Bon Secour River, Oyster Bay, Skunk Bayou Watershed Management Plan

Prepared for:

Foley

CITY OF GULF SHORES ALABAMA

THE SEAL OF BALDWIN COUNTY ALABAMA

Mobile Bay National Estuary Program

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Steering Committee Members

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ACRONYMS AND ABBREVIATIONS

ACAMP	Alabama Coastal Area Management Program
ACEP	Agricultural Conservation Easement Program
ADEM	Alabama Department of Environmental Management
AMCMP	Alabama-Mississippi Clean Marina Program
CI	Collective Impact
CSP	Conservation Stewardship Program
CWA	Clean Water Act
EQIP	Environmental Quality Incentives Program
ESA	Endangered Species Act of 1973
°F	degrees Fahrenheit
FEMA	Federal Emergency Management Administration
GIS	Geographic Information System
GSA	Geological Survey of Alabama
Gulf ICW	Gulf Intracoastal Waterway
MBNEP	Mobile Bay National Estuary Program
MCL	maximum contaminant level
mg/L	milligram per liter
ml	milliliter
MS4	municipal separate storm sewer systems
NAVD88	North American Vertical Datum of 1988
NFWF	National Fish and Wildlife Foundation
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	U.S. Department of Agriculture, Natural Resources Conservation Service
NTU	nephelometric turbidity units
RESTORE	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act
SARP	Southeast Aquatic Resources Partnership
SLAMM	Sea Level Affecting Marshes Model

TMDL	total maximum daily load
UACBER	University of Alabama's Center for Business and Economic Research
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
Volkert, Inc.	Volkert
WMP	Watershed Management Plan
WMTF	Watershed Management Task Force

EXECUTIVE SUMMARY

In 2015, the Mobile Bay National Estuary Program contracted Volkert, Inc., along with sub-consultants Louis Berger and Allen Engineering and Science, to prepare a comprehensive Watershed Management Plan (WMP) for three interconnected watersheds in southern Alabama—Bon Secour River, Oyster Bay, and Skunk Bayou, as shown in **Figure ES-1.** The three watersheds lie adjacent to one another, are located in southwestern Baldwin County, make up the coastline of Bon Secour Bay (located in southeastern Mobile Bay) from the mouth of Weeks Bay to the tip of the Fort Morgan Peninsula, and collectively encompass a total of 43,670 acres.

FIGURE ES-1: BON SECOUR RIVER, OYSTER BAY, AND SKUNK BAYOU WATERSHEDS IN SOUTHWESTERN BALDWIN COUNTY, ALABAMA

Purpose of Watershed Management Plan

The purpose of this WMP is to guide watershed resource managers, policy makers, community organizations, and citizens in protecting the hydrological, biological, and cultural integrity of the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds to ensure that these resources are preserved for future generations. Every action that occurs within a watershed has an effect on its receiving waterbodies, and everyone who lives in a watershed plays a role in protecting and sustaining those waterbodies. To achieve this purpose, the WMP documents current conditions within the watershed, evaluates potential management measures to improve

impaired conditions and create healthier watersheds, and recommends a prioritized list of actions to improve water quality, ecological integrity, and, by extension, the quality of life for all inhabitants of the watersheds.

Watershed Management Plan Goals

The following goals were developed for improving conditions within the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds.

1. Improve water quality
2. Protect and enhance fish and wildlife habitat
3. Improve watershed resiliency to climate change impacts, including sea level rise
4. Expand community access to watershed resources
5. Preserve the cultural heritage of the three watersheds

Public Participation

Public participation is an important part of the watershed management planning process. Not only is the community afforded the opportunity to voice concerns regarding known issues within the watershed, but it also has an opportunity to prioritize issues of concern and recommend potential management measures to address them.

The public participation strategy began with the formation of a 16-member Steering Committee, which included representatives from the public and private sector. This committee was designed to guide the public participation program and the WMP planning process. Three Steering Committee meetings were held during the planning process.

Small group meeting at Bon Secour Fire Department

Recognizing that opinions regarding issues of concern vary across the three watershed communities, stakeholders were engaged by organizing a series of community meetings intended to align efforts in the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds to find one mutually beneficial goal—improving watershed conditions. The Watershed Management Team (Steering Committee, Project Advisory Committee, and Consultant Team) determined that two separate and distinct rounds of stakeholder meetings would be conducted during the development of the WMP. The main focus of these meetings was to present stakeholders with the known issues of concern identified during the first round of meetings and to obtain their input on prioritizing the issues and potential management measures to address these issues. The Watershed Management Team created an online survey for stakeholders and received a total of 246 completed responses.

The Watershed Management Team also encouraged volunteers to participate in the clean-up event for the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds held on September 19, 2015. Approximately 22 volunteers, including families with children, participated. For the clean-up event held September 17, 2016, in these watersheds, volunteer numbers increased from 22 to 199. An effort will be made to continue the Aquila Seafood on Bon Secour check-in/collection point for future events and encourage community participation. Public participation will continue into the implementation phase through the future creation of volunteer monitoring and sampling teams.

Alabama Coastal Cleanup

Critical Issues and Areas

Critical issues and areas affecting the condition of each watershed were identified from multiple sources, including Steering Committee resource knowledge, interviews with knowledgeable experts, input from citizens within the watersheds via public workshops, results of field reconnaissance conducted by the field team, review and interpretation of current and historic data, and analyses of historic aerial photography and maps. Critical issues and areas for each watershed are presented below.

Bon Secour River Watershed

- **Stormwater Management**—An issue of concern to stakeholders within the Bon Secour River Watershed is stormwater management. For example, the frequent occurrences of flooding in and around the city of Foley during and immediately following major storm events impacts various businesses and residences when access is restricted.

- **Litter Control/Management**—The field team observed litter along roadways and in drainage ditches and waterways throughout the entire watershed during the field reconnaissance.

- **Water Quality—**One of the issues of greatest concern to stakeholders within the Bon Secour River Watershed is water quality. Water quality conditions in the watershed are degraded; nutrient loading (nitrogen and phosphorus) appears to be an issue in the upper portion of the watershed where agriculture is the predominant land use according to existing literature sources


- **Erosion and Sedimentation—**Results of the field reconnaissance and discussions with land owners along an unnamed tributary to the Bon Secour River indicate that erosion and sedimentation along that unnamed tributary during major storm events are problematic.


- **Invasive Species**—Several invasive plant species commonly inhabit the Bon Secour River Watershed, including cogon grass, Chinese privet, Chinese tallow, and kudzu. These species can outcompete native plant species, degrade wildlife habitat, and interfere with agricultural crop production, as described in Section 4.5.3, *Invasive Species*.

Oyster Bay Watershed

- **Habitat Protection and Preservation—**While recognizing more than half of the land area within the Oyster Bay Watershed is in the public domain, the stakeholders of this watershed have voiced that they would like to see even more properties acquired and set aside for conservation and preservation.

- **Shoreline Erosion—**An issue of concern to citizens of the Oyster Bay Watershed as expressed during public meetings, small workshops, and in the online survey is the potential for continued shoreline erosion.
- **Water Quality—**Water quality data for the Oyster Bay Watershed are limited but suggest that nutrient loading is not a major problem because agricultural land use is minimal and Oyster Bay is mostly surrounded by undeveloped lands, including a large wetland buffer along its shores.
- **Invasive Species—**Several invasive plant species commonly inhabit the Oyster Bay Watershed, including cogon grass, Chinese privet, and Chinese tallow.
- **Smart Growth—**At public meetings and in responses to the online survey, residents of the Oyster Bay Watershed expressed concern about the application of Smart Growth. Smart Growth is an approach to land development that accepts that growth and development will continue to occur and so seeks to direct that growth in an intentional, comprehensive manner.

Skunk Bayou Watershed

- **Water Quality—**Water quality is an important issue to the stakeholders of the Skunk Bayou Watershed and the Steering Committee. This opinion is based on the fact that the surrounding land use (mostly agricultural) and northern portions of the watershed in general proximity to the upper reaches of the Bon Secour River are similar with regard to water quality conditions.
- **Lack of Agricultural Buffer Strips—**During the field reconnaissance of Skunk Bayou, the field team observed that planted portions of agricultural fields, particularly some sod farms, extended to the very edge the field immediately adjacent to drainage ditches (see photo). This practice increases the opportunity for soil erosion and pollutant loading within the watershed that could be reduced with use of buffer strips.

- **Invasive Species—**Several invasive plant species commonly inhabit the Skunk Bayou Watershed, including cogon grass, Chinese privet, and Chinese tallow.
- **Litter Control/Management—**The field team observed litter in the Skunk Bayou Watershed along the roadsides and in drainage ditches and waterways during field reconnaissance.

Implementation of Recommended Management Measures

Recommended management measures for each critical issue confronting the three watersheds listed above are presented below. Management measures are separated into two categories: 1) those that can be accomplished in the short term (implemented within 0 to 2 years), and 2) those that will take longer to accomplish (implemented over 2+ years). **Table ES-1** summarizes which management measures apply to each watershed. The table includes a rough-order-of-magnitude cost estimate to implement each measure.

TABLE ES-1: MANAGEMENT MEASURES BY WATERSHED

Management Measure	Brief Description	Cost	Proposed Implementation Schedule—Short Term and Long Term
 **Public education and outreach** (Bon Secour River, Oyster Bay, and Skunk Bayou watersheds)	This management measure will build upon the momentum generated during the WMP development process. This measure is to *Develop and Execute a Communications Plan* and to *Host and Participate in Educational and Outreach Events*	$20,000 per year	Short-term Objective: Initiate immediately and continue throughout implementation of the WMP.
 **Litter reduction** (Bon Secour River, Oyster Bay, and Skunk Bayou watersheds)	This management measure is intended to reduce the volume of litter generated within the three watersheds. This project involves the implementation of *Signage, Litter Traps*, *Maintaining Good Housekeeping Practices,* and *Education and Outreach.*	$510,000 to $960,000	Short-term Objective: Initiate immediately and continue throughout implementation of the WMP.
 **Increase conservation easements and protected habitat** (Bon Secour River, Oyster Bay, and Skunk Bayou watersheds)	The purpose of this management measure is to preserve land to reduce the impact of future development. Five recommended parcels include *Bon Secour and Oyster Bay Wetland Acquisition Projects, Little Point Clear Unit, Benton Tract, and Little Point.* Another purpose of this measure is to assess and prioritize additional target areas for preservation.	$14 million to $20 million	Short-term Objective: Initiate action immediately. Purchase parcels recommended for preservation and continue prioritizing other preservation opportunities.
 **Install living shorelines** (Bon Secour River, Oyster Bay, and Skunk Bayou watersheds)	This intent of this management measure is to protect shorelines from erosion by employing natural bank stabilization. This measure will be implemented using the *Living Shoreline* technique on prioritized unprotected shorelines.	$250 per linear foot of shoreline	Short-term Objective: Initiate immediately and continue throughout implementation period of WMP.

TABLE ES-1: MANAGEMENT MEASURES BY WATERSHED			
Management Measure	**Brief Description**	**Cost**	**Proposed Implementation Schedule—Short Term and Long Term**
 **Increase vegetative buffers** (Bon Secour River, Oyster Bay, and Skunk Bayou watersheds)	This management measure involves implementing vegetative buffers along the riparian corridor of disrupted streams. This measure is intended to *restore and protect the riparian corridors of prioritized streams*.	$13,000 to $30,000 per acre	Short-term Objective: Initiate immediately and continue throughout implementation period of WMP.
 **Implement invasive species treatment and monitoring** (Bon Secour River, Oyster Bay, and Skunk Bayou watersheds)	The purpose of this management measure is to control invasive species in all three watersheds. The measure involves frequent implementation of controls to *eradicate invasive species in prioritized areas*.	$100 to $300 per acre treated	Short-term Objective: Initiate immediately and continue throughout implementation period of WMP.
 **Protect continued use of biological resources to preserve culture, heritage, and knowledge of the watersheds** (Bon Secour and Oyster Bay watersheds)	This measure aims at preserving the cultural heritage of the watersheds and recognize the contribution of the biological resources that helped build this region. This includes recording oral histories of individuals who have lived in the watershed for decades and have memories of how resources within the watershed have been and continue to be used.	$25,000	Short-term Objective: Initiate immediately and continue throughout implementation period of WMP.
 **Implement water quality monitoring—ongoing project** (Bon Secour River and Skunk Bayou watersheds)	This management measure is intended to implement ongoing water quality monitoring in the Bon Secour River and Skunk Bayou Watersheds. *Defining an implementation program* to manage defined impairments and pollutant sources.	TBD, based on program requirements	Short-term Objective: Initiate project immediately; have local citizens involved in the water quality monitoring effort
 **Initiate and implement the Alabama-Mississippi Clean Marina Program (AMCMP)** (Bon Secour and Oyster Bay watersheds)	This management measure is intended to encourage marinas in the Bon Secour River and Oyster Bay watersheds to participate in the AMCMP, which is designed to promote environmentally responsible and sustainable marina and boating practices with the goal of reducing nonpoint source pollution.	TBD, based on program requirements	Short-term Objective: Initiate immediately and encourage continued participation throughout implementation period of WMP.

TABLE ES-1: MANAGEMENT MEASURES BY WATERSHED			
Management Measure	**Brief Description**	**Cost**	**Proposed Implementation Schedule—Short Term and Long Term**
 **Install regional stormwater management facilities** (Bon Secour River Watershed)	The purpose of this management measure is to reduce stormwater runoff and contamination in Bon Secour River Watershed. This project involves the installation of *wetland detention pond facilities* in the Bon Secour River Watershed.	$9.4 million to $12.5 million	Long-term Objective: Initiate project within 2 years of adopting the WMP.
 **Implement Stream Restoration Projects** (Bon Secour River Watershed)	The intent of this management measure is to restore degraded streams which interrupt valuable ecosystem services in the Bon Secour River watershed. This project involves *prioritizing stream lengths for restoration* and *implementing restoration techniques*.	$100,000 to $400,000 per stream mile	Long-term Objective: Initiate project within 2 years of adopting the WMP.
 **Conduct studies to determine the effects of expanding impervious cover on groundwater recharge** (Bon Secour River Watershed)	The purpose of this management measure is to collect watershed-specific groundwater data which can be correlated with streamflow data to determine the effects of expanding impervious cover due on water resources.	TBD, based on program requirements	TBD, based on program requirements

Watershed Management Plan Implementation Strategy

Successfully addressing the critical issues and areas identified in this WMP will require an entity who will champion watershed management, building on the momentum generated while developing the WMP. Since many of the critical issues extend beyond political and jurisdictional boundaries and will need the cooperation of landowners and the general public, the initial implementation strategy includes establishing a Watershed Management Task Force (WMTF). The primary responsibility of the WMTF will be overseeing implementation of the management measures, many simultaneously, and providing a platform for coordination on matters that affect local water quality conditions and natural and recreational resources.

Feedback gained through the stakeholder and public outreach efforts associated with this WMP stressed the need for short-term wins or tangible successes promptly following WMP adoption to gain the confidence of the stakeholders 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 watersheds. With these considerations in mind, management measures were grouped into two phases. Short-term management

measures were chosen based on their likelihood of successful implementation within the next 2 years. However, not all of the critical issues identified within this WMP can be addressed within 2 years of WMP implementation. For example, stormwater management within the watersheds will require coordination with private landowners and securing funding to implement actions that will have the greatest economic value. Thus, several of the recommended management measures have been put into a long-term phase of WMP implementation.

On a routine basis (e.g., annually), the WMTF should assess progress toward meeting WMP goals and objectives for each of the three watersheds (see Chapter 1). Results of performance monitoring as discussed 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 need to be made.

Funding

Various federal, state, and local funding mechanisms are available for use in implementing the WMP as presented in Chapter 10. Simultaneously leveraging multiple funding opportunities will maximize WMP success. Identifying and securing required funding will be one of the primary responsibilities of the WMTF.

Monitoring and Adaptive Management

Monitoring is an essential component to the success of this WMP. Routine monitoring of the three watersheds will allow the WMTF to track progress over time to assess the effectiveness of implemented management measures and determine whether changes or additional actions are needed to achieve the goals and objectives of the WMP. Data collected during the monitoring phase will help establish baseline conditions for future assessments and identify new watershed issues that may not currently be known or may arise in the future. Compared to other watersheds in the region, relatively little data exist for the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds, making a full assessment of current watershed conditions or comparison to historical conditions more challenging.

Citizen participation through volunteering is a key element of the Watershed Monitoring and Sampling Plan. Community members will be encouraged to play an active role in watershed management by volunteering to collect data as members of field sampling teams and participating in public outreach events such as the annual Alabama Coastal Cleanup. Citizen participation in watershed monitoring and sampling will not only enable successful implementation but also will establish a sense of community ownership in the watersheds.

Adaptive management will be implemented to maximize the effectiveness and efficiency of implemented management measures and consist of an annual review of progress reports for each watershed and comparison of watershed conditions against goals and objectives identified in this WMP. This review and comparison will allow decision makers to evaluate the success of implemented management measures and recommend changes or additional management measures needed to achieve stated goals and objectives. Adaptive management will ensure that implementation strategies are constantly being evaluated and updated based on the best available science and adjusted according to changing watershed conditions. Adaptive management will also ensure that staff time and funding resources are used in the most efficient way possible to produce measureable results.

1.0 INTRODUCTION

In 2015, Volkert, Inc. (Volkert), along with sub-consultants Louis Berger and Allen Engineering and Science, was contracted by the Mobile Bay National Estuary Program (MBNEP) to prepare a comprehensive Watershed Management Plan (WMP) for three interconnected watersheds—Bon Secour River, Oyster Bay, and Skunk Bayou located in Baldwin County. The three watersheds encompass approximately 43,670 acres within southern Baldwin County as shown in **Figure 1-1.**

FIGURE 1-1: BON SECOUR RIVER, OYSTER BAY, AND SKUNK BAYOU WATERSHEDS IN SOUTHWESTERN BALDWIN COUNTY, ALABAMA

This section articulates the purpose and need for a WMP for the three separate, yet linked, watersheds. The goals and objectives to be achieved by the WMP implementation are presented below, and the period in which these should be achieved is identified. The Watershed Management Team involved with development of the WMP is introduced, and an overview of the WMP and an implementation strategy are presented.

1.1 Purpose of Watershed Management Plan

A watershed is a topographically defined area of land where the water within it flows to a common receiving waterbody such as a river, bay, or estuary. Everyone who lives in a watershed plays a role in protecting and sustaining the receiving waterbody.

The purpose of the WMP is to provide decision-makers and members of the public a priority list of management measures to improve conditions within the Bon Secour River, Oyster Bay and Skunk Bayou watersheds and create a healthier tomorrow for all inhabitants.

The MBNEP identified three goals in the Comprehensive Conservation Management Plan as part of its 5-year strategy (2013–2018) for improving conditions within Mobile Bay: 1) improve trends in water quality in priority watersheds that discharge into priority fishery nursery areas; 2) improve ecosystem function and resilience through protection, restoration, and conservation of habitats, including beaches, bays, backwaters, and rivers; and 3) restore and/or expand human connections to Alabama's coastal resources. To achieve these goals, the MBNEP identified a need for comprehensive watershed planning within the Mobile Bay estuary. To assist the MBNEP in achieving this objective, the National Fish and Wildlife Foundation (NFWF) provided funding to the MBNEP to develop a comprehensive management plan for the Bon Secour River, Oyster Bay, and Skunk Bay watersheds. The MBNEP appointed the city of Foley's Environmental Division to manage the WMP-development process.

The purpose of this plan is to guide watershed resource managers, policy makers, community organizations, and citizens to protect the hydrological, biological, chemical, and cultural integrity of the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds, and, specifically, their 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 healthier watersheds, and recommends a prioritized list of actions to improve water quality, ecological integrity, and, by extension, the quality of life for all inhabitants of the watersheds.

Although only moderately developed, the three watersheds are experiencing growth development as a bedroom community for Mobile, Alabama, and also a seasonal retirement community within the Oyster Bay watershed. Increased agricultural activity, population growth, and impervious cover could have detrimental effects on the health of the ecosystems within the three watersheds unless proper planning is performed. Realizing this, the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds were identified as a priority for planning to preserve and improve their existing environmental quality.

1.1.1 Goals and Objectives for Each Watershed

The Watershed Management Team developed the following goals for improving conditions within the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds.

Goals:

1. Improve water quality
2. Protect and enhance fish and wildlife habitat
3. Improve watershed resiliency to climate change impacts, including sea level rise
4. Expand community access to watershed resources
5. Preserve the cultural heritage of the three watersheds

To achieve these goals, the following objectives were established by the Steering Committee.

Objectives:

1. Characterize the three watersheds, identify causes of impairment, and recommend management actions (to meet Goals 1 and 2)
2. Design an implementation program with a list of priorities and milestones to track success (to meet Goals 1 and 2)
3. Install litter traps in targeted areas (to meet Goals 1 and 2)
4. Design and construct flood and sediment detention infrastructure (to meet Goals 1–3)
5. Create a community-based watershed monitoring program (to meet Goals 1, 2, and 4)
6. Identify potential avenues for financial support (to meet Goals 1–5)
7. Identify and recommend conservation preservation opportunities (e.g., land acquisitions and conservation easements) (to meet Goals 1–5)
8. Identify strategic partnerships and build consensus among watershed stakeholders (to meet Goals 1–5)
9. Solicit community input and establish meaningful roles for citizen engagement (to meet Goals 1–5)
10. Promote watershed awareness by hosting educational workshops, circulating an annual newsletter, and distributing educational materials (to meet Goals 1–5)
11. Compile an oral history of the Bon Secour River Watershed from 1700 to present (to meet Goal 5)
12. Involve longstanding residents by conducting interviews and recording personal narratives (to meet Goal 5)

1.2 Period Addressed by Watershed Management Plan

The WMP will require significant time to implement because of the diversity of recommended management measures to improve conditions within the three target watersheds. This WMP provides a 10- to 12-year time frame for implementing recommended management measures to improve stormwater management, preserve natural habitats, improve water quality, reduce shoreline erosion, reduce the incidence of invasive species, and provide additional recreational access to waters within the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds.

…the long-term health of the watersheds is community-driven, involving all citizens.

This time frame is subject to change, depending on the availability of funding and the success of recommended actions to achieve stated goals and objectives. As part of the adaptive management approach recommended for implementation, the success of implemented management measures should be assessed every 2 to 3 years. A determination should then be made as to whether any management measures should be modified and/or replaced to ensure recommended goals and objectives can still be achieved.

1.3 Watershed Management Team

The process of promoting the long-term health of the watersheds is community-driven, involving all citizens. The Watershed Management Team is led by a Steering Committee comprising citizens representing different geographic locations within the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds. The Steering Committee includes representatives from businesses, civic groups, environmental organizations, governmental agencies residents, and others (see **Table 1-1**). **Table 1-2** presents the individuals who directed the Consultant Team in selecting the Steering Committee members and guided the development of the WMP.

TABLE 1-1: STEERING COMMITTEE

Member Name	Watershed Affiliation
Brittany Peterson	Bon Secour National Wildlife Refuge
Chris Nelson	Seafood Industry
Cindy Hamrick	Housing Authority
Colette Boehm	Alabama Gulf Coast CVB
Dan Bond	City of Gulf Shores
Evans Russell	Business Owner
Miles McDaniel	Riviera Utilities
Ralph Hellmich	City of Foley
Rhonda Bryars	United States Department of Agriculture
Royce Halstead	Peninsula Golf Course
Sandy Thorpe	Swift School

TABLE 1-1: STEERING COMMITTEE	
Member Name	**Watershed Affiliation**
Scott Taylor	Backwater Charter Fisherman
Seth Peterson	Baldwin County
Tommy Cleverdon	Cleverdon Sod Farms
Tracy Dickerson	Walmart
Will Underwood	Alabama Department of Conservation and Natural Resources

TABLE 1-2: PROJECT ADVISORY COMMITTEE	
Member Name	**Affiliation**
Leslie Gahagan	City of Foley, Environmental Division
Roberta Swann	Mobile Bay National Estuary Program
Christian Miller	Mobile Bay National Estuary Program
Patric Harper	U.S. Fish and Wildlife Service, Mobile Bay National Estuary Program Project Implementation Committee Co-chair

The Consultant Team, made up of Volkert, Louis Berger, and Allen Engineering and Science, was responsible for implementing the process for preparing the WMP, which included conducting scientific research within the watersheds, engaging the public and coordinating public involvement activities (e.g., stakeholder involvement), and drafting the WMP for public review.

1.4 Overview of Watershed Management Plan

The WMP has been written in a concise manner to be understandable by all citizens within the watershed, yet provide sufficient technical detail to allow the WMP to be used to support financial grant applications. The WMP has been prepared as an integrated planning document for all watersheds instead of three separate plans. When appropriate, the WMP is divided into individual components for each watershed (e.g., critical issues and recommended management measures) and is organized into the following sections:

Section 2: Public Participation and Stakeholder Engagement provides a summary of the public engagement program established to inform the public about the watershed planning effort, communicate the importance of stakeholder involvement, identify stakeholder issues within the three watersheds, and prioritize issues to be addressed.

Section 3: Watershed Characterization provides background information on the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds to characterize their geography, hydrology, wetlands, soils, biology, land use and demographics, and cultural history and heritage to provide an understanding of current conditions within the three watersheds.

Section 4: Watershed Conditions includes an assessment of the challenges within the three watersheds, such as stormwater management, water quality improvements, habitat preservation, and shoreline erosion, based on previously conducted studies; identifies additional data; and presents suggestions for obtaining this information.

Section 5: Field Reconnaissance presents results of the field reconnaissance intended to verify known watershed conditions, fill data gaps, and identify new areas of concern not previously documented.

Section 6: Identification of Critical Issues and Areas identifies the critical issues and areas within each watershed to be addressed by the WMP based on public input, review of literature, results of field reconnaissance, and professional judgement.

Section 7: Management Measures provides recommended management measures for each critical issue confronting the three watersheds, including suggestions for initial organization to coordinate WMP implementation, public education, engagement and involvement, and methods to measure success.

Section 8: Regulatory Review presents regulatory drivers and constraints to effective implementation of the WMP, including regulatory inconsistencies and regulatory deficiencies that need to be addressed and identifies enforcement mechanisms.

Section 9: Implementing Strategies provides ways to address the critical issues identified for the watersheds by implementing recommended management measures and identifies associated costs and effective organizational implementation approaches, along with a two-phased implementation approach (short term and long term), to achieve success for those management measures that can be implemented immediately versus those that will take more time.

Section 10: Funding Sources identifies available sources of funding for each watershed and examines innovative mechanisms and alternatives for leveraging funding sources.

Section 11: Monitoring and Adaptive Management explores methods to track the performance of implemented management measures, tools for measuring success, how to adaptively manage as implementation commences, ways to the measure success, and recommendations for reporting.

1.5 Implementation Strategy for the Watershed Management Plan

Successfully addressing the critical issues and areas identified in this WMP will require an entity who will champion watershed management. Since many of the critical issues extend beyond political and jurisdictional boundaries and will need the cooperation of landowners and the general public, the initial implementation strategy is establishing a Watershed Management Task Force (WMTF). The primary responsibility of the WMTF will be to oversee implementation of the management measures identified in the WMP to address the critical issues and areas and provide a platform for coordination on matters that affect local watershed conditions.

