat docks framing and decking; steel sheet pile repair; and parking lot repairs. At the East End Beach access, the road will be improved around the fort and the parking lot will be expanded.	 Source: Photo by Environmental Science Associates
FICA-7	Billy Goat Hole Boat Ramp Replacement	This $1,313,400 project is intended to replace aging ramps and finger piers, improve parking, and install a new elevator at restroom/concession stand at Billy Goat Hole. Plans include a redesign of the ramps themselves to allow for launching of boats with reduced interference to traffic on Bienville Blvd. Some of this funding was also used for the Cedar Point Pier acquisition.	 Source: Photo by Environmental Science Associates
FICA-8	Desoto Avenue Boat Ramp Construction	This project was funded by GOMESA and consists of construction of a concrete boat ramp, access piers, bulkhead, parking area, and all related appurtenances. The site will offer Mississippi Sound access and accommodate approximately 40 trailered vehicles.	 Source: Google Earth

TABLE 7-6 Funded, Initiated, or Completed Access (FICA) Management Measures

ID#	Management Measure	Description	Photo
FICA-9	Bike Trail	The Town of Dauphin Island received funding from the Alabama Department of Economic and Community affairs for bike trail improvements.	 Source: Google Earth
FICA -10	Dauphin Island Eco-Tourism and Environmental Education Area	The project will provide compensatory restoration for recreational use losses in Alabama by acquiring approximately 100 acres of privately held land and water bottom in the geographic middle of Dauphin Island. The project will enhance recreational use of the coastal habitat by providing amenities that offer recreational opportunities to the public. These proposed visitor amenities include educational signage, fishing pier, bicycle path, parking area, boardwalks, gazebos, and public restrooms. The fishing pier and boardwalks will allow visitors access to the marsh and water. (Gulf Spill Restoration n.d.)	 Source: www.gulfspillrestoration.noaa.gov

7.3.2 TOURISM MANAGEMENT

As presented in **Chapter 6**, public access and impacts from tourism are concerns for both Island residents and visitors. Dauphin Island is not alone is dealing with these types of issues and can look to how other tourist towns and coastal communities have managed these concerns. Both the City of Charleston, South Carolina and the City of Sedona, Arizona have developed management plans to address tourism and may serve as examples:

- City of Charleston Tourism Management Plan (City of Charleston 2015):

  "The Tourism Advisory Committee will develop objectives and recommendations that address the goal of maintaining the critical and delicate balance between Charleston's residential quality of life and the tourism economy while preserving Charleston's authenticity and sense of place, especially its architectural and cultural heritage."

- City of Sedona Sustainable Tourism Plan (City of Sedona 2022):

  "Today, we launch a new type of Sedona advocacy, promoting responsible visitor behavior that respects our environment and the sensibilities of our residents – while offering travelers every opportunity to reduce their impact and be part of a sustainable future."

Both plans highlighted above seek to not only minimize impacts from tourism on the local residents and environment, but to also reshape the visitor's experience from what traditional tourism has been.

The Town of Dauphin Island, in collaboration with the DIWA, can review these, and other tourism management plans, to select the elements that are most applicable to the Island. Elements for inclusion may consist of the following:

- Transportation
- Parking
- Recreational opportunities
- Beach and waterway access
- Dining and lodging
- Special events
- Environmental education
- Integration with regional tourist initiatives and programs
- Impacts and quality of life for Island residents
- Off-Island integration
- Economic impacts
- Diversity and inclusion

7.3.3 POTENTIAL ACCESS MANAGEMENT MEASURES

Table 7-7 presents the potential Access management measures proposed by the WMP Team for implementation of this WMP.

TABLE 7-7 Potential Access Management Measures

ID#	Management Measure	Description	Cost
A-1	Tourism Management Plan	The Town can work with the DIWA to integrate with regional tourism initiatives and also look for off-Island opportunities to support parking, transportation (e.g., water taxis, trolleys), and lodging.	$150,000 to $250,000
A-2	Create Blueway Trails	The Comprehensive Plan 2030 (Town of Dauphin Island and SARPC 2013) recommended the establishment of canoe/kayak trails and these could be integrated with Mobile County and Paddle the Gulf blueway trail programs (https://paddlethegulf.org/).	See Note 1
A-3	Wheelchair-accessible Beach Mat	With the success of the West End beach mat, the Town should consider adding these mats to all public beaches.	TBD

Note 1: Cost to be absorbed by internal administrative costs of participating organizations, municipalities, county, and agencies.

7.4 Fish and Wildlife

The following section lists Fish and Wildlife projects that were funded, initiated, or completed during the development of this Plan, followed by the management measures proposed by the WMP Team for implementation of this WMP.

7.4.1 FUNDED, INITIATED, OR COMPLETED FISH AND WILDLIFE MANAGEMENT MEASURES

Land Acquisitions

The Town of Dauphin Island, Mobile County, federal agencies, and other stakeholders have made great strides in acquiring lands throughout the Watershed. **Figures 7-5 through 7-7** show land acquisitions in the Dauphin Island Watershed. Note that due to geomorphological changes in the Island and geographic inconsistencies between data sets, there may be some inconsistences in exact parcel locations.

SOURCE: Environmental Science Associates

FIGURE 7-5 Land Acquisitions – Overview

SOURCE: Environmental Science Associates

FIGURE 7-6 Land Acquisitions – East End

SOURCE: Environmental Science Associates

FIGURE 7-7 Land Acquisitions – West End

Funded, Initiated, or Completed Fish and Wildlife Management Measures

Table 7-8 presents the Fish and Wildlife projects that were funded, initiated, or completed during the development of this Plan.

7.4.2 POTENTIAL FISH AND WILDLIFE MANAGEMENT MEASURES

The following section provides a summary of potential Fish and Wildlife management measures proposed by the WMP Team for implementation of this WMP, followed by **Table 7-9** that presents a complete listing of potential measures.

Habitat Conservation

STRATEGIC PARCEL ACQUISITION

This management measure is intended to protect existing significant habitat tracts by developing a coordinated plan with government agencies and private interests to acquire properties or establish new conservation easements. The approach is to avoid or discourage development and fragmentation of properties with sensitive coastal habitats to protect critical ecological functions. Key criteria for strategic parcel acquisition and conservation easements include identifying lands with important natural resources; lands in proximity to or adjacent to existing easements and protected open space areas; lands where habitat may migrate with sea level rise; and parcels of sufficient size to warrant protection and justify the expense involved in protecting high quality habitats.

Parcels with amenable owners should be inspected to verify the occurrence of priority conservation habitat and document its extent and ecological condition, prior to pursuing acquisitions or establishment of new conservation easements. One aspect of this measure is improved education and outreach about biologically significant areas. This could include providing incentives and information to landowners for long-term conservation as part of the Watershed outreach plan to educate the public about the value of coastal habitats

TABLE 7-8 Funded, Initiated, or Completed Fish and Wildlife (FICFW) Management Measures

ID#	Management Measure	Description	Photo
FICFW-1	Land Acquisitions	The Town of Dauphin Island, Mobile County, the State of Alabama, federal agencies, and NGOs have coordinated on multiple land acquisitions in the Watershed (West End, Mid-Island, Aloe Bay, Graveline Bay, Steiner Property, Tupelo Swamp, Gorgas Swamp, Tupelo Gum Swamp, Little Dauphin Island, and others) (NFWF 2020e, 2020f, n.d.a., n.d.b; Gulf Spill Restoration n.d).	 Source: ESA
FICFW-2	Sensitive Habitat Protection and Management Plan	This study identifies sensitive wetland and dune habitat on the Island. The Plan includes maps with potential wetlands as well as the dune study area. The plan offers suggestions to better protect the wetlands as well as property owner's use of these wetlands. The Plan also offers proposed policies and changes to best management practices for construction in the dune areas. The study was paid for by a grant provided by the National Oceanic and Atmospheric Administration (NOAA) pursuant to the Coastal Zone Management Act of 1972.	 Source: ESA
FICFW-3	Ordinance and Zoning Updates and Changes	The Town of Dauphin Island initiated multiple zoning and ordinance changes and updates throughout the development of this watershed management plan (e.g., wetlands, tree, dune, seawall, zoning). **Chapter 9** provides more information.	 Source: Town of Dauphin Island

TABLE 7-9 Potential Fish and Wildlife (FW) Management Measures

ID#	Management Measure	Description	Cost
FW-1	Strategic Parcel Acquisition	This management measure is intended to protect existing significant habitat tracts by developing a coordinated plan with government agencies and private interests to acquire properties or establish new conservation easements.	See Note 2
FW-2	Monitor Priority Habitats Through High Resolution Mapping and Inventory	This program would help manage ongoing protection of sensitive Island habitats, by updating mapping and plant community inventories that are needed to establish their current status and condition.	$300,000 for four surveys at 5-yr. intervals
FW-3	Improve Invasive Species Management	A systematic survey and assessment should be conducted to develop a Watershed invasive control plan, visual inspections of invasive species should be made during all monitoring activities.	$50,000
FW-4	Chinese Tallow Tree Control in the Audubon Bird Sanctuary	The effectiveness of Chinese tallowtree (*Triadica sebifera*) eradication efforts in the Audubon Bird Sanctuary should be regularly monitored, as invasive management can require multiple treatments to adequately control or eliminate this species.	$379,500
FW-5	Forest Management in the Audubon Bird Sanctuary	This program would restore habitats by using either controlled burning or mechanical removal.	$30,000
FW-6	Develop a Sand Management Plan	A plan is needed for management and protection of sand deposits redistributed to public rights-of-way and private properties by frequent storms and could be incorporated into an overall sediment management or beneficial use plan for the Island.	TBD
FW-7	Feral Cat and Red Fox Management	Enhanced tracking of shorebird and sea turtle nest predation by feral cats, racoons, and foxes should be an integral component of Watershed monitoring efforts.	TBD
FW-8	Black Rail Population Surveys	Black Rail has been documented from Dauphin Island in the past but a systematic survey of its occurrence in Island marshes has never been performed	TBD
FW-9	Install a Motus Radio Telemetry Station to Facilitate Migratory Bird Research	This recommended management measure is the installation and maintenance of a Motus Wildlife Tracking System station in the Watershed at a secure location with an available power source and internet access, such as the Dauphin Island Sea Lab.	$20,000

Note 1: Cost to be absorbed by internal administrative costs of participating organizations, municipalities, county, and agencies.

Note 2: Median home price as of this writing is approximately $675,000. Overall range varies from approximately $85,000 for a residential lot, to over $1.8M for larger homes.

MONITOR PRIORITY HABITATS THROUGH HIGH RESOLUTION MAPPING AND INVENTORY

To help manage ongoing protection of sensitive Island habitats, updated mapping and plant community inventories are needed to establish their current status and condition. The recommended measure is to conduct recurring surveys of habitat extent and quality, expand GIS coverages, and provide geospatial analysis to map priority locations for conservation and restoration efforts. More frequent mapping intervals of at least every five years and improved resolution of natural community types will support management goals including habitat preservation for species of conservation concern, treatment of invasive species infestations, and tracking development pressures. The improved mapping would facilitate research, education, and management supporting conservation of native habitats and biodiversity.

The Island's MBNEP priority habitats include shorelines, beaches and dunes, tidal marshes and flats, freshwater wetlands, and maritime forest. Remote sensing with intensive field verification is recommended to accurately map boundaries and discriminate among key habitat characteristics, including floral associations and inventory with sufficient resolution to inform management actions. Plant inventory data collection should be performed by or in consultation with wetland, forestry, and plant community specialists. Analysis of satellite or aircraft imagery, combined with on-the-ground observations, will provide the information needed to effectively determine long-term trends and short-term changes of the distribution and quality of priority habitats.

Source: Barry Vittor & Assoc.

Maritime forest on Dauphin Island

Habitat Restoration

IMPROVE INVASIVE SPECIES MANAGEMENT

Invasive plant infestations are causing habitat degradation on the Island. While many Island locations with invasive plants are known, there is no current status map to inform prioritization of potential management actions. It is recommended to systematically survey the Island to determine the extent of invasive and exotic plants, for the purposes of eradication, maintenance of native biodiversity, and conservation of threatened natural resources. The assessment would identify the location and extent of targeted invasive exotic species to identify the most environmentally damaging species, estimate costs for invasive species removal, and prioritize and recommend treatments. The

MBNEP funded the Invasive Species Control Plan for the Three Mile Creek Watershed (EnviroScience 2019), which could serve as a template for the Island. The following elements of the plan would be applicable to Dauphin Island:

- Assess invasive plant distribution and abundance on accessible land parcels.
- Use budgeting tool and species location maps to prioritize site selection.
- Target high or moderate density non-native invasive communities.
- Continue monitoring the Island to detect new invasive species while they are present in low numbers.
- Manage and protect existing intact native communities.
- Conduct community outreach regarding invasive species detection and control.

The Invasive Species Control Plan for the Three Mile Creek Watershed can be found at: https://www.mobilebaynep.com/assets/pdf/MBNEP_ThreeMileCreek_report_040919_FINAL_web.pdf

TALLOW TREE CONTROL IN THE AUDUBON BIRD SANCTUARY

Chinese tallow tree infestations are widespread in wetlands and uplands within the East End of the Island's interior freshwater marshes and swamps. Invasive plant management is recommended for an approximate 23-acre area in the in the Audubon Bird Sanctuary, shown in **Figure 7-8**.

A small population of golden canna (Canna flaccida) occurs along the east margin of Alligator Lake in the Audubon Bird Sanctuary (**Figure 7-8**). Golden canna is a Priority 1 (S1) species considered critically imperiled in Alabama because of extreme rarity. The species should be flagged and avoided when spraying herbicide or implementing other methods to control the tallow tree infestation.

SOURCE: ESRI

FIGURE 7-8 Priority Area for Chinese Tallow Tree Invasive Plant Management

FOREST MANAGEMENT IN THE AUDUBON BIRD SANCTUARY

Fire suppression and livestock exclusion over many decades in the Audubon Bird Sanctuary property has allowed the conversion in some areas of formerly sparse and open understory of the native maritime forest, to shrubs and other woody species (Bailey 2013). This degraded habitat can potentially be restored using either controlled burning or mechanical removal. The recommended area for management is approximately 2.5-acres in size, as shown in **Figure 7-9**.

SOURCE: ESRI

FIGURE 7-9 Management Area for Dense Pine Management and Forest Restoration

DEVELOP A SAND MANAGEMENT PLAN

The Town of Dauphin Island has enacted policies to ensure maintenance of dune functional values in protecting public and private infrastructures and the public investment in beaches and dunes. A plan is needed for management and protection of sand deposits redistributed to public rights-of-way and private properties by frequent storms, and could be incorporated into an overall sediment management or beneficial use plan for the Island. Options should be considered for methods of sand removal, transport, and strategic placement back into the beach and dune system.

This plan could outline a program between Town public works and DIWSA to develop a consistent policy for where sand gets reused and to better coordinate post-storm cleanup efforts, so sand management efforts to not impact DIWSA infrastructure and reuse of the sand is optimized for ecosystem health and resilience.

Wildlife Management

FERAL CAT AND RED FOX MANAGEMENT

Source: Photo by Environmental Science Associates.

Fox Den on Far West End

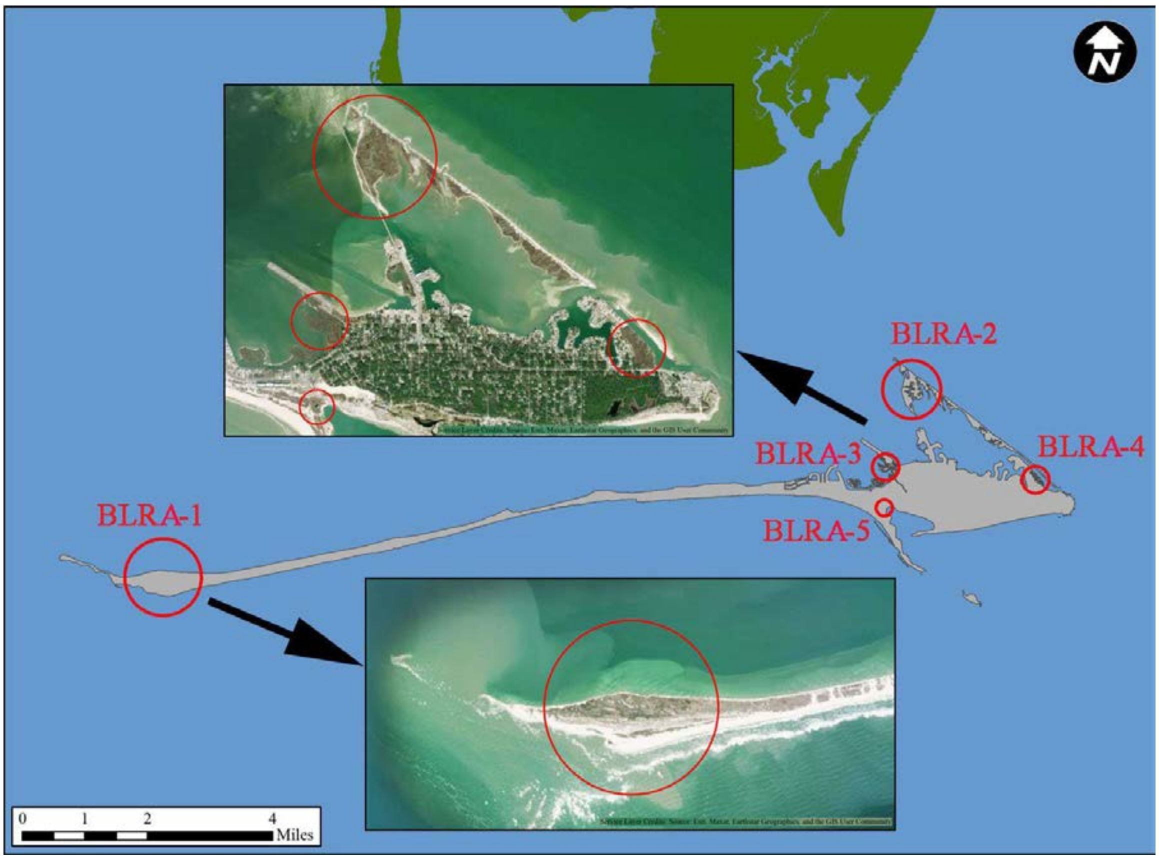
Predation on nesting birds and sea turtles is an increasing problem both east and west of Katrina Cut. Feral and free-roaming cats, racoons, and red foxes are major predators on Island wildlife. The recommended measure is to develop a focused management program for humane control that includes methods to trap, neuter, and relocate feral cats and other predators. In addition, education and outreach should be implemented to encourage property owners with free-roaming pets to better manage their movements, and to use brightly colored collars to increase their visibility to birds and other potential prey.

Red foxes are a major predator of the eggs of nesting shorebirds and sea turtles. It is recommended that the Town coordinate with the other agencies to integrate with their predator management programs to protect threatened and endangered species that utilize Dauphin Island.

BLACK RAIL POPULATION SURVEYS

Among important species of conservation concern, the Eastern Black Rail (Laterallus jamaicensis) is a small, secretive marsh bird listed by the U.S. Fish & Wildlife Service as a threatened species and is listed as a state-ranked species of high conservation concern (Priority 2). The State Wildlife Action Plan (SWAP) (ADCNR 2015) recommends data collection for potential Black Rail marsh habitats to fill information gaps on their status and condition. Black Rail has been documented from Dauphin Island in the past but a systematic survey of its occurrence in Island marshes has never been performed. These tidal marshes are increasingly under stress from sea level rise, coastal erosion, and human modification.

The five-year Fire Bird Project is funded through the Resources and Ecosystems Sustainability Tourist Opportunities, and Revived Economics Act (RESTORE Act; 2012; Public Law 112-141, Section 1604). This multi-state research project is currently studying Eastern Black Rail ecology across the northern Gulf Coast from Texas to Florida, to determine its distribution and abundance, and includes mapping of important marsh habitats. Locations of potential Black Rail occurrence on the Island are recommended to be surveyed through placement of automatic recording units (ARUs) for call-broad-cast surveys. ARUs can provide extended survey windows, potentially allowing for more effective detection of secretive species like Black Rail. The recommended measure is to deploy ARUs at five locations (**Figure 7-10**) and map the wetland complexes according to elevation and vegetative community composition.



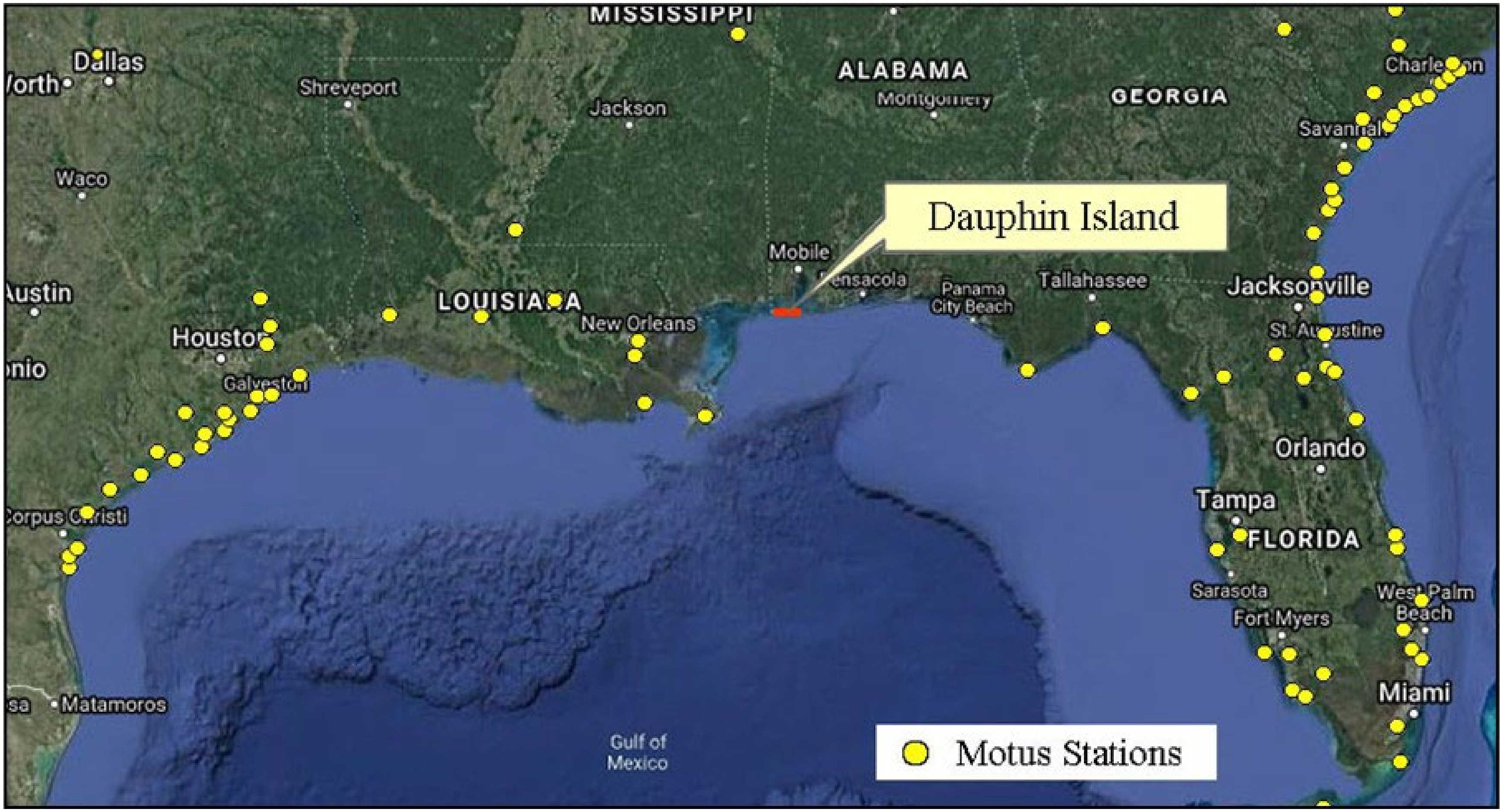
SOURCE: ESRI

FIGURE 7-10 Locations of Recommended Surveys for Eastern Black Rail (BLRA) Populations

INSTALL A MOTUS RADIO TELEMETRY STATION TO FACILITATE MIGRATORY BIRD RESEARCH

This recommended management measure is the installation and maintenance of a Motus Wildlife Tracking System station in the Watershed at a secure location with an available power source and internet access, such as the Dauphin Island Sea Lab. Automated radio telemetry is used in a wide variety of ecological applications particularly for tracking migration of small animals or determining fine scale temporal information about movement or behavior. The Motus system uses a coordinated array of automated radio telemetry stations that are all monitoring the same frequency to detect tagged animals over broader spatial scales. The Motus system collects data from more than 750 receiving stations as well as metadata from stations (location, deployment dates, height, antenna bearing) and tags (species, location, date deployed). Researchers have access to detection data from all receivers within the Motus network regardless of who maintains those stations. Tagged animals are detected on their local array, as well as any other station in the network.