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2.0 PUBLIC PARTICIPATION AND STAKEHOLDER ENGAGEMENT

2.1 Public Participation

Public participation is an important step in the watershed management planning process. Not only is the community afforded the opportunity to voice concerns regarding known issues within the watershed, but it also has an opportunity to prioritize issues of concern and recommended potential management measures to address them. By inviting the community to participate in the planning effort, local residents have ownership in the planning process; therefore, they are more willing to participate in the implementation of recommended management measures designed to meet a project's goals and objectives. The Watershed Management Team devoted considerable attention to implementing a comprehensive public participation strategy for the WMP for the Bon Secour River, Oyster Bay, and Skunk Bayou.

2.2 Steering Committee

The first step in the public participation strategy was the formation of a 16-member Steering Committee comprising public and private sector community members. Steering Committee members included local, state, and federal agency representatives; homeowners' association representatives; and community business representatives. This committee was designed to guide the public participation program and planning process. Three Steering Committee meetings were held during the planning process:

Steering Committee Meeting #1: The first Steering Committee meeting was held on September 23, 2015, with the goals of:

- Introducing committee members to the project
- Providing a project overview
- Obtaining input on strategy for stakeholder engagement (A stakeholder is: "a person [or group] who is responsible for making or implementing a management measure, who will be significantly affected by the action, or who can aid or prevent its implementation" [USEPA 2013])
- Documenting known issues of concern in the watersheds

Steering Committee Meeting #2: The second steering committee meeting was held on January 25, 2016; meeting highlights included:

- Reporting on data gathered from the first round of stakeholder meetings
- Presenting observations noted during field assessments

- Discussing potential management measures to address issues of concern in the three watersheds
- Discussing the second round of stakeholder engagement meetings

Steering Committee Meeting #3: The third Steering Committee meeting was held on June 15, 2016, and committee members were presented the following and solicited for consensus:

- List of goals and objectives for the WMP
- Prioritization of issues of concern identified through stakeholder engagement, literature reviews, field assessment, and professional judgment for each of the three watersheds
- List of management measures to address known issues in each watershed
- Plan for document approach and implementation strategy

See **Appendix A**, *Public Involvement Materials,* Section I.

2.3 Stakeholder Involvement Meetings

Opinions regarding issues of concern vary across the watershed communities in South Baldwin County. To adequately solicit stakeholder involvement, the Watershed Management Team organized a series of community meetings intended to align efforts in the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds to find one mutually beneficial goal—improving watershed conditions (**Table 2-1**).

Small group meeting at Bon Secour Fire Department

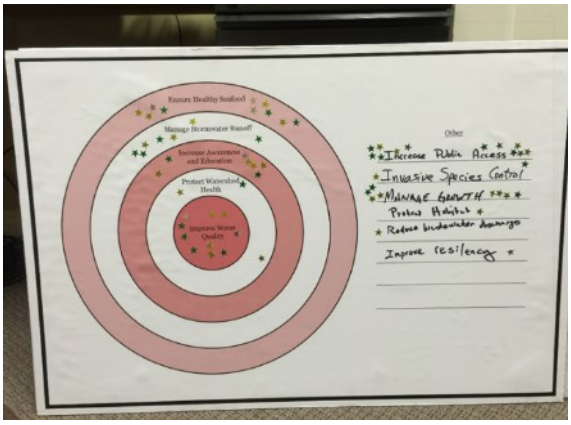
The Watershed Management Team determined that two separate and distinct rounds of stakeholder meetings would be conducted during the development of the WMP. Announcements were published in local newspapers and community newsletters to publicize these events. Other promotional strategies included website postings; community calendars; radio advertising; and flyers at local businesses, neighborhoods, and community centers. The cities of Foley and Gulf Shores were integral partners throughout the public involvement process. Both municipalities advertised these events on electronic meeting boards and provided complimentary space for community gatherings.

TABLE 2-1: LIST OF PUBLIC MEETINGS HELD THROUGHOUT THE BON SECOUR WATERSHED PLANNING PROCESS		
Date	**Time**	**Location**
Tuesday, October 29, 2015	5:00–6:00 p.m.	Peninsula Club House 20 Peninsula Blvd, Gulf Shores, AL
Tuesday, November 3, 2015	5:00–6:00 p.m.	Huggers Landing/Oyster Bay Volunteer Fire Department 19290 Oak Rd W, Gulf Shores, AL
Tuesday, November 10, 2015	5:00–7:00 p.m.	Bon Secour Volunteer Fire Department 7392 Highway 65 Foley, AL 36535
Thursday, November 12, 2015	5:00–600 p.m.	Azell-Ginwright Center 302 4th Ave Foley, AL
Wednesday, December 2, 2015	5:00–7:00 p.m.	Foley Civic Center 407 E Laurel Ave, Foley, AL
Thursday, December 3, 2015	5:00–7:00 p.m.	Gulf Shores Activity *Center* 260 Clubhouse Dr., Gulf Shores, AL
Monday, April 25, 2015	5:30–7:30 p.m.	Gulf Shores Activity Center 260 Clubhouse Dr., Gulf Shores, AL
Tuesday, April 26, 2015	11:30am–1:00 p.m.	City of Foley Civic Center 407 E. Laurel Ave, Foley AL

The first round of stakeholder engagement meetings was held in October, November, and December 2015. The first round of meetings was broken into two types of gatherings: 1) small target group meetings and 2) large community meetings. The small target group meetings consisted of an informal, open-house setting, whereas the large community meetings were convened using a more formal style of presentation.

Small group meeting at Huggers Landing

The focus of the stakeholder engagement meetings during the October–December time frame was to provide an introduction to the watershed planning process and gather input from stakeholders on known issues of concern in each of the watersheds.



Group activity from the first round of large group meetings

Four small, targeted audience meetings were held. Two small target group meetings were held in the Oyster Bay Watershed at the Peninsula and the Huggers Landing Volunteer Fire Department, and two small target group meetings were held in the Bon Secour River Watershed at the Ginwright Center and the Bon Secour Volunteer Fire Department. The Watershed Management Team also attended a septic tank workshop hosted by the Coastal Alabama Onsite Sewage Disposal System Inspection and Maintenance Program in the Bon Secour/Skunk Bayou community in hopes of engaging residents of these two watersheds.

The two large community involvement meetings conducted during the first round of stakeholder meetings were held at the Gulf Shores Activity Center and the Foley Civic Center in December of 2015.

Stakeholders were provided fact and information sheets at the first series of meetings, and participants were asked to complete a written survey. A total of 47 completed surveys was provided by stakeholders (see **Appendix A**, *Public Involvement Materials*, Section II). The data collected from the surveys and through group participation exercises were analyzed by the project team, and a list of known issues of concern for each watershed was created.

Known issues of concern reported included the following by watershed:

- **Bon Secour River**
  - Litter
  - Stormwater management/flooding
  - Erosion/sedimentation
  - Growth management
  - Water quality (i.e., nutrients, bacteria/ pathogens)
  - Invasive plant species
  - Lack of public access
  - Habitat protection
- **Oyster Bay**
  - Stormwater management/flooding
  - Shoreline erosion
  - Growth management
  - Water quality (i.e., nutrients, bacteria/ pathogens)
  - Invasive plant species
  - Habitat protection
  - Litter
- **Skunk Bayou**
  - Stormwater management/flooding
  - Water quality (i.e., nutrients, bacteria/
  - Pathogens
  - Invasive plant species
  - Litter

The second round of stakeholder involvement meetings was held in April 2016. Two formal meetings were conducted—one at the Gulf Shores Activity Center and one at the Foley Civic Center. The Watershed Management Team began each of the meetings by screening an educational video, *Understanding Your Watershed*, produced by the MBNEP (MBNEP 2015a). After the video, results from the field reconnaissance, online survey, and literature review were presented to the audience. Specific project goals and objectives were also discussed and a project timeline was revealed to the public.

Watershed puzzle activity at the second round large group meeting in Foley

The main focus of these meetings was to present stakeholders with the known issues of concern identified during the first round of meetings and to obtain their input on prioritizing the issues and potential management measures to address them. The Watershed Management Team created an online survey for stakeholders to complete, provided a link to the online survey for meeting attendees, and encouraged their participation. A total of **246 surveys** was received. The survey is available for review in **Appendix A**, *Public Involvement Materials,* Section III.

After the online stakeholder survey opportunity expired, the Watershed Management Team reviewed stakeholder priorities and integrated them into the WMP. Primary management concerns reported by residents in the survey are grouped by watershed and listed in **Table 2-2**. The Watershed Management Team used these stakeholder priorities, evidence collected during fieldwork, and professional judgement to develop the watershed specific recommended management measures listed in **Table 2-3**.

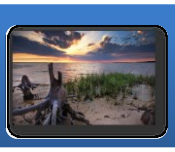
TABLE 2-2: COMMUNITY PRIORITIZED WATERSHED MANAGEMENT ISSUES FROM FINAL ONLINE SURVEY

Bon Secour	Oyster Bay	Skunk Bayou
Water Quality	Habitat Protection	Water Quality
Stormwater Management	Smart Growth	Invasive Species
Litter	Water Quality	Litter

The online survey results provide a clear picture of public perceptions and overall understanding related to the WMP. For example, the Watershed Management Team learned that habitat protection for wildlife and public recreation were citizen priorities. The Little Point Clear Unit within the Bon Secour National Wildlife Refuge, in particular, was reported to be of great importance. The final survey results also suggested a majority of watershed residents are unlikely to volunteer personal time to monitor water quality; however, many watershed residents indicated an interest in clean-up days and educational workshops. In fact, more than 44% of survey respondents (107 people) said they would participate in a local watershed group.

TABLE 2-3: PRIORITIZED MANAGEMENT ACTIONS BY WATERSHED

Install Litter Traps
- Bon Secour
- Skunk Bayou



Increase Conservation Easements/Protected Habitat
- Bon Secour
- Oyster Bay
- Skunk Bayou

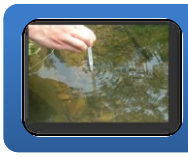
Install Living Shorelines
- Oyster Bay
- Skunk Bayou

Increase Vegetated Buffers
- Bon Secour
- Oyster Bay
- Skunk Bayou

Implement Invasive Species Treatment and Monitoring
- Bon Secour River
- Oyster Bay
- Skunk Bayou

Install Regional Stormwater Management Facilities
- Bon Secour

Implement Stream Restoration Projects
- Bon Secour



Water Quality Monitoring
- Bon Secour
- Skunk Bayou

2.4 Alabama Coastal Cleanup for Bon Secour River, Oyster Bay, and Skunk Bayou Watersheds

The Alabama Coastal Cleanup is an annual event held every September along the Alabama coast. It is a 4-hour event in which volunteers collect trash from waterways and surrounding areas in various locations throughout coastal Alabama. The Watershed Management Team realized the Bon Secour River, Oyster Bay and Skunk Bayou areas did not have an established check-in/collection site, so it established one near Aquila Seafood on the Bon Secour River. The Watershed Management Team also encouraged volunteers to participate in the initial clean-up event held on September 19, 2015, and approximately 22 volunteers, including families with children, participated.

2015 Alabama Coastal Cleanup

The most recent Alabama Coastal Cleanup event was held on September 17, 2016. Participation increased from 22 to 199 volunteers in just a year at the Aquila Seafood collection site. Several local Cub Scout Packs, college and high school students, and area residents turned out for the clean-up along the Bon Secour River, Oyster Bay and Skunk Bayou area. As part of the implementation of the WMP, an effort will be made to continue the Aquila Seafood on Bon Secour check-in/collection point for future events and encourage community participation.

Cub Scout Pack 45 at the Aquila Seafood Collection site

University of South Alabama students clearing debris in Skunk Bayou

Volunteers working along CR-10 East of the Bon Secour River

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3.0 WATERSHED CHARACTERIZATION

3.1 Introduction

The Bon Secour River, Oyster Bay, and Skunk Bayou watersheds have been characterized to describe current conditions and provide a baseline to gage the need for corrective action to address critical issues. The watersheds were characterized by conducting an extensive review of scientific literature and agency technical reports, spatial analysis using Geographic Information System (GIS) software, and results of field reconnaissance surveys.

3.2 Watershed Boundaries

Watershed boundaries are defined by elevation and include all of the lands that drain to a particular waterbody, after which the watershed is typically named. The Bon Secour River, Oyster Bay, and Skunk Bayou watersheds lie adjacent to one another and are located in southwestern Baldwin County (**Figure 3-1**). The three watersheds make up the coastline of Bon Secour Bay (located in southeastern Mobile Bay) from the mouth of Weeks Bay to the tip of the Fort Morgan Peninsula and collectively encompass a total of 43,670 acres.

FIGURE 3-1: BOUNDARIES OF THE BON SECOUR RIVER, OYSTER BAY, AND SKUNK BAYOU WATERSHEDS IN SOUTHWESTERN BALDWIN COUNTY, ALABAMA

3.2.1 Bon Secour River Watershed

The Bon Secour River Watershed is located in southwestern Baldwin County and borders the eastern shore of Mobile Bay at Bon Secour Bay (**Figure 3-1**). The Bon Secour River Watershed encompasses 21,425 acres, consisting of both urban and rural areas. The watershed includes portions of the cities of Foley and Gulf Shores, as well as the Bon Secour community (MBNEP 2015b). It is bordered to the south by the Oyster Bay Watershed and to the west by the Skunk Bayou Watershed.

Bon Secour River

3.2.2 Oyster Bay Watershed

The Oyster Bay Watershed borders the Bon Secour River and is located to the south of the Bon Secour River Watershed in extreme southwestern Baldwin County (**Figure 3-1**). The Oyster Bay Watershed extends east to Highway 59 and west to the tip of the Fort Morgan Peninsula. The watershed includes the north shore of the entire Fort Morgan Peninsula, which borders Mobile Bay. The watershed encompasses 12,907 acres and includes a portion of the city of Gulf Shores (MBNEP 2015b).

Bon Secour National Wildlife Refuge – Oyster Bay Watershed

3.2.3 Skunk Bayou Watershed

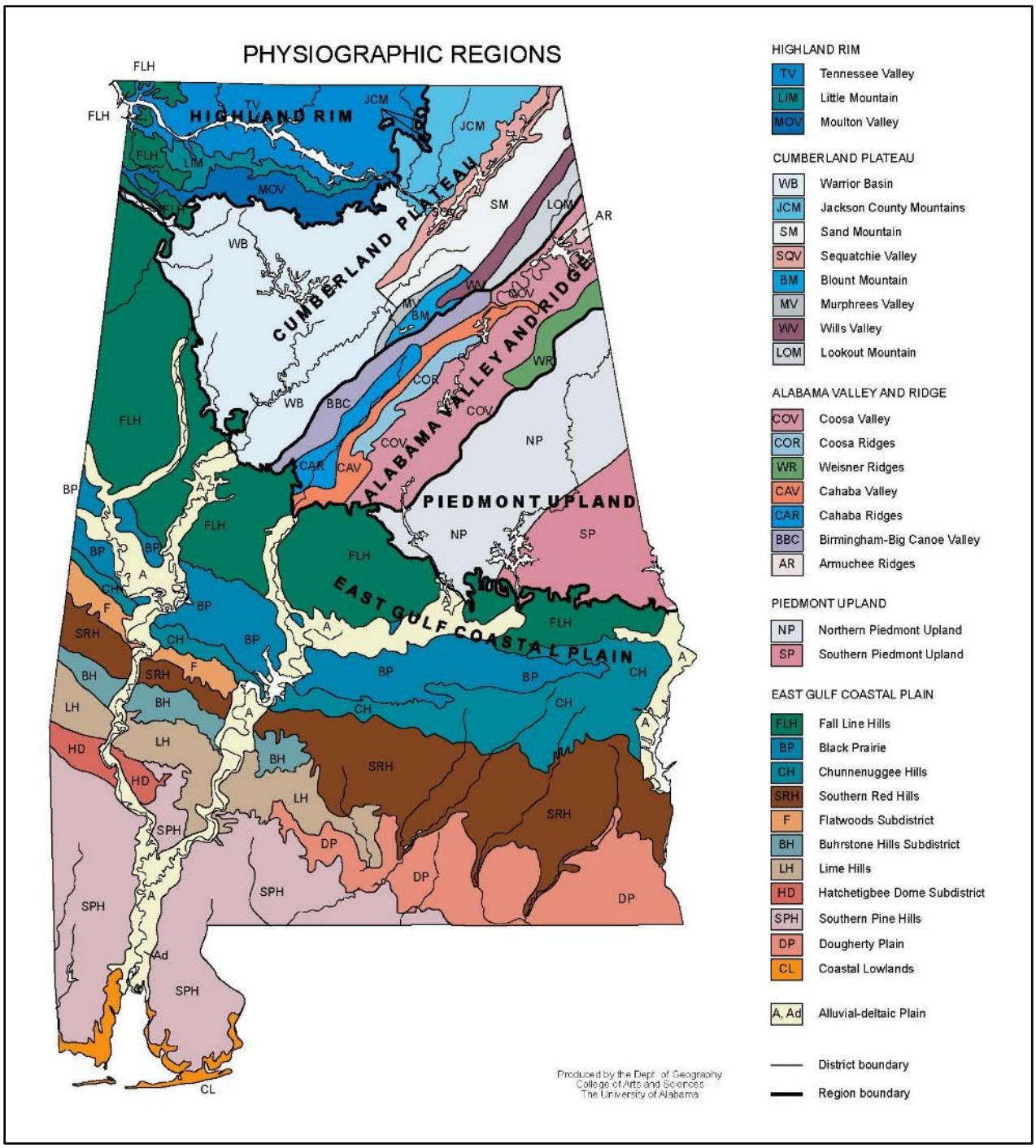
The Skunk Bayou Watershed is located to the west of the Bon Secour River Watershed in southwestern Baldwin County and includes the portion of Mobile Bay's eastern shoreline extending from the mouth of Weeks Bay to the Bon Secour River (**Figure 3-1**). The watershed encompasses 9,338 acres and consists of most rural lands.

Skunk Bayou

3.3 Geological Attributes

3.3.1 Physiographic Provinces

Located adjacent to one another in the southwest portion of Baldwin County, the Bon Secour River and Skunk Bayou watersheds encompass portions of the Southern Pine Hills and Coastal Lowlands physiographic provinces, while the Oyster Bay Watershed is located entirely within the Coastal Lowlands province (**Figure 3-2**). The Southern Pine Hills physiographic province consists of mostly upland areas while the Coastal Lowlands province is primarily flat with some very gently undulating areas. The boundary of the Coastal Lowlands and the Southern Pine Hills is defined by the Pamlico marine scarp (Jones 2004).



Source: University of Alabama (2016)

FIGURE 3-2: PHYSIOGRAPHIC PROVINCES

3.3.2 Topography

3.3.2.1 Bon Secour River Watershed

The Bon Secour River Watershed has relatively flat topography with few changes in elevation. The watershed reaches its highest elevation of 25 feet in the upper portion near its boundary with the Magnolia River Watershed. The lower portion of the watershed has almost no elevation change and consists mostly of wetland habitat (**Figure 3-3**).

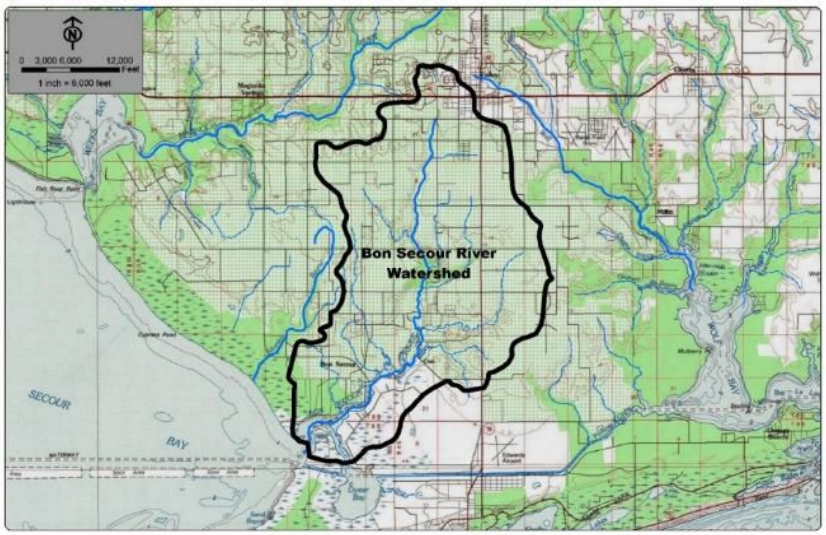


FIGURE 3-3: BON SECOUR TOPO MAP

3.3.2.2 Oyster Bay Watershed

Oyster Bay Watershed has virtually no change in elevation and consists almost entirely of wetland habitat. It reaches its peak elevation of 5 feet at the extreme eastern tip of the watershed near the city of Gulf Shores (**Figure 3-4**).

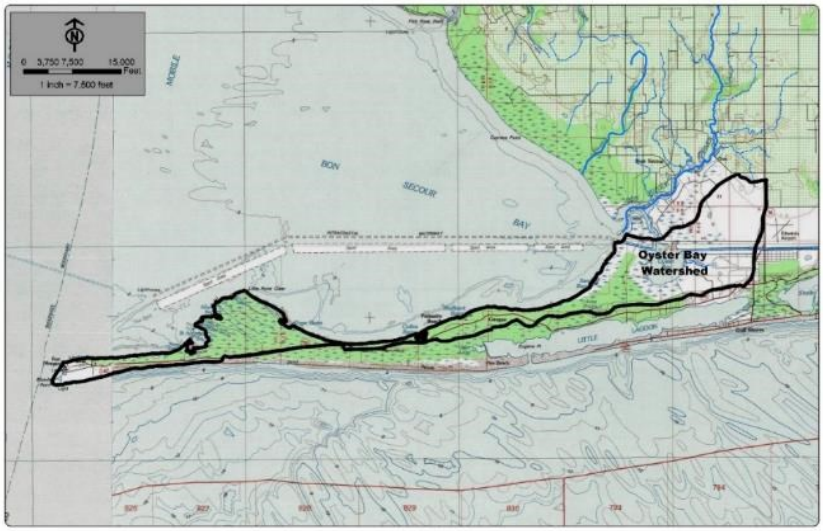


FIGURE 3-4: OYSTER BAY TOPO MAP

3.3.2.3 Skunk Bayou Watershed

The western boundary of the Skunk Bayou Watershed, along Bon Secour Bay, consists of wetland habitat and has virtually no elevation change. The upper portion of the watershed has some change in elevation, reaching a maximum elevation of 16 feet at the northeastern tip (**Figure 3-5**).

FIGURE 3-5: SKUNK BAYOU TOPO MAP

3.3.3 Geology

Geologic formations are the underlying layers of rock beneath the earth's surface. These layers are defined according to their age and composition. Knowledge of underlying geologic formations is important for understanding watershed conditions and is used for sustainable land-use planning because the varying properties of geologic formations determine: 1) the quantity and quality of groundwater that can be withdrawn in a given area and 2) the types of land use activities that occur in a given area (e.g., agriculture or urban development). This is largely due to the fact that each geologic unit is associated with certain aquifers and soil types. Two geologic formations underlie southwestern Baldwin County—the Citronelle Formation and alluvial, coastal, low terrace deposits (**Figure 3-6**).

The Citronelle Formation ranges from middle Pliocene to pre-Nebraskan Pleistocene in age. Citronelle sediments consist of non-fossiliferous, moderate-reddish-brown, fine to very coarse quartz sand; light-gray, orange, and brown sandy clay; and clayey gravel of non-marine origin. In many areas, layers of sandy clay and clayey sand, which range in thickness from 5 to 15 feet, are interbedded with gravelly sand. Sediment type, specifically clay content, often changes abruptly over short distances. Gravels of the Citronelle Formation generally consist of quartzite and chert (Gillett et al. 2000).

FIGURE 3-6: GEOLOGY

Alluvial, low terrace, and coastal deposits consist of very fine to coarse sand that is gravelly in many exposures. Sediments consist of very fine to coarse sand that is sometimes gravelly in nature, interbedded with clay and sandy clay. Thickness of the alluvial, low terrace, and coastal deposits is believed to range from 0 to 200 feet (Gillett et al. 2000).

Section 3.3.4, *Soils*, and Section 3.4.3, *Groundwater Resources*, respectively, present additional information regarding soil types and aquifers in each watershed.

3.3.3.1 Bon Secour River Watershed

The geology of the Bon Secour River Watershed consists of portions of the Citronelle Formation in upland areas of the watershed and alluvial, low terrace, and coastal deposits in low-lying and coastal areas (Gillett et al. 2000) (**Figure 3-6**).

3.3.3.2 Oyster Bay Watershed

The geology of the entire Oyster Bay Watershed, including the Fort Morgan Peninsula, consists of alluvial, low terrace, and coastal deposits (**Figure3-6**).

3.3.3.3 Skunk Bayou Watershed

The Skunk Bayou Watershed overlies portions of the Citronelle Formation and alluvial, low terrace, and coastal deposits. The coastal region of the Skunk Bayou Watershed, which borders

Bon Secour Bay, consists of alluvial, low terrace, and coastal deposits, and the inland portion of the watershed consists of Citronelle sediments (**Figure 3-6**).

3.3.4 Soils

Soils are an important element of watersheds because they influence surface water flow and groundwater recharge rates. Soil types also determine land uses within the three watersheds because certain soil types are more suitable for specific activities, such as agriculture or urban and residential development, than others. Because a diversity of soil types is often present within a given geographic area, soils are grouped into soil complexes for mapping and planning purposes.

Three major soils complexes cover most of southwestern Baldwin County, where the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds are located—Marlboro-Faceville-Greensboro association, Norfolk-Klej-Goldsboro association, and Lakewood-St. Lucie-Leon association (**Figure 3-7**). The properties and suitable land uses of each of these soil complexes within the three watersheds are described in more detail below.

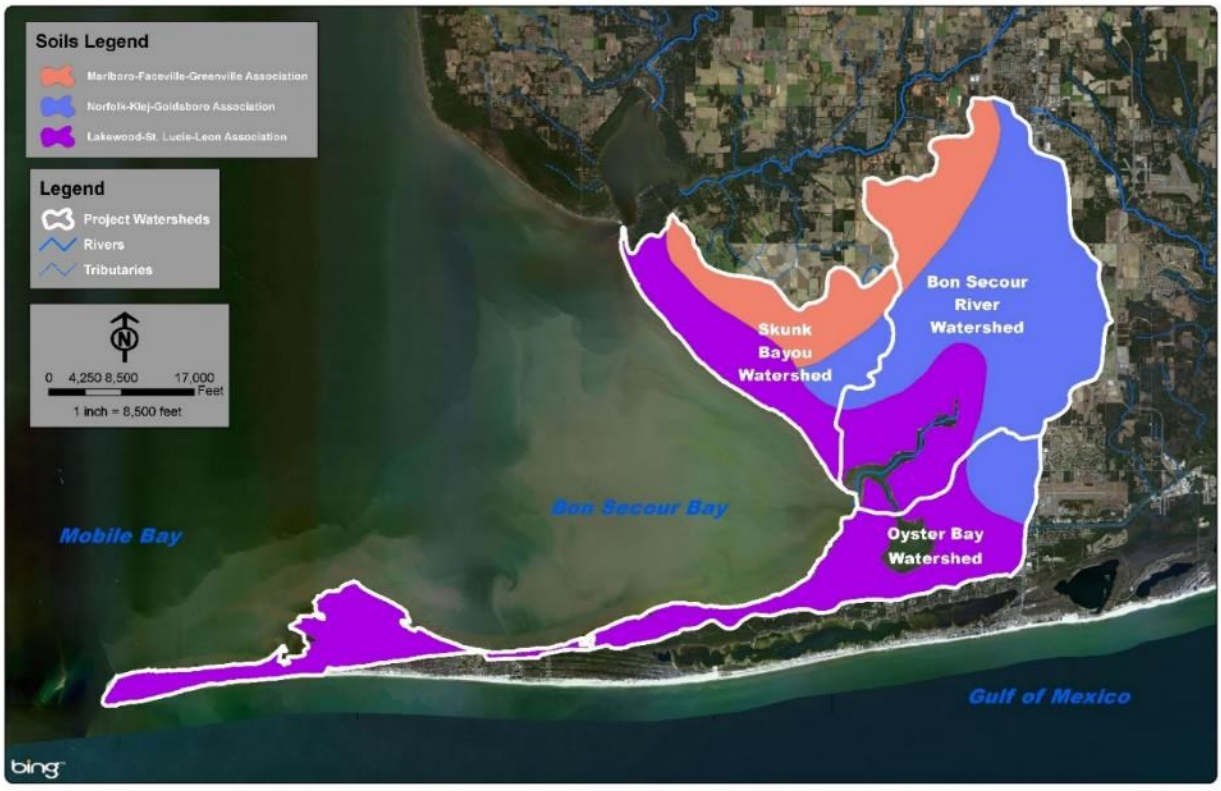


FIGURE 3-7: SOILS

The Marlboro-Faceville-Greensboro association is composed of well drained soils that are well suited for agriculture (both crop and pasture land). Soils of this complex consist of grayish-brown fine to very fine sandy loam intermixed with dark red and brown loam (USDA 1964; ADEM 1996). This soil complex is found in the northwest portion of the Bon Secour River

Watershed and covers the northern portion of the Skunk Bayou Watershed (**Figure 3-7**), where agriculture is the primary land use (**Figures 3-18 and 3-20**, below).

The Norfolk-Klej-Goldsboro association consists of dark grayish-brown, fine, sandy loam soils mixed with dark, grayish-brown, loamy sand. In general, these soils are well drained but depressions in level areas and bottom lands along small streams may drain poorly. Soils of the Norfolk-Klej-Goldsboro association are well suited for both crop and livestock agriculture (USDA 1964; ADEM 1996). This soil complex is found in the eastern portion of the Bon Secour River Watershed and covers 60 to 65% of the total area of the watershed (ADEM 1996). The Norfolk-Klej-Goldsboro association is also present in the southeastern portion of the Skunk Bayou Watershed and the extreme northeastern portion of the Oyster Bay Watershed (**Figure 3-7**). In the three watersheds, land uses associated with this soil association include agriculture and urban and residential development (**Figure 3-19**, below).

The Lakewood-St. Lucie-Leon association consists of sand and muck, sometimes more than 3 feet thick (ADEM 1996). These soils tend to either drain too fast because of a high content of sand or they drain very poorly because a hardened sand layer and muck. For these reasons, soils of the Lakewood-St. Lucie-Leon association are generally considered to be unsuitable for agricultural activities and extensive construction (USDA 1964; ADEM 1996). Land composed of this association is suitable for recreation and light residential development, although some drainage modifications, such as culvert, ditches, or storm drains might be necessary to prevent flooding or damage to building foundations. The Lakewood-St. Lucie-Leon association encompasses 20 to 25% of the Bon Secour River Watershed and is found in the extreme southwest portion of the watershed extending outward from the Bon Secour River (ADEM 1996). This soil association also covers the coastal portion of the Skunk Bayou Watershed and almost the entire Oyster Bay Watershed, including all of the Fort Morgan Peninsula and the area around Oyster Bay (**Figure 3-7**), where agricultural land-use and urban development are either non-existent or extremely minimal (**Figure3-19**, below).

3.4 Hydrology

3.4.1 Rainfall and Climate

Because the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds are located adjacent to one another in southwestern Baldwin County (**Figure 3-1**), rainfall and climate among the three watersheds are nearly identical. The climate of southwestern Baldwin County is subtropical, characterized by long humid summers and short mild winters (ADEM 1996). **Table 3-1** shows the mean monthly precipitation in the Bon Secour River and Oyster Bay watersheds as reported at the nearest National Oceanic and Atmospheric Administration (NOAA) weather station located in Fairhope, Alabama (FAIRHOPE 2 NE, AL US COOP:012813).

Table 3-1: Mean Annual Temperature and Precipitation in Southwestern Baldwin County, Alabama			
Month	**High Temperature (°F)**	**Low Temperature (°F)**	**Precipitation (inches)**
January	61	40	5.63
February	65	43	5.55
March	71	49	5.75
April	78	55	4.45
May	85	64	4.92
June	89	71	6.61
July	91	73	8.03
August	91	72	7.20
September	88	68	5.94
October	80	57	4.25
November	72	49	4.96
December	64	42	4.57

Source: U.S. Climate Data (2015)

During the winter, polar air and precipitation resulting from frontal systems (which form when a cold front overtakes a warm front) and the development of cyclones in the Gulf of Mexico dominate weather patterns throughout the region (Scanlan et al. 2004). Prevailing northerly winds persist throughout the winter (ADEM 1996). January is typically the coldest month of the year (**Table 3-1**). The lowest temperature in 2015—18°F (degrees Fahrenheit)—was recorded on January 9 (NOAA 2016a). The brevity and mildness of the winters contributes to an agricultural growing season of 300 days (ADEM 1996).

Spring is characterized by mild temperatures and is also the wettest season of the year, contributing to the region's 67 inches of mean annual precipitation (U.S. Climate Data 2015). The region received below average precipitation in 2015, during which precipitation totaled approximately 58 inches (NOAA 2016a).

Summer is affected by the Bermuda High, a seasonal high-pressure system that spreads over much of the eastern Gulf and south Atlantic coast from May through September (O'Neil and Mettee 1982). The prevailing southerly winds produced by the Bermuda High are high in both temperature and moisture content, resulting in frequent afternoon thunderstorms (SARPC 2004). Summer temperatures throughout the watersheds typically peak in the mid-90s; however, temperatures of 100°F are occasionally observed. July and August are typically the

hottest months of the year (**Table 3-1**). In 2015, the highest temperature recorded was 96°F on July 30 (NOAA 2016a). Summer temperatures along the coast are generally lower than those inland (O'Neil and Mettee 1982; ADEM 1996; Scanlan et al. 2004).

Fall is a short transitional season with mild temperatures and average monthly rainfall of 6 inches or less (U.S. Climate Data 2015).

The regional climate is strongly influenced by the Gulf of Mexico and the region is occasionally affected by tropical storms and hurricanes in the late spring and summer (O'Neill and Mettee 1982; ADEM 1996). Several historical hurricanes have affected coastal Alabama, including Camille (1969), Frederic (1979), Danny (1997), Ivan (2004), and Katrina (2005). Hurricane Isaac, which made landfall on August 28, 2012, was the most recent major storm event to affect the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds. Hurricane Isaac brought heavy winds and rainfall, causing temporary flooding throughout Mobile and Baldwin counties. Hurricane Isaac was relatively mild compared to past storms and caused no major damage. Current climate change models predict that rising ocean temperatures will result in greater storm intensity (by 2 to 11%) and increased frequency of intense storms by the end of the 21st century (IPCC 2014; NOAA 2015). Sea level rise, associated with climate change will also likely result in increased damage to property along the Alabama Gulf Coast (Climate Central 2014).

3.4.2 Surface Water Resources

Surface waters are bodies of water on the earth's surface (as opposed to underground) such as rivers, streams, lakes, and ponds. Surface waters are a critical resource within any watershed and may be used for drinking water supplies, agriculture, industrial uses, navigation, or recreation. Within a watershed, surface waters have a general flow pattern and direction, channeling waters within the boundaries of the watershed to the lowest point of elevation (in this case a stream, river, or bay). Surface waters are replenished during precipitation events or by springs (points where groundwater flows to the surface). **Figure 3-8** shows the major surface water resources within the three watersheds.

FIGURE 3-8: SURFACE WATER RESOURCES

3.4.2.1 Bon Secour River Watershed

The Bon Secour River is the largest surface water feature in this watershed. The Bon Secour River is a tidally influenced river that is approximately 8 miles in length. The river originates in the city of Foley and flows south and southwest, discharging into Bon Secour Bay in the southeastern corner of Mobile Bay. Near its mouth, the Bon Secour River also discharges into the Gulf Intracoastal Waterway (Gulf ICW) and Oyster Bay via its South Fork (**Figure 3-8**). The river is approximately 2,000 feet wide at its mouth; at 5.5 miles upstream at the County Road 10 Bridge, it decreases to a width of 150 feet and then narrows to less than 50 feet wide about 0.75 mile upstream of the County Road 10 bridge (ADEM 1996). Notable tributaries include Boggy Branch, Bright's Creek, Shutt Creek, Miller's Bayou, and Schoolhouse Creek, although at least six smaller tributaries also branch off of the Bon Secour River. Other surface water resources in the Bon Secour River Watershed include freshwater lakes and ponds and palustrine (freshwater) and estuarine (marine) wetlands, described in Section 3.4.5, *Wetlands*.

3.4.2.2 Oyster Bay Watershed

Oyster Bay and the Gulf ICW are the major surface water feature in the Oyster Bay Watershed. Both are tidally influenced. Oyster Bay receives water from the Bon Secour River, to the north, via the South Fork of the Bon Secour River. Oyster Bay is also traversed by the Gulf ICW along its northern edge (**Figure 3-8**). The surface area of Oyster Bay is approximately 700 acres. Other surface water features in the Oyster Bay Watershed include a series of small freshwater

ponds, mostly located along the south shore of Oyster Bay. The majority of the watershed is covered by palustrine and estuarine wetlands as described in Section 3.4.5*, Wetlands*.

3.4.2.3 Skunk Bayou Watershed

Skunk Bayou originates in the northeastern corner of the watershed and flows southwest, discharging into Bon Secour Bay approximately 1.5 miles north of the mouth of the Bon Secour River (**Figure 3-8**). Skunk Bayou is tidally influenced and is approximately 4 miles in length. Skunk Bayou has four unnamed major tributaries. The Skunk Bayou watershed contains other unnamed small tributary streams and freshwater ponds. A large portion of the watershed along the shore of Bon Secour Bay is composed of palustrine (freshwater) and estuarine (marine) wetlands as described in Section 3.4.5, *Wetlands*.

3.4.3 Groundwater Resources

Groundwater is water that is found underground in cracks and spaces in soils, sand, and rocks. It is stored in and moves slowly through geologic formations called aquifers. Groundwater is sometimes released at points where the aquifer's surface meets the earth's surface. These points are called springs. Springs are often the origin of rivers and streams, so groundwater resources are often closely related to surface water resources. Wells are drilled to extract groundwater from the earth for use as drinking water for humans and livestock, irrigation for crops, or for commercial and industrial purposes. Thus, groundwater resources are a critical component in understanding watershed conditions and for sustainable land-use planning because they affect surface water features and determine the types and intensities of specific land uses in the three watersheds.

3.4.3.1 Bon Secour River Watershed

The Bon Secour River Watershed is served by two major aquifers—the Miocene-Pliocene aquifer and the watercourse aquifer (sometimes referred to as the Beach Sand aquifer). The Miocene-Pliocene aquifer is associated with the Citronelle Formation and is approximately 3,400 feet thick in southern Baldwin County, located in and around the Bon Secour River Watershed. Groundwater from the Miocene-Pliocene aquifer is generally soft and low in dissolved solids but may contain iron in excess of 0.3 milligram per liter (mg/L) and may be corrosive. However, dissolved solids and chloride content generally increase closer to the coastal areas of the watershed. The Miocene-Pliocene aquifer may yield more than 2 million gallons of water per day at each well. Three public supply wells from the Miocene-Pliocene aquifer exist in the Bon Secour River Watershed (Gazzier 2016).

The watercourse aquifer is associated with alluvial, low terrace, and coastal deposits and serves the portions of the Bon Secour River Watershed adjacent to Bon Secour Bay and the Bon Secour River. Groundwater from the watercourse aquifer is generally much harder than that of the Miocene-Pliocene aquifer and is high in iron, chloride, and dissolved solids, particularly in extreme coastal areas. It is also highly acidic and may be corrosive. Wells in this aquifer may yield up to 10 gallons per minute. Seven public supply wells from the watercourse aquifer exist in the Bon Secour River Watershed (Gazzier 2016).

The recharge areas for both aquifers includes all of Mobile and Baldwin counties and parts of Washington County. Rainfall is the major source of recharge for these aquifers. The Miocene-Pliocene and watercourse aquifers are considered to be unconfined because they are hydraulically connected to the land surface by sand and gravel beds. Because sand units between the two aquifers are not completely separated by clay lenses, the watercourse aquifer locally provides recharge for the underlying Miocene-Pliocene aquifer (Gillett et al. 2000).

The Miocene-Pliocene and watercourse aquifers are considered to be highly vulnerable to contamination from the surface throughout the watershed because of the permeability of the underlying sediments, which allows rapid infiltration of water (Gillett et al. 2000). A 2006–2007 assessment of aquifer contamination in southern Baldwin County reported isolated pockets of severe nitrate contamination in the Miocene-Pliocene aquifer. The highest measured pocket of nitrate contamination occurred along Highway 59 between Foley and Gulf Shores and included the extreme southeastern portion of the Bon Secour River Watershed, although the majority of the contaminated area was located within the neighboring Perdido Pass Watershed. Maximum nitrate concentrations were 63.74 mg/L and 80.79 mg/L in 2006 and 2007, respectively. The primary source of aquifer contamination was agricultural practices, likely fertilizer runoff (Murgulet and Tick 2009).

3.4.3.2 Oyster Bay Watershed

The Oyster Bay Watershed is served exclusively by the watercourse aquifer. Two public water supply wells from this aquifer exist within the watershed. They are both located north of the Gulf ICW (Gazzier 2016).

The watercourse aquifer is highly vulnerable to contamination from the surface throughout the entire watershed and is susceptible to saltwater encroachment along extreme coastal areas (Gillett et al. 2000). Saltwater encroachment occurs when a freshwater aquifer becomes contaminated with saltwater. This can occur in coastal areas when groundwater is removed from an aquifer at a faster rate than it is replenished by precipitation. Reduced pressure in the aquifer caused by low groundwater levels allows seawater to flow into the aquifer. Groundwater from the watercourse aquifer at the western portion of the Oyster Bay Watershed (near the tip of the Fort Morgan Peninsula) is unsuitable for most uses because of dissolved solid concentrations greater than 1,000 mg/L and chloride concentrations in excess of 250 mg/L. Saltwater encroachment is also a significant problem in the watercourse aquifer along the coastal portions of the Oyster Bay Watershed (Gillett et al. 2000; Liu et al. 2007; Murgulet and Tick 2009). Rapid economic and population growth in Gulf Shores has been a major driver of saltwater encroachment in this area because water is in greater demand more water is pumped from wells (Gillett et al. 2000; Liu et al. 2007). A study of groundwater resources within the Fort Morgan Peninsula reported that unsustainable groundwater pumping at three irrigation wells on the peninsula and one groundwater well at the Peninsula Golf Course, located in the Oyster Bay Watershed, was driving saltwater encroachment in the aquifer (Liu et al. 2007). Results of modeling efforts predicted that redistribution of pumping locations within the aquifer could alleviate saltwater encroachment, while failure to do so may lead to contamination of the aquifer

throughout the Fort Morgan Peninsula, affecting drinking water sources for much of the Oyster Bay Watershed (Liu et al. 2007).

3.4.3.3 Skunk Bayou Watershed

Like the Bon Secour River Watershed, the Skunk Bayou Watershed is served by both the Miocene-Pliocene aquifer and the watercourse aquifer. The coastal region of the Skunk Bayou Watershed bordering Bon Secour Bay is served by the watercourse aquifer, which is associated with alluvial, low terrace, and coastal deposit geology. Inland portions of the Skunk Bayou Watershed are served by the Miocene-Pliocene aquifer, which is associated with the Citronelle Formation geology. No public supply wells are located within the Skunk Bayou Watershed (Gillett et al. 2000).

Nitrate contamination of the Miocene-Pliocene aquifer was found in the Skunk Bayou Watershed in 2006 and 2007. The area of contamination was identified southeast of Weeks Bay along the boundary of the Skunk Bayou and Magnolia River watersheds. Maximum nitrate concentrations were 121.37 mg/L and 53.40 mg/L in 2006 and 2007, respectively. Leaking, outdated, and/or improperly installed septic tanks in the northeastern portion of the Skunk Bayou Watershed and the southwestern portion of the Magnolia River Watershed are believed to be the source of this nitrate contamination (Murgulet and Tick 2009). However, because agriculture represents the main form of land use in the area, fertilizers and other agricultural runoff may also contribute to nitrate contamination.

3.4.4 Floodplains

Floodplains are low-lying areas adjacent to rivers, bays, or other waterbodies that are subject to periodic flooding. The Federal Emergency Management Administration (FEMA) designates flood zones based on the frequency and probability of flooding. **Figure 3-9** shows 500-year, 100-year, and velocity zone (where storm-related risks are highest) designations for each of the three watersheds. Areas located within 500-year flood zones have a 0.2% probability of flooding in any given year. Areas within 100-year flood zones have a 1% probability of flooding in any given year. Areas within velocity zones have the same flooding probability as those within 100-year flood zones and are also subject to additional hazards associated with waves caused by storms (FEMA 2016).

3.4.4.1 Bon Secour River Watershed

The banks of most of the Bon Secour River and its tributaries lie within the 100-year flood zone. Low-lying areas south of County Road 10 and west of Highway 59 are also located within the 100-year flood zone and are more subject to flooding than areas in the upper two-thirds of the watershed. A small portion of the watershed near the mouth of the Bon Secour River is located within a velocity zone, **Figure 3-9**.

FIGURE 3-9: FLOODPLAINS

3.4.4.2 Oyster Bay Watershed

Nearly all of the Oyster Bay Watershed lies within a FEMA flood zone. Oyster Bay, along with all of the coastal portion of the Fort Morgan Peninsula, is located within a velocity zone. The northern coastline of the Fort Morgan Peninsula is highly exposed to wind and wave action from Mobile Bay and Bon Secour Bay. Areas of the Oyster Bay Watershed that are located outside a velocity zone mostly fall within the 100-year flood zone. A small portion of the watershed is located within the 500-year flood zone and a few areas of higher elevation along the eastern boundaries of the watershed are outside the flood zones (**Figure 3-9**).

3.4.4.3 Skunk Bayou Watershed

The entire coastal boundary of the Skunk Bayou Watershed along Bon Secour Bay is located within a velocity zone. This area is highly exposed and is affected by flooding and storms. The banks along the lower half of Skunk Bayou are within the 100-year flood zone along with the western portion of the watershed, slightly inland from the shoreline. The upper portion of the watershed is located mostly outside the flood zones (**Figure 3-9**).

3.4.5 Wetlands

Wetlands provide beneficial services to humans and play an integral role in the ecology of the watersheds. Wetlands provide habitat for fish and wildlife, improve the quality of surface water and groundwater, provide flood protection, and help control shoreline erosion (USEPA 2016).

As previously noted, wetlands within the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds consist of two main types—palustrine and estuarine wetlands. Palustrine wetlands are freshwater wetlands (salinity <0.5), such as marshes, bogs, and swamps, dominated by trees, shrubs, emergent herbaceous plants, floating leaved and submergent plants, and mosses and lichens (Cowardin et al. 1979). Palustrine wetlands within the three watersheds include emergent wetlands, forested/shrub wetlands, and rivers, lakes, and ponds. Estuarine wetlands are deepwater tidal habitats and adjacent tidal wetlands with ocean-derived water at least occasionally diluted by freshwater runoff from the land (Cowardin et al. 1979). Estuarine wetlands are characterized by salinities >0.5 and are dominated by salt marsh vegetation. Wetlands in the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds were mapped using data from the National Wetland Inventory (NWI).

3.4.5.1 Bon Secour River Watershed

The Bon Secour River Watershed contains 2,258 acres of wetlands, which cover 11% of the total area of the watershed. Wetlands within the watershed are mostly palustrine, and forested/shrub wetlands make up 69% (1,548 acres) of the total wetland coverage. Palustrine wetlands are located along the banks of the Bon Secour River and its tributaries, outside the area of tidal influence. Emergent wetlands, freshwater ponds, and lakes are scattered throughout the watershed for a combined total of 304 acres. Eighteen acres of riverine wetland occur along the upper reaches of the Bon Secour River and its tributaries. Estuarine wetlands cover 388 acres, or 17% of the total wetland coverage in the watershed. Estuarine wetlands occur near the mouth of the Bon Secour River and adjacent to tidally influenced portions of the main stem of the river and its tributaries south of County Road 10 (**Figure 3-10**).

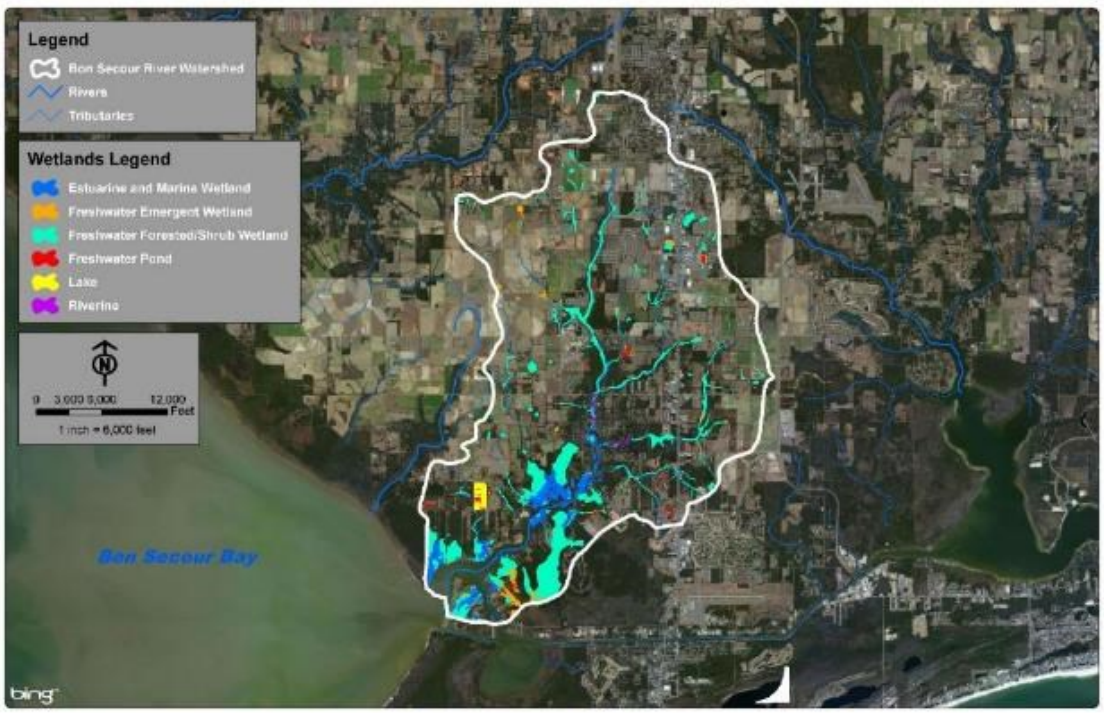


FIGURE 3-10: BON SECOUR RIVER WETLANDS

3.4.5.2 Oyster Bay Watershed

Freshwater forested/shrub wetland – Oyster Bay Watershed

The Oyster Bay Watershed contains 6,851 acres of wetlands, which cover 53% of the total area of the watershed. Large tracts of estuarine wetland (2,278 acres) are located around the edges of Oyster Bay, adjacent to the Gulf ICW, along the coastline south of the mouth of the Bon Secour River, and along coastal portions of the Fort Morgan Peninsula. Palustrine wetlands cover most of the interior portions of the watershed and are located outside the area of tidal influence. Palustrine wetlands within the Oyster Bay Watershed are dominated by forested/shrub wetland (3,805 acres), although a 718-acre tract of emergent wetland exists in the eastern portion of the watershed, west of Highway 59 and north of the Gulf ICW. Freshwater ponds are located around the southern shore of Oyster Bay and along the eastern boundary of the watershed, comprising a total of 48 acres (**Figure 3-11**).

FIGURE 3-11: OYSTER BAY WETLANDS MAP

3.4.5.3 Skunk Bayou Watershed

The Skunk Bayou Watershed contains a total of 4,093 acres of wetlands, which cover 44% of the total area of the watershed. Palustrine wetlands line the banks of Skunk Bayou and its tributaries and cover most of the western boundary of the watershed along the shore of Bon Secour Bay, representing 92% of the total wetlands in the watershed. Most of the palustrine wetlands are forested/shrub wetland (3,188 acres) with patches of emergent wetland (597 acres) intermixed. Freshwater ponds dot the landscape throughout the watershed, covering 30 acres. Estuarine wetlands (278 acres) are located along the southern portion of the Bon Secour Bay shoreline, north of the mouth of the Bon Secour River (**Figure 3-12**).

Forested wetland – Skunk Bayou Watershed

FIGURE 3-12: SKUNK BAYOU WETLANDS MAP

3.5 Political Jurisdictions

Two Baldwin County political jurisdictions overlap with a portion of one or more of the three watersheds included in this plan—the cities of Foley and Gulf Shores. The boundaries of the two political jurisdictions and the three watersheds are shown in **Figure 3-13**. Portions of the Bon Secour River Watershed are under the authority of both the City of Foley and the City of Gulf Shores. Portions of the Oyster Bay Watershed are within the political jurisdiction of the City of Gulf Shores. The Skunk Bayou Watershed is not governed by either of these political jurisdictions. Portions of the three watersheds that are outside city limits fall under the jurisdiction of Baldwin County.

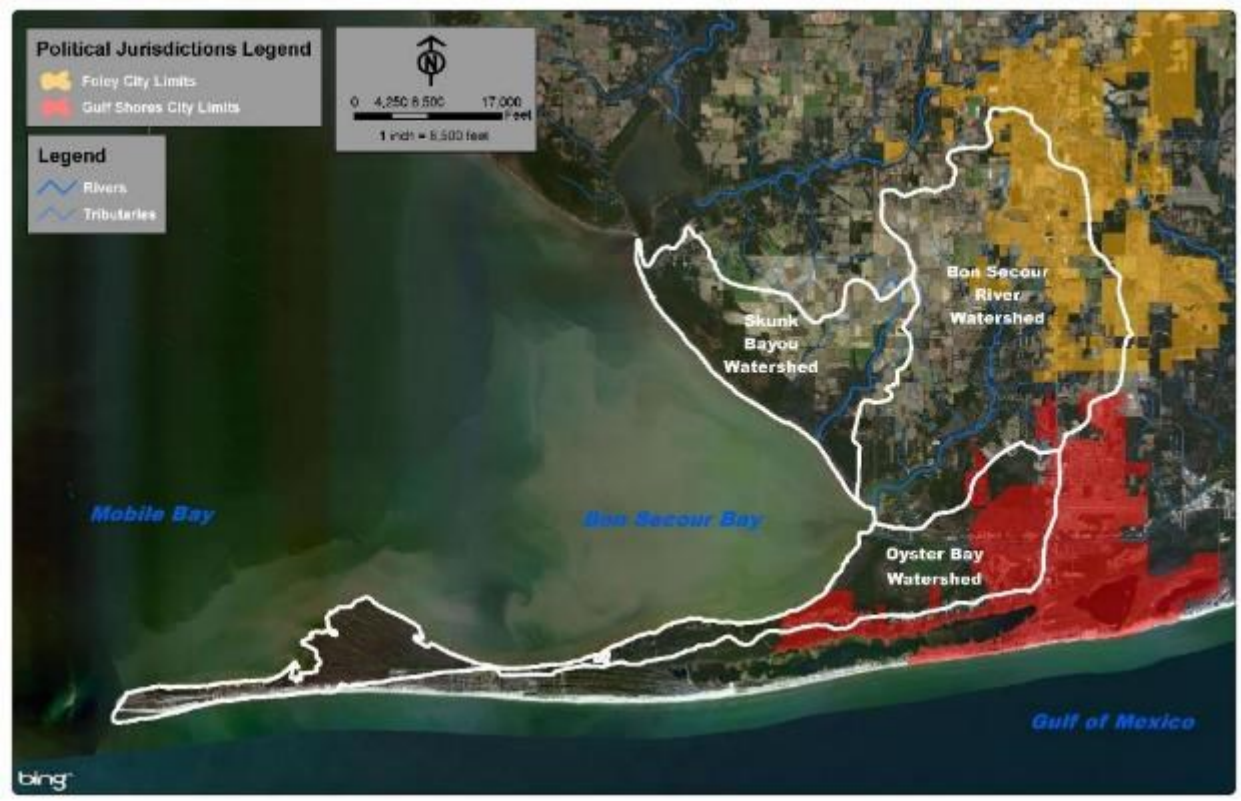


FIGURE 3-13: POLITICAL JURISDICTIONS

3.6 Population and Demographics

Population and population growth are important considerations in watershed planning because population growth is intrinsically tied to land use, development, and various environmental stressors on a watershed, such as increased nutrient loading and flooding. Current and historical population trends are presented for Baldwin County and each of the three watersheds assessed in this plan.