Despite its location within a major migratory flyway, the Alabama coast represents a significant gap within the existing Motus array (**Figure 7-11**). The Motus system harnesses the collective resources of many independent researchers into a larger collaborative effort. Data from across the network is provided to researchers. A condensed version is publicly available. A local Motus station will help document and improvement understanding of migratory patterns and the extent of use of Island habitats during both fall and spring migration, to identify needed conservation actions and make informed decisions regarding protection of neotropical migrant songbirds and their habitats.



SOURCE: Birds Canada 2022

FIGURE 7-11 Motus Radio Telemetry Stations Along the Northern Gulf Coast

7.5 Heritage and Culture

The following section provides a summary of potential Heritage and Culture management measures proposed by the WMP Team for implementation of this Plan, followed by **Table 7-10** that presents a complete listing of potential measures.

7.5.1 POTENTIAL HERITAGE AND CULTURE (HC) MANAGEMENT MEASURES

Create A Cultural Brand

The Strategic Plan (Five E's Unlimited 2007) and Comprehensive Plan 2030 (Town of Dauphin Island and SARPC 2013) both recommended the Island adopt a brand and provided suggestions. After the Deepwater Horizon oil spill, the Town developed the "Sunset Capital of Alabama" tagline to regenerate tourism on the Island. While this tagline is excellent for attracting tourists and the Town has had great success with it, it is intended to be an external marketing mechanism to attract visitors to the Island.

The community may need to do additional branding to adapt visitor behavior once they get to the Island and convey their "island-time" lifestyle so visitors can quickly assimilate to the Island's culture. Examples could include statements like "Welcome to Dauphin Island, you're on island time now," Welcome to Dauphin Island, where life is slower," or "Welcome to island time, we're not in a hurry so don't you be!"

These taglines could apply to public safety to remind people to slow down on the Island, but also culturally to remind them to relax and take it easy. Decorative signs could be posted on entry to the Island and outside restaurants and other areas where there could be long lines and waits. A branding consultant could work with the Town as in the past, to develop this additional outreach for the Island. The overall goal is for the Island to change the visitors and not for the visitors to change the Island.

Sand Island Lighthouse

As presented in **Sections 3.8 and 6.5**, Dauphin Island has a rich cultural and ecological heritage that is important to Island residents and visitors. Sand Island Lighthouse is one of the historical structures valued by the local community and is located on a constructed rock island in the Gulf of Mexico approximately three miles south of Dauphin Island, Alabama. Construction of the 126-foot lighthouse was completed in 1873. The lighthouse functioned until 1933 when it was deactivated by the U.S. Coast Guard in response to the technological advancements made in shipboard navigation equipment that caused coastal lighthouses to become obsolete. In 2007, Thompson Engineering, Inc. completed a study (Thompson Engineering 2007) directed at investigating the feasibility of restoring the lighthouse to a condition that would preserve its major structural features and allow safe access to the public. The study addressed the following objectives:

- Condition and integrity of the foundation
- Condition of the masonry features
- Condition of the iron and metalwork
- Stability of the island on which the lighthouse is located

As part of this study, conditions and correctional cost assessments were broken into two phases: (1) emergency stabilization measures and (2) long term restoration plan. The emergency stabilization measures plan was estimated to cost $1.3 million at the time the report was finalized in September 2007. Accounting for inflation and current market conditions, updated cost estimates for this phase would be $1.9 million if initiated in 2022. The long-term restoration plan, which included restoration work and enlargement of the lighthouse island, costs were estimated to be between $15.9 million and $36 million depending on the final configuration of the island. In 2022 dollars, this is estimated to be between $22 million and $51 million.

During public outreach efforts, some Island residents expressed a desire to restore and protect the Sand Island Lighthouse because of its cultural and historical significance to the Island. However, given its vulnerable location, securing the necessary funding to restore the lighthouse and stabilize its base, and long-term maintenance costs—restoration of the lighthouse could be economically infeasible, and those funds may be better utilized in protecting the Island's shorelines to enhance coastal resilience.

Source: WRDE 2022

Rehoboth Beach Replica Lighthouse

The Town may consider celebrating the heritage of the lighthouse by relocating the lighthouse to Dauphin Island, if economically and logistically feasible, or building a replica on Dauphin Island. The replica lighthouse could be constructed and used in the re-visioned Town gateway as discussed in the Aloe Bay planning effort and could serve as a center piece to a roundabout as done in the image to the right. Or it could be placed near Ft. Gaines or elsewhere on the Island where residents and tourists could pose for photos and celebrate the lighthouse's significance to the Island. This could also help with increasing tourism as photos are shared on social media.

TABLE 7-10 Potential Heritage and Culture (HC) Management Measures

ID#	Management Measure	Description	Cost
HC-1	Create a Cultural Brand	Community may need additional branding to adapt visitor behavior once they get to the Island and convey their "island-time" lifestyle so visitors can quickly assimilate to the Island's culture.	Low
HC-2	Dauphin Island Heritage Trail	Development of a heritage trail print map and potential addition to Town app. Would provide locations and information on historical, cultural, and natural areas of significance for visitors. Could be integrated with other regional initiatives or developed as a broader Coastal Alabama Heritage Trail. Examples from other areas like Sarasota County can be viewed at: https://www.sarasota.wateratlas.usf.edu/upload/documents/Gulf-Coast-Heritage-Trail.pdf	Low
HC-3	Celebrate the Heritage of Sand Island Lighthouse	This could be accomplished through the construction of a replica of the lighthouse as discussed in **Section 7.5.1**, or if funds are not available to replicate the structure the lighthouse, it could be celebrated though placards and historical designation markers near Ft. Gaines and along Aloe Bay to augment what is already presented at the Little Red Schoolhouse.	Med – High
HC-4	Restore and Preserve Isle Dauphin Club	Both the Strategic Plan (Five E's Unlimited 2007) and Comprehensive Plan 2030 (Town of Dauphin Island and SARPC 2013) recommended Isle Dauphine Club improvements. The Club is a heritage and cultural icon on the Island. The Club's mid-century architecture is a great example of the modernist design movement and restoration and preservation of these facilities, which consists of buildings, golf course, pool and beach location make this underutilized facility a great asset to the Island.	High
		The Town may also consider implementing smart-code, form-based code, or other mechanism to encourage and guide future on-Island development to mimic architectural characteristics of Isle Dauphin facilities to maintain historical and cultural design aspects across the Island.	See Note 1
HC-5	Workforce Housing	Housing options to support Island heritage (e.g., oysterman, fisherman) and local business staffing. May target both year-round and seasonal workers.	High
HC-6	Promote Fishing Industry and Oyster Farming	Preservation of heritage and culture includes restoring and preserving traditional ways of living on the Island. The Aloe Bay Master plan seeks to foster elements of this goal and the Town's draft update to its zoning ordinance in July identifies a Working Waterfront District, which encourages water oriented commercial activities.	Low – Medium

Note 1: Cost to be absorbed by internal administrative costs of participating organizations, municipalities, county, and agencies.

Workforce Housing

As discussed in **Section 6.5.2**, increases in home value on Dauphin Island, combined with the dominance of vacation rentals, creates a homeownership and rental market that is unattainable for much of the population needed to support a workforce on the Island. Dauphin Island isn't alone in dealing with this issue. Many tourist and coastal communities struggle with the same problem in how to balance these needs. In nearby Baldwin County a collaboration of the South Baldwin Chamber of Commerce and the Coastal Alabama Chamber of Commerce has created a task force to plan for a roughly $200 million campus that would house a workforce development center and dormitories. The group working on that effort is applying for a planning grant through the U.S. Economic Development Administration to conduct economic and other studies.

The Town of Dauphin Island could pursue similar efforts and can assess underutilized properties or parcels owned by the Town or County that could be repurposed or developed for workforce housing. Options for housing may target both year-round and seasonal workers and could include stipends or subsidized housing for year-round workers. Potential accommodations may include accessory dwelling suites, shared housing, dormitories, tiny homes, mobile homes, living quarter barges, accommodation modules, shipping containers, or creation of an off-Island housing development.

The Dauphin Island Strategic Plan (Five E's Unlimited 2007) presented potential options of infill housing within the larger proposed Aloe Bay project area and the Comprehensive Plan 2030 (Town of Dauphin Island and SARPC 2013) discussed the need for workforce housing with zoning recommendations to address some of these issues. The Town subsequently released a draft update to its zoning ordinance in July 2022, which allows for accessory dwelling units in the Multi-family Residential District, Village District, and Working Waterfront District, which have the potential to support workforce housing. Some of these districts require planning committee approval or special exceptions.

7.6 Environmental Health and Resilience

As a barrier island, the entirety of Dauphin Island is vulnerable to climate related stressors as discussed in **Chapter 5**. While the East End of the Island is generally viewed as less vulnerable than the Island's West End, many areas of the Island are vulnerable due to Island's geomorphology and land development patterns. The following section presents environmental health and resilience projects that were funded, initiated, or completed during the development of this Plan, followed by the management measures proposed by the WMP Team for implementation of this WMP.

7.6.1 COMPLETED CLIMATE ADAPTATION MANAGEMENT MEASURES

Adaptation Pathway Project

Led by researchers at the Northern Gulf of Mexico Sentinel Site Cooperative, the Dauphin Island Adaptation Pathway project focuses on identifying adaptation strategies that would be effective at preventing Island breaching during lower-intensity storms now and in the future. A final report was presented to the Town during the completion of the WMP and recommendations from that report are being incorporated into future planning efforts.

7.6.2 POTENTIAL CLIMATE ADAPTATION MANAGEMENT MEASURES

Climate impacts are projected to cause an increase in temperatures, a permanent rise in ocean water levels, and changes in weather patterns – many of these changes are causing issues on Dauphin Island already. The management measures outlined in this section present options for the Island in addressing some of these issues. **Table 7-11** presents the potential Climate Adaptation management measures proposed by the WMP Team for implementation of this WMP.

TABLE 7-11 Potential Climate Adaptation (CA) Management Measures

ID#	Management Measure	Description	Cost
CA-1	Coastal Construction Control Line	While the Alabama Department of Environmental Management established a Coastal Construction Control Line (CCCL) that prevents new development on the waterside of the line, the location of the line has not been updated for over 40 years. NOAA (2017) noted that the CCCL is located in the water, particularly along the Dauphin Island coast. The Town could work with the State to update the CCCL to discourage development in high-risk coastal areas. The Town has included some restrictions with the release of a draft update to its zoning ordinance in July 2022. Section 7.13.3 limits construction in reference to the CCCL and mean high tide line; and waterside and coastal setbacks are dictated throughout the document.	See Note 1
CA-2	Mandatory Evacuations	Develop mechanism in coordination with local, regional, and state agencies to enforce mandatory evacuations in advance of storm systems for vulnerable areas of the Island. While the entire Island is vulnerable to extreme weather events, some areas of the Island may need more advanced coordination due to the specific issues related to their location (e.g., low lying areas) or due to the occupancy status of the dwellings (e.g., rental units). Public works, DIWSA, and public safety personnel may need more time in these highly vulnerable areas to evacuate people who may not understand the potential threat and impacts of storm systems to the Island and may need to cut off services and access to protect infrastructure, resources, and personnel.	See Note 1
CA-3	Transfer Management to Homeowners' Association	The Town could consider transferring highly vulnerable sections of the Island that require significant and repeated maintenance and repairs to the management of a Homeowners' Association (HOA) or Community Development District (CDD), allowing homeowners to maintain their properties and utilities, but at their own expense. This would lessen the financial impact on the Town and shift some risk management to the HOA.	See Note 1
CA-4	Implement Strategic Property Buyouts	The Town could purchase vacant or developed land in order to prevent or remove property from the danger of hazards. As a risk avoidance measure, this technique would transfer the flooding and erosion risks from the current property owner to the group or entity willing to acquire the property. The Town could investigate funding support from FEMA, HUD, USACE, USDA, bonds, etc.	See Note 2

TABLE 7-11 Potential Climate Adaptation (CA) Management Measures

ID#	Management Measure	Description	Cost
CA-5	Develop Buyout Lease-back Program	The Town could create a public acquisition program in which an entity purchases the property and leases or rents back the land to the previous landowner until the property becomes uninhabitable. This program may enable the Town to recover some of the initial purchase cost. This would help prevent or remove properties from the danger of coastal hazards, such as flooding and erosion. The program could involve eventual restoration of the sites to support natural processes. The program could target highly vulnerable areas that already experience erosion and flooding. The private landowners who are willing to sell early would receive market-rate returns on their real estate investment. A more detailed feasibility analysis beyond the scope of this WMP would need to be conducted to better understand the viability of this option.	See Note 2
CA-6	Develop Post-storm Buyback Program	The Town could develop a program to purchase damaged or destroyed properties after a storm event when homeowners may be more apt to relocate. The buyout would be offered to homeowners in the wake of a storm as an alternative to a rebuilding fee. Consideration could be given to designing a program where the purchase price would be significantly lower post-storm than pre-storm to incentivize property owners to participate in buyout lease-back program or direct buyout program described above. Once acquired, the property would be decommissioned and not viable for redevelopment.	See Note 2
CA-7	Develop Coastal Vulnerability and Resilience Public Education and Outreach Program	Engaging and communicating with the community on an ongoing basis is essential to ensuring that adaptation strategies can be successfully and efficiently implemented. Public engagement offers the opportunity to educate and build commitment and consensus among decision-makers and community members. The program would include education for potential home buyers of the risks associated with owning a home on the Island, including flooding and erosion during extreme storm events, and information on hurricane preparedness. The Town could include hazard disclosures and risk indemnifications as conditions of approval for permits, on parcel information documents and databases, or when providing services to properties-as allowable per guidance form Town legal counsel. Education would also be provided to homeowners prior to the issuance of building permits. This program could also educate the public about separate storm and sewer system and how their behaviors may impact system function (e.g., people opening their clean-out pipes to drain yards and streets, ditch management, fill dirt). Additionally, the program would seek to educate tourists on the environmental issues of the Island and tourist impacts on natural systems, as was done by the Leave Only Footprints campaign in the Cities of Orange Beach and Gulf Shores (NOAA 2017). This may be combined with W-7.	Initial Plan –$125,000 Annual Program –$25,000

Note 1: Cost to be absorbed by internal administrative costs of participating organizations, municipalities, county, and agencies.

Note 2: Median home price as of this writing is approximately $675,000. Overall range varies from approximately $85,000 for a residential lot, to over $1.8M for larger homes.

7.6.3 ECONOMIC RESILIENCE MANAGEMENT MEASURES

Dauphin Island faces significant challenges to its long-term sustainability and resilience and possesses limited resources with which to meet these challenges. In 2019/2020 the Town spent nearly $2 million in excess of disaster assistance funds on infrastructure repairs, clean-up, and recovery from multiple storms. With an annual budget of only $4 million, this equates to over 50% of the budget expended on recovery, significantly impacting the Town (aloebay.org 2022).

Additionally, the Dauphin Island Fiscal Impact Analysis report (King and Jenkins 2022) presented in **Appendix A**, reports that officials estimate the costs of federally declared disasters around $500,000 to $600,000 per event. When a federal disaster is declared, the federal government—through FEMA—covers 85% of the repair and cleanup costs. In instances of a severe storm that is *not* declared a federal emergency, the Town is entirely responsible for these costs. One such event in 2021 resulted in $2.5 million in sand removal costs exclusively on the West End. Because of the lack of federal assistance, these storms are of greater concern for the Town's fiscal situation than declared disasters.

Understanding how to maximize and allocate the Town's resources is important to long-term Island sustainability. Part of this understanding is identifying the areas of the Island that are the most vulnerable and require the most resources from the Town for maintenance and recovery. While the West End of the Island is generally regarded as the most vulnerable, the entire Island is vulnerable to stressors and certain areas on the Island's East End and elsewhere require additional Town resources. In order for equitable distribution and economic resilience, the Town needs a mechanism to assess fees to the areas that require the most attention and resources.

Past recovery expenses indicate that Dauphin Island needs additional revenue to manage coastal erosion, storm events, and flooding impacts. The management measures and policies outlined in this section could generate several million dollars in revenue and provide a way for the Town to offset lost revenues, but they may not cover the full cost to recover from storms.

Special Tax Districts

Special Tax Districts raise additional funds from properties based on their Geological Hazard risk to shift the cost burden to the area where costs are generated. These funds can be used to mitigate against or recover from disaster.

High Hazard Tax District

As mentioned in previous sections, there are many areas of the Island requiring significantly more effort and expenditures from the Town to maintain. Due to this, the Town must find a way to assess the costs of those extra efforts to reflect back on those properties requiring extra Town resources to manage, maintain, and recover after disruptions. The Town may want to consider creating a special High Hazard Tax District or make amendments within the existing districts to assess costs expended to maintain these high hazard areas.

Business Districts

The Dauphin Island Fiscal Impact Analysis report (King and Jenkins 2022) presented in **Appendix A** concluded that most properties on the Island are (1) not owned by Island residents, and (2) not owned for personal use. This is especially apparent on the West End. Thus, a significant portion of the Town's expenditures benefit property owned by off-Island and out-of-state residents. While these properties generate revenues for the Town, most of the revenue they generate goes to owners and management companies off the Island entirely. As Dauphin Island is becoming increasingly commercial, with more rentals being established each year, the Town needs a mechanism to assess these "businesses" to cover the costs to maintain the infrastructure and services they are using. The Town may want to consider reclassifying or amending some of the districts in its latest zoning ordinance to reflect these short-term rental areas as business districts and tax them appropriately.

An example of this could be to change the boundaries or redesignate some of the Short-term Vacation Rental Overlay District with the Resort Commercial District. This could be especially relevant to the West End. The Town may want to consider the area from Mid-Island (approximately from the elementary school to Pirates Cove St.) west to the West End Public Beach as a business district and tax accordingly as this area includes both established businesses and short-term vacation rentals operating as businesses.

This rezoning may also provide the Town with opportunities to re-vision what the West End and Mid-Island areas may look like in the future. The Town can assess what properties in that area owned by local and regional governments may be underutilized and can consider sale, lease, or public private partnership to put them to their highest and best use. The transition of some of these underutilized properties would not only provide revenue to the Town but could potentially be used to leverage funding for future land acquisitions or buyouts. The Dauphin Island Strategic Plan (Five E's Unlimited 2007) made some reference to this area's potential for redevelopment. Since this area already includes more dense development than some other areas of the Island, it could be expanded and enhanced and serve as a gateway to the West End in a similar approach that was used in the development of the Aloe Bay Master Plan. This could also allow for a parking and transportation hub for visitors as they visit and recreate on the West End, with a goal of limiting congestion and vehicular traffic to create a more pedestrian and bike friendly area. This could be addressed in a Tourism Management Plan (see **Section 7.3.1**) and synched with Aloe Bay and an overall Island-wide transportation strategy developed to accommodate cars, shuttles, golf carts, bicycles, and pedestrians.

A similar effort could be conducted to transform the far East End of the Island from Billy Goat Hole to East End Beach. The Town could work with stakeholders to conduct land swaps or acquisitions to bring underutilized areas and assets to their highest and best use. This area is unique with Dauphin Island Sea Lab (DISL) educational facilities presenting opportunities to expand a research and education zone and with the Coast Guard and ferry areas allowing for a more commercial and business-oriented zone. Both the Strategic Plan (Five E's Unlimited 2007) and Comprehensive Plan 2030 (Town of Dauphin Island and SARPC 2013) expressed a desire to enhance economic opportunities at the Ferry Landing/Billy Goat Hole area with the latter recommending the design and development of a business district to establish opportunities for residential and business uses associated with the water access and Ferry Landing.

Table 7-12 presents the potential economic resilience management measures proposed by the WMP Team for implementation of this WMP.

TABLE 7-12 Potential Economic Resilience (ER) Management Measures

ID#	Management Measure	Description	Impact and Effort See Note 1
ER-1	Special Tax District - High Hazard	Create a High Hazard Tax District or make amendments within existing districts to assess costs expended to maintain high hazard areas on the Island.	High impact, low effort (ordinance)
ER-2	Special Tax District - Business	As Dauphin Island is becoming increasingly commercial, with more short-term rentals being established each year, the Town needs a mechanism to assess these “businesses” to cover the costs to maintain the infrastructure and services they are using. The Town may want to consider reclassifying or amending some of the districts in its latest zoning ordinance to reflect these short-term rental areas as business districts and tax them appropriately.	High impact, low effort (ordinance)
ER-3	Vulnerable Area Building Permit Fee	Develop special permit fees in vulnerable and high hazard areas.	High impact, medium effort
ER-4	Storm Recovery Impact Fee	Addition of Storm Recovery Impact Fee on all new development.	High impact, medium effort
ER-5	Post-storm Rebuild Permit Fees	Develop a proportionate permit fee to rebuild homes damaged or destroyed following major storms to offset Town costs for post-storm infrastructure repair in vulnerable areas.	High impact, medium effort
ER-6	Implement Short-Term Rental Permitting Fee for Third Party Managed Rentals	Develop a fee on short-term rentals managed by a third party.	Low to medium impact, low effort (ordinance)
ER-7	Verify Class III Tax Exemptions	Many short-term rental properties may be incorrectly classified as Class 3. The Town could work with the County to verify that the homes claiming Class 3 (lower property tax rate) are indeed Class 3, “owner owned but not rented” homes.	Low impact, medium effort (enforcement)
ER-8	Enforce Short-Term Tax Collection	Some rental properties likely do not collect taxes. Ensuring collection of all the taxes would increase revenues.	Low impact, low effort (monitoring)
ER-9	Increase Tourism and Sales Taxes	Create more revenue from tourism.	Medium impact, medium effort (ordinance)
ER-10	Raise existing Short Term Tax Rate	The combined tax rate for Dauphin Island is 11%, with 5% going to the Town. Some tourist areas have rates as high as 15%, with 7% collection for the Town. During the development of this WMP, the Town approved an increase of 2% on rentals less than 6 months in duration. This increase becomes effective Jan. 1, 2023.	Medium impact, medium effort (ordinance)
ER-11	New Economic Zones	Use the Aloe Bay planning approach to assess underutilized assets for their highest and best use and develop long range vision and implementation plan to revitalize Mid-Island and Far East End into economic zones to increase revenue.	High impact, high effort

TABLE 7-12 Potential Economic Resilience (ER) Management Measures

ID#	Management Measure	Description	Impact and Effort See Note 1
ER-12	Promote Redevelopment Around Aloe Bay Project	The Aloe Bay plan offers many opportunities to increase Town revenues and attract more visitors, while shifting the focus of tourist and economic activity on Dauphin Island away from the vulnerable West End.	Medium impact, medium effort
ER-13	Expand Marina Fees and Taxes	Increase marina fees for day users and increase marina taxes.	Low impact, low effort

Note 1: Reflects how much of a difference it will make to the Town's finances (impact) and amount of resources to implement (effort).

7.6.4 MONITORING AND ACCOUNTING

The current fiscal record keeping, reporting, and the accuracy of local tax data creates limitations for the community in planning and preparing for future storms. Accounting and monitoring of expenditures (and where they occur) would not only assist the Town and affiliated agencies in resource allocation, but also help make the public aware of the Island's financial sustainability. Potential improvements are listed below.