Other demographic characteristics, such as ethnic composition, age distribution, and income and poverty levels, are important for characterizing the populations of the watersheds. Ethnic

composition, age distribution, and income and poverty within each of the three watersheds, as well as Baldwin County, are described in this section.

3.6.1 Baldwin County Population Trends and Projections

Baldwin County is the largest county in Alabama by land area and among the most populated counties in the state. The population of Baldwin County increased by nearly a one-third (30%) from 2000 to 2010 according to the U.S. Census Bureau, and the county's population has more than doubled since 1980 (U.S. Census Bureau 2016). **Table 3-2** shows population and growth rates (% change over 10-year periods) in Baldwin County from 1980 to 2010 and projects county population growth through 2040. County-level population growth projections are published by the University of Alabama's Center for Business and Economic Research (UACBER) (UACBER 2014).

TABLE 3-2: BALDWIN COUNTY PAST, CURRENT, AND FUTURE POPULATION

	U.S. Census Population				Projected Population		
	1980	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**
Population	78,556	98,280	140,415	182,265	225,564	264,992	300,446
% Change	--	25	43	30	24	17	13

Sources: University of Alabama (2014); U.S. Census Bureau (1990, 2000, 2010a, 2010b)

3.6.2 Population Trends and Projections by Watershed

The 2010 Decennial (10-year interval) Census includes data aggregated to three census-specific levels of geographic units—tracts, block groups, and blocks. Census blocks are the smallest and most detailed geographic unit used by the U.S. Census Bureau, and for this reason, they were chosen as the basis for estimating population within the three watersheds. Census blocks are typically bounded by existing physical features, natural features, or political boundaries (e.g., roads, rivers, or state boundaries), but the U.S. Census Bureau does not use watershed boundaries to delineate census blocks (U.S. Census Bureau 2010c). As a result, approximately 30% of the census blocks in the project area exist partially within and partially outside one or more of the project watersheds. Rather than count the entire population of each of these census blocks, aerial imagery was used to estimate the percentage of each block's population present inside each watershed.

Population growth projections from UACBER are published at the county-level, but population projection data are not available for any geographic unit smaller than a county (University of Alabama 2014). To estimate future population trends for the three project watersheds, the percent change that UACBER projected for the county-level population was applied to the estimated 2010 population for each watershed (**Table 3-3**). The resulting calculations approximate the future population in the project watersheds through 2040. However, because factors influencing population trends at the county-level may differ from those in each of the

three watersheds, these watershed-level projections should be considered in coordination with local regulations, demographics, and geographic features that may alter future trends from the projections.

Table 3-3: Population Projections by Watershed				
Watershed	U.S. Census Population	Projected Population		
	2010	2020	2030	2040
Bon Secour River	12,456	15,415	18,110	20,534
Oyster Bay	3,509	4,343	5,102	5,785
Skunk Bayou	1,056	1,307	1,535	1,741

Sources: University of Alabama (2014); U.S. Census Bureau (2010a, 2010b)

3.6.3 Ethnic Composition

3.6.3.1 Baldwin County Ethnic Composition

Table 3-4 presents the ethnic composition of Baldwin County, based on 2010 census data. The ethnic composition of Baldwin County is predominantly people who identify themselves as white or white alone (86%), followed by those who identify themselves as black or African American alone (9%), with other ethnic groups representing at 2% or less of the total county population.

Table 3-4: 2010 Baldwin County Ethnic Composition		
Ethnicity	**Population**	**% of Population**
White alone	156,153	86
Black or African American alone	17,105	9
American Indian and Alaska Native alone	1,216	1
Asian alone	1,348	1
Native Hawaiian and other Pacific Islander alone	89	0
Some other race alone	3,631	2
Two or More Races	2,723	1
Total	**182,265**	**100%**

Source: U.S. Census Bureau (2010a, 2010b)

3.6.3.2 Ethnic Composition by Watershed

Table 3-5 presents the ethnic composition of the three watersheds. It was calculated based on the estimated percentage of each census block that falls within the boundaries of each watershed.

The ethnic composition of the three watersheds differs slightly from that of Baldwin County, but the same general patterns emerge. All of the watersheds are overwhelmingly composed of people who identify themselves as white or white alone, followed those who identify themselves

as black or African American alone or some other race alone. All other ethnic groups are minimally represented. The percent representation of the white or while alone population is slightly higher than the county level percentage in all three of the watersheds.

Table 3-5: Ethnic Composition by Watershed			
Ethnicity	**Population (% Representation) by Watershed**		
	Bon Secour River	**Oyster Bay**	**Skunk Bayou**
White alone	10,241 (89)	3,304 (94)	956 (91)
Black or African American alone	1,059 (9)	44 (1)	19 (2)
American Indian and Alaska Native alone	74 (1)	24 (1)	12 (1)
Asian alone	105 (1)	15 (0)	5 (0)
Native Hawaiian and Other Pacific Islander alone	13 (0)	0 (0)	0 (0)
Some Other Race alone	738 (6)	51 (1)	41 (4)
Two or More Races	225 (2)	72 (2)	23 (2)

Sources: U.S. Census Bureau (2010a, 2010b)

3.6.4 Age Distribution

3.6.4.1 Baldwin County Age Distribution

Table 3-6 presents the age distribution of Baldwin County, based on 2010 census data. The majority of the Baldwin County population falls within the 30 to 49 age class, followed closely by the 17 and under and 50 to 64 age classes.

Table 3-6: 2010 Baldwin County Ethnic Composition		
Age	**Population**	**% of Population**
17 and Under	41,898	23
18 to 29	24,081	14
30 to 49	47,693	26
50 to 64	38,025	21
65 and Older	30,568	16
Total	**182,265**	**100**

Sources: U.S. Census Bureau (2010a, 2010b)

3.6.4.2 Age Distribution by Watershed

Table 3-7 presents the age distribution of the population within each watershed. The age distribution of Bon Secour River Watershed and Skunk Bayou Watershed populations is mostly consistent with the overall age distribution within the population of Baldwin County. However, the age distribution of the Oyster Bay Watershed population is noticeably different in the 50 to 64 and 65 and older age classes. The percentages of the Oyster Bay Watershed population that fall within these age classes, especially the 65 and older age class, are substantially higher than those of the other two watersheds and Baldwin County.

TABLE 3-7: ETHNIC COMPOSITION BY WATERSHED

Age	Population (% Representation) by Watershed		
	Bon Secour River	Oyster Bay	Skunk Bayou
17 and Under	2,863 (23)	658 (15)	266 (25)
18 to 29	2,296 (18)	424 (13)	174 (16)
30 to 49	3,114 (25)	846 (25)	302 (29)
50 to 64	2,280 (19)	831 (24)	189 (17)
65 and Older	1,904 (15)	750 (23)	125 (13)

Sources: U.S. Census Bureau (2010a, 2010b)

3.6.5 Income and Poverty

Table 3-8 shows the median household income and the estimated population living below the poverty level in Baldwin County and in each watershed. Median household income and population with income below the poverty level were estimated based on census block groups that completely or partially intersect each watershed. Median household income in each of the three watersheds is substantially lower than that of Baldwin County. The Bon Secour River Watershed has the largest amount of population with income below the poverty level of any of the three watersheds despite having the highest median household income. The percent of the population with income below the poverty level in the Bon Secour River Watershed is more than 50% higher than that of Baldwin County. The amount of population with income below the poverty level in the Oyster Bay Watershed is slightly higher than, but on par with the county average while Skunk Bayou is well below that of Baldwin County.

TABLE 3-8: 2010 INCOME AND POVERTY LEVEL IN BALDWIN COUNTY AND BY WATERSHED

County/Watershed	Median Household Income (USD)	Population and % with Income below Poverty Level
Baldwin County	$51,888	24,002 (13)
Bon Secour River	$41,142	5,588 (21)
Oyster Bay	$48,663	1,610 (15)
Skunk Bayou	$41,788	382 (8)

Sources: U.S. Census Bureau (2010a, 2010b)

3.7 Landcover

3.7.1 Transportation

The Bon Secour River, Oyster Bay, and Skunk Bayou watersheds are not highly developed for transportation, although the Bon Secour River Watershed is the most developed of the three. Transportation routes primarily consist of state-maintained highways and county roads (**Figure 3-14**). Highway 59 is the main north-south artery in the area. Highway 59 traverses the Bon Secour River Watershed, running through the center of Foley, where it becomes the primary center of development. A small section of Highway 59 is within the boundaries of the Oyster Bay Watershed at the extreme northeastern portion of the watershed. Highway 98 is a major east-west corridor in the area, but it only crosses the extreme northern portion of the Bon Secour River Watershed. Notable county roads within the Bon Secour River Watershed include County Roads 49, 65, 26, 16, 12 and 10. County Roads 49 and 12 are the main roadways within the Skunk Bayou Watershed. Skunk Bayou is a rural area and contains very little transportation infrastructure. Highway 180 (Fort Morgan Road) is the main transportation route in the Oyster Bay Watershed. Highway 180 traverses the entire watershed east to west from the tip of the Fort Morgan Peninsula to Highway 59 in Gulf Shores. No airports or railroads are located in any of the three watersheds.

FIGURE 3-14: TRANSPORTATION CORRIDORS IN THE WATERSHEDS

3.7.2 Historical Land Use

Land use is among the most important drivers of watershed conditions and often determines when, where, and which stressors occur. The Bon Secour River, Oyster Bay, and Skunk Bayou watersheds have a long history of human use, and the watersheds have changed drastically over time. The figures below are based on land use data collected between 1970 and 1985 and are intended to establish a baseline from which to measure growth and change in land use type in recent decades.

3.7.2.1 Bon Secour River Watershed

From 1970–1985, agriculture was the dominant land use type in the Bon Secour River Watershed, comprising approximately 64% of the total land cover in the watershed. Forests, wetlands, and waterbodies made up the majority of the remainder of the watershed, covering approximately 27% of the total area. The remaining 9% of the watershed consisted mostly of urban and residential development, which was primarily centered around the city of Foley and along the shores of the Bon Secour River (**Figure 3-15**).

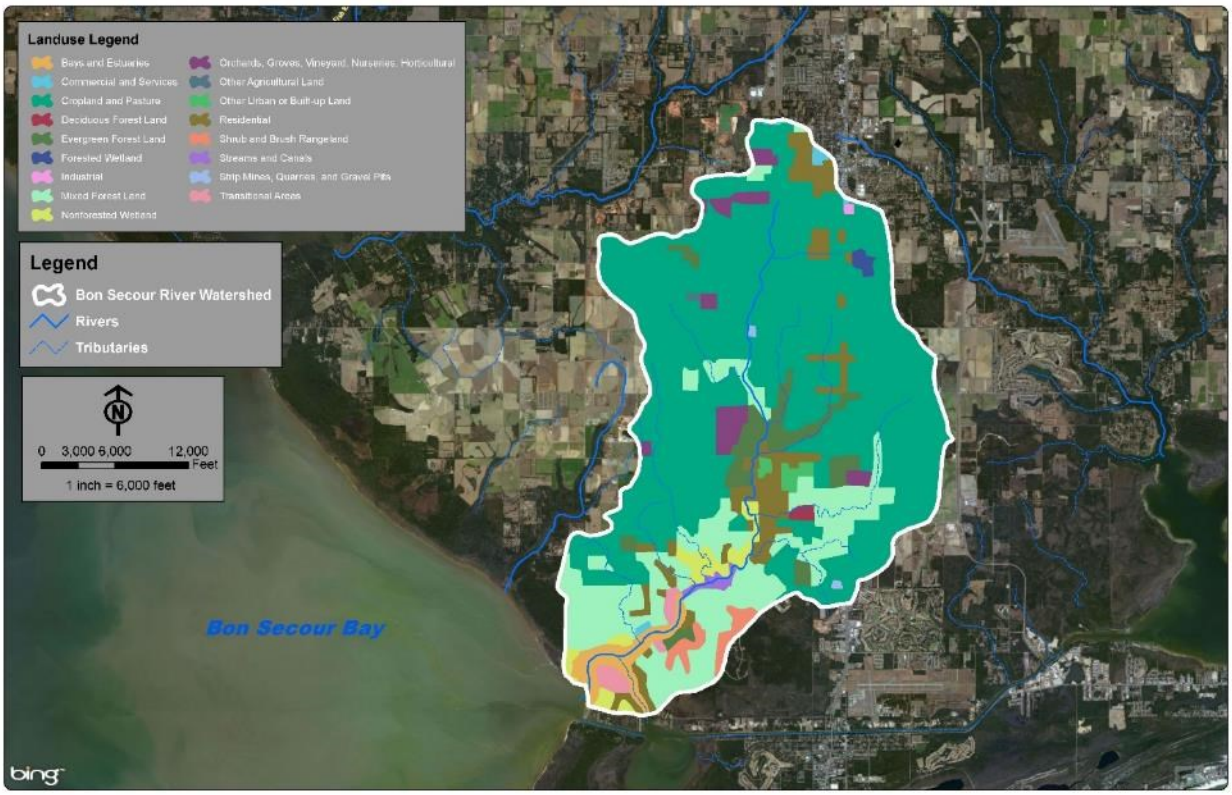


FIGURE 3-15: BON SECOUR HISTORICAL LAND USE

3.7.2.2 Oyster Bay Watershed

Land cover in the Oyster Bay Watershed from 1975–1980 was dominated by undeveloped lands. Forests, wetlands, beaches, waterbodies, and other natural features made up approximately 84% of the total area of the watershed. The remaining 16% of the watershed consisted of residential development with a small amount of urban development in the city of Gulf Shores (**Figure 3-16**).

FIGURE 3-16: OYSTER BAY HISTORICAL LAND USE

3.7.2.3 Skunk Bayou Watershed

Land use in the Skunk Bayou Watershed from 1975–1980 was split between agriculture and undeveloped lands. Forests, wetlands, waterbodies, and other natural features made up approximately 52% of the total area of the watershed, while agriculture accounts for approximately 48%. Residential development accounted for less than 1% of the total area of the watershed, and there was no urban development (**Figure 3-17**).

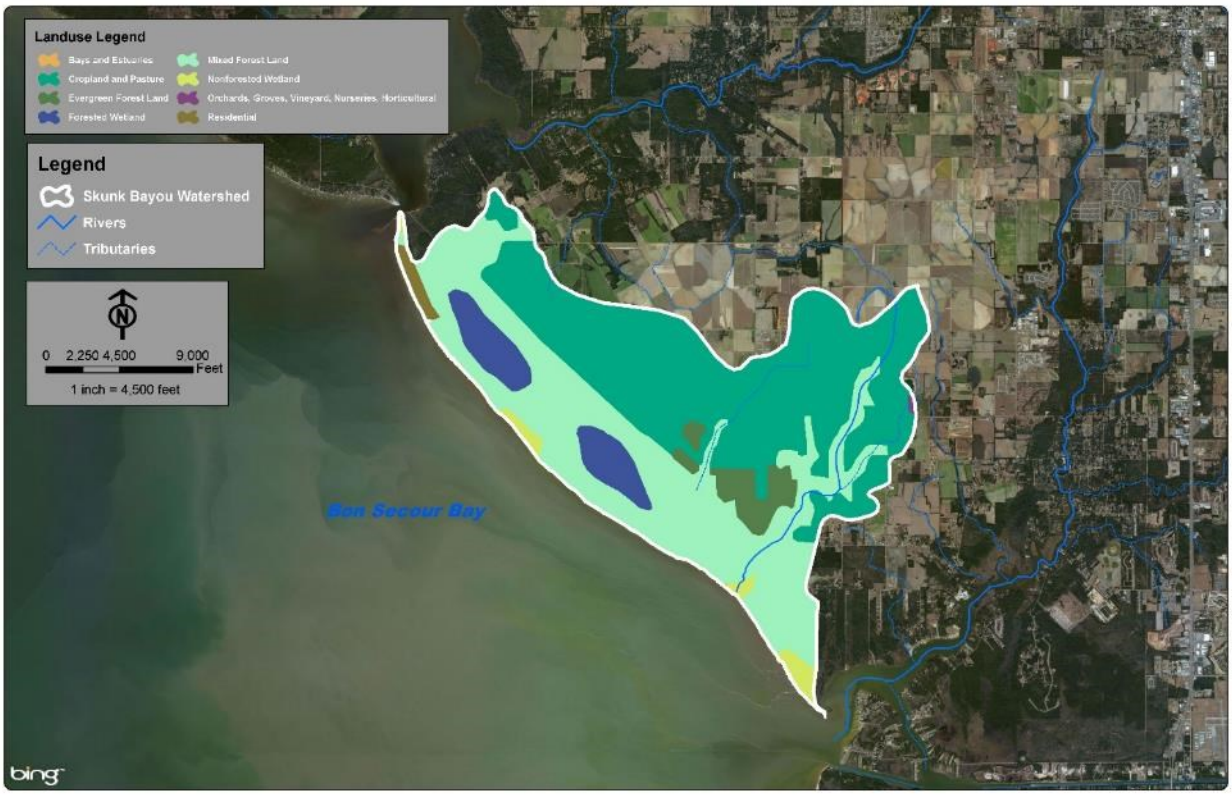


FIGURE 3-17: SKUNK BAYOU HISTORICAL LAND USE

3.7.3 Current Land Use

The figures below are based on 2011 land use data for the three watersheds. These figures are intended to show the change in land use within the watersheds during the past three decades.

3.7.3.1 Bon Secour River Watershed

By 2011, agricultural land use in the Bon Secour River Watershed had decreased from 64% to 39% of total land cover in the watershed. While agriculture is still the dominant land use type within the watershed, this decrease demonstrates the changing cultural and socioeconomic conditions during this period. Forests, wetlands, and

Urban land use in Bon Secour River Watershed (downtown Foley)

waterbodies covered 36% of the watershed in 2011; a 9% increase from 1970 to 1985. This increase may be partly attributable to conservation easement and land acquisition programs designed to conserve natural habitats at risk of development. Urban and residential use skyrocketed from 9% in 1970 to 1985 to 25% of the total area of the watershed by 2011. Urban development is centered around the cities of Foley and Gulf Shores and traverses the watershed along Highway 59 (**Figure 3-18**). The observed changes in land use are not surprising when considering the dramatic increase in population during this period.

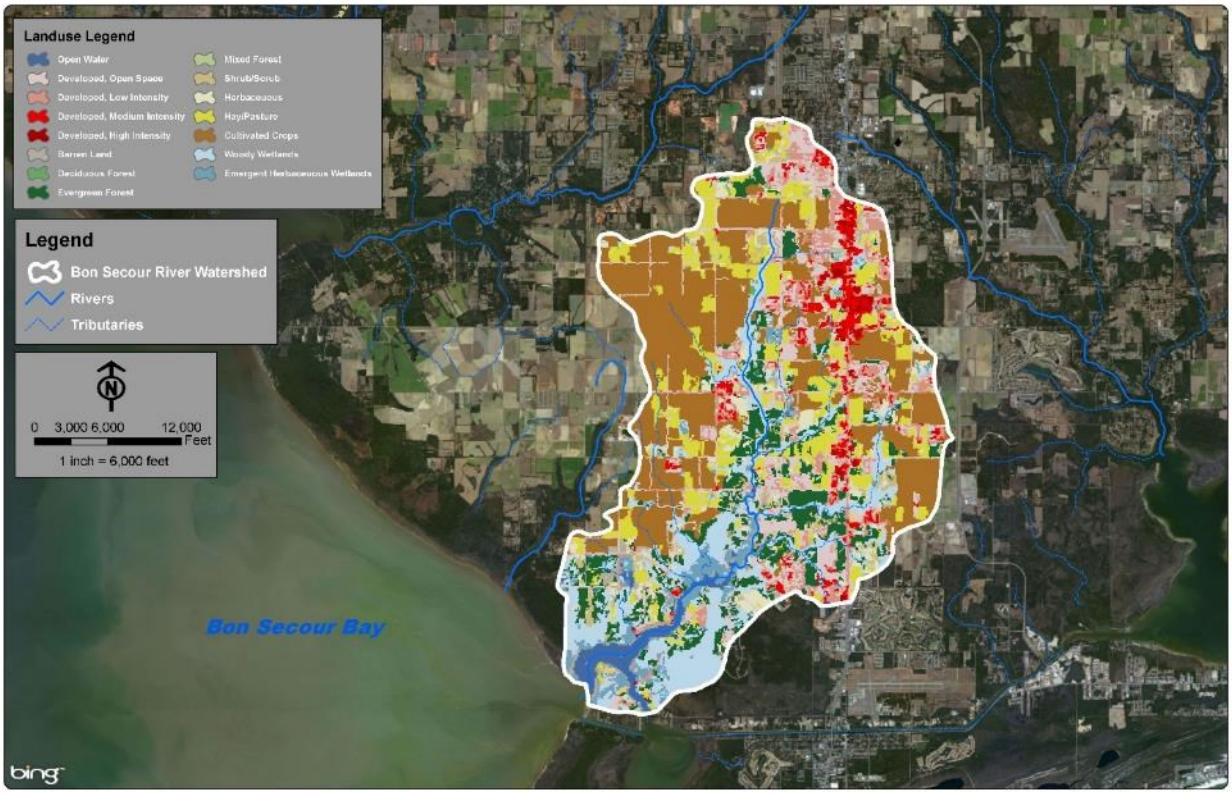


FIGURE 3-18: BON SECOUR CURRENT LAND USE

3.7.3.2 Oyster Bay Watershed

Land use in the Oyster Bay Watershed has experienced a slight increase in urban and residential development but has not changed drastically since 1970–1985 compared to other parts of Baldwin County. Data from 2011 show that the watershed is still dominated by undeveloped lands. Forests, wetlands, beaches, waterbodies, and other natural features make up approximately 78% of the total area of the watershed, and urban and residential development cover 22% (**Figure 3-19**). A corresponding 6% decrease in undeveloped lands and 6% increase in urban and residential development during this period demonstrate a

Mixed land use in Oyster Bay Watershed

net conversion from natural to developed lands. Most of the new development is located in the eastern portion of the watershed in the city of Gulf Shores, although new residential development has also occurred at the western end of the Fort Morgan Peninsula. One explanation for the relatively small change in land use, despite a drastic increase in county population during this period, is the presence of the Bon Secour National Wildlife Refuge and other conservation lands that make up a large portion of the watershed and protect fragile habitats along the Fort Morgan Peninsula from future development.

FIGURE 3-19: OYSTER BAY CURRENT LAND USE

3.7.3.3 Skunk Bayou Watershed

Land use in the Skunk Bayou Watershed changed minimally from 1970–1985 to 2011 (**Figure 3-20**). The majority of the watershed is composed of undeveloped forests, wetlands, waterbodies, and other natural features, covering 56% of the total area of the watershed. Agricultural land use decreased from 48% to 40% of the total area of the watershed, while urban and residential development increased from less than 1% to approximately 3% by 2011. An explanation for the conversion of agricultural lands to undeveloped or natural habitats may be the presence of a large wetland mitigation bank that covers most of the

Agricultural land use in Skunk Bayou Watershed

coastal portion of the watershed. The decrease in agriculture may also reflect changing cultural and socioeconomic conditions. The lack of any major growth in urban or residential development is not surprising given the rural nature of this watershed.

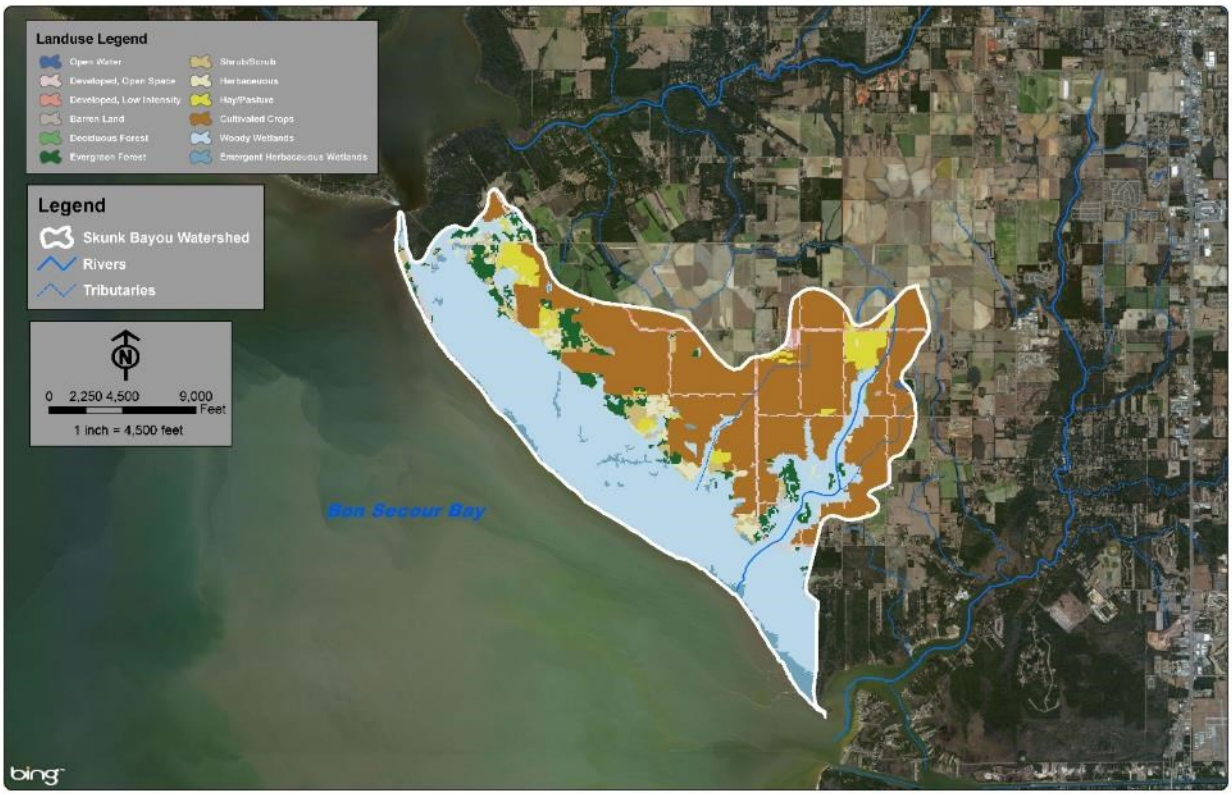


FIGURE 3-20: SKUNK BAYOU CURRENT LAND USE

3.7.4 Future Land Use

Table 3-9 shows the predicted percent cover of land use types (urban/residential, agriculture, and natural/undeveloped) within each watershed through 2040. These estimates are based on the rate of change of each land use category within each watershed from 1970-1985 to 2011 and predicted increases in Baldwin County population (**Table 3-2** in Section 3.6.1).

TABLE 3-9: FUTURE LAND USE PROJECTIONS

Land Use	2011	2020	2030	2040
Bon Secour River Watershed				
Urban/residential	25%	27%	28%	29%
Agriculture	39%	36%	34%	33%
Natural/undeveloped	36%	37%	38%	38%
Oyster Bay Watershed				
Urban/residential	22%	23%	23%	23%
Agriculture	<1%	<1%	<1%	<1%
Natural/undeveloped	78%	77%	77%	77%
Skunk Bayou Watershed				
Urban/residential	3%	4%	4%	4%
Agriculture	41%	40%	40%	39%
Natural/undeveloped	56%	56%	56%	57%

3.7.5 Growth Management

Because population growth and urban development are some of the main drivers of watershed impacts and ecosystem stressors, growth management is a critical component in maintaining watershed health. As shown in **Table 3-9**, urban/residential land use is expected to increase most in the Bon Secour River Watershed. In the Bon Secour River Watershed, urban/residential development is expected to increase by 4% by 2040, representing approximately 856 acres of new development. Urban/residential development is anticipated to be lower for the Oyster Bay and Skunk Bayou watersheds, with each watershed increasing only 1% by 2040 (126 acres and 93 acres, respectively). Any new development in the Oyster Bay Watershed is likely to occur in the eastern portion of the watershed, in or near the city of Gulf Shores, although slight increases in residential development along the Fort Morgan Peninsula are also possible. However, potential for future development along the Fort Morgan Peninsula is limited because large amounts of land are in the public domain (e.g., Bon Secour National Wildlife Refuge) and are protected from future development. Urban/residential growth within the Skunk Bayou Watershed is expected to be negligible because of the rural nature of the watershed and the large amounts of undeveloped land protected from future development by the mitigation bank that covers the coastal portion of the watershed.

3.7.5.1 Impervious Cover

Impervious cover includes any hard surface that diverts water to adjacent areas. Examples of impervious surfaces include roads, parking lots, sidewalks, and rooftops. Impervious surfaces can disrupt natural watershed hydrology. A significant portion of rainfall in undeveloped watersheds is absorbed into soils (infiltration), where it is stored as groundwater and slowly discharged to streams through seeps and springs. As watersheds are urbanized, much of the vegetation is replaced by impervious surfaces, reducing the area where infiltration to groundwater can occur and increasing the amount of water that is diverted as stormwater runoff. Impervious surfaces increase the volume and velocity of stormwater entering streams and rivers, increasing the risk of flooding (USGS 2016a). Impervious surfaces also affect water quality by increasing the rates of erosion and sedimentation and the loading rates of nutrients and other pollutants that are transported by stormwater runoff. Examples include oil and other automotive fluids, which are washed from parking lots, or fertilizers, which are transported from lawns or farms during rainfall events.

Impervious cover is estimated to comprise approximately 6.6% of the total area of the Bon Secour River Watershed and less than 1% (approximately 0.71%) of the Skunk Bayou Watershed based on watershed reports generated using the USGS StreamStats planning tool (USGS 2016b). Impervious cover data for the Oyster Bay Watershed is not currently available. However, urban development can be used as a general proxy for impervious cover. Urban and residential development currently account for approximately 25%, 23%, and 3% of the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds, respectively. Based on the ratio of urban development to impervious cover in the other two watersheds, impervious cover in the Oyster Bay watershed is estimated to be around 6%. However, this is likely an overestimate due to the extremely limited amount of paved surfaces along the Fort Morgan Peninsula.

Impervious cover in downtown Foley, Bon Secour River Watershed

Impervious cover in the three watersheds is likely to increase in future decades because development is expected to increase as populations continue to rise (**Table 3-9**). Impervious cover does not appear to be an issue for the Skunk Bayou Watershed because of its rural nature. However, careful planning and management of future growth will be a critical step in maintaining water quality and overall watershed health in the Bon Secour River and Oyster Bay Watersheds.

3.8 Recreation

Recreational uses of natural resources in the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds include fishing, hunting, boating, swimming, and wildlife watching. These activities play an important role in defining the culture in the watersheds and also attract tourists to the communities, providing economic benefits. The shorelines of the watersheds consist of both public and private lands, thus providing recreational access for members of the communities and visitors to the area.

3.8.1 Bon Secour River Watershed

The Bon Secour River and Bon Secour Bay are central to recreation within the Bon Secour River Watershed. Fishing, shrimping, oystering, boating, swimming, and wildlife watching are pastimes enjoyed by generations of Bon Secour locals and visitors alike. Despite development within the watershed, the shoreline of the Bon Secour River remains less developed than many other waterways in the region, and the preservation of the natural integrity of the river allows for ongoing traditional uses of its resources. Much of the Bon Secour River is bordered by private lands, limiting the volume of visitor traffic, especially motorboat traffic, compared to other nearby watersheds. The heaviest boat traffic occurs at the southwestern-most portion of the watershed, which is adjacent to the confluence with the Gulf ICW.

3.8.2 Oyster Bay Watershed

Recreation within the Oyster Bay Watershed includes many of the same activities as the Bon Secour River Watershed, although boat traffic is primarily limited to Bon Secour Bay, north of the Fort Morgan Peninsula. The opening of the Gulf ICW separates the Oyster Bay Watershed from the Bon Secour River Watershed. The Gulf ICW serves as a major corridor for both commercial shipping and recreational boating and receives heavy use.

The Bon Secour National Wildlife Refuge provides a plethora of recreational opportunities for residents and visitors of the Oyster Bay Watershed. The refuge includes hiking trails complete with interpretative signage, unique wildlife watching opportunities, and beach access where fishing is permitted. The refuge attracts bird watching enthusiasts from around the world to see the vast number of migratory birds that use its habitats as stopover locations during seasonal migrations (Moore and Woodrey 1993). The refuge also provides public launch points for non-motorized boats. Educational programs are offered to students and visitors of all ages. In addition to providing public access and recreation opportunities, the Bon Secour National Wildlife Refuge stimulates the local economy through ecotourism expenditures, job creation, and tax revenue. A 2005 economic study conducted by the U.S. Fish and Wildlife Service (USFWS), Division of Economics, concluded that the Bon Secour National Wildlife Refuge generated $28.38 in total economic benefits to surrounding communities for every $1.00 allocated to the refuge's operating budget in 2004 (Caudill and Henderson 2005). The refuge received 115,647 visits during Fiscal Year 2016 (the total number of individuals who visited the refuge is greater because this value does not account for the number of individuals in each visiting party).

3.8.3 Skunk Bayou Watershed

Skunk Bayou is the least developed of the three watersheds. While it does not draw as many tourists because of limited formal access and amenities, the watershed does provide opportunities for some traditional recreational uses such as fishing, hunting, kayaking or small watercraft boating, and wildlife watching. In areas adjacent to the Skunk Bayou Watershed, residents and visitors launch various sizes of watercraft at nearby public launches to access coastal waters.

3.9 Culture and History of the Watersheds

The Bon Secour River has long provided a navigational route for mariners, traders, and native people along the Alabama Gulf coast. Spanish missionaries, French explorers, and Baltic Germans were among the earliest settlers who visited the area. The river and surrounding village is said to have been named after the Cathedral Notre Dame de Bon Secour by Frenchman Jacques Cook. Among the oldest in Montréal, the Cathedral's name literally translates in English as "safe harbor" (Scanlan, Borden, and Wallace et al. 2004), a name well suited for the peaceful fishing village that began to form along the river in the late 19th century.

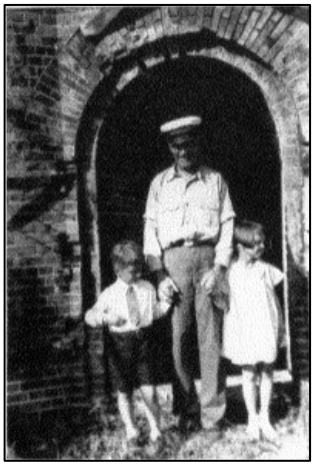
3.9.1 Archaeological Records

Native Americans were among the first people to permanently occupy the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds. Archeological evidence suggests that the earliest of these tribes were likely cultural descendants of people from the Mississippian period. According to Brown (2007), a large "concentration of Pensacola villages and artifacts occurred along Mobile Bay in the Mobile-Tensaw Delta, and in the southern portions of the Tombigbee and Alabama River valleys." The presence of these settlements today are quite inconspicuous. A notable, regional example—the Bottle Creek Indian Mounds—is located on an isolated island deep within the cypress-gum swamps of the Tensaw River Delta.

It is believed that historic sites and artifacts within the Bon Secour River Basin have suffered substantial losses, attributed mostly to powerful hurricanes that have reshaped the landscape over time. Nonetheless, shell mounds still abound along the coastlines, river and tidal flats of the watersheds (Wakeford et al. 1965). These prehistoric shell middens have survived disturbance from severe storms and coastal development. Today, they tell an important story about the original inhabitants of Alabama's coastal plains.

3.9.1.1 Historical Records

Educational, religious, and entrepreneurial values have always shaped quality of life along the Bon Secour River. A resilient community dating back to the 1700s, Bon Secour is an unincorporated village with a unique culture oriented toward the sea. Historical records indicate that fertile soils and abundant natural resources were among the most important factors that brought early settlers to Bon Secour. Timber, fur, and salt provided the raw materials for the first commercial businesses. During the 19th century, agricultural production developed rapidly, and Foley quickly "became the center of population, commerce, and finance in the immediate area" (ADEM 1996). However, commercial fishing and shellfishing in particular soon emerged as the principle industry driving the local economy. Growth in the seafood industry has slowed in recent years, resulting from a shift to a more service-based economy. Nonetheless, the industry still employs many residents in the watershed and remains important to the heritage of Bon Secour. Several small businesses still process and ship large quantities of Gulf of Mexico seafood out Bon Secour.



Mr. Cragie, the Government caretaker, with Ella Rose and her brother William standing at an arched entrance inside Fort Morgan

Individuals with a connection to this region of coastal Alabama possess a strong sense of local pride. Residents have continuously adapted to shifting social, economic, and environmental conditions over the past 300 years. Over time, this resiliency has shaped the identity of entire communities. Nowhere is this more evident than in Bon Secour River Watershed, where historically blue collar workers have always depended on fertile soil and a healthy estuary. A longtime south Baldwin County resident, Ella Callaway, may have said it best during a personal interview with the Consultant Team. As a former employee of Baldwin Oil, Ms. Callaway recounted a shared sentiment among farmers in the Bon Secour River Watershed. "They would tell me, we have the best of both worlds…if we can't do good fishing, we can farm" (Callaway 2016). This interdependence may partially explain why water quality, healthy fisheries, and habitat protection all remain important values to residents today.

Ella Rose (Hutchinson) Callaway was born in Mobile and moved to Fort Morgan with her family in 1932. Although she later moved to New Orleans, she spent her childhood living on Mobile Point (adjacent to *Fort Morgan State Historic Site*) and attended grade school in Foley. Ms. Callaway's personal account of her childhood provided an invaluable perspective of life growing up on a very primitive Fort Morgan Peninsula.

Ella Callaways' childhood home at Mobile Point, Fort Morgan, 1932–1939

During the Great Depression, the Works Progress Administration began constructing the first road along the peninsula, from the Lagoon west to the end of Mobile Point at Fort Morgan. What was once a sandy trail, unfit for regular vehicular use, would become part of State Road 182. The camp closed in 1939 and the State of Alabama finished remainder of the project.

Ella Callaway and her brothers behind the house at Fort Morgan

Ms. Callaway recalled that when she was growing up, her family generated their own electricity, and that fresh groceries came in by boat, shipped from Mobile. The majority of landowners at this time chose not to develop waterfront property along the Gulf but did live along Oyster Bay and the Lagoon. Bon Secour was much more established than Oyster Bay. The mail carrier for Oyster Bay traveled by boat to Bon Secour to get the mail for the Oyster Bay/Lagoon residents. After living at the fort for several years, the Hutchinson family rented a house in Foley at a rate of fifteen dollars $15.00 per month, so the children had somewhere to stay during the week while attending school in Foley. Describing her earliest memories of Foley, Ms. Callaway smiled, “Foley was nice, and we just loved it” (Callaway 2016).

3.9.2 Cultural Resources

Based on a field review and archival research of the watersheds, seven known historically significance sites exist. These areas are located within the boundaries the Bon Secour River and Oyster Bay watersheds. A list of these resources is provided in **Table 3-10**.

TABLE 3-10: HISTORICALLY SIGNIFICANCE SITES WITHIN THE WATERSHEDS						
Number	**Locale**	**Type**	**Name**	**Date**	**Status[a]**	**Comment**
1	Bon Secour	Architecture/Engineering: Creole/Gulf Coast Cottage	Allen House	1875–1899	National Register of Historic Places	1880 listed as a significant year
2	Foley	Architecture/Engineering: Commerce District	Foley Downtown Historic District	1900–1794	National Register of Historic Places	Architects: Frank Lockwood et al.
3	Fort Morgan Peninsula	Military	Fort Morgan	1850–1874	National Register of Historic Places	Architect: Simon Bernard
4	Bon Secour	Architecture/Engineering: Creole/Gulf Coast Cottage	Hamner House	1875–1899	National Register of Historic Places	1885 listed as a significant year
5	Oyster Bay	Architecture/Engineering: Creole/Gulf Coast Cottage	Nicholson House	1875–1899	National Register of Historic Places	1880 listed at a significant year
6	Bon Secour	Architecture/Engineering: Creole/Gulf Coast Cottage	Orrell House	1900–1924	National Register of Historic Places	1900 listed as a significant year
7	Bon Secour	Architecture/Engineering: Gulf Coast / Antebellum Style	Swift-Coles Historic Home		Registry of Alabama Historical Landmarks	1900 listed as a significant year

[a] National Register of Historic Places—includes resources that have been officially listed, historic landmarks, and historic archeological sites.

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4.0 WATERSHED CONDITIONS

This chapter includes an assessment of the challenges facing each of the three watersheds and identifies additional data and information needs.

4.1 Water Quality Standards

4.1.1 Water Use Classifications

Under the guidance of the U.S. Environmental Protection Agency (USEPA), the Alabama Department of Environmental Management (ADEM) is responsible for establishing Water Use Classifications for waters in Alabama. Each Water Use Classification is accompanied by specific water quality standards. Water Use Classifications, and associated water quality standards to support such uses, were established through public participation in the initial establishment and periodic review of water quality standards by ADEM (ADEM 2015). **Table 4-1** summarizes thresholds for water quality standards for each of the seven Water Use Classifications in Alabama.

TABLE 4-1: ALABAMA WATER USE CLASSIFICATIONS AND WATER QUALITY STANDARDS

Water Use Classification	pH	Water Temperature	Dissolved Oxygen	Fecal Coliform Bacteria (geometric mean)	Turbidity (above background)
Outstanding Alabama Water	6.0–8.5[a] 6.5–8.5[b]	< 90°F	< 5.5 mg/L	126 colonies/100 ml[a] 35 colonies/100 ml[b]	< 50 NTU
Public Water Supply	6.0–8.5	< 90°F	< 5.0 mg/L	548 colonies/100 ml[a] 275 colonies/100 ml[b]	< 50 NTU
Swimming and Other Whole Body Water-Contact Sports	6.0–8.5[a] 6.5–8.5[b]	< 90°F	< 5.0 mg/L	126 colonies/100 ml[a] 35 colonies/100 ml[b]	< 50 NTU
Shellfish Harvesting	6.5–8.5	< 90°F	< 5.0 mg/L	126 colonies/100 ml[a] 35 colonies/100 ml[b]	< 50 NTU
Fish and Wildlife	6.0–8.5[a] 6.5–8.5[b]	< 90°F	< 5.0 mg/L	548 colonies/100 ml[a] 275 colonies/100 ml[b]	< 50 NTU
Limited Warmwater Fishery	6.0–8.5* 6.5–8.5[b]	< 90°F	< 3.0 mg/L	548 colonies/100 ml[a] 275 colonies/100 ml[b]	< 50 NTU
Agricultural and Industrial Water Supply	6.0–8.5[a] 6.5–8.5[b]	< 90°F	< 3.0 mg/L	700 colonies/100 ml[a] 500 colonies/100 ml[b]	< 50 NTU

Source: ADEM (2015); notes: mg/L – milligram per liter; ml – milliliter; NTU – nephelometric turbidity units

[a] Freshwater

[b] Marine and estuarine waters

4.1.1.1 Bon Secour River Watershed

The Bon Secour River has a long history of commercial and recreational shrimping.

Water Use Classifications in the Bon Secour River Watershed include *Swimming and Other Whole Body Water-Contact Sports*, *Fish and Wildlife*, and *Shellfish Harvesting*. The entire length of the Bon Secour River, including Boggy Branch, is designated for *Swimming and Other Whole Body Water-Contact Sports* and *Fish and Wildlife*. The portion of Bon Secour River west of the inlet that connects it to Oyster Bay is also designated for *Shellfish Harvesting*. Bon Secour Bay, in its entirety, is designated for *Swimming and Other Whole Body Water-Contact Sports*, *Fish and Wildlife*, and *Shellfish Harvesting*. These classifications apply to all of the coastal boundaries of the watershed. No other waterways in the Bon Secour River Watershed are specifically listed in the ADEM Administrative Code 335-6 and, therefore, carry a Water Use Classification of *Fish and Wildlife* by default (ADEM 2015).

4.1.1.2 Oyster Bay Watershed

Oyster Bay is designated for *Fish and Wildlife* and *Shellfish Harvesting*. The portion of the Gulf ICW is designated for *Fish and Wildlife* from Bon Secour Bay to Highway 59. Bon Secour Bay and all coastal waters of the Gulf of Mexico contiguous to the state of Alabama are designated for *Swimming and Other Whole Body Water-Contact Sports*, *Fish and Wildlife*, and *Shellfish Harvesting*. These classifications apply to all coastal waters of the Oyster Bay Watershed. No other waterways in the Oyster Bay Watershed are specifically listed in the ADEM Administrative Code 335-6 and, therefore, carry a Water Use Classification of *Fish and Wildlife* by default (ADEM 2015).

4.1.1.3 Skunk Bayou Watershed

None of the waterways within the Skunk Bayou Watershed are specifically listed in the ADEM Administrative Code 335-6 and, therefore, carry a Water Use Classification of *Fish and Wildlife* by default. Bon Secour Bay is designated for *Swimming and Other Whole Body Water-Contact Sports*, *Fish and Wildlife*, and *Shellfish Harvesting*. These classifications apply to all of the coastal boundaries of the Skunk Bayou Watershed (ADEM 2015).

4.1.2 Clean Water Act Section 303(d) Impaired Waters and Total Maximum Daily Load Program

The goal of the Clean Water Act (CWA), administered by USEPA, is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (33 United States Code §1251[a]). Under Section 303(d) of the CWA, states are required to identify impaired waters and submit a list of these waters to USEPA. These are waters that are too polluted or otherwise degraded to fully support their designated uses, based on water quality standards established

by each state. In Alabama, ADEM is responsible for compiling and submitting a list of 303(d) impaired waters to USEPA. The 303(d) list includes the causes and sources of water quality impairment for each listed waterbody.

For waterbodies included on the 303(d) list the state must calculate the maximum amount of each pollutant causing water quality impairment that can be allowed, such that the water quality standards for the waterbody are maintained. This calculation is known as a total maximum daily load (TMDL). TMDLs are developed according to a specified schedule and must be approved by USEPA after an opportunity for public comment. Waterbodies can be removed from the 303(d) list after a TMDL is developed or after other changes have been made to correct water quality issues.

4.1.2.1 Bon Secour River Watershed

The Bon Secour River appears on Alabama's 303(d) list because of atmospheric deposition of mercury. This listing includes the entire length of the river from mouth to source (**Figure 4-1**), although it is listed in two separate segments. The Bon Secour River was first placed on Alabama's 303(d) list in 2006 (ADEM 2016a). Bon Secour Bay has been on Alabama's 303(d) list since 1998 because of pathogens. The source of contamination is believed to be onsite wastewater systems, urban runoff, and storm sewers in adjacent developed areas (ADEM 2016a).

FIGURE 4-1: ALABAMA'S 303(D) LISTED WATERS IN THE WATERSHED

A TMDL for an unnamed tributary to the Bon Secour River was approved in 2009. The tributary is located in the northwest corner of the Bon Secour River Watershed. The source of the tributary begins at Craft Farms Road and flows in a southeasterly direction until merging with Bon Secour River just east of County Road 65 and north of County Road 12. The 1.64-mile-long tributary has a total drainage area of 3.36 square miles and has a Water Use Classification of *Fish and Wildlife*. The unnamed tributary was first placed on Alabama's 303(d) list in 1998 because of pathogens (fecal coliform bacteria). ADEM originally collected data in 1995 and impairment was again confirmed by data collected in 2006 and 2007. The TMDL report concluded that compliance with terms and conditions of National Pollutant Discharge Elimination System (NPDES) sanitary and storm water permits, coupled with voluntary load reductions should allow compliance with the TMDL (ADEM 2009).

4.1.2.2 Oyster Bay Watershed

Oyster Bay has appeared on Alabama's 303(d) list since 2006 because of pathogens. The sources are currently unknown (ADEM 2016a). Bon Secour Bay makes up the coastal boundary of the Oyster Bay Watershed along the northern shore of the Fort Morgan Peninsula. The causes and sources of impairment of Bon Secour Bay are described above.

4.1.2.3 Skunk Bayou Watershed

None of the waterbodies within the Skunk Bayou Watershed are listed as impaired on Alabama's 303(d) list (ADEM 2016a); however, the coastal portion of the watershed borders Bon Secour Bay from Weeks Bay to the Mouth of the Bon Secour River. Bon Secour Bay appears on Alabama's 303(d) list because of pathogens, as described above.

4.2 Water Flow

The nature of water flow in streams is greatly influenced by land use and management of its contributing watershed. The conversion of natural areas to farm land changes how water drains from the landscape, and this process is more pronounced when natural areas are converted to impervious surfaces. Development increases the volume of water in streams and influences how quickly stream flows change following storm events. Development also disrupts groundwater infiltration.

Stream flow characteristics for each watershed were developed by integrating an understanding of the local hydrology with information derived from a nearby monitored watershed[1] using the U.S. Geological Survey's (USGS) web-based water resource tool called StreamStats. These characteristics are summarized below.

[1] USGS does not operate any monitoring stations within the Bon Secour River, Oyster Bay, or Skunk Bayou watersheds.

4.2.1 Bon Secour River Watershed

The closest USGS water flow monitoring station is located on the Magnolia River, which drains the watershed directly north of the Bon Secour Watershed, at Highway 98 near the town of Foley, Alabama (USGS 02378300). It is reasonable to assume that general water flow characteristics of the Magnolia River are comparable to flow characteristics typical of the Bon Secour River because of similarities in the watersheds' land use, topography, and soils. During rainfall events, stream flows increase rapidly over several hours. Flows decrease relatively quickly during the first hours after the event, then taper down slowly over days until resuming base flow conditions. This change in stream flow over time, or stream flow hydrograph, is typical of partially developed watersheds.

The smaller tributaries within the Bon Secour River Watershed either dry out during dry weather conditions or convey low discharge rates and velocities, but during intense rainfall events, the tributaries are extremely flashy with high discharge rates and velocities occurring quickly (Cook et al. 2014). Impaired stream conditions during dry weather could be, at least in part, the result of reduced groundwater infiltration due to impervious cover.

4.2.2 Oyster Bay Watershed

The western portion of Oyster Bay Watershed consists of a narrow strip of low-lying land adjacent to Bon Secour Bay. The area lacks defined fluvial (non-tidal) watercourses because rainfall that does not infiltrate but rather generally sheet flows downslope a relatively short distance before discharging into the bay, fringe marshes, or ponded areas scattered within the landscape. The majority of the watershed lacks impervious cover and does not generate significant stormwater runoff. Localized ponding occurs in the more developed portion of the watershed when stormwater runoff exceeds the infiltration rates, where the ground elevation intercepts groundwater, or where local topography concentrates runoff. Generally, this ponded water percolates into the soil within a few hours after a significant storm event.

Waterways within the eastern portion of Oyster Bay Watershed are small and highly manipulated, traversing developed areas, including a golf course. Because of the small catchment sizes and developed drainage areas, these tributaries are flashy, responding quickly to rainfall events. These streams drain into the tidally influenced marshes within Oyster Bay and Bon Secour Bay.

4.2.3 Skunk Bayou Watershed

Water flow in the Skunk Bayou Watershed was evaluated using USGS's StreamStats Version 4.0, which includes a function to delineate watersheds, characterize land use and the percent impervious surfaces in a watershed, and estimate flow for unmonitored streams. The small drainage area, lack of impervious surfaces, and large forested area in the watershed indicates that stream flows follow a typical hydrograph for non-developed watersheds. Flows increase in response to rain events, but at a slower rate, and likely produce reduced peaks than if the watershed were more developed. After a rain event, flows slowly taper over several days until base flow is once again restored. Lower-order tributaries are likely flashier because of the size

of the contributing drainage area and the development in the upper reaches of the watershed. During dry weather conditions, the tributaries likely experience intermittent flows, either periodically drying out or conveying extremely low flows.

4.3 Sediment Transport and Sedimentation Conditions

Sediment is transported in watersheds by overland flow, which is concentrated in small depressions and gullies and eventually discharged into streams that transport the sediment with material eroded from the stream banks and bottom until it is ultimately deposited. Erosion rates are accelerated by housing developments and poor land management practices by increasing the volume and velocity of stormwater runoff, resulting in negative impacts to the habitats of the receiving waterbodies. The following sections summarize the sediment transport and sedimentation conditions of the Bon Secour River, Oyster Bay, or Skunk Bayou watersheds.

4.3.1 Bon Secour River Watershed

The Geological Survey of Alabama (GSA) conducted a sediment loading study for the Bon Secour River Watershed in 2014 (Cook et al. 2014). Based on the geology of the area, the watershed has the potential to generate high sediment loads because of the presence of highly erodible soils formed from Citronelle Formation sediments in the area. The results of the GSA study indicate that because of current land use and land management practices, the watershed delivers a much greater sediment load to the system than if no human activity were present. Flashy runoff from development in the watershed has also increased the capacity of the streams to transport sediment, resulting in extensive erosion and scour within the streams. The study found that the streams with the two largest sediment loads in the watershed also had the largest areas of developed land within their drainage areas. The drainage area of the stream with the third-largest sediment load was dominated by agricultural land use, primarily turf farming. In contrast, other streams with drainage areas dominated by row crop agricultural land use had relatively small sediment loads.

When compared to the sediment loads of 30 streams throughout Alabama, the sediment loads of the streams in the Bon Secour River Watershed were comparable to other urban and transitional urban watersheds in Baldwin and Mobile counties, delivering large sediment loads to the receiving waterbodies. As expected, the study also demonstrated that streams draining less developed watersheds than the Bon Secour River Watershed produced smaller sediment loads.