- Working with the County to update property tax rolls including identifying where homeowners may not be paying their legally required share of taxes.
- Accounting for sales taxes and other taxes that will allow the Town to determine which sector and parts of the Island are generating taxes.
- More detailed accounting for how money is spent on the Island for government services (e.g., maintenance of roads).
- More detailed information on revenues generated by hotels and short-term rentals on the Island, including a breakdown by area.

7.7 Administrative

The following section presents administrative management measures proposed by the WMP Team for implementation of this WMP.

7.7.1 INTERGOVERNMENTAL COORDINATION

As presented in **Section 6.6.1**, governance through collaboration among all entities was identified as a major concern in the Dauphin Island's Strategic Plan (Five E's Unlimited 2007) and the Town has made progress in this direction with the Parks and Beach Board being dissolved and brought under Town management as the new Parks & Recreation Department.

While numerous local, regional, state, and federal agencies have shown a sustained and dedicated commitment to the betterment of Dauphin Island, a more coordinated, focused, and formalized intergovernmental group may be needed to move actions and projects identified in this WMP forward in securing funding and implementing any regulatory changes needed for successful implementation of this plan. A DIWA led by the Town and including local, regional, state, and federal agency representatives could be established to prioritize needs identified in the WMP and identify support for implementation.

7.7.2 TOWN MANAGER

As presented throughout this chapter and in **Chapter 1**, the Island has numerous projects proposed, funded, initiated, and under construction—with over fifty projects catalogued at the beginning of this watershed planning effort. Managing the complexity, magnitude, and elongated timelines of so many projects has left the Mayor and Town Council carrying many of the administrative roles and duties of municipal staff. While the Town is working diligently to improve its economic footing as presented in the **Section 7.6.3**, it may be prudent to consider hiring a full-time Town Manager to not only coordinate and oversee the many projects planned or ongoing, but also to implement and manage a more robust monitoring and accounting program as described in **Section 7.6.4**. The Town Manager could also be very beneficial in identifying and pursuing future funding for management measures outlined in this chapter.

This position is also important for continuity of Island sustainability and resilience. Many of the issues and management measures addressed and outlined in this plan (e.g., Aloe Bay) are long-term items that require a sustained and consistent management approach, don’t occur within one political term, and can extend across numerous political elections. While Town leadership has stayed consistent in recent history, there has been an influx of new residents that could have the potential to alter Town leadership and disrupt long-term planning efforts. Having a Town Manager in place could provide stability to ensure continuity of efforts should elected leadership change.

7.7.3 PLAN UPDATES

The scope and breadth of the recommended improvements from this WMP will require significant time to implement. This WMP provides a 10-year framework to begin the implementation of recommended actions. This time frame is subject to change, depending on the availability of funds, success of recommended projects, and watershed response. As part of the recommended adaptive management approach, a review of the WMP recommendations should be performed every two years, with an in-depth assessment every three to five years. This review should consider monitoring results from implemented projects and whether changes are warranted to the project type, scope, or area of implementation to achieve the stated goals and objectives of the WMP.

As discussed in **Section 6.6.1**, this WMP builds on the Island’s Strategic Plan (Five E’s Unlimited 2007) and Comprehensive Plan 2030 (Town of Dauphin Island and SARPC 2013). With the last comprehensive plan completed by the Town in 2013, it may be beneficial for local leaders to adopt this WMP and incorporate into an updated Town of Dauphin Island Comprehensive Plan that looks at the 2050 planning horizon.

7.8 Projects Previously Submitted to Deepwater Horizon Oil Spill Portals

Table 7-13 presents a compiled list of proposed projects generated from different lists developed after the *Deepwater Horizon* Oil Spill by local resource management agencies and nongovernmental organizations. Only proposed projects that have not already been presented in this chapter are included in this compilation. Some projects may have been submitted to different funding sources and some projects may have been renamed or combined with other projects with similar goals so may not appear on this list. Sources for this list included:

- AL Portal – Projects submitted to the Alabama RESTORE Council Portal for funding consideration. (http://www.alabamacoastalrestoration.org/View-Projects)
- NOAA Project Portal – Projects submitted to NOAA for Natural Resource Damage Assessment consideration. (http://www.gulfspillrestoration.noaa.gov/restoration/give-us-your-ideas/viewsubmitted-projects)
- Deepwater Horizon Project Tracker – Provides a comprehensive list of projects submitted to various funding agencies. Projects form this source appear in previous sections of this chapter so are not included in the table. (https://dwhprojecttracker.org/)

TABLE 7-13 Projects Previously Submitted on Deepwater Horizon Oil Spill Portals

Project #/ Portal	Project Name	Sponsor	Link
87 (AL Portal)	Improved By-Passing of Beach Sands Dredged from the Mobile Ship Channel ($2.4M)	Town of Dauphin Island	https://research.dcnr.alabama.gov/ACR/ProjectView?projectID=87
91 (AL Portal)	Fill Borrow Pits dug in 2010 to Protect Again Oil Spill Damage ($5.6M)	Town of Dauphin Island	https://research.dcnr.alabama.gov/ACR/ProjectView?projectID=91
92 (AL Portal)	West End Beach and Barrier Island Restoration Project ($58.6M)	Town of Dauphin Island	https://research.dcnr.alabama.gov/ACR/ProjectView?projectID=92
100 (AL Portal)	Dauphin Island Sea Lab Research Building ($7M)	DISL	https://research.dcnr.alabama.gov/ACR/ProjectView?projectID=100
216 (AL Portal)	Dauphin Island Water Supply ($7.7M)	DIWSA	https://research.dcnr.alabama.gov/ACR/ProjectView?projectID=216
296 (AL Portal)	Promotion of Year-Round Tourism Activities on Dauphin Island with Emphasis on the Off-Season ($2.5M)	Town of Dauphin Island	https://research.dcnr.alabama.gov/ACR/ProjectView?projectID=296
324 (AL Portal)	Isle Dauphine Beach and Golf Study ($375k)	Dauphin Island Properties Owners Association (DIPOA)	https://research.dcnr.alabama.gov/ACR/ProjectView?projectID=324
403 (AL Portal)	POA Isle Dauphin Beach Restoration ($600k)	DIPOA	https://research.dcnr.alabama.gov/ACR/ProjectView?projectID=403
406 (AL Portal)	Restoration of Isle Dauphin Facilities and Certain Amenities	DIPOA	https://research.dcnr.alabama.gov/ACR/ProjectView?projectID=406
531 (AL Portal)	DISL Resilient Marine Science Research Building ($10M)	DISL	https://research.dcnr.alabama.gov/ACR/ProjectView?projectID=531
540 (AL Portal)	Renovation of DISL Marine Science Hall ($7.6M)	DISL	https://research.dcnr.alabama.gov/ACR/ProjectView?projectID=540
321 (NOAA Portal)	Dauphin Island Campground Expansion	Dauphin Island Park and Beach Board (now part of Town of Dauphin Island)	https://www.gulfspillrestoration.noaa.gov/restoration/give-us-your-ideas/view-submitted-projects
391 (NOAA Portal)	Coastal Alabama Habitat Restoration - Bayou Heron, Dauphin Island, Alabama ($8M)	ADCNR/Volkert	https://www.gulfspillrestoration.noaa.gov/restoration/give-us-your-ideas/view-submitted-projects
11713 (NOAA Portal)	Dauphin Island Emergency Response Personnel Storm Shelter ($3.2M)	DIWSA	https://www.gulfspillrestoration.noaa.gov/restoration/give-us-your-ideas/view-submitted-projects

CHAPTER 8 Implementation Strategies

Introduction

In **Section 1.2.2**, the vision, goal, and objectives of this watershed management plan (WMP) were presented. In **Chapter 6** the critical issues and areas affecting the Dauphin Island Watershed were identified, and **Chapter 7** presented potential management measures to address these issues.

To fulfill the WMP vision, goal, and objectives, a clearly defined approach and implementation strategy is needed to address the threats identified as affecting the Dauphin Island Watershed. The actions and strategies identified within this chapter are recommended to successfully implement the management measures in this WMP.

8.1 Implementation Team

Implementation of the Dauphin Island WMP will require leadership and substantial coordination. A coordinated, focused, and formalized intergovernmental group will be needed to move actions and projects identified in this WMP forward in securing funding and implementing any regulatory changes needed for successful implementation of this plan. A Dauphin Island Watershed Alliance (DIWA) led by the Town and including local, regional, state, and federal agency representatives and local stakeholders should be established to prioritize needs identified in the WMP and identify support for implementation. Potential members of this alliance may include:

- Alabama Department of Conservation and Natural Resources – State Land Division and Marine Resources Division
- Dauphin Island Water and Sewer
- Mobile Bay National Estuary Program
- Mobile County
- Town of Dauphin Island – representatives may include Mayor, council members, and members of the planning commission.
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service

The DIWA should build upon existing public involvement efforts and create new opportunities for public and stakeholder input and engagement, to advocate and promote the goals and objectives of this WMP and promote wise stewardship of the Watershed. The DIWA should ideally involve input and collaboration from all stakeholders within the Watershed, including but not limited to those listed below:

- Alabama Audubon
- Alabama Charter Fishing Association
- Alabama Coastal Fisherman's Association
- Alabama Coastal Foundation
- Alabama Power
- Alabama Department of Environmental Management
- Alabama Department of Transportation
- Alabama Gulf Coast Recovery Council
- Alabama Water Watch
- Auburn University
- Churches
- Coastal Alabama Business Chamber
- Coastal Conservation Association
- Dauphin Island Bird Sanctuary
- Dauphin Island Foundation
- Dauphin Island Sea Lab
- Dauphin Island Sea Lab Foundation
- Dauphin Island Heritage and Arts Council
- Dauphin Island Property Owners Association
- Developers
- Ecotourism and Charter Boats

- Fish and Oyster Industry
- Geological Survey of Alabama
- Gulf Coast Ecosystem Restoration Council
- Local Businesses and Industry
- Local civic organizations
- Marinas
- Maritime Industry
- Mississippi-Alabama Sea Grant Consortium
- Mobile Bay Ferry
- National Fish and Wildlife Foundation
- National Oceanic and Atmospheric Administration
- Natural Resources Conservation Service
- Organized Seafood Association of Alabama, Inc
- PLACE: SLR
- Realtors
- Rental Management Agencies
- Schools
- South Alabama Regional Planning Commission
- The Nature Conservancy
- Town of Dauphin Island – residents and property owners
- University of South Alabama
- U.S. Coast Guard
- U.S. Department of Agriculture
- U.S. Department of Housing and Urban Development
- U.S. Environmental Protection Agency
- U.S. Geological Survey

8.2 Implementation Schedule

Implementation of recommended management measures should begin immediately following approval and adoption of this WMP. Initial implementation should focus on the most critical issues, funding possibilities, and prioritized management measures to support the objectives identified in the WMP. The following steps should be given priority:

- Create the DIWA within the first six months.
- Create a Town of Dauphin Island Town Manager position, to include responsibilities for implementation of this WMP and leadership of the DIWA, within the first six months; and fill that position withing the first year.
- Apply for and solicit funding to implement recommendations presented in this WMP within the first year.
- Implement priority management measures presented in this section as soon as funding becomes available.

- Establish a formal Monitoring Program within the first two years.
- Establish the Public Education and Outreach Program within the first two years.

The following sections present the priority management measures to be implemented to support the WMP objectives and is not inclusive of all management measures to support implementation of this WMP. **See Chapter 7** for a full listing of all potential management measures.

8.2.1 SHORT-TERM IMPLEMENTATION STRATEGIES

Short-term progress and tangible successes in early implementation of recommendations in this WMP are critical to community and stakeholder buy-in following WMP adoption. This will help to nourish stakeholder confidence and build on the momentum generated through WMP development. Parallel with this need to capture early successes is the need to foster and harness interest in environmental stewardship of the Watershed. With these considerations in mind, management measures were grouped into two phases: short-term and long-term. The short-term priority management measures described in this section were chosen based on the likelihood of successful implementation within the next two years.

Table 8-1 presents the short-term management measures. A more detailed description of each recommended management measure is provided in **Chapter 7**.

8.2.2 LONG-TERM IMPLEMENTATION STRATEGIES

Not all of the critical issues identified within this WMP can be addressed within two years of WMP adoption. Although some projects listed as long-term can be initiated within a two-year period, additional analysis, planning, data collection, design, etc. may push completion of project implementation beyond that range. **Table 8-2** summarizes recommended long-term priority management measures. For both short- and long-term implementation strategies, the preparation of detailed cost estimates was not possible due to the conceptual level of planning that guided development of this WMP. Therefore, cost estimates are intended for preliminary budgetary consideration.

TABLE 8-1 Short-Term Implementation Strategies

ID#	Management Measure	WMP Section	Supports WMP Objective(s)	Estimated Total Cost
AD-1	Create DIWA	7.7	1	See Note 1
AD-2	Town Manager	7.7	1	See Note 1
ER-1	Special Tax District - High Hazard	7.6	1	See Note 1
ER-2	Special Tax District - Business	7.6	1	See Note 1
ER-3	Vulnerable Area Building Permit Fee	7.6	1	See Note 1
ER-4	Storm Recovery Impact Fee	7.6	1	See Note 1
ER-5	Post-storm Rebuild Permit Fees	7.6	1	See Note 1
ER-6	Implement Short-Term Rental Permitting Fee for Third Party Managed Rentals	7.6	1	See Note 1
ER-7	Verify Class III Tax Exemptions	7.6	1	See Note 1
ER-8	Enforce Short-Term Tax Collection	7.6	1	See Note 1
ER-9	Increase Tourism and Sales Taxes	7.6	1	See Note 1
ER-10	Raise existing Short Term Tax Rate	7.6	1	See Note 1
W-2	I&I Study	7.1	2	See Note 2
W-3	Comprehensive Island-wide Stormwater Master Plan	7.1	1, 2	See Note 2
W-5	Net-Zero Stormwater Policy for New Development	7.1	1, 2	See Note 1
W-6	LID Code Revisions	7.1	2	See Note 1
W-7	Wetland Ordinance Strengthening	7.1	2, 3	See Note 1
W-8	Increase Residential and Commercial Landscape Requirements	7.1	2	See Note 1
W-7	Stormwater Homeowner Education Program (may be combined with CA-1)	7.1	2, 5	Initial Plan – $50,000 Program – See Note 1
FW-6	Develop a Sand Management Plan	7.4	1, 3, 4	TBD
CA-1	Coastal Construction Control Line	7.6	1, 2	See Note 1
CA-2	Mandatory Evacuations	7.6	1	See Note 1

TABLE 8-1 Short-Term Implementation Strategies

ID#	Management Measure	WMP Section	Supports WMP Objective(s)	Estimated Total Cost
CA-7	Develop Coastal Vulnerability and Resilience Public Education and Outreach Program (may be combined with W-7)	7.6	5	Initial Plan – $125,000 Annual Program – $25,000

Note 1: Cost to be absorbed by internal administrative costs of participating organizations, municipalities, county, and agencies.
Note 2: Cost to be determined based on funding and scope for similar FICW projects presented in Table 7-1.

TABLE 8-2 Long-Term Implementation Strategies

ID#	Management Measure	WMP Section	Supports WMP Objective(s)	Unit Type	Estimated Cost per Unit	Estimated Total Cost
W-1	Upgrade Water and Sewer Infrastructure	7-1	1, 2	–	–	See Note 4
W-4	Water Supply	7-1	1, 2			TBD
C-1	Develop Beach/Shoreline Management Plan to include Back Bay	7.2	1, 3, 4	Initial Plan Plan Updates	$500,000-$1M $200,000 -$500,000	$500,000+
C-2	Katrina Cut Back Bay Restoration	7.2	1, 3, 4	–	–	$35M See Note 5
C-3	Sand Bypass System	7.2	1, 4	Initial Construction	$82M - $103M	$82M - $103M (USACE and USGS 2020)
				2-yr. Renourishments	$1M - $1.2M	$10.4M - $29.7M (20-50 yr.)
				Monitoring	3% of Project Cost	$2.5M – $3.1M See Note 3
C-4	Back Bay Marsh Restoration	7.2	1, 3, 4	Project	$5M-$40M	TBD

TABLE 8-2 Long-Term Implementation Strategies

ID#	Management Measure	WMP Section	Supports WMP Objective(s)	Unit Type	Estimated Cost per Unit	Estimated Total Cost
C-5	Borrow Pits Restoration	7.2	1, 3, 4	–	–	$350,000-$500,000 for design and $5.1-$6.4M for construction See Note 5
C-6	Seawall Softening and Natural Enhancement or Removal	7.2	1, 3, 4	Per Linear Ft.	$500-$1,000	TBD
FW-1	Strategic Parcel Acquisition	7.4	1, 2, 3, 4	Parcel	See Note 2	TBD
CA-3	Transfer Management to Homeowners' Association	7.6	1	–	–	See Note 1
CA-4	Implement Strategic Property Buyouts	7.6	1, 3, 4	Parcel	See Note 2	TBD
CA-5	Develop Buyout Lease-back Program	7.6	1, 3, 4	Parcel	See Note 2	TBD
CA-6	Develop Post-storm Buyback Program	7.6	1, 3, 4	Parcel	See Note 2	TBD
ER-11	New Economic Zones	7.6	1	–	–	See Note 1

Note 1: Cost to be absorbed by internal administrative costs of participating organizations, municipalities, county, and agencies.

Note 2: Median home price as of this writing is approximately $675,000. Overall range varies from approximately $85,000 for a residential lot, to over $1.8M for larger homes.

Note 3: Cost estimated from (USACE and USGS 2020)

Note 4: Cost to be determined based on funding and scope for similar FICW projects presented in Table 7-1.

Note 5: The costs presented are primarily from the U.S. Army Corps of Engineers/USGS Barrier Island Assessment Report (2020), National Fish and Wildlife Foundation project funding sheets, or the Thompson Katrina Cut Report (2013). In order to put the costs presented into 2022 values the estimates would need to use the Engineering News Record (ENR) Annual Average Construction Cost Index to escalate costs. From 2013 the factor is 1.35; and to escalate costs from 2020 the factor is 1.13. The ENR Cost Index is based on the average cost of materials, equipment, and labor across 20 U.S Cities.

8.3 Implementation Actions

8.3.1 EVALUATION FRAMEWORK AND MILESTONES

The evaluation framework for this WMP, its implementation, and its success can be divided into three primary areas—inputs, outputs, and outcomes—as summarized below.

- **Inputs** include human resources of time and technical expertise, organizational structure, management, and stakeholder participation.
- **Outputs** include implementation of management measures, public outreach and education, and the monitoring program.
- **Outcomes** include increased public awareness, improved watershed conditions, and improved water quality.

An effective evaluation framework allows the WMP and implementation strategy to be modified as necessary to maximize efficiency and achieve stated goals. The evaluation framework for the Dauphin Island Watershed should focus on answering these questions during the indicated time frames. If the answer to any of these questions is negative, the implementation strategy should be re-evaluated and revised.

Short-Term Milestone Period (0 to 2 years)

The following questions should be asked:

- Has the necessary funding been quantified, sources identified, and received?
- Has Public Education and Outreach Programs been developed and implemented?
- Has a Monitoring Program been established, and a qualified entity identified to carry out the program?
- Have the short-term management measures been funded or initiated?

Mid-Term Milestone Period (2 to 5 years)

The following questions should be asked:

- Has the Monitoring Program been successfully implemented?
- Have any management measures been implemented?
- Did the level of public interest and participation rise to the level of helping to achieve the WMP goals?
- Has additional funding been identified and secured?

Long-Term Milestone Period (5 to 10 years)

The following questions should be asked:

- Have specific projects and management measures proposed in the WMP been fully implemented and completed?
- Have the objectives outlined in **Section 1.2.2** been addressed effectively?

8.3.2 REGULATORY FRAMEWORK

One of the most pressing issues for this Watershed is the increase in development in vulnerable, high hazard areas of Dauphin Island. To accommodate the continued population growth and the increase in seasonal tourism, the Town should develop consistent zoning and design standards to limit development in these areas and to minimize impervious cover, incentivize low impact design and green infrastructure, conserve riparian zones, and retain stormwater runoff.

During the first year following the approval of the WMP, the Town in coordination with DIWA should consider recommendations presented in this WMP and begin implementing them as appropriate. Local leaders should enhance, strengthen, and enforce land development codes and ordinances focused on stormwater management and resilience at a watershed scale. This effort should take a holistic view of the Watershed and the interconnectedness of Island systems. Additionally, authorities should consider ordinances to specific problem areas within the Watershed where identified problems are documented, and development would further exasperate the problems. Simply creating ordinances that demonstrate no further harm to nearby neighbors will by itself provide measurable improvements in water quality, habitat management, and resilience.

8.3.3 FUNDING

The DIWA should evaluate the potential funding sources identified in **Chapter 10** and work with the Mobile Bay National Estuary Program (MBNEP) and grant writers to develop a funding request program that matches specific management measures with funding sources. As a coordination effort, the DIWA can also serve to match leveraging opportunities between stakeholder groups to help secure funds for projects. The progress of this effort will be measured by the number of projects funded and the value of funds secured. Seeking a fair, successful, and sustainable stream of funds to implement the management measures should be one of the first actions of the DIWA. Development of capital improvement plans, and education showing the limit in funding has proven to be a useful means of developing citizen support of adequate funding.

8.3.4 EDUCATION PROGRAM

Educational programs related to the Dauphin Island Watershed issues presented in **Chapters 6 and 7** (wetlands, water quality, stormwater management, erosion, sea level rise, flooding, etc.) should be developed and targeted toward all user groups including government officials, residents and property owners, business, and tourists. Outreach and education efforts should develop tailored messages to these different audiences on issues relating to implementation of the WMP. The primary goal should be providing understanding to the target audiences of the necessity of implementing the management measures outlined in the WMP and gain their buy-in and ownership to the success of the WMP.

Many of the management measures proposed in this WMP are directly related to better informing the community of the role they play in their watershed. To efficiently implement the proposed programs, it is recommended that DIWA coordinate with existing entities such as the Create a Clean Water Future and Alabama Smart Yards programs.

Once the WMP is approved, a variety of outreach techniques should be implemented to keep the public interested, informed, and engaged. Management of any natural resource is enhanced by the understanding, support, and participation of all stakeholders. Successful implementation of the WMP includes public education and outreach, which is one of the U.S. Environmental Protection Agency's nine key elements for watershed planning. Consistent targeted education and outreach will increase awareness of and support for the recommended management measures necessary to protect and improve the health of the Dauphin Island Watershed.

The following goals should be considered in the development of public education and outreach plans:

- Inform, educate, and engage key stakeholders and the public to increase awareness of the benefits provided by the Dauphin Island Watershed, issues impacting the Watershed, and potential solutions to address these issues.
- Educate community members so they increasingly value natural resources and recognize the importance of preserving and protecting these resources.
- Explore additional opportunities to engage the public in the restoration and protection of the Watershed.
- Develop a sense of ownership of the Watershed and the success of implementing this WMP.

Targeted Audiences

Specific community stakeholders must become leaders in the WMP implementation process. These targeted audiences and the ways the WMP address the values important to each of those stakeholders are identified in this section. The following stakeholder groups have the ability to make changes through regulation or policy, participation in restoration activities, management of stormwater runoff, or communication of the Dauphin Island WMP goals and objectives.

Local Government Officials

Local elected officials and their staff are responsible for establishing priorities for local programs, developing policies, and setting annual budgets. These roles can influence the successful implementation of the WMP. This stakeholder group should be informed of the opportunity presented by the WMP to unify the public with the concept of protecting the Watershed with local engagement. Local government officials can vote to support the WMP, develop and implement WMP recommendations, and encourage stricter enforcement of regulations outlined in this plan. Local officials should be encouraged to work with state and federal agencies to facilitate WMP projects. They can also promote a sense of watershed community through community-wide activities such as trash collection and tree planting events.

Business and Industry

Success is closely tied to financial support. Support from an active and diverse group of private stakeholders is needed to attract and match sources of federal, state, and local funding. Businesses and industry within the Dauphin Island Watershed should be motivated to support the WMP, as all businesses within the Watershed will benefit from its restoration. Local residents will enjoy improved surroundings, a better living environment, and increased satisfaction and pride in their community. Businesses can enhance their public image by demonstrating their support for preservation and restoration of a local resource. The WMP recommends engagement opportunities for private business and industry in the implementation of projects to support the surrounding community, local workforce, and economy while promoting their company image and fostering goodwill. Private industry can also seize opportunities to become involved in recommended projects such as installing stormwater retention ponds for their facilities or funding components of other projects and programs throughout the Watershed. Sponsors can be highlighted on signage or plaques.