The GSA study effectively demonstrated that development and land management practices in the Bon Secour River Watershed has resulted in increased sediment loads. In the decade between 2001 and 2011, the watershed experienced a 7.8% increase in developed land, which was largely a conversion of agricultural land. The GSA study attributes this urbanization and increase in the amount of impervious surfaces in the watershed to intensified flood events, stream bank erosion, and sedimentation. To prevent increasing the sediment load delivered by the watershed and avoid further degrading the system, future development will need to be managed considering impacts from runoff and sediment loads.

4.3.2 Oyster Bay Watershed

The lack of defined water courses and low-lying topography in the western portion of the Oyster Bay Watershed indicates that insignificant fluvially driven sediment transport occurs within this portion of the Oyster Bay Watershed, other than after rainfall events in localized disturbed areas that have not been stabilized (i.e., construction sites). Shoreline erosion from wave action occurs along Bon Secour Bay, as evidenced in a review of historical aerials.

The eastern portion of the Oyster Bay Watershed also has experienced shoreline erosion, including the retreat of marsh vegetation in Oyster Bay. Although not formally studied, the small tributaries in this portion of the watershed likely generate small sediment loads because of the size of the contributing drainage areas and extent of undeveloped land.

4.3.3 Skunk Bayou Watershed

While the Skunk Bayou Watershed is largely undeveloped, the mix of land use in developed areas and the type of developmental pressure are similar to those in the Bon Secour Watershed, making the 2014 GSA study (Cook et al. 2014) applicable to this watershed, as well. It is reasonable to assume that the Skunk Bayou Watershed currently delivers a smaller sediment load than the Bon Secour Watershed because of the size and extent of natural areas in the watershed. However, future development will require management and treatment of sediment to avoid further degrading the system.

4.3.4 Data Gaps

Additional studies need to be conducted to determine whether the lack of groundwater recharge associated with impervious cover contributes to dry stream channels or low flow and discharge rates during dry weather conditions in the Bon Secour River Watershed.

4.4 Water Quality

Water quality is an important factor for healthy ecosystems, safe access to natural resources, and public health and safety. Water quality also determines the types of uses and activities for which a waterbody is suitable, as described in Section 4.1.1, *Water Use Classifications*. Use of surface waters for public water supplies, fishing, swimming, and agricultural uses depend on water quality (**Table 4-1**). Poor water quality can render waters unsuitable for these uses and can have detrimental effects on the natural environment. Many factors affect water quality, including land use, climate, groundwater, and geological resources. Water quality may be the single most important factor in determining the overall health of a watershed. Available water quality data for each of the watersheds are summarized below.

4.4.1 Data Sources

A review of scientific literature and technical reports was conducted for use in describing the current watershed conditions based on the best available water quality data. Compared to other watersheds, minimal data are available for the Bon Secour River and Oyster Bay watersheds,

and no water quality reports were available for the Skunk Bayou watershed. Data sources used to characterize water quality in the Bon Secour River Watershed include a 1996 ADEM technical report (ADEM 1996); a 2008 MBNEP monitoring report prepared in collaboration with ADEM, Gulf of Mexico Program, and USEPA (Summersell 2008); and a 2014 GSA study (Cook et al. 2014). Summersell 2008 was the most recent available data source for the Oyster Bay Watershed. Differences in sampling locations, methodology, and reporting units make comparison among these studies difficult. A summary of findings and conclusions is presented in the sections below.

The ADEM 1996 technical report documented measured nutrient concentrations, pathogen loads, and other water parameters from nine sampling sites throughout the Bon Secour River Watershed. Samples were collected along the Bon Secour River and its tributaries from January through September 1995. Sampling locations extended from Foley, near the headwaters of the river, south to Schoolhouse Creek.

Summersell 2008 measured nutrients and other water parameters at 11 sampling sites within the Bon Secour River Watershed and two sites within the Oyster Bay Watershed. Sampling sites in the Bon Secour River Watershed were located along the main stem of the river from just below County Road 10, south to the mouth of the Bon Secour River. Sampling sites in the Oyster Bay Watershed were located at the southern end of the South Fork of the Bon Secour River, near the northern boundary of Oyster Bay, and in the Gulf ICW south of Plash Island.

Cook et al. (2014) is the most comprehensive study to date for the Bon Secour River Watershed. This technical report documented the results of water quality sampling conducted between November 2013 and January 2014. Nutrient concentrations, contaminant loads, and other water quality parameters were measured at six sampling sites in the Bon Secour River and its tributaries. Sampling sites extended from Foley, near the headwaters of the river, south to Shutt Creek at Bon Secour Highway, and east to Highway 59.

4.4.2 Nutrients

Nutrient concentrations are important water quality parameters because nutrients act as a “fertilizer” for primary producers (plants and algae) in aquatic systems. Nitrogen (N; usually in the form of nitrate [NO_3]) and phosphorus (P; usually in the form of phosphate [PO_4^{3-}]) are the main nutrients associated with algal growth in marine and aquatic systems. Excess nutrients in a system (nutrient loading) can lead to eutrophication, which is associated with a variety of environmental problems including hypoxia or anoxia (little or no available oxygen), fish kills, and increased frequency of harmful algal blooms. Eutrophication is a condition in which overabundance of nutrients in a system causes an algal bloom, which eventually dies and decays. Decay of algal cells by bacteria requires oxygen and depletes dissolved oxygen in the water column, rendering aquatic habitats unusable to animals and potentially contributing to the environmental issues described above. High concentrations of certain nutrients in drinking water can also pose a public health risk. Thus, nutrient-impaired water can dramatically increase treatment costs required to meet drinking water standards.

4.4.2.1 Nitrogen

Common sources of nitrogen in surface waters include fertilizer runoff from agricultural operations, golf courses, and lawns and leaking or improperly maintained septic tanks or sewer systems. USEPA considers the maximum contaminant level (MCL) to be 10 mg/L, although 1 mg/L is considered to be the maximum amount of nitrate safe for consumption by infants less than 6 months of age. The MCL represents the maximum concentration allowed in drinking water under the USEPA's National Primary Drinking Water Regulations (USEPA 2009). Nitrate concentrations in streams typically vary from 0.5 to 3.0 mg/L, although streams without significant nonpoint sources of pollution generally do not exceed 0.5 mg/L. Streams fed by shallow, groundwater-draining agricultural areas may approach the 10 mg/L MCL (Maidment 1993; Cook et al. 2014).

Bon Secour River Watershed

The ADEM 1996 technical report noted that nitrate concentrations north of County Road 12 showed a strong correlation with both rainfall and season. Nitrate concentrations peaked following rainfall events and during the winter and spring. Higher nitrate concentrations during winter and spring were attributed to seasonal land use practices, such as fertilizer application and tilling. The highest nitrate concentration (3.970 mg/L) was recorded in an unnamed tributary to the Bon Secour River located in the northwest portion of the Bon Secour River Watershed near its boundary with the Skunk Bayou Watershed. The high nitrate concentration at this sampling station was likely from agricultural practices because agriculture is the dominant land use type in this portion of the watershed (**Figure 3-18**). Average nitrate concentrations at sampling stations north of County Road 12 had average nitrate concentrations ranging from 0.067-2.514 (mg/L). Average nitrate concentrations at sampling stations south of County Road 12 ranged from 0.403-1.709 (mg/L) and showed no relationship to rainfall or season. The absence of nitrate fluctuations, regardless of rainfall or season, can likely be attributed to differences in land use (less agriculture) and larger tracts of wetland, which buffer the banks of the lower portion of the river (**Figure 3-18**).

Summersell (2008) measured nitrogen as total nitrogen, rather than nitrate. Nitrogen concentrations measured at eight sampling stations between County Road 12 and Bright's Creek (upper portion of the study area) ranged from 0.029 to 0.038 mg/L, while values measured at three sampling stations between Witt Creek and the mouth of the Bon Secour River (lower portion of the study area) were between 0.133 to 0.782 mg/L. The highest nitrate concentration (0.782 mg/L) was recorded in the upper reach of the Bon Secour River, just south of County Road 10. This was the northwestern most site within the study area. Although different sampling sites, methodologies, and reporting units make comparison among studies difficult, Summersell (2008) essentially corroborated the findings of the ADEM 1996 report, noting that nitrogen concentrations are highest in the upper and especially northwestern portion of the watershed and decrease toward the mouth of the Bon Secour River.

Nitrate concentrations reported by Cook et al. (2014) ranged from 0.115 to 2.59 mg/L. All sites were sampled during or immediately after a precipitation event to capture maximum concentrations as a result of elevated stream discharges. The highest nitrate concentration

(2.59 mg/L) was reported in Shutt Creek at Bon Secour Highway, followed by the Bon Secour River at County Road 12 (1.62 mg/L). Both sites are surrounded by or downstream of agricultural lands. The lowest nitrate concentration (0.0115 mg/L) was recorded in Boggy Branch at Highway 59. This site is located in a developed area and likely receives substantial urban runoff and less agricultural runoff, compared to other sites in the watershed. These results align with those of the two previous studies that found the highest nitrate concentrations at study sites in the northwestern portion of the watershed. Like previous studies, Cook et al. (2014) concluded that elevated nitrate concentrations are likely attributable to land use practices, and agricultural land use contributed the largest fraction to the total nitrogen load in the watershed.

Overall, review of data from previous studies indicates that nitrogen loading may be an issue in the northwestern portion of the Bon Secour Watershed. Nitrogen likely enters streams and tributaries from non-point sources originating from agricultural land use. Although nitrogen concentrations previously reported at some sites exceeded 3.0 mg/L, most values were within the expected range when accounting for dominant land uses in the watershed, and review of the available scientific literature did not yield any records of severe eutrophication-driven impacts. Nitrogen concentrations reported in all previous studies were well below the MCL of 10 mg/L.

Oyster Bay Watershed

Total nitrogen concentrations measured by Summersell (2008) at two sampling locations in the Oyster Bay Watershed were consistent with values reported near the mouth of the Bon Secour River in the Bon Secour River Watershed. Total nitrogen concentrations were at the lower end of the range of values reported during the study; the lowest value (0.020 mg/L) was reported in the Gulf ICW, south of Plash Island. The total nitrogen concentration at the southern end of the South Fork of the Bon Secour River, near the northern boundary of Oyster Bay, was 0.029 mg/L. These values are at the lower end of the normal expected range and suggest that nitrogen loading is not an issue, at least in the upper portion of the Oyster Bay Watershed.

Although the Summersell (2008) data were limited to sites along the extreme northern boundary of the watershed, nitrogen loading is not likely to be an issue in the Oyster Bay Watershed because agricultural land use is minimal and Oyster Bay is mostly surrounded by undeveloped lands, including a large wetland buffer along the shores of Oyster Bay (**Figure 3-19**).

Skunk Bayou Watershed

Nitrogen data were not available for the Skunk Bayou Watershed; however, because land use in the Skunk Bayou Watershed is primarily agricultural (**Figure 3-20**), it is likely that nitrogen concentrations are slightly elevated throughout the watershed, similar to those in the adjacent northwestern portion of the Bon Secour River Watershed, but well below the MCL of 10 mg/L.

4.4.2.2 Phosphorous

Phosphorus in surface waters typically originates from the mineralization of phosphates from soils, rocks, and sediments or runoff and containing fertilizers, detergents, or other industrial products. Phosphorus (including phosphate) is not regulated under the USEPA's National

Primary Drinking Water Regulations, thus an MCL has not been established. However, the natural background concentration of total dissolved phosphorus in streams is typically around 0.025 mg/L. Phosphorus concentrations greater than 0.05 mg/L could be high enough to cause excessive algal growth in freshwater systems (Maidment 1993; Cook et al. 2014).

Bon Secour River Watershed

The ADEM 1996 report observed a similar pattern for phosphate as nitrate, described above. Phosphate concentrations in the Bon Secour River and its tributaries north of County Road 12 increased following rainfall events and peaked during winter and spring, while concentrations recorded south of County Road 12 showed no relationship to rainfall or season. Average phosphate concentrations north of County Road 12 ranged from 0.054 to 0.189 mg/L, while average concentrations south of County Road 12 ranged from 0.033 to 0.231 mg/L.

Summersell (2008) measured phosphorus as total phosphorus, rather than phosphate. Phosphorus concentrations were relatively stable across all sampling stations in the Bon Secour River and its tributaries, except one measurement taken in the lower Bon Secour River at the mouth of Witt Creek. Total phosphorus at the mouth of Witt Creek was 0.48 mg/L, while phosphorus concentrations at all other sampling locations ranged from 0.07 to 0.13 mg/L.

Cook et al. (2014) also reported phosphorus as total phosphorus, and all sites were sampled during or immediately after a precipitation event to capture maximum concentrations as a result of elevated stream discharges. Total phosphorus concentrations ranged from 0.043 to 0.699 mg/L. The highest reported total phosphorus concentration (0.699 mg/L) was in Turkey Creek at County Road 65. The lowest value (0.043 mg/L) was reported in Shutt Creek at Bon Secour Highway, followed closely by an unnamed tributary at Highway 59, near County Road 12 (0.058 mg/L).

Overall, review of existing data indicates that phosphorus concentrations commonly exceeded 0.05 mg/L throughout the watershed. Elevated concentrations following rainfall events and higher concentrations downstream of agricultural areas suggest that phosphorus likely enters streams and tributaries from non-point, agriculturally related sources. Although phosphate concentrations reported throughout most of the Bon Secour River Watershed are high enough to contribute to excessive algal growth, no records of severe eutrophication-driven impacts were found.

Oyster Bay Watershed

Total phosphorus concentrations reported by Summersell (2008) were 0.07 mg/L at both sampling sites along the extreme northern boundary of the Oyster Bay Watershed. These concentrations were the lowest values reported during the study in either watershed. Although these values exceed the 0.05 mg/L threshold for potentially contributing to excessive algal growth, no records of severe eutrophication-driven impacts in Oyster Bay were discovered. This may be at least partly attributable to the fact that Oyster Bay is an estuarine system, where phosphorus is less likely to be a limiting nutrient for algal growth than nitrogen.

Phosphorus concentrations in the Oyster Bay Watershed are not expected to be particularly high because agricultural land use is minimal and Oyster Bay is mostly surrounded by undeveloped lands, including a large wetland buffer along the shores of Oyster Bay. The South Fork of the Bon Secour River is the mostly likely source of phosphorus to the Oyster Bay Watershed.

Skunk Bayou Watershed

Phosphorus data were not available for the Skunk Bayou Watershed; however, because land use within the Skunk Bayou Watershed consists primarily of agriculture, it is likely that phosphorus concentrations throughout the watershed are within the range of those reported in the adjacent northwestern portion of the Bon Secour River Watershed.

4.4.2.3 Pathogens

Concentrations of certain bacteria (usually *Escherichia coli*) are often measured during water quality assessments to serve as an indicator of pathogen load. These bacteria indicate the presence of fecal material in drinking water and recreation waters and are commonly associated with pathogens (disease-causing bacteria, viruses, and protozoans) that can pose a potential health risk to users who come in contact with contaminated water. Potential sources of *E. coli* include malfunctioning or improperly maintained sewer systems and septic tanks, agricultural runoff, and animal waste from pets or wildlife that can enter waterways during rainfall events.

Bon Secour River Watershed

Average fecal coliform bacteria (*E. coli*) concentrations reported in the ADEM 1996 study ranged from 0 to 11,732 mg/L. The highest pathogen concentration (32,500 mg/L) was recorded in an unnamed tributary to the Bon Secour River located in the largely agricultural northwest portion of the Bon Secour River Watershed near its boundary with the Skunk Bayou Watershed. Fecal coliform concentrations at all stations increased by an approximate factor of 10 following rainfall events of 0.5 inch or more. This pattern is indicative of non-point source pollution. Pathogen loading in the portion of the Bon Secour River and its tributaries north of County Road 12 was attributed to a combination of urban runoff and agricultural runoff, while pathogen loading south of County Road 12 was attributed primarily to agriculture. The ADEM 1996 report concluded that much of the Bon Secour River and its tributaries would have difficulty in meeting the criteria for its designated Water Use Classifications. However, fecal coliform concentrations were reported in mg/L, rather than the standard accepted unit of colonies per 100 ml, making adherence to Water Use Classification criteria difficult to assess. Further discussion of pathogen loading in the Bon Secour River Watershed is provided above in Section 4.1.2, *Clean Water Act Section 303(d) Impaired Waters and Total Maximum Daily Load Program*.

Oyster Bay Watershed

Oyster Bay is currently on Alabama's 303(d) because of pathogens (ADEM 2016a). No additional data are currently available.

Skunk Bayou Watershed

No pathogen data were available for the Skunk Bayou Watershed; however, the coastal portion of the watershed borders Bon Secour Bay from Weeks Bay to the mouth of the Bon Secour River. Bon Secour Bay appears on Alabama's 303(d) list because of pathogens, as described in Section 4.1.2, *Clean Water Act Section 303(d) Impaired Waters and Total Maximum Daily Load Program*. Because land use within the Skunk Bayou Watershed consists primarily of agriculture, it is likely that pathogen concentrations are elevated throughout the watershed. Pathogen loads in Skunk Bayou and its tributaries are probably similar to those in the adjacent northwestern portion of the Bon Secour River Watershed.

4.4.2.4 Contaminants

Other surface water contaminants include metals and organic (carbon-based) compounds such as oil and grease. Numerous metals are naturally present in streams in small concentrations, and in Alabama, relatively high concentrations of some metals, such as aluminum and iron, are common because of the erosion of fine-grained sediments, including aluminum rich clays. However, toxic metals, such as arsenic, cadmium, and lead, are generally anthropogenic in origin (Cook et al. 2014). Mercury typically enters surface waters via atmospheric deposition. Oil and grease typically enter streams from point sources such as storm drains, sewers, or leaking septic tanks.

4.4.2.5 Bon Secour River Watershed

Cook et al. (2014) reported concentrations of 13 metals measured at six sites throughout the Bon Secour River Watershed. Aluminum concentrations were high across all sampled sites, as expected. Copper and zinc concentrations exceeded USEPA standards for the protection of aquatic life at one of the six sites each, and lead exceeded the USEPA standard at four of the six sites. Although the Bon Secour River currently appears on Alabama's 303(d) list because of atmospheric deposition of mercury, measured concentrations reported by Cook et al. (2014) were below USEPA thresholds. Oil and grease were only detectible at one site (Shutt Creek at Bon Secour Highway).

Detectible and sometimes high concentrations of anthropogenically derived metals, such as copper, zinc, and lead, are probably related to industrial components of urban runoff in the watershed (Cook et al. 2014). Metal contaminants are sometimes stored in sediments and can persist in aquatic systems for very long periods. Therefore, the presence of metals in the Bon Secour River Watershed may be a result of previous contamination rather than from an active source. Although oil and grease were detectible at one site, these substances do not appear to be a major source of impairment within the watershed.

4.4.2.6 Oyster Bay Watershed

No additional contaminant data were available for Oyster Bay Watershed. Although previous industrial activities could have caused metal contamination of Oyster Bay, no active sources are known, except atmospheric mercury deposition. Therefore, metal contamination is not likely to be an issue in the Oyster Bay Watershed. Oil and grease are not likely to be detectible in Oyster

Bay because residential development is limited and Oyster Bay is surrounded by wetlands and other undeveloped lands.

4.4.2.7 Skunk Bayou Watershed

No additional contaminant data were available for the Skunk Bayou Watershed. With the exception of atmospheric mercury deposition, metal contamination is not likely to be an issue because no industrial activity occurs in the watershed. The watershed is primarily composed of agricultural land, undeveloped forests, and wetlands (**Figure 3-20**).

4.4.3 Summary of Water Quality Conditions

4.4.3.1 Bon Secour River Watershed

Water quality conditions in the Bon Secour River Watershed are somewhat degraded but could be restored with appropriate management actions. Nutrient loading (nitrogen and phosphorus, including phosphate) appears to be an issue in the upper portion of the watershed, where agriculture is the predominant land use type (ADEM 1996; Summersell 2008; Cook et al. 2014). Elevated nutrient concentrations following rainfall events suggest that nutrient inputs originate from non-point sources, most likely agricultural runoff (ADEM 1996; Cook et al. 2014). Pathogen loading may also a problem, although recent data were not available to confirm the current status of pathogen loading. Pathogen sources are likely the same as those for nutrients, as evidenced by higher concentrations in areas that receive agricultural runoff (ADEM 1996). In general, nutrient and pathogen loading appeared to be highest in the upper portions of the watershed with concentrations decreasing toward the mouth of the Bon Secour River, commensurate with changes in land use type (ADEM 1996; Summersell 2008; Cook et al. 2014). Other contaminants detected in the Bon Secour River Watershed include copper, zinc, and lead. No active sources were detected, suggesting that detectible levels of anthropogenically sourced metals may be remnants from previous industrial activities. Mercury concentrations were relatively despite the river's 303(d) listing. Oil and grease were detected at one site but do not appear to be a major issue in the watershed (Cook et al. 2014).

4.4.3.2 Oyster Bay Watershed

Water quality data for the Oyster Bay Watershed are limited but suggest that nutrient loading is not a major problem in Oyster Bay. Nitrogen concentrations were at the low end of the expected range, and although phosphorus levels were high enough to potentially contribute to algal growth, they were still low for the region (Summersell 2008). Nutrient loading is not expected to be an issue in the Oyster Bay Watershed because agricultural land use is minimal and Oyster Bay is mostly surrounded by undeveloped lands, including a large wetland buffer along the shores of Oyster Bay. Oyster Bay currently appears on Alabama's 303(d) list for pathogens (ADEM 2016a), but recent data were not available to confirm current pathogen impairment. With the exception of atmospheric mercury deposition, metals and other contaminants are not known to be an issue in the Oyster Bay Watershed.

4.4.3.3 Skunk Bayou Watershed

Virtually no water quality data are available for the Skunk Bayou Watershed; however, based on surrounding land use (mostly agricultural) and proximity to the upper reaches of the Bon Secour River Watershed, it can be assumed that water quality conditions are similar. Waterways in the Skunk Bayou Watershed probably experience some level of nutrient and pathogen loading because of agricultural runoff, especially following rainfall events. Nutrient and pathogen loading are likely more severe in the upper portion of the watershed because the lower portion of the watershed, near the shoreline of Bon Secour Bay, consists of large, unfragmented tracts of forested wetland that act as a buffer (**Figure 3-20**). With the exception of atmospheric mercury deposition, metals and other contaminants are not likely to be an issue because there is no urban development in the watershed.

4.4.4 Data Gaps

Although data compiled from the available reports provide a general overview of conditions within the three watersheds, significant data gaps exist. Additional data, collected at consistent locations and intervals would provide a better understanding of baseline conditions and the major drivers of location-specific water quality issues. Relatively few data are available for the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds compared to other watersheds in the region. The implementation of a monitoring program within each watershed would significantly improve the understanding of current watershed conditions and provide a benchmark from which to measure future changes.

4.5 Biological Data

4.5.1 Flora and Fauna

Southwest Alabama has a tremendous diversity of plant and animal species and habitats. Because the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds are located adjacent to one another in southwestern Baldwin County, many of the same habitats and species are likely to occur in all three watersheds.

Inland habitats in all three watersheds contain upland forests, scrub forests, pine savannahs, riparian buffers, marshes, swamps, and palustrine wetlands. Coastal habitats within the three watersheds include estuarine wetlands, salt marshes, and oyster reefs. The Oyster Bay Watershed, which includes much of the 23-mile-long Fort Morgan Peninsula also contains beaches, dunes, interdunal swales, and maritime forests (MBNEP 2013). Large tracts of conservation lands within each of the watersheds have preserved

Pitcher plant, Oyster Bay Watershed

the integrity of these habitats (**Figures 3-18** through **3-20**). Of particular note is the Bon Secour National Wildlife Refuge that includes more than 6,000 acres of federally managed pristine wildlife habitat within the Oyster Bay Watershed.

The habitats described above support a variety of wildlife species including birds, mammals, herpetofauna, fishes, and invertebrates. Common mammal species known to occur in the watersheds include common gray fox (*Urocyon cinereoargenteus*), raccoon (*Procyon lotor*), coyote (*Canis latrans*), nine-banded armadillo (*Dasypus novemcinctus*), and Virginia opposum (*Didelphis virginia*). Less common mammals include bobcat (*Lynx rufus*), river otter (*Lutra canadensis*), and southern flying squirrel (*Glaucomys volans*) (MBNEP 2013). Herpetofauna species found in the watersheds include black pine snake (*Pituophis melanoleucus lodingi*), cottonmouth (*Agkistrodon piscivorus*), five-lined skink (*Eumeces fasciatus*), alligator snapping turtle (*Macrochelys temminckii*), yellow-bellied slider (*Trachemys scripta scripta*), and American alligator (*Alligator mississippiensis*). Common fish species include red drum (*Sciaenops ocellatus*), speckled trout (*Cynoscion nebulosus*), southern flounder (*Paralichthys lethostigma*), mullet (*Mugil cephalus*), and bream (*Abramis brama*).

The coastal region of Alabama is especially important for migratory birds, which use the area for stopover habitat during spring and fall migrations between North America and Central and South America. More than 400 species of birds have been identified within the Bon Secour National Wildlife Refuge alone (MBNEP 2013), and the National Audubon Society has designated most of the Oyster Bay Watershed as an Important Bird Area. Birds in the three watersheds include many species of raptors, wading birds, shorebirds, waterfowl, and passerines.

4.5.2 Threatened and Endangered Species

The Endangered Species Act of 1973 (ESA) provides for the conservation of species that are designated by USFWS as endangered or threatened throughout all or a significant portion of their range, and the conservation of the ecosystems on which they depend. The ESA prohibits take of any endangered or threatened species, where take is defined as: “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” When a species is listed as endangered or threatened under the ESA, USFWS can also designate critical habitat, which is defined as: “a specific geographic area(s) that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection.”

4.5.2.1 Protected Species

According to USFWS, 17 species listed endangered or threatened species are known to occur in Baldwin County (**Table 4-2**). Many of these species occur within the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds. However, the four sea turtle species and the Alabama beach mouse only occur within the Oyster Bay Watershed. Although they have been delisted due to recovery, Bald eagles (*Haliaeetus leucocephalus*) also occur in all three watersheds.

TABLE 4-2: FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES		
Common Name	**Scientific Name**	**Status**
Birds		
Piping plover	*Charadrius melodus*	Threatened
Red knot	*Calidris canutus rufa*	Threatened
Wood stork	*Mycteria americana*	Threatened
Mammals		
Alabama beach mouse	*Peromyscus polionotus ammobates*	Endangered
West Indian manatee	*Trichechus manatus*	Endangered
Reptiles		
Alabama red-bellied turtle	*Pseudemys alabamensis*	Endangered
Eastern indigo snake	*Drymarchon corais couperi*	Threatened
Gopher tortoise	*Gopherus polyphemus*	Candidate
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered
Kemp's Ridley sea turtle	*Lepidochelys kempii*	Endangered
Loggerhead sea turtle	*Caretta*	Threatened
Fishes		
Alabama sturgeon	*Scaphirhynchus suttkusi*	Endangered
Gulf sturgeon	*Acipenser oxyrinchus*	Threatened
Clams		
Alabama heelsplitter	*Potamilus inflatus*	Threatened
Southern clubshell	*Pleurobema decisum*	Endangered
Plants		
American chaffseed	*Schwalbea americana*	Endangered

Source: USFWS (2016a)

4.5.2.2 Critical Habitat for Protected Species

The Oyster Bay Watershed is the only one of the three watersheds that contains designated critical habitat for endangered or threatened species. It contains critical habitat for the Alabama beach mice and loggerhead sea turtles (USFWS 2016b) (**Figure 4-2**). Much of the designated Alabama beach mouse critical habitat in the Oyster Bay Watershed is within the boundaries of the Bon Secour National Wildlife Refuge, which contains the largest contiguous tract of habitat for this species anywhere (MBNEP 2013). Only a small amount of loggerhead sea turtle habitat occurs within the Oyster Bay Watershed. It is located at the western end of the Fort Morgan Peninsula (USFWS 2016b).