Academia

Local schools and higher education institutions have an opportunity to inform students about issues in their community. Teachers and instructors can introduce students to the WMP goals and objectives. The extensive scientific and technical data presented in the WMP regarding the current status of the Watershed and measures to improve conditions can be utilized as educational tools for all levels of curriculum.

Local Resource Managers

Local resource managers provide services related to water supply and wastewater treatment to Dauphin Island residents and can assist in guiding water quality management within the Watershed. The actions recommended in this WMP will improve water quality of the Watershed by reducing stormwater pollutants and trash in waterways and increasing public understanding of human impacts on water resources. Local resource managers can help by getting involved in Watershed preservation and restoration efforts, assisting with outreach and communication, and sponsoring community events.

Community Leaders

Community leaders have a vital role in implementing the WMP and its goals. They should be advocates of the WMP and encourage elected officials to prioritize the WMP recommendations. They should participate in education and outreach, litter reduction campaigns, and share restoration ideas. Community leaders should understand that the WMP represents a community-wide approach for protecting water quality, habitats, and living resources of the Watershed through the goals of improving recreational opportunities, beautifying the area, and highlighting historical and cultural aspects of the Watershed. Community leaders can host events, promote recreational and outreach activities, create and launch neighborhood anti-littering campaigns, and educate residents on the benefits of preservation and restoration to their properties. Many leaders and stakeholders have been identified through the process of developing the WMP, and some are already involved. While the MBNEP has led the effort to initiate the work, future efforts and project implementation must be rooted within the community of stakeholders, along with the residents and property owners on Dauphin Island.

Media

Newspapers, television news programs, on-line news sources, social media (e.g., Twitter, Facebook, Instagram), and radio stations are significant sources of information for the public. The WMP sets the stage for a better future for the Dauphin Island Watershed and a vision, supported by the public, to preserve the area and provide community-wide access to a beautiful natural resource. Local media can help by publishing stories highlighting the WMP and its recommendations, creating news stories describing accomplishments of the WMP, advertising cleanup or anti-littering events and campaigns, and sharing stories about the involvement of local leaders in the WMP.

8.3.5 MONITORING PROGRAM

The DIWA should develop success criteria to judge progress towards meeting the overall goals and objectives outlined in **Chapter 1**. These success criteria should be developed with input from stakeholders and the general public and should be evaluated on a routine basis. This evaluation process along with performance monitoring presented in **Chapter 11**, should be used to assess whether specific management measures are addressing the critical issues and areas they were designed to address or whether adjustments are required.

A regular reporting schedule is necessary to archive and track monitoring data and assess the overall success of management actions. Progress reports for the Watershed should be prepared and shared with MBNEP and stakeholders. Reporting should be conducted on at least an annual basis, although interim reporting may be helpful in critical watershed areas or where more frequent monitoring is needed to track the success of specific management actions. Annual reports should include, at a minimum: (1) a summary of Watershed conditions including field results from monitoring and sampling activities, (2) an update on the status of management measures implemented to date, and (3) a summary of anticipated management measures to be implemented during the next twelve months.

All monitoring activities should be conducted in accordance with the Alabama Department of Environmental Management and MBNEP Science Advisory Committee protocols, and the DIWA should ensure that all planned projects occurring within the Watershed include a robust monitoring program to prevent adverse impacts and unintended consequences to Watershed resources.

A vital element of the monitoring program will be volunteer citizen participation (e.g., Alabama Water Watch) to enable successful implementation and establish a sense of community ownership within the Watershed. Efforts should be made to recruit as many volunteer monitors as possible.

8.4 Accountability and Reporting

At least annually, the DIWA should assess the progress toward meeting the goals and objectives of the WMP through the implementation of priority management measures. Performance measures will include consideration of whether specific management measures are addressing the critical issues they were intended to remedy and if adjustments need to be made. A regular reporting schedule is necessary to archive and track monitoring data and assess the overall success of management actions. Progress reports for the Watershed should be prepared and submitted to MBNEP. Reporting should be conducted on at least an annual basis, although interim reporting may be helpful in critical watershed areas or where more frequent monitoring is needed to track the success of specific management actions.

Annual reports should include, at a minimum: (1) a summary of watershed conditions including field results from monitoring and sampling activities, (2) an update on the status of management measures implemented to date, and (3) a summary of anticipated management measures to be implemented during the next 12 months. These criteria can be presented annually in the form of a report card to stakeholders and the public. The report card should include, at a minimum: (1)the field results collected during monitoring activities, (2) an update on implemented management measures, and (3) a summary of measures planned for the next twelve months. This WMP recommends the reporting of success of the plan in simple to understand grades of A, B, C, D, and F.

8.5 Local Programs

Management measures and implementation activities should align and conform with the local programs presented below.

8.5.1 COMMUNITY RATING SYSTEM

The National Flood Insurance Program (NFIP) provides federally backed flood insurance within communities that enact and enforce floodplain regulations. To be covered by a flood insurance policy (for the structure and/or its contents), a property must be in a community that participates in the NFIP. To qualify for participation in the NFIP, agencies adopt and enforce a floodplain management ordinance to regulate development in flood hazard areas. The main objective of the flood ordinance is to minimize the potential for flood damage on future development, thus protecting people and property in the County. This ordinance has been effective in requiring new buildings to be protected from damage from the 100-year base flood. However, flood damage still occurs as the result of floods that exceed the base flood, flooding in low-lying areas, flooding in unmapped areas, and from flooding that affects buildings constructed before the community joined the NFIP.

The NFIP established the Community Rating System (CRS) program to provide incentives for communities that exceed minimum requirements with their floodplain management programs. The CRS program aims to achieve three major goals:

1. Reduce damage to insurable property
2. Strengthen and support the insurance aspects of the NFIP
3. Encourage a comprehensive approach to floodplain management

Under the CRS, communities are rewarded for doing more than simply regulating construction of new buildings to the minimum national standards. Under the CRS, the flood insurance premiums for a community's homes and businesses are discounted to reflect that community's work efforts beyond the minimum requirements of the program. This includes efforts to reduce flood damage to existing buildings, managing development in areas not mapped by the NFIP, protection of new buildings beyond the minimum NFIP protection level, preservation and/or restoration of natural floodplain functions, helping insurance agents obtain flood data, and public education related to flood insurance and risk.

The CRS program recognizes and awards credits for floodplain management activities in four categories: public information, mapping and regulations, flood damage reduction, and warning/response. The more points a community receives, the better the discount property owners within that community receive on their flood insurance policies. Participation in CRS can reduce insurance premiums for policy holders by as much as 45%. Additionally, implementation of CRS activities can give participating communities a competitive edge with other Federal assistance programs. The Town of Dauphin Island participates in the NFIP and CRS with 1,937 policies in place on the Island (FEMA 2021).

8.5.2 ALABAMA COASTAL AREA MANAGEMENT PROGRAM

The Alabama Coastal Area Management Program (ACAMP) was approved by the National Oceanic and Atmospheric Administration in 1979 as part of the National Coastal Zone Management Program. The Alabama Department of Conservation and Natural Resources (ADCNR), State Lands Division, Coastal Section is responsible for overall management of ACAMP. The purpose of ACAMP is to balance economic growth with the need for preservation of Alabama's coastal resources for future generations. The program promotes wise management of the cultural and natural resources of the state's coastal areas and fosters efforts to ensure the long-term ecological and economic productivity of coastal Alabama. ACAMP is implemented in the legislatively defined Alabama Coastal Area which extends from the continuous 10-foot contour seaward to the 3-mile limit in Mobile and Baldwin Counties.

ADCNR, State Lands Division, Coastal Section staff work jointly with staff from the Alabama Department of Environmental Management (ADEM) to implement the federally approved program. ADCNR serves as the lead agency responsible for overall management of the program including planning, fiscal management, and education and dissemination of public information. ADEM oversees regulatory, permitting, monitoring, and enforcement responsibilities of the program. Based upon current federal legislation, the State of Alabama continues to administer the ACAMP as its Coastal Zone Management Program under the Coastal Zone Management Act of 1972. The Coastal Zone Management Act also requires the state to develop and implement its Alabama Coastal Nonpoint Pollution Control Program, to deter potential impacts and enhance coastal waters, under Section 6217 of the Coastal Zone Act Reauthorization Amendment of 1990. These proposed Watershed Management Plan prioritizations and projects are developed to ensure implementation of the program measures and best management practices that support the Alabama Coastal Nonpoint Pollution Control Program and the ACAMP goals.

Annual program activities include Coastal Cleanup, implementation of public access construction projects, planning support for local governments, implementation of the Alabama Coastal Nonpoint Source Control Program measures, and providing grant funds and technical assistance to Alabama's coastal communities and partners. ACAMP's annual grant program supports projects that protect, enhance, and improve the management of natural, cultural, and historical coastal resources and that increase the sustainability, resilience, and preparedness of coastal communities and economies.

As part of the implementation of this WMP, MBNEP endorses full and continued support of ACAMP. More information on the Alabama Coastal Area Management Program can be found on the ADCNR website (https://www.outdooralabama.com/coastal-programs/alabama-coastal-area-management-program) and ADEM's Coastal Programs website: http://adem.alabama.gov/programs/coastal/).

CHAPTER 9 Regulatory Review

Introduction

As part of the development of the watershed management plan (WMP) for the Dauphin Island Watershed, a review of existing regulations at the Federal, State, and local level was conducted.

The geopolitical boundaries of the Dauphin Island Watershed include overlapping jurisdictions and adjacent portions of Mobile County and the Town of Dauphin Island, with additional lands under State of Alabama and Federal jurisdiction in the Watershed along the Mississippi Sound, Mobile Bay, and the Gulf of Mexico.

The past and current status of permitting requirements, developments, ordinances, and compliance issues were researched with information from local government officials, State and Federal agencies, and the Dauphin Island WMP Steering Committee.

The laws, regulations, and ordinances reviewed in the WMP focus on water quality, stormwater, erosion and sediment control, coastal zone issues, wetlands, and other Waters of the United States (WOTUS), and land disturbances (**Table 9-1**).

TABLE 9-1 Alabama Department of Environmental Management Water Quality Criteria by Use Classification

Regulatory Requirement	Regulatory Authority/Permitting Agency	Jurisdiction
Clean Water Act: Section 303(d) (1972)	EPA and ADEM • Impaired Waters List/TMDLs	Federal and State
Clean Water Act: Section 401 (1972)	EPA and ADEM • State Water Quality Criteria • ADEM Administrative Code 335-6-10	Federal and State
Clean Water Act: Section 402 (1972)	EPA and ADEM • NPDES • ADEM Administrative Code 335-6-6	Federal and State
Clean Water Act: Section 404 (1972)	USACE • Waters of the U.S.	Federal
Clean Water Act: Section 319 (1972)	Non-Point Source Pollution Program	Federal and State
Coastal Zone Management Act (1972)	NOAA, USACE, and Form 166, Coastal Consistency	Federal and State
Federal Water Pollution Control Act (1948, 1972, 1977)	Federal Law	Federal
Rivers and Harbors Act of 1899	Section 10 - 33 U.S.C. 403	Federal
Code of Alabama 1975: Title 9, Title 22, Title 35	ADEM, Alabama State Legislature • Title 9, Chapter 7 • Title 22, Chapters 22, 23, 24, 25, 27, 28, 30 (A-F), 34, 35, 36, 37, 38, 40 • Title 35, Chapter 19	State
Construction Site Erosion and Stormwater Management	ADEM • NPDES General Permit Number ALR100000	State
Executive Order Number 43 (2001)	ACAMP and Alabama Department of Conservation and Natural Resources, State Lands Division	State
Alabama Coastal Area Act 534 (1976)	Alabama Department of Conservation and Natural Resources, State Lands Division	State
Alabama Coastal Area Management Program	ADEM, Alabama Department of Conservation and Natural Resources, State Lands Division • Alabama Code Section 9-7-1 et seq. • ADEM Administrative Code 335-8	State
Alabama Environmental Management Act (1982)	ADEM, ACAMP, and Alabama Department of Economic and Community Affairs	State
Alabama Water Pollution Control Act	ADEM • Alabama Code Section 22-22-1	State

NOTES: ACAMP = Alabama Coastal Area Management Program; ADEM = Alabama Department of Environmental Management; EPA = U.S. Environmental Protection Agency; NOAA = National Oceanic and Atmospheric Administration; NPDES = National Pollutant Discharge Elimination System; TMDL = total maximum daily load; USACE = U.S. Army Corps of Engineers.

Federal, State, and local governments are all in the process of planning to change, developing proposed changes to, or have changed their existing regulatory procedures. Examples of such changes to regulations and requirements for compliance during the 2020–2022 WMP period include:

- 2021 Nationwide Permits – USACE modified twelve (12) existing nationwide permits (NWPs) and issued four (4) new Nationwide Permits within this time frame. Sixteen (16) of the Nationwide Permits had a modification to the general conditions and definitions. The revised permits went into effect on March 15, 2021.
    a. Revised permits included: NWP's 21, 29, 39, 40, 42, 43, 44, 50, 51 and 52. These NWPs have been revised to remove the 300-linear-foot limit for losses of stream bed. The limit for losses of WOTUS for each of these permits remains at 0.5 acre. Mitigation General Condition 23 was modified to include a requirement for compensatory mitigation for stream bed losses exceeding 3/100-acre.
        i. NWP 48 was revised to provide for greater flexibility in its use for commercial shellfish mariculture activities. This NWP authorizes new operations as well as existing operations where operations is seeking permission to continue on-going shellfish cultivation activities. A preconstruction notification (PCN) has been added to this final NWP for all direct impacts to submerged aquatic vegetation greater than 0.5 acre.
    b. New NWP's issued consist of NWP's 55, 56, 57, and 58.
        i. NWP 55 – authorizes structures in marine and estuarine waters including structures anchored to the seabed on the Outer Continental Shelf, for the purpose of seaweed mariculture activities. Shellfish production proponents have been integrated in these activities if those actions are on the same structure or a structure that is part of the same project.
        ii. WP 56 – authorizes structures in marine and estuarine waters, including structures anchored to the seabed on the Outer Continental Shelf, for the purpose of finfish mariculture activities. Shellfish and seaweed production proponents have been integrated in these activities if those actions are on the same structure or a structure that is part of the same project.
        iii. NWP 57 – authorizes activities required for the construction, maintenance, repair and removal of electric utility lines, telecommunication lines, and associated facilities in WOTUS. There is a 0.5-acre limit for losses of WOTUS for each single and complete project.
        iv. NWP 58 – authorizes activities required for the construction, maintenance, repair, and removal of utility lines for water and other substances, excluding oil, natural gas, products derived from oil or natural gas, and electricity. Associated utility line facilities, such as substations, access roads, and

foundations for above-ground utility lines, in WOTUS, are authorized provided that the activity does not result I the loss of greater than 0.5 acre of WOTUS for each single and complete project.

Tables 9-2 through 9-6 provide a summary of Federal, State, and local permits required for certain activities within the Watershed.

TABLE 9-2 Federal Permits: U.S. Army Corps of Engineers, Mobile District, Nationwide Permit Program – Expires 2026

Permit	Activity
NWP 1	Aids to Navigation
NWP 2 -	Structures in Artificial Canals
NWP 3	Maintenance
NWP 5	Scientific Measurement Devices
NWP 6	Survey Activities
NWP 7	Outfall Structures and Associated Intake Structures
NWP 9	Structures in Fleeting and Anchorage Areas
NWP 10	Mooring Buoys
NWP 11	Temporary Recreational Structures
NWP 12	Oil or Natural Gas Pipeline Activities
NWP 13	Bank Stabilization
NWP 14	Linear Transportation Projects
NWP 15	US Coast Guard Approved Bridges
NWP 16	Return Water From Upland Contained Disposal Areas
NWP 18	Minor Discharges
NWP 19	Minor Dredging
NWP 20	Response Operations for Oil or Hazardous Substances
NWP 22	Removal of Vessels
NWP 23	Approved Categorical Exclusions
NWP 24	Indian Tribe of State Administered Section 404 Program
NWP 25	Structural Discharges
NWP 27	Aquatic Habitat Restoration, Enhancement and Establishment Activities
NWP 28	Modifications of Existing Marinas
NWP 29	Residential Developments
NWP 30	Moist Soil Management for Wildlife
NWP 31	Maintenance of Existing Flood Control Facilities
NWP 32	Completed Enforcement Actions
NWP 33	Temporary Construction, Access and Dewatering
NWP 42	Recreational Facilities

TABLE 9-2 Federal Permits: U.S. Army Corps of Engineers, Mobile District, Nationwide Permit Program – Expires 2026

Permit	Activity
NWP 43	Stormwater Management Facilities
NWP 45	Repair of Uplands Damaged by Discrete Events
NWP 46	Discharges in Ditches
NWP 48	Commercial Shellfish Mariculture Activities

NOTE: NWP = Nationwide Permit.

TABLE 9-3 Federal Permits: U.S. Army Corps of Engineers, Mobile District, General Permit Program – Expires October 1, 2026

Permit	Activity
ALGP-01	Excavated Boat Slips
ALGP-02	Maintenance Dredging
ALGP-03	New Work Channel Dredging
ALGP-04	Debris Removal
ALGP-05	Piers, Pile-Supported Structures, and Dolphins
ALGP-06	Reserved
ALGP-07	Boat Ramps and Marine Ways
ALGP-08	Reserved
ALGP-09	Reserved
ALGP-10	Living Shorelines
ALGP-11	Shoreline and Bank Stabilization and Protection
ALGP-12	Reserved
ALGP-13	Filling of Previously Dredged Area
ALGP 14 through 23	Reserved
ALGP-24	Piers and Pile-Supported Structures Located in Weeks Bay
ALGP-25	Reserved
ALGP-26	Reserved

TABLE 9-4 State Permits: Alabama Department of Environmental Management

Permit	Activity	Expiration
ALR100000	Discharges from construction activities that result in a total land disturbance of 1 acre or greater and sites less than 1 acre but are part of a common plan of development or sale	March 31, 2026
ALR040000	Stormwater discharges from regulated small Municipal Separate Storm Sewer System Phase II	September 30, 2026

TABLE 9-4 State Permits: Alabama Department of Environmental Management

Permit	Activity	Expiration
ALS000006	Stormwater Discharges from Alabama Department of Transpiration's Municipal Separate Storm Sewer System	September 30, 2024
ALG020000	Discharges associated with the manufacture of asphalt, concrete, asphalt roofing, linoleum and printed asphalt felt and of hot mix asphalt from asphalt cement consisting of stormwater, non-contact cooling water, uncontaminated condensate, cooling tower blowdown, boiler blowdown, demineralizer wastewater, vehicle and equipment exterior washing operations, and stormwater from fueling, petroleum storage and handling, equipment storage, and maintenance areas	September 30, 2022
ALG030000	Discharges associated with boat and ship building and repair industries (including offshore oil and gas well drilling and production platforms building and repair) consisting of storm water, non-contact cooling water, uncontaminated condensate, cooling tower blowdown, boiler blowdown, demineralizer wastewater, treated sanitary wastewater, bilge/ballast water, wash water, hydrostatic and pressure test water, hydroblast water (not including wet abrasive blast water), and storm water from fueling, petroleum storage and handling, equipment storage, and maintenance areas	September 30, 2022
ALG060000	Discharges associated with lumber, wood, and paper products industry (not including wood preserving operations) consisting of storm water, process water from wet decking, non-contact cooling water, uncontaminated condensate, cooling tower and boiler blowdown, demineralizer wastewater, exterior vehicle and equipment wash water and storm water from petroleum storage and handling, fueling, and equipment storage and maintenance areas	June 30, 2027
ALG110000	Discharges from concrete batch plants (not including storm water or process wastewater discharges from cement manufacturing)	August 31, 2027
ALG120000	Discharges associated with primary metals, metal finishing, fabricated metal products, industrial commercial machinery, electronic equipment, transportation equipment, measuring and analyzing instruments, and foundries, consisting of stormwater, hydrostatic test water from new containers, non-contact cooling water, uncontaminated condensate, cooling tower blowdown, boiler blowdown, demineralizer wastewater, vehicle and equipment exterior washing operations, and stormwater from fueling, petroleum storage and handling, equipment storage, and maintenance areas	September 30, 2022
ALG140000	Discharges associated with transportation industries and warehousing consisting of storm water; non-contact cooling water; uncontaminated condensate; cooling tower blowdown; boiler blowdown; demineralizer wastewater; vehicle and equipment wash-water; storm water from fueling, petroleum storage and handling, equipment storage, maintenance areas; and wastewater associated with airfield pavement deicing from existing and new primary airports with 1,000 or more annual jet (non-propeller aircraft) departures.	September 30, 2022

TABLE 9-4 State Permits: Alabama Department of Environmental Management

Permit	Activity	Expiration
ALG150000	Discharges associated with food and kindred products industries consisting of stormwater, non-contact cooling water, uncontaminated condensate, cooling tower and boiler blowdown, demineralizer wastewater, exterior vehicle and equipment wash-water and stormwater from petroleum and non-petroleum oil storage and handling, fueling, equipment storage and maintenance areas.	May 31, 2027
ALG160000	Discharges of storm water (not containing leachate) from active and inactive landfills, transfer stations, and land disturbance activities associated with opening and closing cells at landfills; discharges of vehicle and equipment exterior wash water; and discharges of storm water from fueling, petroleum storage and handling, equipment storage, and maintenance areas	January 31, 2027
ALG170000	Storm water discharges associated with the manufacturing and storage of paints, varnishes, lacquers, enamels, and allied products; non-contact cooling water, uncontaminated condensate, cooling tower blowdown, boiler blowdown, demineralizer wastewater, vehicle and equipment exterior washing operations; and storm water from fueling, petroleum storage and handling, equipment storage, and maintenance areas	September 30, 2022
ALG180000	Discharges associated with the salvage and recycling industry consisting of storm water, non-contact cooling water, uncontaminated condensate; cooling tower and boiler blowdown, demineralizer wastewater, vehicle and equipment exterior washing operations, and storm water from fueling, petroleum storage and handling, equipment storage, and maintenance areas	September 30, 2022
ALG200000	Discharges associated with the plastic and rubber industry (excluding industries covered under 40 CFR part 414-organic chemical, plastics, and synthetic fiber industries) consisting of storm water, non-contact cooling water, uncontaminated condensate, cooling tower blowdown, boiler blowdown, demineralizer wastewater, vehicle and equipment exterior washing operations; and storm water from petroleum storage and handling, equipment storage, and maintenance areas	September 30, 2022
ALG230000	Discharges associated with the stone, glass, and clay industry consisting of storm water, non-contact cooling water, uncontaminated condensate, cooling tower blowdown, boiler blowdown, demineralizer wastewater, vehicle and equipment exterior washing operations; and storm water from fueling, petroleum storage and handling, equipment storage, and maintenance areas	September 30, 2022
ALG230000	Discharges associated with the stone, glass, and clay industry consisting of storm water, non-contact cooling water, uncontaminated condensate, cooling tower blowdown, boiler blowdown, demineralizer wastewater, vehicle and equipment exterior washing operations; and storm water from fueling, petroleum storage and handling, equipment storage, and maintenance areas	September 30, 2022