Photo credit: USFWS

Alabama beach mouse at Bon Secour National Wildlife Refuge

FIGURE 4-2: DESIGNATED CRITICAL HABITAT IN THE OYSTER BAY WATERSHED

4.5.3 Invasive Species

Invasive species are plants and animals that have been introduced to areas outside their native range by human activity or other means and have the potential to cause ecological damage or economic loss. The potential for harm distinguishes invasive species from non-native species, which have also been introduced outside their native range but do not pose an ecological or economic threat. The Alabama Invasive Plant Council maintains a list of plant species considered to be invasive within the state of Alabama. The statewide invasive plant list (most recently updated in 2012) contains 65 confirmed species and 26 additional species with the potential to become invasive in Alabama. The most common invasive plant species in the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds are described below:

- **Cogongrass (*Imperata cylinrica*)** is a fast-spreading invasive weed that has proven to be extremely difficult to eradicate. Cogongrass poses a threat to both wildlife habitat and economic interests within the three watersheds. It affects agriculture by interfering with crop production and degrades wildlife habitat by displacing or outcompeting native vegetation. Cogongrass is also highly flammable, posing a potential fire hazard to nearby homes. Cogongrass has expanded rapidly since it was first introduced into the United States in Mobile County in 1911 (ALIPC 2004). This species is currently found throughout all three watersheds.
- **Chinese privet (*Ligustrum sinense*)** is an invasive shrub first introduced into the United States in the 1850s. Chinese privet spreads rapidly and commonly occupies fence rows, forested creek bottoms, and upland forests. The dense, stemmy infestations can reach 30 feet in height, displace most native species, and prevent regeneration of bottomland hardwood and upland pine forests (ALIPC 2016). This species is currently found throughout all three watersheds.
- **Chinese tallow (*Triadica sebifera*)** (popcorn tree) is a deciduous species that is spread largely by seed dispersal from birds. This species is common throughout south Alabama and infests stream banks, riverbanks, and wet areas as well as upland forests. Chinese tallow is an aggressive species with the potential to rapidly replace native bottomland forest vegetation (ALIPC 2016). This species is currently found throughout all three watersheds.
- **Kudzu (*Pueraria montana*)** is an extremely fast-growing invasive vine that can cover trees, buildings, fences, road signs, and telephone and utility poles. Kudzu is one of the most notorious invasive species in the south and has proven nearly impossible to eradicate. It was intentionally introduced into the United States from the 1930s to the 1950s for erosion control before its potential risk as an invasive species was realized (ALIPC 2016). Kudzu is currently found throughout Baldwin County, including all three watersheds.

4.6 Coastal Zone

The coastal zone is the dynamic interface between land and water. Because of the significant role of the coastal zone in regional ecology, economics, and general human activities, it is important to characterize the current condition of this area as well as understand how conditions are changing over time. For the purposes of this report, the coastal zone is defined as the extent of shoreline within each watershed below the mean higher high water tidal elevation, which is 0.7 foot North American Vertical Datum of 1988 (NAVD88), based on the NOAA Gage 8735180, *Dauphin Island, AL*.

4.6.1 Bon Secour River Watershed

Within the coastal zone, the Bon Secour River and tributaries meander through a relatively vegetated and flat landscape before terminating in a shallow, semi-enclosed estuary with an open connection to Bon Secour Bay (Mobile Bay), Oyster Bay, and the Gulf ICW. The U.S. Army Corps of Engineers (USACE) historically has maintained a navigation channel and turning and maneuvering areas within the river. GSA studied the shoreline of the coastal zone of the Bon Secour River Watershed in 2011 by as part of a broader study to classify the shoreline within the river system and quantify shoreline change (Jones and Tidwell 2011). Based on GIS files generated as part of that study, the watershed includes more than 30 miles of tidally influenced shoreline, most of which is natural without shore protection (**Figure 4-3**). Wood and steel bulkheads are the most common types of armoring present within the protected areas, totaling approximately 5 miles of the shoreline within the coastal zone.

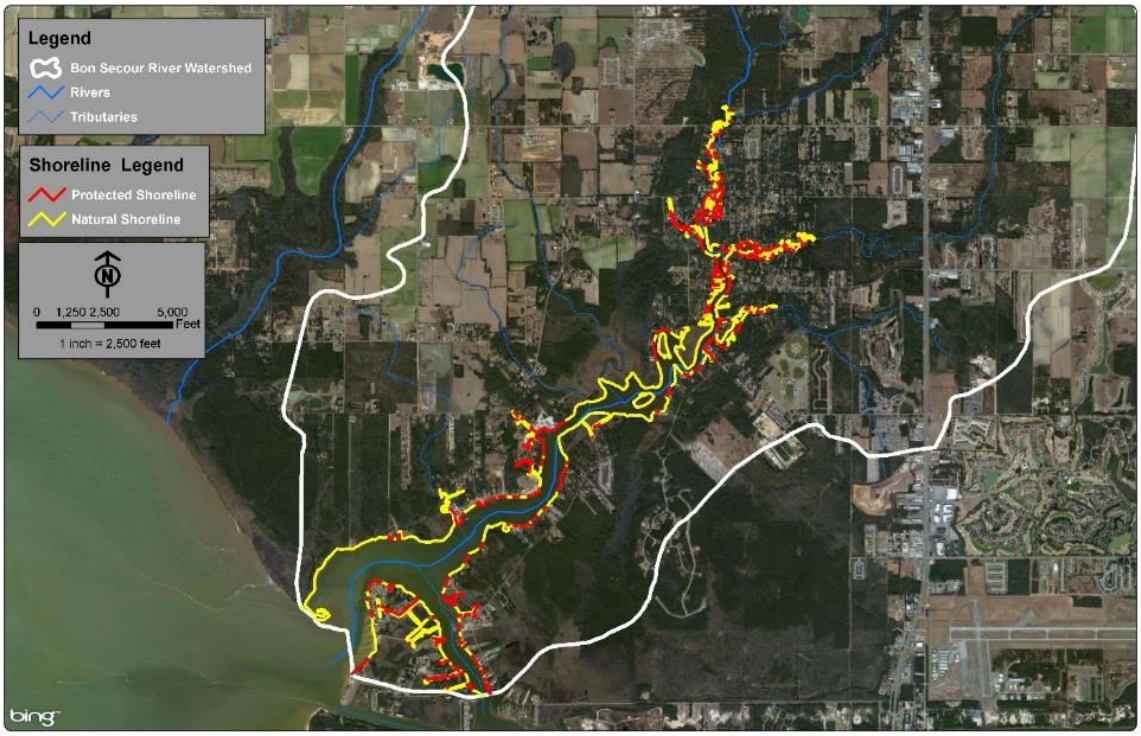


FIGURE 4-3: BON SECOUR RIVER WATERSHED SHORELINE

Review of aerial imagery from 1955 to 2015 shows that the coastal zone has become more developed, although natural areas persist along the shoreline (University of Alabama 1955, 2015). Unprotected shorelines have retreated slightly over time, likely related to a combination of wave action/high flows and sea level rise. Linear ditches installed to promote drainage within marsh areas for mosquito control are evident in the earlier aerials. Some of the smaller ditches are slowly fading into the landscape over time and are not identifiable in locations in the 2016 aerial imagery. In other areas, additional channels have been cut into the landscape during the past 60 years, connecting development to the river. Vegetative cover along the shoreline has been denuded in locations of development; however, in other locations, the canopy appears denser in 2015 than 1955.

1955 aerial showing the Bon Secour River

2015 aerial showing the Bon Secour River

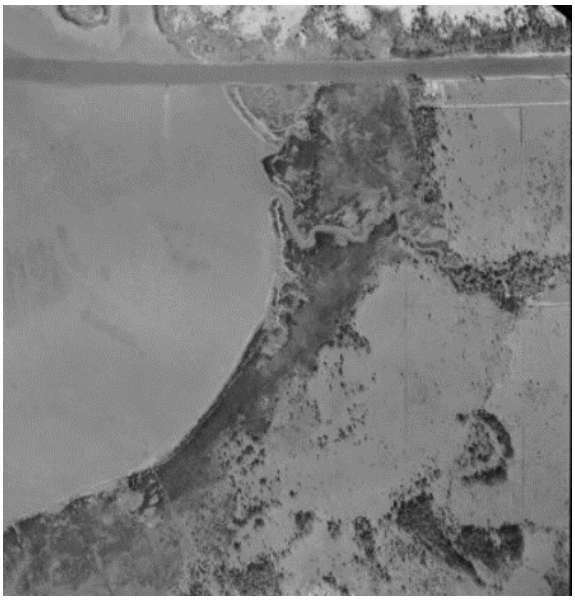
Overall the coastal zone within the Bon Secour River Watershed has been moderately manipulated over time. Future management of the coastal zone will be vital as the sea level rises and development pressures within the coastal zone, as well as in the upper watershed, threaten the health of this critical area. Balancing the continued economic development of the coastal zone while accounting for natural resources will ensure long term health and stability of the coast, both environmentally and economically.

4.6.2 Oyster Bay Watershed

The coastal zone of the Oyster Bay Watershed consists of the narrow buffer between the land and the Intercostal Water Way, Oyster Bay, and Bon Secour Bay. The coastal zone also extends up Bear Creek, a tributary to Oyster Bay. Most of the coastal zone within Oyster Bay is buffered by tidal marsh. Based on GIS files generated as part of the 2011 GSA study (Jones and Tidwell 2011), more than 35 miles of shoreline exist within Oyster Bay, greater than 85% (approximately 4.7 miles) consist of natural, unprotected shoreline. The remainder of the shoreline primarily consists of steel and wood bulkhead and rubble/riprap (**Figure 4-4**). The shoreline along Bon Secour Bay is a combination of bulkheads / hard armor and natural, unprotected shoreline.

FIGURE 4-4: OYSTER BAY WATERSHED SHORELINE

Review of aerial imagery from 1940 to 2015 shows the unprotected shorelines have retreated slightly over time, likely related to a combination of wave action/high flows and sea level rise. The habitat buffering the coastal zone on the landward side of Oyster Bay has actually improved over time, with a large portion of the contributing watershed east of Oyster Bay that was in agricultural production supporting dense forest stands today. The coastal zone of the western portion of the Oyster Bay watershed has become more developed over the past decades, with pronounced shoreline erosion occurring in areas.



1955 aerial showing agricultural area east of Oyster Bay

2015 aerial showing forested area east of Oyster Bay

Because most of the land buffering the coastal zone in Oyster Bay is currently protected, this critical area is not subject to the same level of development pressures the rest of the Oyster Bay Watershed experiences. The need for focused coastal zone management for the western portion of the watershed is critical, since much of the coastal zone is privately owned.

4.6.3 Skunk Bayou Watershed

The coastal zone within the Skunk Bayou Watershed is predominately natural with very little development. Based on GIS files generated as part of the 2011 GSA study (Jones and Tidwell 2011), nearly 98% of the 6 miles of shoreline that run along Bon Secour Bay within the Skunk Bayou Watershed consisted of natural, unprotected shoreline. While portions of the unprotected shorelines have retreated slightly over time, likely related to a combination of wave action/high flows and sea level rise, the coastal zone provides high value habitat that has changed little over the decades.

Photo credit: The Nature Conservancy

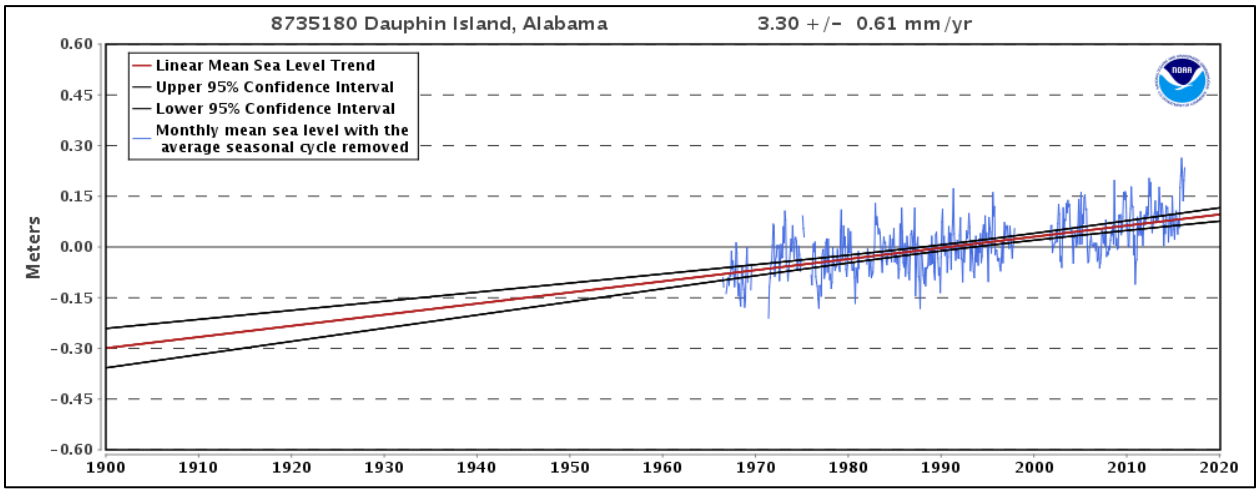
Aerial view of the 2012 living shoreline project

In 2012, The Nature Conservancy and its partners constructed approximately one-third of a mile of living shoreline breakwaters, just offshore of the Skunk Bayou Watershed in Bon Secour Bay. Living shoreline breakwaters are designed to prevent or reverse shoreline erosion by reducing wave energy, while providing hard structure habitat for oysters, shrimp, fish, and other marine life. Subsequently, NOAA and its partner trustees selected this site for additional restoration using funding from the Deepwater Horizon Oil Spill. This project, known as the Swift Tract Living

Shoreline Project, will construct an additional 1.6 miles of living shoreline breakwaters along the shore of the Skunk Bayou Watershed (NOAA 2013). The project is currently under construction.

4.6.4 Climate Change / Sea Level Rise

As indicated previously, the coastal zone of the Bon Secour River Watershed, the Oyster Bay Watershed, and the Skunk Bayou Watershed have experienced some amount of shoreline recession, likely due to a combination of sea level rise and wave action. As sea levels are rising, the land surface in Coastal Alabama is also gradually lowering, or subsiding, which compounds the issue of coastal recession (Bernier et al. 2011). Combining the rate of sea level rise with the rate of land subsidence, the relative sea level rise for the Gulf coast is approximately 0.8 to 1.2 inches per decade (ICF International 2012). The long-term tide gage record at Dauphin Island, Alabama, reveals a local sea level rise rate of 0.13 inch per year, as shown in **Figure 4-5** (NOAA 2016b).



Source: NOAA (2016b)

FIGURE 4-5: LONG-TERM SEA LEVEL TRENDS AT DAUPHIN ISLAND, ALABAMA 1980

The rate of future sea level is widely debated, and given the range of variables and assumptions involved in calculating these rates, most future sea level rise rates are expressed in terms of three scenarios:

- Low: based on historic rates of observed sea level change
- Intermediate: accounts for a modest acceleration in rate and projected ocean warming
- High: assumes rapid rate acceleration and projected ocean warming / ice sheet loss / glacial melting

USACE (2016) has developed a sea level change curve calculator, which allows the user to select different sea level change rate scenarios and planning horizons and incorporates user-selected tide gage data to account for local land surface subsidence rates. Future sea levels and tidal data in the study area were determined for the period 2015 to 2100 using an intermediate scenario in the USACE calculator and plotted with the typical marsh elevation in

the study area (1.5 feet NAVD88). These results are shown in **Figure 4-6.** The figure illustrates that if projected ocean warming occurs, the existing marshes will be submerged by 2075. If sea level rise rates accelerate rapidly, marshes will be submerged by 2045. In contrast, if low rates are applied, the marshes will not be submerged within the period evaluated.

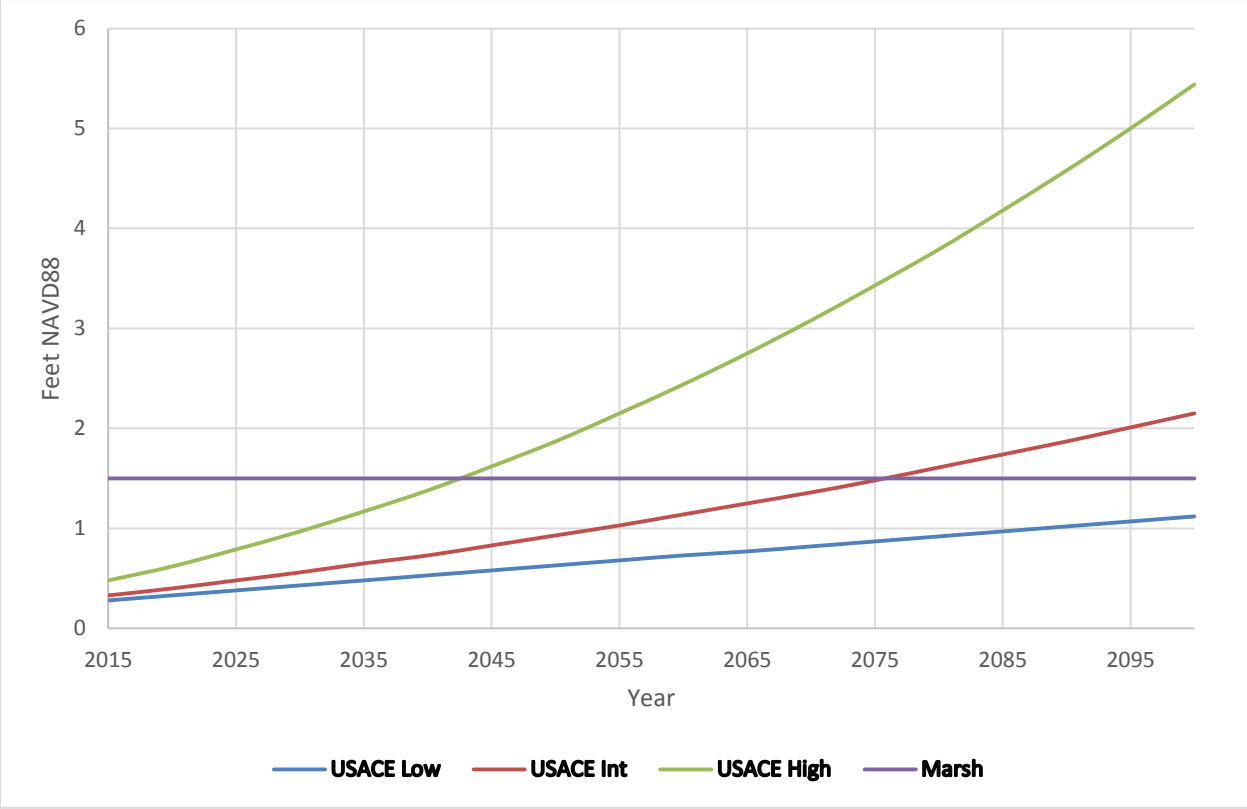


FIGURE 4-6: RELATIVE SEA LEVEL CHANGE PROJECTIONS, GAGE 8735180, DAUPHIN ISLAND, ALABAMA

Locally, this evolution in landscape will consist of conversion of the fringe marshes to open water and loss of this important habitat that is vital from ecological and economic perspectives. Slowly over time, the tides will reach higher elevations and areas that are currently upland will be inundated with salt water, resulting in alterations to the upland landscape buffering the coastline. During storm events, wave energy will be higher and the shoreline will be vulnerable to erosion and slope failure.

4.6.5 Sea Level Affecting Marshes Model

As previously discussed, relative sea level rise has likely contributed to tidal marsh loss experienced in the Bon Secour River Watershed, the Oyster Bay Watershed, and the Skunk Bayou Watershed. Projections indicate that this essential habitat is vulnerable to future sea level rise, particularly in the Gulf coast. Due to the substantial ecological and economic implications of this habitat loss, efforts are being made to quantify the potential loss to inform management decisions.

The Sea Level Affecting Marshes Model (SLAMM) was developed by a USEPA contractor (Warren Pinnacle Consulting, Inc.) to support these planning efforts and management decisions. The model simulates changes in tidal marsh area and habitat type[2] in response to sea level rise. SLAMM simulates five primary processes that affect tidal marshes: inundation, erosion, overwash (when barrier islands are submerged), saturation (a rise in the groundwater table), and accretion (the rise of the marsh surface elevation as a result of sediment deposition). The model allows the user to input local data [i.e., local accretion rates and local subsidence rates (gradual lowering of the land surface)] and modify an array of parameters (i.e., rate of sea level rise) to customize the model.

In 2009, USFWS employed SLAMM to model the Bon Secour National Wildlife Refuge (Clough and Larson 2009). Four different sea level rise scenarios derived from the work of the Intergovernmental Panel on Climate Change (IPCC 2001) were modeled: the A1B[3] mean and maximum scenarios and the A1B maximum plus 1 meter and the A1B maximum plus 1.5 meters, which were included to account for the effect of ice flow on sea level rise. The area modeled included most of the Oyster Bay Watershed and a small portion of the Bon Secour River Watershed. The acres of each habitat type within this study area was calculated for current conditions and year 2025, 2050, 2075, and 2100 under each sea level rise scenario. The model results indicated that each sea level rise scenario would result in a reduction in swamp and brackish marsh habitats, and an increase in open water, tidal flat, and saltmarsh habitats. The increase in saltmarsh habitat was a result of marsh migration, or the conversion of uplands to saltmarsh with rising sea levels, assuming that the adjacent upland areas remained undeveloped and that habitat conversion was not obstructed. As expected, the degree of change for each habitat over time was more severe with the more extreme predictions.

SLAMM was executed as part of this study for an area covering the three watersheds. It was established using the same input parameters applied in 2009. The A1B minimum, mean, and maximum sea level scenarios were modeled. The acres of each habitat type within the study area were quantified for 2016, 2025, 2050, 2075, and 2100. The current habitat coverage within the modeled area and the habitat coverage in the year 2100 under the A1B maximum scenario is illustrated in **Figure 4-7**. **Figure 4-8** depicts the change in habitat acres over time.

[2] The model includes 26 categories of habitat type derived from the National Wetlands Inventory.

[3] The A1 sea level rise scenario assumes rapid economic growth followed by rapid introductions of new and more efficient technologies. The 'B' designation provides an additional level of assumptions: that the global energy source consists of a balanced mix of fossil fuel sources and non-fossil fuel sources. Within the A1B scenario, minimum, mean and maximum estimates of global average sea level rise have been developed.

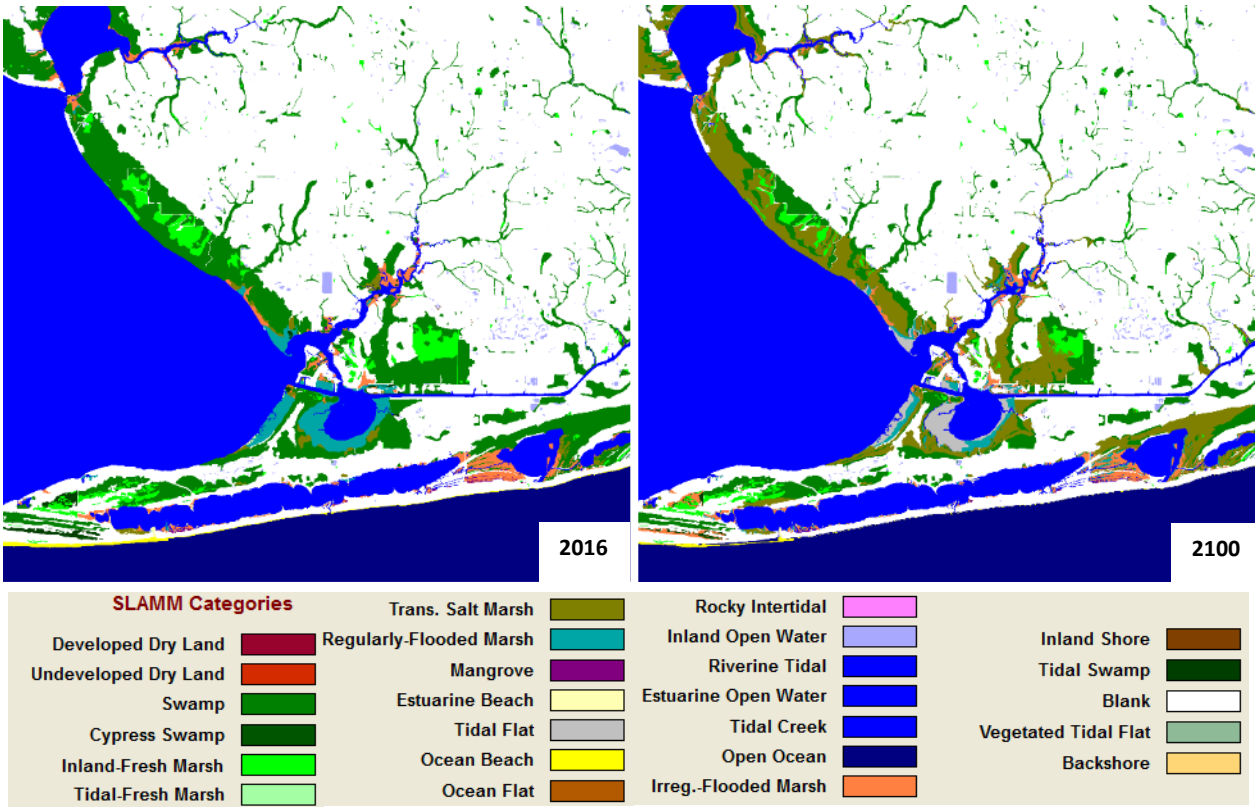
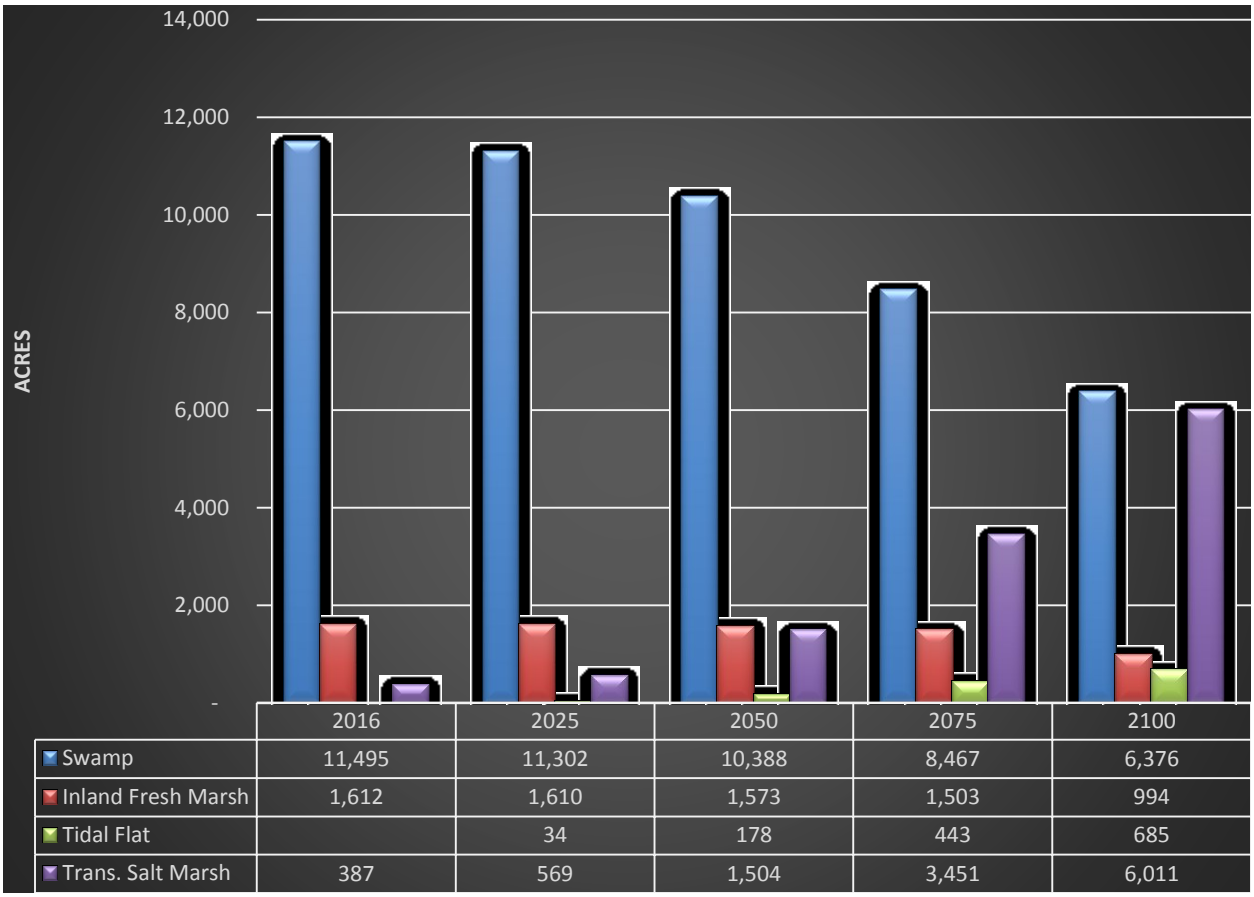