TABLE 9-4 State Permits: Alabama Department of Environmental Management

Permit	Activity	Expiration
ALG240000	Discharges associated with the textile industry consisting of non-contact cooling water, uncontaminated condensate, cooling tower blowdown, boiler blowdown, demineralizer wastewater, vehicle and equipment exterior washing operations; and storm water from fueling, petroleum storage and handling, equipment storage, and maintenance areas	September 30, 2022
ALG250000	Discharges of non-contact cooling water, cooling tower blowdown, uncontaminated condensate, and boiler blowdown with and without demineralizer waste-water (steam electric power plants are excluded from coverage under this permit.)	March 31, 2022
ALG280000	Wastewater associated with offshore oil and gas exploration and production activities. Specifically, the permit authorizes the discharge of deck drainage from platform complexes, remote well structures, pigging platforms, temporary rigs, floating construction facilities and waste collection barges; treated sanitary and domestic wastewater of less than 10,000 gallons per day; noncontact cooling water and boiler blowdown; and low volume miscellaneous discharges. The discharge of well treatment, completion, and workover fluids; produced sand; produced water; drilling muds and cuttings; and discharges incidental to the normal and proper operation of a vessel while being used as a means of transportation are not authorized by this permit, nor are any discharges to areas of biological concern	March 31, 2025
ALG340000	Discharges associated with petroleum products or its derivatives consisting of groundwater and/or stormwater incidental to groundwater cleanup operations which has been contaminated with automotive gasoline, aviation fuel, jet fuel, or diesel fuel; storm water runoff from petroleum storage and fueling areas; uncontaminated storm water from fueling, petroleum storage and handling, equipment storage, and maintenance areas; vehicle and equipment exterior washing operations (excluding commercial car washes) that do not use solvents; and hydrostatic test water generated on-site.	January 31, 2027
ALG360000	Discharges associated with cooling water and filter backwash, sumps and drains; oil water separators; treated sanitary wastewater; pretreated drilling supernate; uncontaminated storm-water associated with hydroelectric generating facilities; and waste-water resulting from maintenance and repair activities associated with cleaning, pressure washing, blasting and painting of structures over water.	January 31, 2026
ALG640000	Discharges of filter backwash, sedimentation basin wash water, and decant water from water treatment plants (discharges from water treatment plants that use ion-exchange or reverse osmosis are not covered by this general permit.)	June 30, 2023
ALG670000	Discharges associated with hydrostatic test waters from new and existing petroleum and natural gas pipelines	September 30, 2022
ALG850000	Discharges from the mining and processing (wet or dry) of construction sand and gravel, chert, dirt, and/or red clay, and areas associated with these activities	May 31, 2027
ALG870000	Discharges from the application of pesticides	October 30, 2021

TABLE 9-4 State Permits: Alabama Department of Environmental Management

Permit	Activity	Expiration
ALG890000 (<5 Acre Small Mining)	Discharges from small non-coal/non-metallic mining and dry processing and areas associated with these activities.	January 31, 2018

TABLE 9-5 Town of Dauphin Island: Local NDPES Permits

Permit	Permittee	Activity	Expiration
AL0050547 AL0075370	Dauphin Island Water, Sewer and Fire Protection	NPDES Permit	August 31, 2023 February 28, 2025
ALG280001	Dauphin Island Gathering Partners – Pigging Platform	Minor General Permit	March 31, 2025
AL0077721	Dauphin Island Reverse Osmosis No. 6	NPDES Permit	January 31, 2027
ALR10BFNJ	Sunset Cove	Construction Stormwater	March 31, 2026

NOTE: NPDES = National Pollutant Discharge Elimination System

TABLE 9-6 Town of Dauphin Island: Local Ordinances

Ordinance/Resolution	Purpose
Resolution No. 10052021	Six-month moratorium on the issuance of permits for new construction of seawalls, retaining walls, and similar structures or other means of deflecting wave energy on the Islands south shoreline and dune region. September 20, 2022–March 20, 2023
Ordinance No. 9A	Ordinance to create a town planning commission to consist of 9 members to be appointed to terms. The planning commission is empowered by Title 11, Chapter 52, of the Code of Alabama.
Ordinance 96	Establishes zoning regulations for the Town of Dauphin Island by providing definitions, for districts, a zoning map for use and location of land and building for residence, trade, industry, or other purposes; to regulate and restrict the size of buildings and other structures, providing for accessory buildings and structures, providing area and exception supplements, providing for off-street parking requirements, providing for sign regulations, providing for landscaping and regulation of fences, providing for nonconforming uses and buildings and providing for administration and enforcement.
Ordinance 12	Safeguard the health, safety, and welfare of the residents by regulating the storage, handling, use, or production of hazardous or toxic substances within identified Zone of Influence surrounding wells in the Island's shallow groundwater aquifer.
Ordinance 17	Establishes a bird sanctuary within the entire area embraced within the corporate limits of the Town of Dauphin Island.

TABLE 9-6 Town of Dauphin Island: Local Ordinances

Ordinance/Resolution	Purpose
Ordinance 20C	Establishes litter control on the Island making littering a violation of the law resulting in fines. Litter includes paper, plastic, garbage, bottles, cans, glass, crockery, scrap metal, construction materials, rubbish, disposable packages, or containers which are discarded, thrown, or otherwise deposited.
Ordinance 30	Establishes a permit requirement to excavate or dig on any street, lane, road, or right-of-way of the Town of Dauphin Island.
Ordinance 34	Prohibits the excavation or digging on any land, including submerged land on Dauphin Island for the purpose of exploring, excavating or surveying any historical artifacts without obtaining a permit.
Ordinance 44A	Regulates the use of the town owned dock at Billy Goat Hole on the East End of Dauphin Island. It sets aside the municipal dock for the exclusive use by recreational boats or sports craft unless a special permit or authorization is issued.
Ordinance 55A	Flood Damage Prevention Ordinance to promote the public health, safety, and general welfare and to minimize public and private losses due to flood conditions in specific areas by provisions designed to restrict or prohibit uses which are dangerous to the health, safety, and property due to water or erosion hazards, control filling, grading, dredging, and other development which may increase flood damage or erosion, prevent or regulate the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards to other lands and control the alteration of natural floodplains, stream channels, and natural protective barriers which are involved in the accommodation of flood waters.
Ordinance 61	Regulates the use of red clay and construction clay within the Town of Dauphin Island for the protection of beaches, streams, creeks, lakes, and bay.
Ordinance 66A	Prohibits the pedestrian and vehicular use of the sand berms along the Gulf beaches and the Silver Cay aera on the Western portion of Dauphin Island.
Ordinance 68	Establishes open burning standards for the utilization of fires for cooking food, recreational and ceremonial purposes, fires set in salamanders or other devices, and opening burning of debris from construction, demolition, and property maintenance.
Ordinance 77	Prohibits the use of glass containers or other material subject to breaking, shattering or disintegrating, leaving sharp edges which are likely to cause injury to any person on said Gulf beach.
Ordinance 79	Requires a permit authorizing removal of sand from private property and to prohibit the removal of sand from the Town's rights-of-way.
Ordinance 85A	Regulates and restricts development affecting wetlands, protecting and preserving wetlands, addressing wetland mitigation when appropriate and permitted by appropriate State and Federal Agencies, and providing penalty for violations.
Ordinance 87B	Preserves, protects, replace and properly maintains trees and vegetation within the Town.
Ordinance 91	Provides for the disposing of abandoned or derelict vessels by providing a means of removing and disposing of abandoned or derelict vessels situated in the public property and waterways of the Town or its police jurisdiction.

TABLE 9-6 Town of Dauphin Island: Local Ordinances

Ordinance/Resolution	Purpose
Land Disturbance Ordinance	Controls the discharge and surface runoff of eroded soil, sediment and other pollutants from land on which land-disturbing activities are conducted, to the maximum extent practicable, and provides enforcement procedures and penalties to ensure compliance with such controls.

9.1 Overview of Laws, Regulations, and Ordinances

Actions, permitting, and restrictions are all driven by legal authorities, legal documents (e.g., rules, regulations, ordinances, case law/rulings/judgments, notice and rulemaking procedures), and legal criteria and legal rights (e.g., private, public, government, political, riparian, littoral). Although the following descriptions and details of specific laws, rules, regulations, and permits will be separated for convenience they overlap with much interplay, imposing various conditions and requirements and creating conflicting situations from time to time. The level of jurisdictional authority and interagency cooperation varies across each category.

This section provides a general overview of what standards apply in the Watershed. It does not include a comprehensive list of accounting for every relevant statutory provision. For more specific information, please reference the regulatory requirements listed in **Table 9-1**. Keep in mind that governing procedures related to Federal oversight, State coastal management programs, and surface water protection, including wetlands, are periodically updated over time. You can also read more about the South Alabama Regulatory Review at https://www.mobilebaynep.com/assets/pdf/Final-South-AL-Stormwater-Regulatory-Review-Update_w-appendicies.pdf.

9.1.1 FEDERAL AUTHORITIES

The Federal Water Pollution Control Act and the Clean Water Act amendments provide the basis for the primary Federal regulatory and permitting procedures relating to stormwater management within the Dauphin Island Watershed. The following specific Clean Water Act sections are particularly pertinent to controlling stormwater runoff, erosion, and sedimentation problems within the Watershed.

Federal Water Pollution Control Act

The Federal Water Pollution Control Act was enacted in 1948 and was significantly reorganized and expanded in 1972. In 1977, when the amendments were added, the Federal Water Pollution Control Act became known as simply the Clean Water Act (CWA).

The CWA establishes the basic structure for regulating discharges of pollutants into the WOTUS and regulating water quality standards for surface waters. The CWA and its amendments provide the basis for the primary Federal regulatory and permitting procedures relating to water quality, stormwater management, and the discharge of dredge and fill materials into jurisdictional WOTUS. The most applicable sections of the CWA related to controlling stormwater runoff and erosion and sedimentation within the Watershed are listed below.

Clean Water Act Section 303(d)

Under CWA Section 303(d) of the 1972 CWA, states, territories, and authorized tribes are required to develop lists of impaired waters. These impaired waters are waters that do not meet the water quality standards that states, territories, and authorized tribes have set for them, even after point sources of pollution have installed the minimum required levels of pollution control technology. The law requires that these jurisdictions establish priority rankings for waters on the lists and develop total maximum daily loads (TMDLs) for these waters. The TMDLs are used to establish limits for the amount and type of pollutant discharges that the receiving streams can handle without experiencing further degradation. Once a stream or stream segment has been classified as impaired (i.e., listed on the State's 303(d) list) for the contaminant identified, EPA and ADEM must inspect and sample the water to determine the amount or limit of the loading to the stream. The Alabama Section 303(d) list is required to be updated every two years. The most current list can be accessed at http://adem.alabama.gov/programs/water/303d.cnt. Waterbodies within the Watershed that are listed on the Alabama Section 303(d) list are identified and discussed in **Chapter 4.**

Clean Water Act Section 319

Under CWA Section 319, the Alabama Non-Point Source Management program protects and restores water quality by: strategically focusing programmatic goals and objectives to achieve and sustain water quality standards, clearly articulating programmatic goals so that project workplan planning and implementation reflect actions to advance those goals, reflect a balance between watershed-based planning and implementation that best utilizes resources to deliver measurable nonpoint source pollutant load reductions and water quality improvement results, leverage and integrate a mix of public and private sector programs to align priorities and make the best use of available resources to control nonpoint sources of pollution, and the tracking and reporting of results to demonstrate progress and ensure accountability.

Clean Water Act Section 401 (33 USC Section1341) and Clean Water Act Section 401(a)

All CWA Section 404 permit applications, pursuant to CWA Section 401(a), must be submitted to ADEM for review of the proposal's consistency with the State's water quality program. ADEM reviews applications to ensure the proposed discharge of dredged or fill material will not cause or contribute to a violation of State water quality standards as outlined in ADEM Administrative Code R. 335-6-10.

Clean Water Act Section 402

Section 402 of the CWA authorizes permitting under the NPDES program with EPA having primary permitting authority. The NPDES program requires dischargers to obtain permits before discharging pollutants into WOTUS (40 CFR 122). The NPDES program covers point source discharges from the following:

- Industrial facilities
- Municipal Separate Storm Sewer Systems(MS4s)
- Concentrated animal feeding operations
- Publicly owned treatment works
- Combined sewer overflows and sanitary sewer overflows
- Construction
- Non-coal/non-metallic mining and dry processing less than 5 acres, other land disturbance activities, and areas associated with these activities

The EPA has delegated the authority to administer the NPDES program to ADEM, who by ADEM Admin. Code Reg. 335-6-6 regulates and permits certain point source discharges. By ADEM Admin. Code Reg. 335-6-12, ADEM regulates discharges from construction sites and land clearing; imposes requirements for erosion and sediment control and the use and maintenance of best management practices, and imposes requirements for inspections, reporting, and enforcement. In December 2009, EPA issued a Final Rule addressing a phased-in program for numeric and non-numeric effluent limits on sediment/erosion control at construction sites, focusing on stormwater discharge turbidity. (74 Fed. Reg. 62996; 40 CFR 450).

The EPA promulgated the *Effluent Limitations Guidelines and Standards for the Construction and Development Point Source Category* rule in December 2009 and amended May 2015 (EPA 2015). These regulations cover stormwater discharges from construction sites and are implemented in the NPDES permit program. Through the NPDES permit program, discharges from construction sites and land clearing are regulated by the ADEM Construction General Permit, ALR100000 (effective April 1, 2016). This permit applies to construction activities resulting in land disturbance of one acre or more (and smaller sites that are part of a common plan of development or sale). It also imposes requirements for erosion and sediment control, best management practices (BMPs), inspections, reporting, and enforcement. The 2009 Rule requires owners and operators of permitted construction activities to adopt certain requirements, as follows:

- Implementing erosion and sediment controls
- Stabilizing soils
- Managing dewatering activities
- Implementing pollution prevention measures
- Providing and maintaining a buffer around surface waters
- Prohibiting certain discharges
- Using surface outlets for discharges from basins and impoundments

Clean Water Act Section 404

The U.S. Army Corps of Engineers (USACE) and the EPA administer CWA Section 404 (33 USC 1344) to regulate activities resulting in the discharge of dredged or fill material into navigable waters or WOTUS, including wetlands. The USACE and EPA, through rulemaking procedures, have proposed, noticed, and issued rules and regulations to CWA Section 404 (USACE: 33 CFR 320; EPA: 40 CFR 230). The agencies also issue other interpretive writings intended to guide how the law is implemented and enforced. These writings include Regulatory Guidance Letters, Interpretive Guidance (usually following a lawsuit and judicial opinion, Executive Order, or Congressional Act), Standard Operating Procedures, and Memorandum of Agreements or Understanding. The law states that no dredge or fill material can be discharged by anyone or any entity, including governmental entities, agencies, and programs, without a permit (or an exemption) into jurisdictional WOTUS, including jurisdictional wetlands, floodplains, streams, rivers, bays, estuaries, or other aquatic sites.

There are several types of permits that can be issued, including an individual CWA Section 404 permit, a letter of permission, a general permit, a regional permit, an NWP, and even an after-the-fact permit. Permits may also impose general, regional, or local conditions or criteria, including but not limited to CWA Section 401 water quality certification conditions and coastal program consistency certification conditions. The permits can also require approvals from Alabama Department of Conservation and Natural Resources (ADCNR) (submerged lands lease or riparian easement if in State waters or on State water bottoms). Permit applications are reviewed and evaluated by

USACE based on the environmental criteria outlined in the CWA Section 404(b)(1) guidelines and regulations promulgated by EPA. The permits must also meet State water quality standards and coastal area requirements and must be consistent with each program.

Coastal Zone Management Act (P.L. 92-583; 16 U.S.C. Section 1451 et seq.)

The Coastal Zone Management Act is administered by the National Oceanic and Atmospheric Administration and provides coastal states an opportunity to develop and implement coastal area management programs. States electing to do so are provided with funding support. The Act places specific requirements on Federal agencies to ensure that their activities (and the activities they permit) are consistent with approved State programs (15 CFR 930). Currently, the coastal program's implementation is split between ADEM and the ADCNR and only applies to lands and waters seaward of the continuous 10-foot contour. Within the coastal area, a separate coastal management permit or coastal consistency certification is required pursuant to ADEM Administrative Code Rs. 335-8. This requirement applies to projects impacting wetlands (dredge or fill), developments greater than five acres, shoreline stabilization, docks and piers, construction on beaches and dunes, and other similar activities impacting coastal waters.

Alabama developed a coastal area management program in 1979 and maintains a federally approved program (see program description under State Authorities). The Federal consistency provisions most relevant to the WMP include the requirement that CWA Section 404 and Section 402 permits comply with Alabama's Coastal Area Management Program. ADEM has also developed a non-regulatory Coastal Nonpoint Pollution Control Program, according to Section 6217 of the act.

9.1.2 STATE AUTHORITIES

Several of the State statutes that affect activities in the Dauphin Island Watershed have been mentioned in the discussion of the Federal statute. ADEM is the primary State environmental regulatory agency in Alabama. In addition, the ADCNR may also have jurisdiction over certain activities that affect State waters, State natural resources (such as fish and wildlife), and State lands.

Alabama Coastal Area Management Program

The Alabama Coastal Area Management Program (ACAMP) was approved by National Oceanic and Atmospheric Administration in 1979 as part of the National Coastal Zone Management Program. As such, the ADCNR is responsible for the overall management of the ACAMP program. (See **Section 8.5.2**) Its ultimate purpose is to balance economic growth with preservation of Alabama's coastal resources by promotion of wise management of the cultural and natural resources of the State's coastal areas, which include the Dauphin Island Watershed. ACAMP is implemented in the area defined as the "Alabama Coastal Area," which extends from the continuous 10-foot contour seaward to the 3-mile limit in Mobile and Baldwin Counties.

ADCNR, in conjunction with ADEM, is the lead agency responsible for overall management of the program including planning, fiscal management, and education through dissemination of public information. Likewise, ADEM oversees regulatory, permitting, monitoring and enforcement responsibilities of the program. Based upon current Federal legislation, the State of Alabama continues to administer the ACAMP as its Coastal Zone Management Program under the Coastal Zone Management Act of 1972. The Coastal Zone Management Act also requires the State to develop and implement its Alabama Coastal Nonpoint Pollution Control Program, in order to deter potential impacts and enhance coastal waters, under Section 6217 of the Coastal Zone Act Reauthorization Amendment of 1990.

COASTAL ZONE MANAGEMENT

The Alabama Coastal Area Management Act, Alabama Code Section 9-7-1 et seq., provides the State's statutory authority to develop and implement a coastal area management program. ADEM, through Admin. Code Reg. 335-8-1, et seq., regulates the filling and excavation of wetlands and certain types of development within the coastal area, requiring a determination of consistency by the applicant proposing the activity. This is usually part of the CWA Section 404 joint application process initially filed with the Corps of Engineers. The ADEM coastal area management plan (now administered by ADCNR) and the ADEM Coastal Regulations (administered by ADEM) are limited to the coastal area. Here "coastal area" is defined as an area with outside or upland boundary determined by the continuous 10- foot contour in Mobile and Mobile Counties. The last time any significant changes, updates, or amendments were made to the Coastal Regulations was 1995. There are general and nationwide permits issued by the Corps of Engineers that presently have been given coastal program and regulation consistency for discharging fill to wetlands in the coastal area, such as NWP 18. The present consistency determination was made by ADEM in January 2017, for five years. The Corps of Engineers on December 27, 2021, issued a Rule published in the Federal register to reissue and modify Nationwide Permits. In this rule, the 2017 version of the existing NWP 18 expired on February 24, 2022. However, in the Final Rule, NWP 18 was reissued to go into effect February 25, 2022, and is set to expire March 14, 2026.

ADEM and ADCNR have also developed a Coastal Nonpoint Pollution Control Program according to Section 6217 of the Coastal Zone Management Act. This program is non-regulatory, relying heavily on existing State, county, and local programs to address various non-point sources of pollution impacting coastal waters. The necessary management measures that comprise the State's program include Coastal 6217 Management Boundary; Agriculture; Forestry; Urban Development; Marinas; Hydromodification; and Wetland and Riparian Areas. To date, the program has undertaken or funded several projects designed to gather data on existing or potential pollutant sources, test new technology through pilot projects, assist property owners and regulators in developing and implementing pollution controls in the coastal counties. The State program is currently considered "conditionally approved" by National Oceanic and Atmospheric Administration.

Alabama Water Pollution Control Act

The Alabama Water Pollution Control Act, Alabama Code Section 22-22-1, is the State's version of the CWA. The Alabama Water Pollution Control Act prohibits the discharge of pollutants to waters of the State without a permit. It provides the foundation for the State's delegated authority to implement various Federal water quality programs, including the CWA Section 402 NPDES permitting program, Section 303 water quality standards and TMDL, and Section 319 Non-Point Source programs. Water quality programs are generally implemented through ADEM Administrative Code R. 335-6. The Alabama Water Pollution Control Act provides the framework for adopting rules that establish water quality standards, effluent limitation guidelines, and other rules as needed to enforce water quality standards adopted by ADEM.

Clean Water Act Section 401(a) Water Quality Certification

As outlined in CWA Section 401(a), ADEM must review CWA Section 404 permit applications to ensure that the proposed permitted action is consistent with the State's water quality program. This review is to ensure that any discharge of dredged or fill material will not cause or contribute to a violation of the State's water quality standards. State water quality standards are outlined in ADEM Admin. Code Reg. 335-6-10.

Construction Site Stormwater

The CWA and Federal regulations require construction site operators to obtain NPDES permit coverage for regulated land disturbances and associated discharges of stormwater runoff to State waters. Effective April 1, 2021, ADEM established the new General NPDES Permit No. ALR100000 for discharges associated with regulated construction activity that will result in land disturbance equal to or greater than 1 acre, or from construction activities involving less than 1 acre, and that are part of a common plan of development or sale equal to or greater than one acre. This permit replaced the previous General NPDES Permit No. ALR100000, which expired on March 31, 2021. The General Permit falls under the authority of ADEM Admin. Code Reg. 335-6-6, along with the other actions regulated by the NPDES program.

Construction site operators and/or owners seeking coverage under this general permit must submit a Notice of Intent (NOI) following the permit requirements. Operators and/or owners of all regulated construction sites must implement and maintain effective erosion and sediment controls following a Construction Best Management Practices Plan prepared and certified by a qualified credentialed professional. For priority construction sites, the Construction Best Management Practices Plan must be submitted to ADEM for review along with the NOI. Priority construction sites include any sites that discharge to (1) a waterbody listed on the most recent EPA approved 303(d) list of impaired waters for turbidity, siltation, or sedimentation; (2) any waterbody for which a TMDL has been finalized or approved by EPA for turbidity, siltation, or sedimentation; (3) any waterbody assigned the Outstanding Alabama Water use classification following ADEM Admin. Code Reg. 335-6-10-.09; and (4) any waterbody assigned a special designation per ADEM Admin. Code Reg. 335-6-10-.10. A qualified credentialed inspector or qualified credentialed professional must regularly inspect regulated construction activities to ensure effective erosion and sediment controls are being maintained.

Municipal Separate Storm Sewer System General NPDES Permit

Mobile County Phase II MS4 General Permit (No. ALR040043) was initially issued September 6, 2016, and it expired on September 30, 2021. Currently, Mobile County has asked for an extension on providing information for the new permit and it was granted by ADEM. However, Phase II MS4 programs cover small, urbanized areas and non-traditional MS4s such as public universities, departments of transportation, hospitals, and prisons. As such, the Town of Dauphin Island is not included within the County's MS4 program.

Clean Water Act Section 303(d)

The EPA requires that ADEM designate waters for which technology-based limits alone do not ensure the attainment of applicable water quality standards. States are required to submit their list of impaired waters to the EPA on April 1 of each even-numbered year. For each water submitted on the list, the pollutant causing the impairment is included, when known. Impairments include things such as nutrients, pesticides, pathogens, metals, organic enrichment, and siltation and can be caused by point sources or nonpoint sources. Additionally, ADEM assigns a priority for development of TMDLs based on the severity of the pollution and the waterbodies designated usage. ADEM classified Dauphin Island water use as Swimming and Whole-Body Contact, Fish & Wildlife, and Shellfish Harvesting. Dauphin Island and its surrounding waters were listed on Alabama's 2010 303(d) list of impairments due to the Deepwater Horizon Oil Spill. Development has altered the habitats and increased volume and velocities of stormwater runoff have impacted the local waterways. No TMDL has been calculated for the Dauphin Island Watershed at this time. Any development or redevelopment activity affecting these streams should take the listing and impairment into consideration and increased regulatory agency scrutiny of proposed activities is expected.

9.1.3 LOCAL GOVERNMENT REGULATIONS

In addition to the overarching Federal and State regulations, the Town of Dauphin Island and Mobile County have various regulations, ordinances, and permitting requirements that cover activities within the Watershed.

Mobile County

Environmental programs for Mobile County are regulated through the Mobile County Commission. The primary responsibility of the Mobile County Commission is to manage the Environmental Grants Program, oversee the MS4 Stormwater Management Program and the Conservation Property Management Program. They are also responsible for Environmental Regulatory Compliance, Solid Waste Management, Community Resilience and Disaster Recovery.

The Mobile County Commission protects water quality using the following ordinances and regulations.

MOBILE COUNTY FLOOD DAMAGE PREVENTION ORDINANCE

The Mobile County Flood Damage Prevention Ordinance (March 2010) applies to all areas of special flood hazard within the jurisdiction of Mobile County. The purpose of the ordinance is to promote the public health, safety, and general welfare and to minimize public and private losses due to flooding condition within these specific areas. This ordinance also contains regulations that also help protect water quality, which includes measures to control the alteration of natural floodplains, stream channels, and natural protective barriers that are involved in the accommodation of floodwaters.

MOBILE COUNTY SUBDIVISION REGULATIONS

These regulations are issued by the Mobile County Commission. They apply to every subdivision in all unincorporated areas of Mobile County outside the planning jurisdiction of another municipality. The main objective of these regulations is to establish procedures and guidelines for planning and development of all subdivisions. This includes, but is not limited to, standards related to minimum size of lots, the design and construction of streets, roads, and drainage features, and the installation of water and sewer facilities. Water quality provisions can be found in Sections 4, 7, and 8 of the regulations whereas Section 4.12 requires the implementation of measures to protect streams and other water bodies with the design of subdivisions. Additionally, a statement that all applicable Federal and State permits have been acquired prior to a construction plan is approved is required. Good engineering practices, judgement, and criteria to be employed to control stormwater runoff and water detention during construction activities is specified in Section 7.5. Section 8.1 includes stormwater detention requirements for any watershed that contains a public drinking water source.

MOBILE COUNTY MS4 PHASE II PERMIT

The Mobile County Commission was granted a Phase II MS4 General Permit October 1, 2021 (Permit No. ALR040043). This General Permit is set to expire on September 30, 2026. Requirements of the permit include identifying major sources of stormwater pollution, reducing pollutants in runoff from industrial, commercial, and residential areas, controlling stormwater discharges from new development and redevelopment areas, and implanting a water quality monitoring program. Likewise, the intent of these regulations is to protect water quality by reducing the impacts by controlling unregulated sources of stormwater discharges. As such, Mobile County satisfies these regulations through public education, the illicit discharge detection and elimination program, requiring guidance for construction site runoff control, requiring post-construction stormwater management and requiring good housekeeping.

MOBILE COUNTY STORMWATER MANAGEMENT PROGRAM PLAN

The Mobile County Stormwater Management Program Plan is currently being prepared by the Mobile County Commission as part of the requirements of the County's NPDES MS4 Permit. Originally, the plan was due April 1, 2022, but the County has asked for an extension, which was approved by ADEM. The former plan was written in October 2013 and was created to protect water quality by reducing, to the maximum extent practicable, the discharge of pollutants in stormwater. The plan documents that no State law, ordinance, or other regulatory mechanism exists to provide the Mobile County Commission the authority to inspect and enforce the implementation of proper erosion control and sediment controls, controls for the wastes from construction sites or post-construction stormwater management controls. The plan states that if non-compliance with the standards established by ADEM regarding erosion and sediment controls are identified, a representative of the stormwater management program should contact ADEM for assistance with enforcement. Furthermore, because the State of Alabama lacks home rule authority, Mobile County is unable to enact new programs without going through the process of getting approval at the State level. Going thorough this route to obtain approval can be both time prohibitive and costly.

Town of Dauphin Island

The Town of Dauphin Island, as with any municipality, passes ordinances and resolutions to further provide guidance and compliance with State and governmental regulations. As such, the Town of Dauphin Island currently has seventy-five Ordinances and four resolutions listed. **Table 9-6** summarizes the pertinent ordinances and resolutions for this WMP. Below, the four most important ordinances for this plan are summarized.

ZONING ORDINANCE (NO. 96)

Throughout the development of this WMP, the Town's Planning Commission has been working to revise the entire Zoning Ordinance for the Island. The purpose of this ordinance is to govern the use of land and buildings, the heights and bulk of buildings, size of yards, and other open spaces and other features. Likewise, an official zoning map was created to denote the different zoning areas. Zoning areas include single-family residential, two-family residential, multifamily residential, resort commercial, central business, conservation park, mobile home park, the village, and working waterfront. Other requirements set forth within the zoning ordinance includes site planning, master planning, animals, screening of utility, garbage receptacles, garbage cans, gas, fuel tanks or liquid petroleum tanks, garbage and trash disposal, water supply, septic tanks, lot aeras, satellite receiving dishes, junked vehicles, and recreational vehicles.

On July 20, 2022, the Town released a revised draft of its Zoning Ordinance and planned two public hearings required for the passage of such an Ordinance. Some of the proposed changes included Lighting Regulations, Short-Term Vacation Rental Overlay District, and Lot Coverage and Dimensional Requirements.

WETLANDS ORDINANCE (NO. 85 A)

On August 5, 2022, the Town adopted a new Wetlands Ordinance. This ordinance was issued to regulate and restrict development affecting wetlands, protect and preserve wetlands, address wetland mitigation when appropriate and permitted by appropriate State and Federal agencies, and provide a penalty for violations. Because of impacts to natural resources from increasing residential and commercial development, the Town of Dauphin Island provided guidance to protect the important natural resources that provide ecosystem functions such as natural flood and storm water control, groundwater recharge, natural pollution treatment, erosion and sediment control, wildlife habitat creation, recreation and open space enhancement, and educational opportunities. The primary goal of the new ordinance is to avoid impacting wetlands whenever possible. The Wetland Ordinance establishes an impact fee of $20 per square foot (maximum $20,000) for the filling of designated wetland areas. This is in addition to fees that may be associated with USACE and/or ADEM permitting and mitigation requirements.

SEAWALLS (RESOLUTION NO. 10052021)

On April 5, 2022, the Town passed a temporary moratorium on the issuance of certain building permits for construction and/or repair of seawalls, retaining walls and similar structures along the south side of the island. This was a six-month moratorium that was extended by the Town Council pending adoption of a new ordinance. The following structures are included in this resolution: seawalls, retaining walls, and other similar structures or other means of deflecting wave energy such as riprap. Other types of construction repairs properly permitted are excluded from this resolution. The Town held a public hearing on October 17, 2022, to receive comments on the proposed Ordinance 106.

DUNES (ORDINANCE NO. 66A)

This ordinance relates to the protective berms on the western portion of the Town of Dauphin Island and a small portion on the north side of the Island near Silver Cay. The purpose of this ordinance is to prohibit pedestrian and vehicular use on the sand berms to enable the berms to further stabilize and serve their intended purpose. Pedestrian access to the beach areas is through the designated areas along the walkways that cross over the dunes.

As part of the revised Zoning Ordinance, the Town has created a Dune Protection Overlay District and BMPs are required for construction in the Dune Protection Overlay District. This overlay zoning district requires specific regulations and policies that permit reasonable use and repair of the dune systems or resources, consistent with sound sand dune conservation practices. The overlay requirements address dune protection and management techniques that are both beneficial and effective in protecting the Island's dune system while also allowing property owners the opportunity to use, develop, and maintain their land as they intend.

TREES (ORDINANCE NO. 87B)

The purpose of this ordinance is to preserve, protect, replace, and properly maintain trees and vegetation with the Town. It was last updated on August 21, 2019.

Regulations Pertaining to Living Shoreline Projects

State-owned submerged lands include all of the water bottoms waterward of the average high tide line, referred to as "mean high tide." Any activities within these lands, such as projects proposing to implement living shoreline techniques, must be performed per Alabama Administrative Code r. (Ala. Code Section) 220-4-.09, Placement and Configuration of Piers and Other Improvements on State Submerged Lands. These regulations define what is permissible waterward of a private property line (i.e., State-owned water bottoms). Because of the fluctuation of the mean high tide overtime, these projects will require verification of the mean high tide line before conducting any activity. The code specifies that:

1. to the maximum extent possible, shoreline stabilization should be accomplished by the establishment of appropriate native wetland vegetation. Riprap materials, pervious interlocking brick systems, filter mats, wave attenuation units and other similar stabilization methods should be utilized in lieu of vertical seawalls wherever feasible, and
2. shoreline restoration, including the use of “living shoreline” techniques for shoreline stabilization, may be permitted upon such terms and conditions as the Commissioner acting through the State Lands Division may require. Such techniques may include, but are not limited to, the planting of native vegetation, the placement of wave attenuation structures, the placement of fill materials, and/or other techniques. Fill material placed and/or sediments accredited below the ordinary low water line of non-tidal streams or the mean high tide line of tidal water through the implantation of shoreline restoration shall not be construed as reclamation nor cause a change in the title to State-owned submerged lands.

The regulations of this code have been summarized for use in a publication created by MBNEP with grant funding obtained from National Oceanic and Atmospheric Administration. This publication, “Living Shorelines, A Guide for Alabama Property Owners” (Herder et al. 2014), explains the following:

- State-Owned Submerged Lands
  - In Alabama, the mean high tide line is the boundary between State-owned submerged lands and upland private properties along tidal waters.
  - “All the beds and bottoms of the rivers, bayous, lagoons, lakes, bays, sounds and inlets within the jurisdiction of the State of Alabama are the property of the State of Alabama to be held in trust for the people thereof.” (Ala. Code Section 9- 12-22).
  - Any installed structures must maintain at least a ten-foot (10’) setback from adjacent properties.
  - Any structures installed must be designed and placed in a manner that will not unreasonably restrict or infringe upon the riparian rights of adjacent upland riparian owners.
  - Structures oriented perpendicularly to the shoreline are seldom permitted by regulatory agencies, since they usually disrupt sediment transport along the shore and impact downdrift shorelines negatively.

- Riparian Rights
  - Although waterfront property owners do not own the submerged lands waterward of their properties, they do retain special riparian rights to that tidal area.
  - In Alabama, riparian rights include the right to build a pier or dock over State lands, harvest oysters, and access the water.
  - The legal boundary between a privately-owned upland property and the State-owned submerged bottom generally shifts with natural changes in the shoreline, so they are called “ambulatory” boundaries.
  - There are some technical words or terms that must be understood in order to discuss changes in shoreline property lines in more detail, including some instances in which property lines may become “fixed.”
- Ambulatory Property Lines
  - The legal boundary between a privately owned upland property and the State-owned submerged bottom generally shifts with natural changes in the shoreline, so they are called “ambulatory” boundaries.
  - There are some technical words or terms that must be understood in order to discuss changes in shoreline property lines in more detail, including some instances in which property lines may become “fixed.”

9.2 Regulatory Framework

9.2.1 REGULATORY OVERLAP

Federal, State, and local requirements overlap within the Watershed. The over-arching Federal and State water quality regulations apply to all areas of the county and within the Town of Dauphin Island. Any proposal to fill jurisdictional wetlands, located within the Dauphin Island Watershed, must have:

- A proper permit application for a CWA Section 404 permit with review by all agencies and the public (unless authorized by an NWP);
- Appropriate ADEM Section 401 water quality certification;
- Consideration of CWA Section 303(d) impacts (for listed stream segments);
- ADEM coastal program consistency determination if in the coastal area;
- A CWA Section 402 NPDES – ADEM Admin. Code Reg. 335-6-12 construction stormwater permit (if greater than 1 acre will be disturbed).
- City and/or County land disturbance permits;

- City and/or County development permits and plat approvals; and
- City and/or County building permits.

The overlap between Federal, State, and local requirements is unavoidable; nevertheless, the degree of overlap has been lessened by EPA delegating certain programmatic or regulatory authority to ADEM, and ADEM delegating certain coastal program requirements to the local authorities. The Town of Dauphin Island exerts their jurisdiction and permitting requirements within their respective geographical boundaries. In addition to the Federal and State permit requirements, each local entity requires permits for development, land disturbance, and building construction, depending on the jurisdiction. Often the Federal or State permit is a prerequisite to the issuance of the local permit. Where City and County jurisdictions overlap, it is customary for the more stringent requirements to apply. In general, the current level of regulatory overlap is not considered a significant issue relative to stormwater management within the Watershed.

A regulatory "matrix" based on several elements deemed critical to effective stormwater management programs was created to assist in the review process. The matrix is contained in **Table 9-7**.

TABLE 9-7 Regulatory Matrix of the Dauphin Island Watershed Complex

	Regulatory Agency		
Regulation Application	**ADEM**	**Mobile County**	**Dauphin Island**
Construction Phase Stormwater Management	Yes	No[6]	No
Design Standards	AL Handbook*[1]	N/A	N/A
Design Storm Event	2yr-24 hour[1]	N/A	N/A
Site Size	> 1 acre[2]	N/A	N/A
Stabilization Times	13 days[1]	N/A	N/A
Inspection Requirements	1/month or 3/4-inch rain[1]	N/A	N/A
BMP Maintenance/Repair Times	5 days[1]	N/A	N/A
Non-Compliance Reporting	Yes[3]	N/A	N/A
Turbidity Monitoring	No	N/A	N/A
Buffer Requirement	Yes - 25 feet[1]	N/A	N/A
Litter/Trash/Recycling	Yes[10]	N/A	Yes[11]
Post-Construction Stormwater Management	No	In Special Watersheds	Yes
Stormwater Quality	N/A	No	no
Stormwater Quantity	N/A	Yes	Yes

TABLE 9-7 Regulatory Matrix of the Dauphin Island Watershed Complex

	Regulatory Agency		
Regulation Application	**ADEM**	**Mobile County**	**Dauphin Island**
Design Storm	N/A	10 year/50 year[6,7]	10 year/50 year
Site Size	N/A	Any	Not Specified
Inspection Requirements	N/A	No	No
Maintenance	N/A	Designated[6]	Not Specified
Reporting	N/A	5 years (or ownership change)	No
Calculation Method	N/A	Not Specified	Not Specified
WOTUS Protection	Yes	Yes	Yes[9]
Permit Requirement	In coastal areas[4]	ADEM/USACE	ADEM/USACE/DI
Setback Requirement	No	No	No
Buffer Requirement	No	Yes, variable[6,8]	No
Coastal Area Resource Protection	Yes[4]	No	Yes

NOTES: ADEM = Alabama Department of Environmental Management; BMP = best management practice; DI = Dauphin Island; NDPES = National Pollutant Discharge Elimination System; USACE = U.S. Army Corps of Engineers; WOTUS = waters of the U.S.

1 ADEM NPDES General Permit ALR100000, Part III

2 ADEM NPDES General Permit ALR100000, Part I

3 ADEM NPDES General Permit ALR100000, Part IV

4 ADEM Admin. Code Reg. 335-8 (Coastal Area Management Program)

5 Mobile Co. Stormwater Management Program Plan provides that the Mobile Co. Commission has no authority to inspect and enforce the implementation of erosion and sediment controls.

6 Mobile Co. Subdivision Regulations, Section 8

7 Maximum release rate equivalent to the 10-year pre-development rate/detention capacity to accommodate volume from a 50-year post development storm.

8 Buffer Zone is within 100 feet of public drinking water source; within 50 feet of perennial streams and their associated wetlands, and within 25 feet of natural drainage features and their associated wetlands. Only applies to Section 8 of the Mobile Co. Subdivision Regulations.

9 Town of Dauphin Island Ordinance Number 85A protects environmentally sensitive aeras including WOTUS.

10 Low Impact Development Handbook for the State of Alabama – Maintenance schedules require the removal of trash and debris as part of maintenance activities.

11 The Town of Dauphin Island Ordinance Number 20C prohibits littering and establishes protocols for trash collection,

The rows in the table list the following review elements considered:

- Construction phase BMPs
- Post-construction stormwater management
- Wetland protection
- Coastal area protection

The columns in **Table 9-7** summarize the results of the review of the regulations or ordinances for each of the four regulatory entities having jurisdiction within the Dauphin Island Watershed. There is some degree of consistency among the various programs concerning the elements that are addressed (e.g., all programs require some type of construction phase BMPs, address stabilization time). However, there are significant differences between each regulatory entity's specific requirements, as stated in the regulations or ordinances (e.g., design storm). These differences and any perceived deficiencies are addressed in the following sections.

9.2.2 REGULATORY GAPS

Often the Federal or State regulatory requirements serve to provide a measure of consistency or provide some minimum baseline for local regulation, and often local units of government rely on or defer to the State or Federal requirements. Without this foundation, it is difficult to achieve regulatory consistency among local units of government. Even when State and Federal regulations are in place, they usually have such a broad nature and scope (national or statewide) that they may not be meaningful at a watershed specific level. In such cases, it falls to the local units of government to adopt and implement regulations that are effective in achieving specific watershed management goals.

Currently, except for compliance with FEMA, there are no overarching Federal or State regulatory requirements for post-construction stormwater quantity or quality. Regulatory gaps can also be due to antiquated regulations. At the State level, the coastal area management program regulations relating to resource impacts (ADEM Administrative Code R. 335-8-2) have not been revised in over 20 years. ADEM and ADCNR struggle to maintain a federally approved coastal management program, due in part to the lack of a regulatory framework that will allow the State to ensure the Federal goals can be met. Significant advancements in resource protection alternatives have been realized during the intervening years, some of which may be precluded by outdated regulations. Because Federal and State regulatory requirements are so broad in nature and scope, developing and implementing local stormwater management regulations and ordinances are often the best or only way to achieve watershed resource protection goals and/or address local stormwater-related impacts.

Local ordinances were reviewed for the Dauphin Island Watershed and it was revealed that there is no overlap with the other ordinances or statues that have been issued by the Town of Dauphin Island. The recently revised wetland ordinance corrects a gap in wetland resource management on the island. Previously, there was no mechanism for ADEM to be involved in regulating wetland impacts by residential construction, if the wetlands were not part of the tidal marsh fringe that is offsite wetlands or WOTUS. The revised ordinance requires that all lots flagged by the Town as likely to contain wetlands must be evaluated by a wetland professional; any wetlands on the parcel must be delineated and proposed impacts must be permitted by USACE and ADEM prior to issuance of a building permit by the Town. Because of this gap closure, no construction will be allowed in flagged lots before a Section 404 permit has been obtained. There still remains a potential gap in recognition of parcels that have not been flagged but that do actually have wetlands somewhere on the parcel. The potential level of risk to wetland resources is small; 941 undeveloped Island parcels have now been flagged as having or likely to have wetlands and there are relatively few parcels that contain unrecognized wetlands.

9.2.3 REGULATORY INCONSISTENCIES

Regulatory inconsistencies between Federal, State, and local units of government are inevitable and can contribute to ineffective watershed management, serve as impediments to restoration efforts, and cause confusion in the regulated community. Consistency among the local government ordinances will be a key factor in effectively implementing the management measures necessary to protect the Watershed's natural resources. Development entities often gravitate to or seek incorporation into jurisdictions with less regulation. The long-term costs of this approach to the broader community and its citizens will be realized as flooding increases and water quality decreases. Additional costs due to poor flood zone management include the following:

- Flood zones expand, which increases insurance rates
- Waterbodies become polluted, which prompts additional regulatory oversight, expensive restoration projects, decreased land value with decreased tax income, and increased stormwater treatment costs
- Stormwater conveyance, maintenance, and dredging costs manifest and increase.

Examples of regulatory inconsistencies are discussed in detail in the South Alabama Stormwater Regulatory Review (Carlton 2018).

9.2.4 REGULATORY DEFICIENCIES

The following insufficiencies regarding regulatory review, oversight, and enforcement within the Dauphin Island Watershed have been noted:

- There are currently no Federal or State post-construction stormwater management requirements, which leaves these regulations to fall under local government jurisdiction. A further review of the ordinances set forth by the Town of Dauphin Island has revealed that no post-construction stormwater control regulations are in place.

- Inconsistencies were identified for the Construction Phase of Stormwater Management as depicted on **Table 9-7**. Site size, stabilization times, inspection requirements, BMP maintenance and repair times, and buffer requirements are regulated at the State level but are not enforced in the county and local levels.
- The Town of Dauphin Island just released an ordinance that requires properties within the Town's limits to seek wetland permitting if wetlands are present on their property. The inconsistency lies in the fact that enforcement of setback and buffer requirements are enforced on the Federal level and not on the State or local level. The current ordinance mentions nothing about buffers or setbacks.

Regulatory inconsistencies between Federal, State, and local units of government are inevitable and can contribute to ineffective watershed management, serve as impediments to restoration efforts, and cause confusion in the regulated community. The Town of Dauphin Island has been working to close some of the regulatory deficiencies with respect to wetlands within their community and have even passed ordinances to limit the utilization of red clay as a fill material on the island. However, until local regulation occurs for construction phase stormwater management and post-construction stormwater management, issues may continue to arise from stormwater runoff due to construction activities on the island.

9.3 Enforcement

All of the Dauphin Island Watershed falls within Mobile County. Because the Town of Dauphin Island is its own entity, local regulations on the Island are enforced through ordinances. This provides additional support to the Federal and State agencies with enforcement rights heling identify water quality concerns within the Dauphin Island Watershed in a timely manner.

9.4 Recommendations

There has been some confusing regarding the updated Dune Protection Overlay District map related to dunes because the expanded District includes many residential areas on the north side of Bienville Boulevard, west of the school. Dunes are not located in that area, except for accumulations of sand removed from the road—mostly it is sand flat. It is suggested that the Town of Dauphin Island should clarify how the Dune Protection Overlay District boundaries are being set.

The purpose of post-construction stormwater management is to ensure that the original design, placement and implementation of the original stormwater retention and treatment safeguards maintain their purpose to effectively prevent non-stormwater discharges from entering environmentally sensitive areas after construction has been completed. There is a lack of post construction stormwater management in the State of Alabama, as such, numerous projects that have had to utilize proper BMPs to maintain compliance fail to do so after construction. Failure of poorly designed detention ponds, riparian buffers, and Low Impact Developments can cause more sedimentation and flooding issues in environmentally sensitive areas if not inspected and maintained after construction activities have ceased. This, in essence, can cause long term issues. Therefore, it is suggested that the Town of Dauphin Island should implement some way to create and enforce a post-construction stormwater management plan to reduce or even eliminate some of these residual issues that arise from poorly designed BMPs.

Setbacks and riparian buffers are areas of vegetation that border a body of water or other environmentally sensitive areas and help prevent sedimentation from entering these aeras thus improving water quality. By trapping and removing sediment and contaminants from stormwater, these buffers can improve water quality, wildlife, and property values. In order for these buffers to become effective, it is best to pair with other BMP means such as grassed filter strips. The *LID Handbook for the State of Alabama* suggests that these buffers work best with a shallow water table and poorly drained soils, which are both present on Dauphin Island.

Buffers are only required by ADEM during construction activities whereas Mobile County requires buffers to protect WOTUS. Since vegetative buffers play an integral part in protecting wetlands and other environmentally sensitive areas, it is suggested that the Town of Dauphin Island use permanent riparian buffers, whenever possible. These buffers would provide a way to protect the environmentally sensitive areas from sedimentation and pollutants carried in stormwater on the island as well providing more greenspace, which will help with flooding and erosion.

CHAPTER 10 Financing Alternatives

Introduction

Significant and reliable funding will be necessary to execute the management measures proposed within this watershed management plan (WMP). Implementation of this Plan will require stakeholder and community support through coordination and a variety of financial resources. We encourage a combination of securing federal, state, and local funding, and creating public-private partnerships. Such partnerships are recommended because government jurisdiction will not necessarily be confined to the Dauphin Island Watershed boundary, and partnerships can better facilitate the available resources. Examples of partnerships include arrangements between landowners and governments, or collaboration between civic groups and government. Together, public and private entities can explore financial assistance opportunities such as grants and cooperative agreements. Funding across an entire watershed is a challenging endeavor, and some financing alternatives are better suited for targeted areas. By leveraging multiple funding opportunities amid organized partnerships, the success of the WMP implementation can be maximized. Potential teaming partners are listed as follows:

- Alabama Audubon
- Alabama Coastal Foundation
- Alabama Department of Conservation and Natural Resources
- Alabama Department of Economic and Community Affairs
- Alabama Department of Environmental Management
- Alabama Department of Public Health
- Alabama Department of Transportation
- Alabama Power Company
- Alabama Water Watch
- Alabama Wildlife Federation
- Auburn University Marine Extension and Research Center
- Coastal Conservation Association
- Dauphin Island Bird Sanctuary
- Dauphin Island Sea Lab
- Geological Survey of Alabama
- Gulf Coast Ecosystem Restoration Council
- Mississippi-Alabama Sea Grant Consortium
- Mobile Bay National Estuary Program
- Mobile Baykeeper
- Mobile County Commission
- Mobile County Conservation District
- Mobile County Health Department
- Mobile County Public Schools
- Mobile County-Alabama Cooperative Extension
- National Fish and Wildlife Foundation
- Pelican Coast Conservancy
- South Alabama Land Trust
- Southeast Aquatic Resources Partnership
- The Nature Conservancy
- Town of Dauphin Island
- University of South Alabama
- U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Geological Survey
- U.S. Department of Agriculture – Forest Service
- U.S. Department of Agriculture – Natural Resource Conservation Service

Financial structures and sources that could provide funding for the management measures and projects identified in this WMP are discussed below. Some financial structures could be helpful across the entire Watershed and some within limited areas. Many would require public-private partnerships and cooperation among landowners, organizations, and governments, rather than imposition by governmental entities.

10.1 Financial Strategies

Multiple funding sources are available to execute this WMP. The following sections detail these sources and the opportunities available for each source.

10.1.1 FEDERAL FUNDING PROGRAMS

Federal funding opportunities, such as grants, revenue sharing, and loans, can be pursued through the U.S. Environmental Protection Agency, National Oceanic and Atmospheric Administration, U.S. Fish and Wildlife Service, U.S. Geological Survey, U.S. Army Corps of Engineers, and the U.S. Department of Agriculture. These funding opportunities can be used by public and private entities to execute the measures proposed in the WMP. Funding opportunities can be located and applied for through the federal portal at Grants.gov.

Some of the most viable funding sources for the Watershed include the Resources and Ecosystems Sustainability, Tourist Opportunities and Revived Economies (RESTORE) Act, National Fish and Wildlife Foundation's (NFWF's) Gulf Environmental Benefit Fund, and the Gulf of Mexico Energy Security Act (GOMESA).

The RESTORE Act was signed into law in 2012 in direct response to the Deepwater Horizon oil spill of 2010. The RESTORE Act established the Gulf Coast Restoration Trust Fund in the U.S. Treasury Department and designated that 80% of all administrative and civil penalties in connection with the oil spill be deposited in the Trust Fund and invested. The Gulf Coast Ecosystem Restoration Council has oversight of 60% of the Trust Fund, with 30% designated for developing a comprehensive recovery plan and the other 30% allocated to the states under the Spill Impact Component and spent according to the state's individual State Expenditure Plan. A total of 35% of the Trust Fund was evenly split among the five Gulf states for economic and ecological recovery. The National Oceanic and Atmospheric Administration Science Component was awarded 2.5% of the Trust Fund, which they dedicated to the Gulf Coast Ecosystem Restoration Science, Observation, Monitoring, and Technology Program, and the Center of Excellence for use in the Research Grants Program was awarded the remaining 2.5% of the funds. The Alabama Gulf Coast Recovery Council governs direct funding to Alabama. Projects and programs that propose restoration and protection of Gulf Coast natural resources, ecosystems, and habitats may be eligible for funding (U.S. Treasury Department 2020).

NFWF was created by Congress in 1984 and is the nation's largest private conservation grant-maker (NFWF 2002). They work to coordinate individuals, government agencies, nonprofit organizations, and corporations with the intent of sustaining and enhancing the nation's natural resources. Specifically, the NFWF prioritizes protecting and restoring imperiled species, promoting healthy oceans and estuaries, improving working landscapes for wildlife, advancing sustainable fisheries, and conserving water for wildlife and people. NFWF provides competitive funding to projects that support their initiatives. Each initiative has a business plan that projects should align with, and many actions proposed within the Dauphin Island WMP are well suited for a NFWF grant. The NFWF Gulf Environmental Benefit Fund was established as a result of the Deepwater Horizon Oil Spill and supports state and local organizations that are committed to conserving, restoring, and enhancing coastal habitats. Similar to the Natural Resource Damage Assessment process, the Gulf Environmental Benefit Fund was established under a different legal framework and supports projects that complement ongoing Natural Resource Damage Assessment work. The NFWF Five Star Urban Waters Restoration Grant Program is well suited for Dauphin Island because it focuses on water quality issues in priority watersheds, including pollution from stormwater runoff and degraded shorelines caused by development. Additional grant opportunities include the Conservation Partners Program and the National Wildlife Refuge Friends Program.

GOMESA was signed into law in 2006 to enhance outer continental shelf oil and gas leasing activities and revenue sharing in the Gulf of Mexico. GOMESA bans oil and gas leasing within 125 miles of the Florida coastline in the Eastern Planning Area (and a portion of the Central Planning Area) until 2022 and allows for existing leases to be exchanged for bonuses and credits to be used on other leases in the Gulf. Funding for projects is generated through revenue sharing with Gulf states and the Land and Water Conservation Fund. Revenue sharing provisions were extended to Alabama, Louisiana, Mississippi, and Texas. Funds are specified for use in coastal conservation, coastal restoration, and hurricane protection. For Alabama, money is dispersed to the State, Baldwin County, and Mobile County. The pursuit of such funds is recommended for Dauphin Island WMP project implementation.

The EPA announced a $3.75 million grant to support local projects to protect and sustain healthy watersheds (https://www.epa.gov/hwp/healthy-watersheds-consortium-grants-hwcg). EPA has made an official award to the U.S. Endowment for Forestry and Communities, Inc. (Endowment) to support the coordinated efforts of the Endowment and its partner organizations. The Healthy Watersheds Consortium Grant Program goal is to accelerate strategic protection of healthy, freshwater ecosystems and their watersheds (http://www.usendowment.org/partnerships/healthywatershedsconsor.html). The EPA also supports the Five-Star Restoration Program by providing funds to NFWF, the National Association of Counties, National Oceanic and Atmospheric Administration's Community-based Restoration Program, and the Wildlife Habitat Council. These groups are then able to make subgrants to support community-based wetland and riparian restoration projects. Competitive projects must have a strong on-the-ground habitat restoration component with long-term ecological, educational, and/or socioeconomic benefits to the people and their community. Preference is given to projects that are part of a larger watershed or community stewardship effort and include a description of long-term management activities. "Projects must involve contributions from multiple and diverse partners, including citizen volunteer organizations, corporations, private landowners, local conservation organizations, youth groups, charitable foundations, and other federal, state, and tribal agencies and local governments" (Private Landowner Network 2015). It is desirable that each project involve at least five partners who are expected to contribute funding, land, technical assistance, workforce support, or other in-kind services that are equivalent to the federal contribution.

10.1.2 STORMWATER PROGRAMS

The EPA provides numerous resources to support funding procurement for stormwater projects. Their Water Finance Clearing House and Water Infrastructure and Resilience Finance Center serve as a database and assistance center, respectively, to locate funding opportunities and support local decision-makers regarding stormwater infrastructure. Additionally, the Clean Water State Revolving Fund provides low-cost financing for a variety of water quality infrastructure projects. Beyond the traditional acquisition of funding, the EPA also recommends that communities explore establishing a stormwater utility. A stormwater utility operates similarly to a water or electric utility and collects fees associated with the controlling and treating stormwater (EPA 2009). A stormwater utility within the Watershed would provide stable, long-term support of stormwater management through equitable and transparent funding. Fees may be based on the parcel size, property type, and/or the degree of impervious area, or fees may be fixed in a specific geographic area. For example, lots within a residential development may be subject to predetermined stormwater user fees, which are not a function of the lot characteristics. Property owners could also earn credits or be subject to surcharges as a function of stewardship. Individuals who implement on-site attenuation or related Low Impact Development measures could experience reduced fees. In contrast, those that increase industrial activity or modify the land use in a way that negatively impacts stormwater management could see an increase in fees. Additionally, certain roadways, rights-of-way, or undeveloped areas may be exempt from fees. The utility fee generally appears as an individual bill, as a line item on a water and/or sewer bill, or as a component of property tax bills. This revenue source would support the stormwater utility with planning and executing programs that address stormwater issues identified within the Dauphin Island Watershed. Citizens might not be educated or knowledgeable regarding issues related to local water quality and stormwater management. As such, it can be expected that they would likely approach the development of a stormwater utility with skepticism or distrust. Extensive education and outreach would be needed to support the successful implementation of a stormwater utility. Local programs such as

"Create a Clean Water Future" (https://www.cleanwaterfuture.com/) can help provide educational resources.

10.1.3 STATE FUNDING PROGRAMS

The Alabama Coastal Area Management Program (ACAMP) was approved by the National Oceanic and Atmospheric Administration in 1979 as part of the National Coastal Zone Management Program. Its purpose is to balance economic growth with the need for preservation of Alabama's coastal resources for future generations. Annual program activities include coastal cleanup, implementation of public access construction projects, planning support for local governments, and providing funds to Alabama's coastal communities and partners. ACAMP's annual grant program supports projects that protect, enhance, and improve the management of natural, cultural, and historical coastal resources and that increase the sustainability, resilience, and preparedness of coastal communities and economies. Therefore, ACAMP should be considered as a top financial resource on the state level. The Clean Water State Revolving Fund (CWSRF) is another program that should be considered for stormwater/nonpoint source projects. The CWSRF is a loan assistance authority for water quality improvement projects. For example, the Town might consider financing a stormwater improvement plan for the East End of the Island by using an SRF loan.

10.1.4 STATE REVOLVING FUNDS

The EPA State Revolving Fund (SRF) loan program offers a reliable source of funding (Berahzer 2010). There are separate SRF programs for "Clean Water" and "Drinking Water". Funds are provided annually to each state by the federal government with the states providing a 20% matching amount. To receive funding, a project must be on the state's annual "Intended Use Plan" (IUP) list. The IUP contains a "comprehensive" list and a shorter "fundable" or "priority" list. A public comment process is required for the IUP. Since 2007, the SRF has moved beyond the traditional "water treatment works" projects and has begun to emphasize nonpoint sources and estuary protection as funding priorities. Projects that strengthen compliance with federal and state regulations and enhance protection of public health are eligible for consideration to receive SRF loans. There are also benefits to obtaining such funding. The engineering, inspection, and construction costs are eligible for reimbursement if a project qualifies.

10.1.5 LOCAL GOVERNMENT

The Town of Dauphin Island and Mobile County are the coordinating municipalities within the Dauphin Island Watershed and have an established relationship that will only help to further the goals of this Plan and funding strategies.

Property, Sales, or Other Taxes (General Fund)

The use of public "general funds" to finance projects is considered undesirable because no dedicated source of continuing and consistent funding would be created. This limits the success of funding WMPs as these programs would have to compete with maintenance and construction projects for funding. Environmental projects are often considered less essential than priorities such as police, fire, and emergency medical personnel. Environmental projects are also vulnerable to budget cuts (Spitzer 2010). It is important for the Town of Dauphin Island to set aside funds specifically for environmental projects identified in **Chapters 7** and **8**.

Impact Fees

Impact fees are paid by developers (usually at the time of development) to obtain a building permit. The fee is designed to reimburse the government for the additional impact a development may have on the community. They may be for transportation (i.e., increased impact on roads and bridges as a result of constructing a development), water and sewer (i.e., the impact on the system capacity as a result of increased volume and demand), as well as other public infrastructure impacts. Typically, a direct relationship between the development and the impact fee must exist. These fees must often be authorized by statute and are used for capital improvements, not for maintenance. They are a one-time, up-front charge for new construction (Mustian 2010). New sub-developments are not excessively being built on the Island; however, there are still new home being built that could provide a small revenue. Also, when the Aloe Bay waterfront development is built there will be potential for impact fees to be collected.

10.2 Business and Industry

The business and industry community on Dauphin Island is small compared to the other parts of the Alabama coast; however, it does have active retail, wholesale, industrial operations, technology, utilities, maritime industries, and residential and commercial development. Every one of these commercial interests has an economic stake in the health of the Island and will directly benefit from its recovery or suffer from its decline. Healthy, productive watersheds can reduce water treatment and mitigation costs, support recreation and tourism, increase property values and job opportunities, and generate revenue, which is to the direct benefit of commercial development and production (EPA 2018). The Dauphin Island Chamber of Commerce has an established record of facilitating business partnerships that support sustainable growth and development on the Island. As such, it is recommended that coordination continue to take place with the Chamber to leverage the organization's leadership capacity and existing partnerships to execute the goals of the WMP.

10.3 "Green" Stimulus Funding Under the 2009 American Recovery and Reinvestment Act

The EPA introduced, as a part of its SRF Loan Program, a Green Project Reserve, and maintained this funding mechanism in FY 2010. The Green Project Reserve stipulates that at least 20% of the SRF funds shall be used by the states for projects that address green infrastructure, water or energy improvements, or other environmentally innovative activities (Berahzer 2010). In general, the combination of the Green Project Reserve and the additional subsidization could lead to better financing terms for stormwater projects. Many stormwater projects and Low Impact Development strategies may be considered "green" under this funding category. Examples include porous pavement, bioretention facilities, rain gardens, green roofs/walls/streets, wetlands restoration, constructed wetlands, urban retrofit programs, infiltration basins, landscaped swales, downspout disconnection, and tree planting. Land acquisition services and the actual cost for the purchase of land or easements may also be included in the scope of this definition.

10.4 Non-Governmental Organizations and Other Private Funding

Funding opportunities available from private foundations and corporations are identified as non-governmental organizations and other private entities. These programs are included here because of their inclusion in the EPA Clearinghouse of funding opportunities for environmental reclamation and are applicable to ongoing efforts in the WSW Complex.

Table 10-1 presents an overview of financial resources that could support implementing the recommendations included in the WMP. Funding categories are represented as one of the following:

- financial assistance
- technical assistance
- quality monitoring
- information and education

10.5 Regional Collaboration Opportunities

There are regional collaboration opportunities applicable to watershed projects. The EPA Region 4 sponsors four: the Green Infrastructure Partnership, Smart Growth Implementation Assistance, and Watershed Protection and Restoration Assistance collaboration opportunities; the fourth collaborative opportunity is through the Gulf of Mexico Alliance (GOMA), which is a partnership of the states of Alabama, Florida, Louisiana, Mississippi, and Texas.

Green Infrastructure Partnership

The primary goal of the Green Infrastructure Partnership is to reduce runoff volumes and sewer overflow events through the widespread use of green infrastructure management practices that help maintain natural hydrologic functions by absorbing and infiltrating precipitation where it falls. The EPA lists funding opportunities for this program at: https://www.epa.gov/green-infrastructure/green-infrastructure-funding-opportunities.

Smart Growth Implementation Assistance

The Smart Growth Implementation Assistance program is an annual, competitive solicitation open to state, local, regional, and tribal governments (and non-profit organizations that have partnered with a governmental entity) to incorporate smart growth techniques into their future developments. Program opportunities are listed at: https://www.epa.gov/smartgrowth/epa-smart-growth-grants-and-other-funding.

Watershed Protection and Restoration Assistance

Through the Watershed Protection and Restoration Assistance partnership, the staff of EPA Region 4 works with state and local governments and watershed organizations to facilitate protection and restoration efforts in targeted watersheds. Funding opportunities for this program are listed at: https://www.epa.gov/nps/funding-resources-watershed-protection-and-restoration.

Gulf of Mexico Alliance

The goal of GOMA is to significantly increase regional collaboration to enhance the ecological and economic health of the Gulf of Mexico. Priority issues for this group include water quality, habitat conservation and restoration, ecosystem integration and assessment, nutrients and nutrient impacts, coastal community resilience, and environmental education. GOMA lists funding opportunities at the following website: https://gulfofmexicoalliance.org/announcements/funding/.

10.6 Summary

Table 10-1 provides an overview of potential financial resources that could support the implementation of the measures proposed in the Dauphin Island WMP. The table addresses the type of funding as well as the form of aid provided. Almost all sources provide financial assistance, and some provide technical assistance as well. Examples of technical assistance include sharing information, sharing data, consulting, training, assisting with management measures, and engaging in project partnerships. These funding opportunities are presented as guidance, and consideration should be given to the reality that the financial section of the economy is continuously evolving. Flexibility will be necessary if existing funds cease or a new funding source becomes available. We recommend establishing an authority in addition to public-private partnerships. Such measures could support the acquisition of additional funding, provide a centralized framework, and ultimately enhance the viability of the Dauphin Island WMP.

TABLE 10-1 Funding Available to Support Plan Implementation

Funding Source	Description	Type	Actions Funded
Alabama Coastal Area Management Program	Annual Grant Program	State	Financial assistance, water, quality monitoring
Alabama Department of Environmental Management	Section 319 Grant Funds	State	Financial assistance, water, quality monitoring
	Clean Water SRF		
Department of the Interior	Land and Water Conservation Fund	Federal	Financial assistance
Gulf Coast Ecosystem Restoration Council	Council-Selected Restoration Component of the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act (RESTORE)	Federal	Financial assistance
National Oceanic and Atmospheric Administration	Marine Debris Removal	Federal	Financial assistance
	Marine Debris Prevention, Education and Outreach Partnership Grant	Federal	Financial assistance, information, and education
	Gulf of Mexico Bay-Watershed Education and Training (B-WET) Program	Federal	Financial assistance, information, and education
	Restore Act Science Program	Federal	Financial assistance
	Broad Agency Announcement	Federal	Financial assistance, information, and education
	Environmental Literacy Grants	Federal	Financial assistance, information, and education
	Community-based Restoration Program	Federal	Financial assistance, technical assistance
National Park Service	National Maritime Heritage Grant	Federal	Financial assistance, information, and education
National Science Foundation	Environmental Engineering R&D Grant	Federal	Technical assistance, water quality monitoring

TABLE 10-1 Funding Available to Support Plan Implementation

Funding Source	Description	Type	Actions Funded
Southeast Aquatic Resources Partnership	Aquatic Habitat Restoration Program	Federal	Financial assistance
U.S. Department of Agriculture, Natural Resource Conservation Service	Environmental Quality Incentives Program	Federal	Financial assistance, technical assistance, water quality monitoring
	Conservation Innovation Grants	Federal	Financial assistance, technical assistance
	Conservation Stewardship Program	Federal	Financial assistance, technical assistance
	Agricultural Conservation Easement Program	Federal	Financial assistance, technical assistance
U.S. Environmental Protection Agency	106 Grant Funds (Water Pollution Control)	Federal	Financial assistance, water quality monitoring
	National Wetland Program Development Grants	Federal	Financial assistance, technical assistance, water quality monitoring
	Clean Water State Revolving Funds	Federal	Financial assistance, technical assistance
	Urban Waters Small Grants	Federal	Technical assistance, water quality monitoring
	Gulf of Mexico Division	Federal	Financial assistance, technical assistance
	Environmental Education Grants Program	Federal	Financial assistance
U.S. Geological Survey	State Water Research Act Program	Federal	Financial assistance, technical assistance
	Cooperative Matching Funds Program	Federal	Financial Assistance
U.S. Fish and Wildlife Service	Partners for Fish and Wildlife	Federal	Financial assistance, technical assistance
	Coastal Program	Federal	Financial assistance, technical assistance
	National Coastal Wetlands Conservation Grant	Federal	Financial assistance
	State Wildlife Grants Program	Federal	Financial assistance
	Urban Wildlife Refuge Partnership	Federal	Financial assistance, information, and education
	National Fish Habitat Action Plan	Federal	Technical assistance, financial assistance
Alabama Department of Conservation and Natural Resources	Alabama Coastal Area Management Program	Federal	Technical assistance, financial assistance

TABLE 10-1 Funding Available to Support Plan Implementation

Funding Source	Description	Type	Actions Funded
United States Endowment for Forestry and Communities, Inc.	Healthy Watersheds Consortium Grant Program	Private-public partnership	Financial assistance, technical assistance, water quality monitoring
Gulf of Mexico Alliance	Gulf Star Grants Program	Private-public partnership	Information and education, financial assistance, water quality monitoring
Cornell Douglas Foundation Grants	Cornell Douglas Foundation Grants	Private	Information and education, financial assistance
The Home Depot	Community Impact Grants Program	Private	Financial assistance
Gulf Research Program	Gulf Sea Level Variation and Rise Grants	Private	Financial assistance
	Thriving Communities Grants	Private	Financial assistance
National Education Association Foundation	Captain Planet Foundation Grants	Private	Financial assistance, information, and education
National Environmental Education Foundation	Everyday Capacity Building Grants	Private	Financial assistance, information, and education
National Endowment for the Humanities	Landmarks of American History and Culture	Federal	Financial assistance, information, and education
	Infrastructure and Capacity Building Challenge Grants	Federal	Financial assistance
National Fish and Wildlife Foundation	Conservation Partners Program	Private	Technical assistance, information, and education
	Gulf Environmental Benefit Fund	Private	Financial assistance
	National Wildlife Refuge Friends Program	Private	Financial assistance, information, and education
	Five Star & Urban Waters Restoration Program	Private	Financial assistance, information, and education; water quality monitoring
	Gulf Coast Conservation Grant Program	Private	Financial assistance

CHAPTER 11 Monitoring

Introduction

Monitoring can be divided into two basic categories: administrative and environmental. Administrative monitoring consists of tracking program accomplishments, the degree to which management measures are implemented (e.g., number of acres preserved), and other programmatic indicators. Environmental monitoring consists of direct measurement or tracking of various environmental indicators (e.g., water quality, wetland health) in an effort to detect changes or monitor long term environmental trends. The monitoring program should clearly define the relevant questions that need to be answered and be focused on assessing the implementation of recommended management measures and the success of those measures in accomplishing the goals and objectives stated in **Chapter 1** of this watershed management plan (WMP).

The administrative monitoring program should track the number of management measures that are implemented in the Watershed and the degree to which they are implemented. Potential indicators would include acres of wetlands preserved or restored, miles or shoreline stabilized or protected, etc. Since this WMP identifies several areas where additional investigation is needed in order to fully develop appropriate management measures, the number of studies or investigations conducted should also be tracked.

Environmental monitoring is more complex. An environmental monitoring program to track the efforts and success of this WMP should be developed and pursed in a consistent fashion. The environmental monitoring program should incorporate the outlined framework identified in the Mobile Bay Subwatershed Restoration Monitoring Framework (**Appendix D**) as recommend by the Mobile Bay National Estuary Program (MBNEP) Science Advisory Committee: Monitoring Working Group.

11.1 Monitoring Watershed Conditions

The natural system within the Dauphin Island Watershed has been extensively altered by urbanization. Urban hydrology has many harmful effects on native systems, including reducing infiltration, increasing stormwater runoff volumes and pollutant loads, and degrading natural aquatic habitats. There are a number of different environmental indicators that can be monitored to determine the overall environmental conditions in a watershed and track environmental trends. In order for the indicators to be meaningful, they must be monitored in a consistent manner (protocols) and be in a format that is comparable to some accepted baseline condition.

Measures of watershed conditions can be quantitative and/or qualitative and be made by direct measurement (sampling) or through the use of remote sensing. Measures such as wetland health, riparian buffer health, presence of invasive species, or changes in streambank or shoreline morphology and changes in land use and land cover are examples of environmental conditions that lend themselves to the use of remote sensing with limited ground truthing required and are often only apparent over long time periods. Other measures like water quality samples, are collected in-situ with standard procedures and should include a suite of concurrent field measurements. These measurements, known as “field parameters,” are used when interpreting analytical data. The exact suite of measurements will vary, but should include those factors that will best evaluate the physical, chemical, and biological characteristics specific to water quality concerns for the study area.

11.1.1 WATER QUALITY MONITORING

Long-term water quality monitoring data for the Dauphin Island Watershed were available at limited stations, predominantly associated with bacterial monitoring for beach access. There were also limited hydrologic, vegetation, geochemical, and physiochemical data available to summarize the surface water characteristics of the

Watershed. Isolated sampling events were completed but overall, were insufficient to provide a confident evaluation of conditions (see **Section 4.3**). This lack of comprehensive baseline water quality data combined with accelerated population growth and development occurring on the Island, amplifies the need to fully assess the water quality and environmental health of the Watershed and analyze spatial and temporal trends over time.

As presented in **Chapter 6** of this WMP, significant changes in land use are occurring on Dauphin Island, predominately due to increased development and urbanization, which increases the loss of wetlands and riparian buffers that assist in filtering pollutants and providing water storage for flood control. These alterations have the potential to increase pollutant loads to the receiving waters in the Watershed and therefore, consistent long-term monitoring is necessary to detect short- and long-term trends in water quality and environmental health of the Watershed.

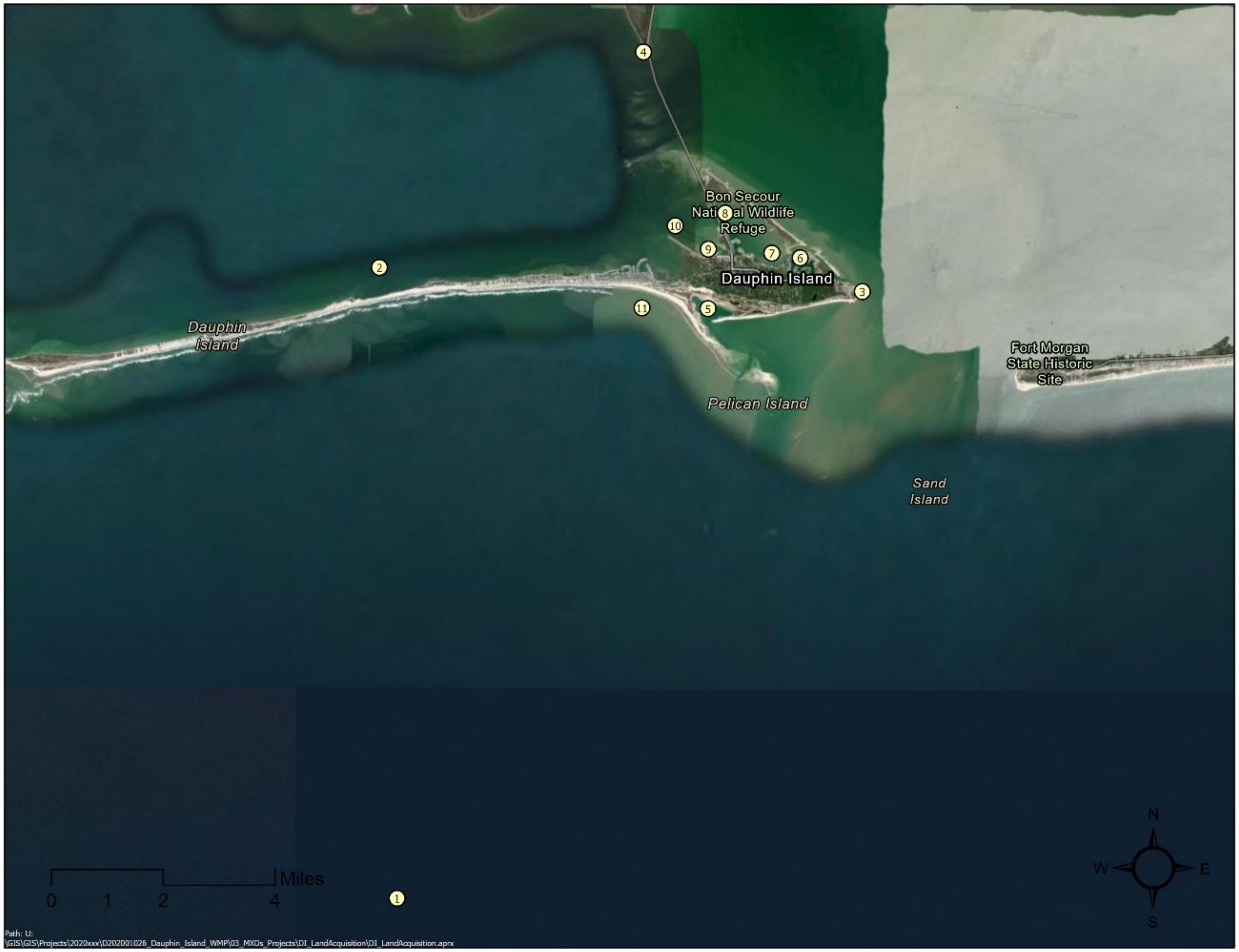
A comprehensive, long-term water quality monitoring program is recommended to document the overall health of the Dauphin Island Watershed and to track changes in Watershed conditions over time. This will also help with assessing the performance of management measures and may determine where additional resources may be needed. The monitoring program should clearly define the overall water quality objectives and identify which known and potential issues in the Watershed are being evaluated. The monitoring program should encompass the greatest possible portion of the Watershed with the least number of samples to maintain cost efficiency, while providing sufficient detail to identify probable source areas for elements of concern. A quarterly monitoring program for most water-quality parameters should be sufficient to address the needs identified in this plan. To assure consistency, permanent sample locations should be established and should occur during the same time frame each quarter and under similar hydrologic conditions. Standard sampling and analyses protocols accepted by state and federal agencies should be used to collect and analyze data and should be performed in accordance with the Mobile Bay Subwatershed Restoration Monitoring Framework (**Appendix D**). Citizen participation in the water quality program should be encouraged and coordinated through Alabama Water Watch. The help of volunteers will not only augment the water quality monitoring program, but also establishes a sense of community ownership within the Watershed. Efforts should be made to recruit as many volunteer monitors as possible.

Dauphin Island, a barrier island community, has limited surface water elements with the majority of the hydrologic and pollutant loading generated via stormwater or wastewater sources. In the absence of an existing monitoring program, it is recommended that the development of a comprehensive routine monitoring program is incorporated into the recently funded "Dauphin Island Restoration and Management Support System Effort." At a minimum, the proposed coastal monitoring stations should be supported to provide expanded coastal observational capacity (**Table 11-1**). In addition, surface water monitoring of the coastal embayments adjacent to Dauphin Island would provide valuable information on the potential impact of point and/or non-point discharges to the receiving waters. Potential monitoring stations are provided below for consideration during development of the comprehensive monitoring program (**Table 11-1** and **Figure 11-1**).

TABLE 11-1 Potential Surface Water Monitoring Locations

Station No.	Station Name	Latitude	Longitude
1	FOCAL Mooring Site	30.090200	-88.211600
2	Katrina Cut Station	30.254036	-88.218047
3	Dauphin Island Station	30.248471	-88.073547
4	Cedar Point Station	30.310422	-88.139408
5	Pelican Cove	30.243848	-88.119672
6	Barcelona Bay	30.257162	-88.092175
7	Dauphin Island Bay South	30.258329	-88.100661
8	Dauphin Island Bay North	30.268688	-88.114678
9	Bayou Aloe	30.259305	-88.119664
10	Graveline Bay	30.265322	-88.129607
11	Gulf of Mexico	30.243949	-88.139410

Concurrently, observed flooding and stormwater discharges have been identified as a concern within the developed portions of the Island. It is recommended that the stormwater conveyance systems are inventoried and characterized to identify potential opportunities for the implementation of best management practices to reduce pollutant loads to the embayments and minimize damage to personal property.



SOURCE: Figure by Environmental Science Associates 2022

FIGURE 11-1 Potential Water Quality Monitoring Stations

Water Quality Monitoring Parameters

Conventional water quality field parameters such as temperature, pH, specific conductance, turbidity, dissolved oxygen, and salinity should be collected for the Dauphin Island Watershed. Additionally, the following supplemental water quality parameters can be used to monitor the overall health of the Watershed:

- Sediment loading and turbidity
- Total nitrogen
- Dissolved inorganic nitrogen
- Total phosphorus
- Dissolved inorganic phosphorus
- Chlorophyll-a
- Biological oxygen demand and chemical oxygen demand
- Bacteria
- Total organic carbon
- Organic pesticides and herbicides
- Metals
- Petroleum, oil, and grease

In locations where the depth of water is sufficient, samples should be collected at specific depth intervals to create depth profiles.

STANDARD FIELD PARAMETERS

Standard field parameters are basic in situ measurements of parameters that should be conducted concurrently with sampling of all other laboratory analytical parameters described in this section. These parameters should, at a minimum, include measurements of temperature, dissolved oxygen, pH, specific conductance, salinity, and turbidity.

TOTAL NITROGEN

Total nitrogen concentration in water is a combined measure of inorganic nitrogen (nitrites, nitrates, and ammonia) and organic nitrogen. Organic nitrogen levels derive from sewage runoff, animal manure, and decomposition of aquatic organisms, while inorganic nitrogen concentrations derive from erosion and residential runoff (fertilizers). Excessive algae growth causes low dissolved oxygen concentrations and odiferous, unsightly water. The success of management measures will be assessed, in part, by the degree to which total nitrogen concentrations reduced or stabilized.

DISSOLVED INORGANIC NITROGEN

Dissolved inorganic nitrogen (DIN) is needed by plants to grow and reproduce. DIN sources are primarily anthropogenic, including urban runoff and fertilizers. A measure of DIN provides an assessment of human sources of nitrogen, and correlates those sources to land use and observed water quality. Nitrate concentrations in streams without significant nonpoint sources of pollution in the Watershed generally do not exceed 0.5 mg/L (Maidment 1993), and a nitrate concentration of 0.5 mg/L or greater in streams may cause excessive algae growth. The success of management measures will be assessed, in part, by the degree to which DIN concentrations in the surface water system are reduced or stabilized.

TOTAL PHOSPHORUS

The total phosphorus concentration is a measure of both organic and inorganic forms. Both organic and inorganic phosphorus can either be dissolved in the water or suspended (attached to particles in the water column). Natural and human sources of phosphorus include soil and rocks, wastewater, fertilizers, septic systems, animal manure, disturbed land areas, and drained wetlands (EPA 2017). Since phosphorus is the nutrient in short supply in most fresh waters, even a modest increase in phosphorus can create accelerated plant growth, algae blooms, low dissolved oxygen, and death of fish, invertebrates, and other aquatic animals. The success of management measures will be assessed, in part, by the degree to which the concentration of phosphorus in the surface water system is reduced or stabilized.

DISSOLVED INORGANIC PHOSPHORUS

Dissolved inorganic phosphorus is the form that plants need to grow and reproduce. The sources of inorganic phosphorus include soil and rocks, fertilizers, and disturbed land areas (EPA 2017). An important source of inorganic phosphorus may be fertilizers applied to lawns. As urban development in the Watershed continues, runoff from lawns may constitute an even greater source than at present. Collection and analyses of water samples for dissolved inorganic phosphorus will allow correlation between sources and land use, and can be used to indicate if management measures have been successful in reducing or controlling sources of phosphorus.

CHLOROPHYLL-A

Measurements of nutrient concentrations (nitrogen and phosphorus) in the embayments adjacent to Dauphin Island could provide insight into their availability for use by aquatic plants like algae. Additional monitored parameters, such as chlorophyll-a, are used to estimate algal biomass or the abundance of aquatic vegetation. Chlorophyll-a is an indirect measure of the ability of aquatic vegetation to utilize available nutrients, used because it is easier to measure than algal biomass. There is generally a good agreement between planktonic primary production and algal biomass. Annual measurements should be made to determine trends in Chlorophyll-a concentrations as changes in Chlorophyll-a concentrations would indicate the effectiveness of management measures in limiting nutrient inputs.

DISSOLVED OXYGEN, SALINITY, AND TEMPERATURE PROFILING

The collection of routine field parameters has already been discussed. However, in addition to routine data collection, depth profiles of dissolved oxygen, salinity, and temperature should be determined at selected monitoring locations to provide data about the stratification of water in portions of tributaries. Stratification of water quality is important to aquatic life, especially if dissolved oxygen levels are very low near the bottom of the water column. Typical reasons for low dissolved oxygen are algae blooms caused by excessive nutrient concentrations, high water temperature, die off and decomposition of aquatic vegetation (also driven by excessive nutrient levels), and decomposition of any organic material, including terrestrial leaves and grass clippings.

BACTERIA

Water resources surrounding Dauphin Island are used for recreation, swimming, and fishing. Monitoring for fecal coliform and enterococcus bacteria should be part of the monitoring plan for the Watershed as needed to ensure limiting and reducing pathogen inputs (reduction of septic tank failure).

TOTAL ORGANIC CARBON

Potential sources of total organic carbon (TOC) include natural organic matter and anthropogenic sources, like petrochemicals, solvents, and pesticides. Elevated TOC concentrations could spur excessive algae growth and create the potential for low dissolved oxygen. Monitoring TOC concentrations would indicate the effectiveness of the management measures in limiting unfiltered runoff into the receiving waters of the Watershed.

ORGANIC PESTICIDES AND HERBICIDES

Unlike many other contaminants, pesticides and herbicides derive solely from anthropogenic sources. The presence of pesticides and herbicides is primarily due to stormwater runoff from agriculture, and lawn and garden application. Monitoring for selected pesticide and herbicide concentration would indicate the success, or lack thereof, of the management measures in limiting unfiltered urban runoff into surface water drainages.

METALS

As with many other potential contaminants, metals in the environment derive from both natural and anthropogenic sources. For example, aluminum and iron can originate from eroding sediments and iron bacteria. Conversely, lead, cadmium, copper, and nickel are not typically from natural sources in Alabama. The presence of these metals is most likely due to human activities. Monitoring metal concentrations would indicate the success, or lack thereof, of the management measures in limiting unfiltered urban runoff into surface water drainages.

PETROLEUM, OIL, AND GREASE

Petroleum in the surface waters will derive solely from anthropogenic sources. The presence of petroleum is primarily due to stormwater runoff from parking lots and roads, with minor contributions from leaking storage facilities. Monitoring for selected petroleum, oil, and grease parameters would indicate the success, or lack thereof, of the management measures in limiting unfiltered urban runoff into surface water drainages.

In addition to the collection and analyses of surface water samples, biological assessments, and coastal zone evaluations should also be conducted as part of Watershed monitoring.

11.1.2 BIOLOGICAL AND HABITAT MONITORING

The purpose of biological and habitat monitoring is to assess and monitor the ecological health of the Watershed. Biological assessments may include flora and fauna population surveys and habitat analyses and should utilize a standard protocol established by a state or federal agency, such as the U.S. Army Corps of Engineers hydrogeomorphic approach for assessing the functional capacity of tidal marshes (Shafer et al. 2007). Efforts should be coordinated with management measures discussed in **Chapter 7**. Biological assessments should include population surveys of conservation species of concern and invasive species, as well as characterization of priority habitats. Habitat evaluations should be focused on wetlands and upland coastal forests and documentation of invasive species should be included.

This information will be necessary to determine if the management measures recommended by this WMP (**Chapter 7**) are meeting the goals of the MBNEP's Comprehensive Conservation and Management Plan, specifically to "improve ecosystem function and resilience through protection, restoration, and conservation of habitats". The information will also be necessary to assess whether goals and objectives of this WMP, presented in **Chapter 1**, are being met.

Monitor Priority Habitats Through High Resolution Mapping and Inventory

As presented in **Section 7.3.3**, to help manage ongoing protection of sensitive Island habitats, updated mapping and plant community inventories are needed to establish their current status and condition. The status of land cover and habitats has been assessed periodically in the Watershed with varying degrees of spatial resolution. The most recent assessments were performed by the U.S. Geological Survey (USGS) based on 2013 aerial imagery and 2015 field data collection (USGS 2017) and by the MBNEP based on 2016 imagery and field data collection (Radiance Technologies 2017). An updated map is needed to continue tracking the status and trends of important habitats and sensitive natural resources. Analysis of aerial imagery, combined with surface level observations, is a cost-effective method to determine long-term trends and short-term changes in habitats and altered land. Project specific acquisition of aerial imagery is not required for the mapping. Aerial imagery two years old or less and with ≤1 meter resolution is sufficient. Wetland mapping should focus on freshwater swamps and tidal marshes. Field identification of plant species should be made by qualified biologists. Periodic surveys should be performed at least every five years to monitor the status of priority habitats.

Invasive Species Monitoring

Invasive species infestations are a common issue throughout the entire Gulf Coast. They compromise the overall health of the native ecosystems. In addition to a systematic survey and assessment conducted to develop a Watershed invasive control plan, visual inspections of invasive species should be made during all monitoring activities. All sampling teams should be trained in the identification of each invasive species that are known to appear in the Watershed. Observations should be enumerated, recorded in field notes, and documented with photographs.

The effectiveness of Chinese tallow tree (*Triadica sebifera*) eradication efforts in the Audubon Bird Sanctuary should be regularly monitored, as invasive management can require multiple treatments to adequately control or eliminate this species. Care should be taken to avoid native flora during treatments.

Enhanced tracking of shorebird and sea turtle nest predation by feral cats, racoons, and foxes should be an integral component of Watershed monitoring efforts. Efforts should build on the invasive species management discussed in **Chapter 7.**

Bird Monitoring

Long-term bird monitoring should build on the management measure recommendations presented in **Chapter 7**. Eastern black rail surveys should be designed to meet standards and specifications for effective sampling and habitat characterization. As part of the surveys autonomous recording units should be deployed across different locations at each of the five recommended survey locations, including high marsh where greater numbers of black rails tend to occur and in areas with potentially fewer birds. In addition to autonomous recording unit sampling, visual point count surveys are recommended. Surveys should be conducted during both breeding and overwintering seasons. The specific design of the black rail monitoring effort should be coordinated with the U.S. Fish and Wildlife Service, Audubon Society, and other experts involved in such surveys.

Restoration Project Monitoring

As presented in **Chapter 7**, there have been numerous restoration projects planned and implements in the Watershed. The long-term success and evolution of these projects should be monitored to compare the results to original project goals and to assess how these projects have integrated with the overall ecological health of the Watershed.

Appendix L of the 2020 U.S. Army Corps of Engineers and USGS Barrier Island Study (**Appendix E** of this Plan) presents the Alabama Barrier Island Restoration Assessment Monitoring and Adaptive Management Plan and can be used to guide the WMP monitoring program in assessing the effectiveness of many of the restoration projects that have been implemented during the development of this WMP.

All monitoring activities should be conducted in accordance with Alabama Department of Environmental Management and MBNEP Science Advisory Committee protocols, and the Dauphin Island Watershed Alliance (see **Chapter 8**) should ensure that all planned projects occurring within the Watershed include a robust monitoring program to prevent adverse impacts and unintended consequences to Watershed resources.

11.1.3 COASTAL ZONE MONITORING

Analyses of coastal zone shorelines should be performed in a consistent manner using photographs taken year after year from the same location and orientation, and with time sequenced, geo-referenced aerial photographs if they are available. Documentation of significant alterations in land use, associated changes in impervious cover and stormwater management systems is recommended to be regularly inventoried.

Shoreline Monitoring

Continued analyses of shorelines should be performed on an annual basis using photographs taken periodically from the same location and orientation, and with time-sequenced, geo-referenced aerial photographs. These techniques will allow evaluation of the success of implemented coastal zone projects and programs, and identification of shorelines that are experiencing erosion or habitat loss due to sea level rise. Efforts should be coordinated with the comprehensive shoreline management plan discussed in **Chapter 7**.

11.1.4 OTHER PARAMETERS

LAND USE AND IMPERVIOUS COVER

As urbanization and development increases on Dauphin Island, percentages of impervious surfaces will also increase. Impervious surfaces can have a major influence on Watershed conditions. The percentage of impervious cover within the Watershed should be monitored at five-year intervals consistent with the USGS National Land Cover Database updates (Homer et al. 2012). The resulting data should be stored in electronic map format, to facilitate data interpretation and analysis.

LITTER

While litter can be difficult to quantify, sampling teams should make visual observations during routine water quality sampling to generally assess litter conditions at various points throughout the Watershed. These observations should be documented in field notes and photographed when possible. Litter monitoring may also identify areas within the Watershed that should be targeted for future action.

Another option for documenting trash amounts and locations throughout the Watershed is through the Escaped Trash Assessment Protocol. The protocol was created by the Trash Free Watershed Program of the U.S. Environmental Protection Agency to provide a uniform method to collect data on trash types, amounts, and what areas pose the greatest risk to humans and wildlife. Trash-related data can be uploaded to a publicly available database and a summary report will be generated. This data helps to identify trends over time as well as mitigation and source reduction measures. Users can add features to the methodology to address the types of data they want to produce, such as certain types or volume of trash collected. More information on the program and program protocols can be found at http://www.epa.gov/sites/production/files/2021-06/revised_final_etap_6.7.21.docx.

MANAGEMENT MEASURE MONITORING

A regular reporting schedule is necessary to archive and track monitoring data and assess the overall success of management actions The success of the progress of the WMP implementation can be tracked by indicators other than water quality and habitat health. Some additional potential indicators of the successful implementation of management measures presented in **Chapter 7** may include: the number of studies and plans developed, the number of laws/regulations passed, and the number of tax and zoning modifications.

Progress reports for the Watershed should be prepared and shared with MBNEP and stakeholders. Reporting should be conducted on at least an annual basis, although interim reporting may be helpful in critical watershed areas or where more frequent monitoring is needed to track success of specific management actions. At a minimum, annual reports should include the following:

- A summary of watershed conditions including field results from monitoring and sampling activities
- An update on the status of management measures implemented to date

- A summary of anticipated management measures to be implemented during the next 12 months

11.2 Implementation Schedule

The implementation monitoring schedule for the WMP should be prepared by appropriate personnel. The schedule should be modified as needed to address each of the specific management measures contained in **Chapter 7** of this WMP as they are implemented. Each management measure should be listed as a major task in the implementation schedule, with all subtasks being listed to help organize and complete the necessary sampling. The schedule should include the start and projected end dates for each task, and the personnel assigned to each task. The implementation schedule should be reviewed annually and updated as needed. The status of the implementation schedule should be reported annually to the Town of Dauphin Island, Mobile County, and MBNEP as part of an annual report. The schedule will serve as an important tool to assess the status of the WMP and to identify where corrective actions are needed to address problems encountered in the implementation of the WMP.

11.3 Citizen Participation and Monitoring

A vital element of the Watershed Monitoring Program will be citizen participation through volunteering as an Alabama Water Watch monitor. With the help of volunteers, the Watershed Monitoring Program will enable successful implementation and establish a sense of community ownership within the watersheds. Community volunteers are able to take part in watershed management by assisting with collecting data as members of field sampling teams and participating in public outreach events. Previous volunteer watershed monitoring networks have proven to be a successful model for long-term monitoring and community engagement in watershed throughout the country. Efforts should be made to recruit as many volunteer monitors as possible.

11.4 Adaptive Management

As this WMP transitions into the implementation phase, adaptive management principles will need to be implemented. Adaptive management is the iterative process of changing management measures as dictated by future results. Adaptive management will allow for maximized effectiveness and efficiency in implementing management measures.

Appendix L of the 2020 U.S. Army Corps of Engineers and USGS Barrier Island Study presents the Alabama Barrier Island Restoration Assessment Monitoring and Adaptive

Management Plan (**Appendix E**). The adaptive management process should consist of a thorough review and integration of this Monitoring and Adaptive Management Plan with the WMP monitoring program to measure progress of improving Watershed conditions against goals and objectives identified in this WMP, and in the Barrier Island Study, as many of these projects have been implemented during the development of this WMP.

This review and integration of monitoring plans will allow decision-makers to evaluate the success of implemented management measures, recommend changes, and determine if additional management measures are needed to achieve stated goals and objectives. Incorporating adaptive management throughout implementation will ensure strategies are continually being assessed and updated, based on the best available science and changing Watershed conditions. Adaptive management will also ensure that staff time and funding resources are used in the most efficient way possible to produce positive and measurable results

11.5 Anticipated Costs

Following approval of this WMP, the specific costs of the monitoring program should be determined by developing more detailed scopes of work for the monitoring program and soliciting bids for completion of the detailed scope of work. It should be possible to fund the monitoring costs through grants or other funding sources identified in **Chapter 10** of this WMP. The Geological Survey of Alabama and the USGS have cooperative programs that allow them to share annual costs of collecting environmental data.

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