FIGURE 4-7: 2016 CURRENT HABITAT COVERAGE AND 2100 HABITAT COVERAGE UNDER THE A1B MAXIMUM SCENARIO FOR SEA LEVEL RISE



	2016	2025	2050	2075	2100
Swamp	11,495	11,302	10,388	8,467	6,376
Inland Fresh Marsh	1,612	1,610	1,573	1,503	994
Tidal Flat		34	178	443	685
Trans. Salt Marsh	387	569	1,504	3,451	6,011

FIGURE 4-8: CHANGE IN HABITAT ACRES OVER TIME

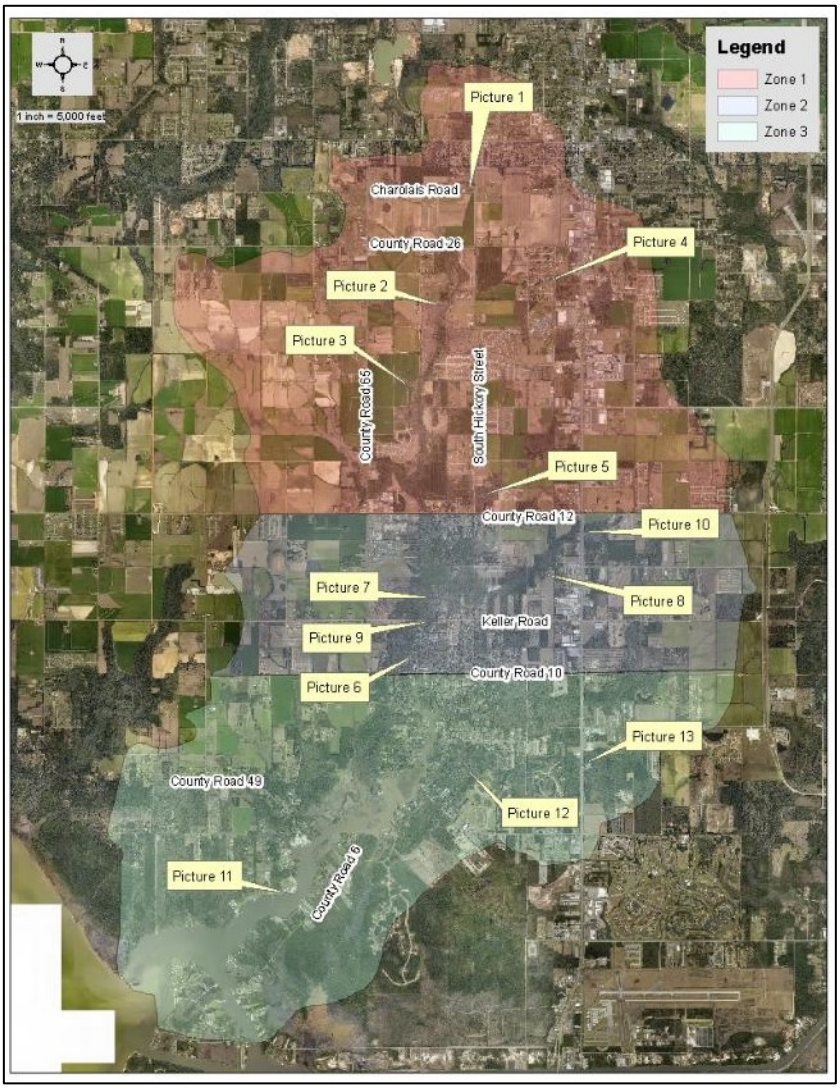
Similar to the model results from the USFWS 2009 study, SLAMM indicated that each sea level rise scenario would result in a reduction in swamp and inland fresh marsh habitats, and an increase in tidal flat and saltmarsh habitats.

5.0 FIELD RECONNAISSANCE

A field team conducted a reconnaissance of each watershed on foot in areas where access was granted by landowners, by boat on river reaches that were navigable, and by vehicle to gain a first-hand knowledge of current conditions within each watershed. The field reconnaissance was conducted from October 2015–December 2015 and in January 2016.

5.1 Bon Secour River Watershed

Because of the diversity of the Bon Secour River Watershed, the field reconnaissance was divided into three zones (**Figure 5-1**). Zone 1 included the headwaters of the river south to County Road 12. Zone 2 was bound between County Road 12 and County Road 10. Zone 3 began at County Road 10 and continued to the mouth of the river.



Note: Locations on this map are shown in the pictures that follow.

FIGURE 5-1: BON SECOUR RIVER WATERSHED ZONE MAP

Zone 1—The Bon Secour River begins in the upper portion of Zone 1. Several agricultural drainage ditches feed into the river in Zone 1, and an unnamed tributary provides input from a developed portion of the city of Foley. Turkey Branch intersects the river from the west near County Road 12.

In this zone, the river is very shallow under normal flow conditions and cannot be navigated. Riparian buffers range from non-existent (agricultural fields) to approximately 500 feet wide. In areas where a riparian buffer is present, the buffer is dominated by privet hedge and popcorn trees, indicating historical

disturbance. The banks of the river from the headwater to County Road 12 are stabilized with natural vegetation, and the field team observed minimal bank erosion. In areas accessed on foot, the field team observed litter in the river throughout this zone. They also found litter deposited in the floodplain, providing evidence that this zone of the river floods during substantial rainfall events. While driving in Zone 1, the field team also observed:

- Litter in the river and along multiple roadsides
- Cogon grass along multiple roadsides
- Litter in the concrete flume in the community of Aaronville
- Kudzu along the roadside of South Hickory Street

Picture 1: Headwater of the Bon Secour River looking downstream

Picture 2: Litter deposited in Bon Secour River in Zone 1

Picture 3: Privet hedge and litter in the floodplain in Bon Secour River in Zone 1

Picture 4: Shopping cart found in concrete flume in the community of Aaronville

Picture 5: Kudzu along roadside of South Hickory Street

Zone 2—In Zone 2, the river becomes navigable. Canoes, kayaks, and small jon boats can be used to access the river from County Road 12 to Keller Road. Larger boats, including pontoon boats, ski boats, and center consoles without canopies, can travel between Keller Road and County Road 10. Little area is developed along the river between County Road 12 and Keller Road, and large riparian buffers (in excess of 500 feet) occur along the river banks. From Keller Road to County Road 10, single-family homes line both sides of the river.

The field team noted minimal bank erosion in the river between County Road 12 and County Road 10. Mainly natural vegetation stabilizes most of the shoreline, but some homeowners use rip rap and bulkheads to stabilize the banks on their properties. Silt is deposited on the river bottom in shallower areas in the section between County Road 12 and Keller Road.

Picture 6: View of vegetated banks in Zone 2

Picture 7: Silt deposited on river bottom in Zone 2

An unnamed tributary that drains storm water from the southeast quadrant of Foley and Highway 59 enters the river just north of Keller Road. This tributary is very unstable—evident by its incised banks and the exposed pipeline that crosses the tributary. Also, the field team noted sand deposition where this tributary enters into the river and litter in the floodplain of the tributary at the Highway 59 crossing.

Picture 8: Exposed pipeline in an unnamed tributary to Bon Secour River

Picture 9: Sediment deposition at confluence of an unnamed tributary and Bon Secour River

Piicture 10: Trash in floodplain of unnamed tributary downstream of Highway 59

Zone 3—The majority of the river banks in Zone 3 are lined with single-family homes, and commercial seafood businesses are located near the mouth. Estuarine wetlands begin to appear in this zone of the river. Natural vegetation, rip rap, and bulkheads stabilize the river banks, so the field team noted only minimal bank erosion. Several named tributaries, i.e., Boggy Branch, Bright's Creek, School House Creek, and Shutt Creek, enter the river in this zone. Boggy Branch and Bright's Creek are lined with single-family homes that have banks stabilized by natural vegetation, rip rap, and bulkheads.

Picture 11: Aquila Seafood

Picture 12: Bulkhead bank along Bright's Creek

The field team observed litter in the floodplains of both Boggy Branch and Bright's Creek downstream of where they cross under Highway 59.

Picture 13: Litter in Bright's Creek floodplain

5.2 Oyster Bay Watershed

The Oyster Bay Watershed is composed mainly of large tracts of undeveloped areas. Approximately 3,200 acres of the Bon Secour National Wildlife Refuge and the Baldwin County Mitigation Bank 1, approximately 600 acres, are located in the watershed. Privet hedge and popcorn trees are found lining the roadways and in wetlands throughout the watershed. Along the Ft. Morgan Peninsula, the majority of the residential homeowners maintain yards that are still native vegetation, and the driveways are constructed with pervious surfaces. Shoreline erosion is evident by the location of dead and decaying trees to the current shoreline.

Picture 14: Eroding shoreline at Peninsula Golf Course, view looking west

Picture 15: Eroding shoreline at Peninsula Golf Course, view looking east

5.3 Skunk Bayou Watershed

The majority of the Skunk Bayou Watershed is composed of sod and row crop farms. Numerous drainage ditches cut through these fields and drain into Skunk Bayou or wetland areas within the watershed. Minimal, if any, buffer strips are between the sod/row crop and the drainage ditches. The riparian buffer of Skunk Bayou contains privet hedge and popcorn trees. Cogon grass lines the roadside in many areas of the watershed. The field team observed litter in multiple places along the roadways.

Picture 16: Headwater of Skunk Bayou

Picture 17: Planted row crop with Skunk Bayou in the background

Picture 18: Example of a sod farm in the watershed

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6.0 IDENTIFICATION OF CRITICAL ISSUES AND AREAS

Critical issues and areas affecting the condition of the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds were identified from multiple sources including Steering Committee resource knowledge, interviews with knowledgeable experts, input from citizens within the watersheds via public workshops, results of field reconnaissance conducted by the field team, review and interpretation of current and historic data, and analyses of historic aerial photography and maps.

Critical issues and areas for each watershed are presented below. While some issues are common to all three watersheds, unique aspects of issues specific to each watershed are described separately.

6.1 Critical Issues and Areas of the Bon Secour River Watershed

Critical issues and areas identified within the Bon Secour River Watershed are described below.

- **Stormwater Management**—One major issue of concern to stakeholders within the Bon Secour River Watershed is stormwater management. For example, the frequent occurrences of flooding in and around the city of Foley during and immediately following major storm events impact various businesses and residences when access is restricted. Development and expansion of impervious cover impede groundwater infiltration and, therefore, increase the amount of surface water runoff, which frequently exceeds the capacity of waterways and stormwater infrastructure.

Flooding on County Road 12E

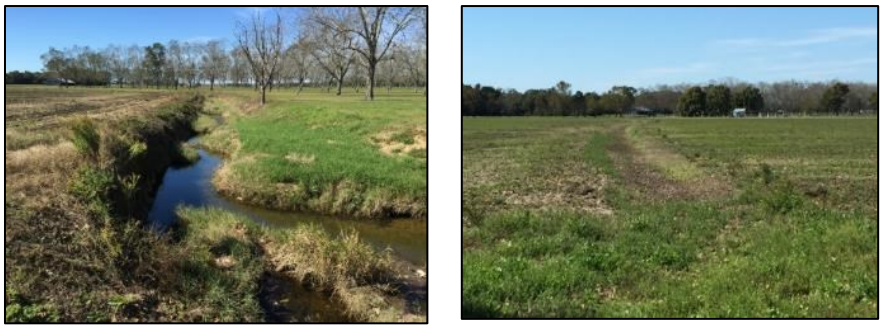
Flash flooding in downtown Foley afer rainfall event

- **Litter Control/Management**—The field team observed litter along roadways and in drainage ditches and waterways throughout the watershed. Members of the community identified littering as an issue of concern during public scoping meetings. During the 2015 Alabama Coastal Cleanup, volunteers collected several bags of litter and household debris.

Litter in Bon Secour River

Bags of litter and household debris collect during the Albama Coastal Cleanup

- **Water Quality—**One of the greatest concerns to stakeholders in the Bon Secour River Watershed is water quality. As stated in Section 4.4.3, water quality conditions in the watershed are degraded. Nutrient loading (nitrogen and phosphorus) appears to be an issue in the upper portion of the watershed where agriculture is the predominant land use (ADEM 1996; Summersell 2008; Cook et al. 2014). Elevated nutrient concentrations following rainfall events suggest that nutrient inputs originate from non-point sources, most likely agricultural runoff (ADEM 1996; Cook et al. 2014). Buffer strips between agricultural practices and drainage ditches are minimal. Pathogen loading is also a problem in some parts of the watershed, and a TMDL has been developed for an unnamed tributary to the Bon Secour River (in the northwestern portion of the watershed) to address pathogen contamination. Generally, nutrient and pathogen loading are highest in the upper portions of the watershed with concentrations decreasing toward the confluence with Bon Secour Bay, despite Bon Secour Bay's 303(d) listing for pathogen contamination. Other contaminants detected in the Bon Secour River Watershed include copper, zinc, and lead, which may be remnants from past industrial activities because no potential active sources have been identified. Mercury concentrations were relatively low despite the river's 303(d) listing for mercury contamination.



Examples of agricultural fields in the upper portion of the watershed

- **Erosion and Sedimentation—**Results of the field reconnaissance and discussions with land owners along an unnamed tributary to the Bon Secour River indicate that erosion and sedimentation along the unnamed tributary during major storm events are problematic (see photos below). Results of a GSA study indicate that because of current land use practices, the watershed delivers a much greater sediment load than if no human activity were present. The GSA study effectively demonstrates that development and land management practices in the Bon Secour River Watershed have resulted in increased sediment loads. For example, during the decade between 2001 and 2011, the watershed experienced a 7.8% increase in developed land, primarily conversion of agricultural lands. The GSA study attributes this rapid urbanization and expansion of impervious cover in the watershed to reduced groundwater infiltration, intensified flood events, stream bank erosion, and sedimentation.

Unnamed tributaries to the Bon Secour River

- **Invasive Species**—Several invasive plant species commonly inhabit the Bon Secour River Watershed, including cogon grass, Chinese privet, Chinese tallow, and kudzu. These species can outcompete native plant species and degrade wildlife habitat and interfere with agricultural crop production, as described in Section 4.5.3, *Invasive Species*.

6.2 Critical Issues and Areas of the Oyster Bay Watershed

Critical issues and areas identified within the Oyster Bay Watershed are described below.

- **Habitat Protection and Preservation—**While recognizing over half of the land area within the Oyster Bay Watershed is in the public domain (Bon Secour National Wildlife Refuge and the Baldwin County Mitigation Bank 1) and designated for conservation and preservation, the stakeholders of this watershed indicated they would like to see even more properties acquired and set aside for conservation and preservation. Several available parcels in the watershed were identified during the planning process.
- **Shoreline Erosion—**An issue of concern to citizens of the Oyster Bay Watershed, expressed during public meetings, small workshops, and in the online survey, is the potential for continued shoreline erosion. As described in Section 4.6, *Coastal Zone*, a review of aerial imagery from 1940 to 2015 demonstrates that the unprotected

shorelines have retreated over time likely because of wave action/high flows and sea level rise. The habitat buffering the coastal zone in locations on the landward side of Oyster Bay has actually improved over time, and a large portion of the contributing watershed east of Oyster Bay that once was in agricultural production now supports dense forest stands. An area of concern, the western portion of Oyster Bay, has become more developed over the past decades, with significant shoreline erosion occurring in these areas. Additionally, several citizens at the two public meetings expressed concern that shoreline erosion near Bon Secour Bay was/is being caused by maintenance dredging of the Gulf ICW conducted by USACE. This issue needs further investigation.

Shoreline erosion at Peninsula Golf Course

- **Water Quality—**Although water quality is an issue of importance to the citizens of Gulf Shores and the Oyster Bay Watershed echoed by members of the Steering Committee, the data, while limited, do not support this position. As stated in Section 4.4.3, *Summary of Water Quality Conditions*, water quality data for the Oyster Bay Watershed are limited but suggest that nutrient loading is not a major problem because agricultural land use is minimal and Oyster Bay is mostly surrounded by undeveloped lands, which includes a large wetland buffer along the shores of Oyster Bay. Nitrogen concentrations are generally at the low and phosphorus levels are low for the region (Summersell 2008). Oyster Bay currently appears on Alabama's 303(d) list for pathogens (ADEM 2016a), but recent data were not available to confirm current pathogen impairment. Additional data collection is necessary to determine the current status of water quality in Oyster Bay.
- **Invasive Species—**Several invasive plant species commonly inhabit the Oyster Bay Watershed, including cogon grass, Chinese privet, and Chinese tallow. These species can outcompete native plant species and degrade wildlife habitat.
- **Smart Growth—**At public meetings and in responses to the online survey, residents of the Oyster Bay Watershed expressed concern about the application of Smart Growth. Smart Growth is an approach to land development that accepts that growth and development will continue to occur and so seeks to direct that growth in an intentional, comprehensive manner. USEPA defines Smart Growth as "development that serves the economy, the community, and the environment." Smart Growth values long-range regional considerations of sustainability over short-term economic gains. The goals of Smart Growth are to achieve a unique sense of community and place, while preserving and enhancing natural and cultural resources and promoting public health.

6.3 Critical Issues of the Skunk Bayou Watershed

- **Water Quality—**Water quality is the most important issue to the stakeholders of the Skunk Bayou Watershed and the Steering Committee. This opinion is based on the fact that the surrounding land use (mostly agricultural) and northern portions of the Skunk Bayou in general proximity to the upper reaches of the Bon Secour River are similar with regard to water quality conditions. As a result of this observation, it has been concluded that the waterways of the Skunk Bayou Watershed likely experience some level of nutrient and pathogen loading. As stated in Section 4.4.3, specific water quality data for Skunk Bayou is extremely limited. Similar to the Bon Secour River Watershed, nutrient and pathogen loading are likely more severe in the upper portion of the watershed because the lower portion of the watershed, near the shoreline of Bon Secour Bay, consists of large tracts of forested wetland that act as a buffer (**Figure 3-20**).
- **Lack of Agricultural Buffer Strips—**During the field reconnaissance of Skunk Bayou, the field team observed that planted portions of agricultural fields, particularly some sod farms, extended to the very edge of drainage ditches (see photo). This practice enhances opportunities for soil erosion and pollutant loading within the watershed that could be reduced with use of buffer strips.

Edge of field adjacent to draingae ditch

- **Invasive Species—**Several invasive plant species commonly inhabit the Skunk Bayou Watershed, including cogon grass, Chinese privet, and Chinese tallow. These species can outcompete native plant species and degrade wildlife habitat and interfere with agricultural crop production.
- **Litter Control/Management—**The field team observed litter in the Skunk Bayou Watershed along the roadsides and in drainage ditches and waterways during field reconnaissance.

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7.0 MANAGEMENT MEASURES

The Bon Secour River, Oyster Bay, and Skunk Bayou watersheds boast expansive natural resources that are experiencing development pressure and ongoing agricultural activity, resulting in an increase of impervious surfaces and watershed management challenges. The development of management measures to address these challenges evolved from an assimilation of technical findings (garnered though field reconnaissance and literature reviews) with stakeholder-defined issues of concern and priorities defined though a series of Steering Committee and community meetings and the results of a well-participated online survey. Section 6 summarized the critical issues and areas within each watershed. This section recommends management measures for each critical issue confronting the three watersheds.

The management measures are separated into two categories: 1) those that can be accomplished within the short term (implemented within 0-2 years) and 2) those that will take longer to accomplish (implemented over 2+ years). **Table 7-1** summarizes which management measures apply to each watershed.

TABLE 7-1: MANAGEMENT MEASURES FOR EACH WATERSHED

	Measure	Bon Secour	Oyster Bay	Skunk Bayou
Short Term (0–2 years)	Public education and outreach	✓	✓	✓
	Litter reduction	✓	✓	✓
	Increase conservation easements and protected habitat	✓	✓	✓
	Install living shorelines	✓	✓	✓
	Increase vegetative buffers	✓		✓
	Implement invasive species treatment and monitoring	✓	✓	✓
	Preserve culture, heritage, and knowledge of watersheds	✓	✓	
	Water quality monitoring	✓		✓
	Alabama-Mississippi Clean Marina Program (or AMCMP)	✓	✓	
Long Term (2+ years)	Install regional stormwater management facilities	✓		
	Implement stream restoration projects	✓		
	Conduct studies to determine the effects of expanding impervious cover on groundwater recharge	✓		

7.1 Short-term Management Measures (implemented within 0–2 years)

7.1.1 Public Education and Outreach (Bon Secour River, Oyster Bay, and Skunk Bayou Watersheds)

Source: NCHRP (2009)

Results of the stakeholder and public engagement process implemented as part of this WMP development revealed that the communities in these watersheds value and want to protect the natural and recreational resources. Addressing critical issues and areas identified in this WMP will require public support and engagement because several of the issues extend beyond political and jurisdictional boundaries and will need the cooperation of landowners and the public. Unlike other watersheds with active and dedicated interest groups, the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds are at the early stages of creating this type of engagement and environmental stewardship, though the results of the survey indicate that nearly half of those who participated are interested in participating in a watershed interest group. The objectives of this management measure are to foster a culture of mutual contribution so residents understand how implementing the recommended measures will improve the health of the watershed, improve natural habitat conditions, and sustain quality of life over time. To generate this support, this measure will capitalize and build on the momentum generated during this WMP development process and will implement the following:

- **Develop and Execute a Communications Plan**—The Communications Plan will leverage a range of media to encourage participation of events, celebrate successes, and identify the issues and events that resonate with the communities. Initially identified elements of the Communications Plan include:
  - Publish an annual newsletter reporting watershed issues and accomplishments
  - Design and distribute educational materials for each watershed
  - Develop a website (linked from municipal websites) detailing content of the WMP with updates on implementation of the management measures
  - Install signs along roadways indicating delineation of each watershed.
- **Host and Participate in Educational and Outreach Events**—This management measure will strive to strengthen participation in ongoing events and develop additional events for targeted audiences. Initially identified events include:
  - Host educational workshops on specific topics (i.e., stormwater management, the importance of vegetated buffers)
  - Work with local schools to develop engagement programs, such as tree planting days or targeted lessons on pollution control
  - Bolster participation in the annual Alabama Coastal Cleanup
  - Encourage public involvement in water quality monitoring efforts

7.1.2 Litter Reduction (Bon Secour River, Oyster Bay, and Skunk Bayou Watersheds)

Litter affects the aesthetics, wildlife, and water quality of the receiving waterbody. Reducing the volume of litter in the three watersheds will support the realization of the first two goals of this WMP: improve water quality and protect and enhance fish and wildlife habitat, addressing a critical issue identified by stakeholders. The recommended approach to litter reduction is a combination of structural measures (i.e., the installation of devices to capture and collect litter) and non-structural measures focused on reducing the amount of litter generated in the watersheds.

- **Install Signage (Bon Secour River, Oyster Bay, and Skunk Bayou Watersheds)**—Studies have shown that installing signs to prompt people to dispose of waste items in a desirable way is effective in reducing litter (NCHRP 2009). This measure involves the installation of such signs in identified litter hotspots, such as fishing locations and along waterways with heavy boater traffic.
- **Construct Litter Traps (Bon Secour River and Skunk Bayou Watersheds)**—Litter traps have been installed at strategic locations along waterways and drainage channels to collect and retain litter and debris and are periodically cleaned. Multiple types of devices are available to capture and collect trash and debris. Selecting the most effective device for a particular litter concentration "hot spot" depends on the characteristics of the location (i.e., a storm sewer outfall versus an open drainage swale), the volume and type of litter and debris in the system, and the operation and maintenance needs of the device. Three litter concentration "hot spots" were initially identified within the Bon Secour River Watershed as part of development of this WMP (**Figure 7-1**). This management measure involves evaluating these locations to select the most appropriate litter trap site(s). Once installed, communicating the volume of litter regularly removed from the trap via the Communications Plan will support the outreach effort to encourage watershed stewardship as well as communicate the information in the WMP. This measure also involves further evaluating all three watersheds to identify and prioritize other hotspot locations for litter trap installation.

FIGURE 7-1: POTENTIAL LITTER TRAP LOCATIONS

- **Maintain Good Housekeeping Practices (Bon Secour River, Oyster Bay, and Skunk Bayou Watersheds)**—The municipalities already implement good housekeeping practices that facilitate litter control, including street sweeping and frequently cleaning up roadside litter. Continuing these practices and identifying opportunities to augment them will reduce the amount of litter entering the waterways.
- **Education and Outreach (Bon Secour River, Oyster Bay, and Skunk Bayou Watersheds)**—Public education and behavior change programs are effective litter reduction techniques. Identified education and outreach measures include publishing the volume of litter regularly removed from litter traps on municipal websites and in newsletters and developing and implementing a trash reduction campaign that includes publishing a series of articles in local media and organizing clean-up days. It is assumed that the cost to execute these outreach efforts will be included in the Communications Plan, discussed above.

7.1.3 Increase Conservation Easements and Protected Habitat (Bon Secour River, Oyster Bay, and Skunk Bayou Watersheds)

Bon Secour River, Oyster Bay, and Skunk Bayou watersheds are experiencing development pressure, and population growth and urban development (the main drivers of watershed impacts and ecosystem stressors) are predicted for all three watersheds. The effect of this developmental pressure on watershed health was identified as a critical issue by the stakeholders. Increasing conservation easements and protecting habitat along waterway buffers and in the coastal zone is an identified approach to balancing economic development with the goal of protecting and enhancing fish and wildlife habitat, while expanding public access at targeted locations. **Figure 7-2** shows lands currently protected from development in the three watersheds.

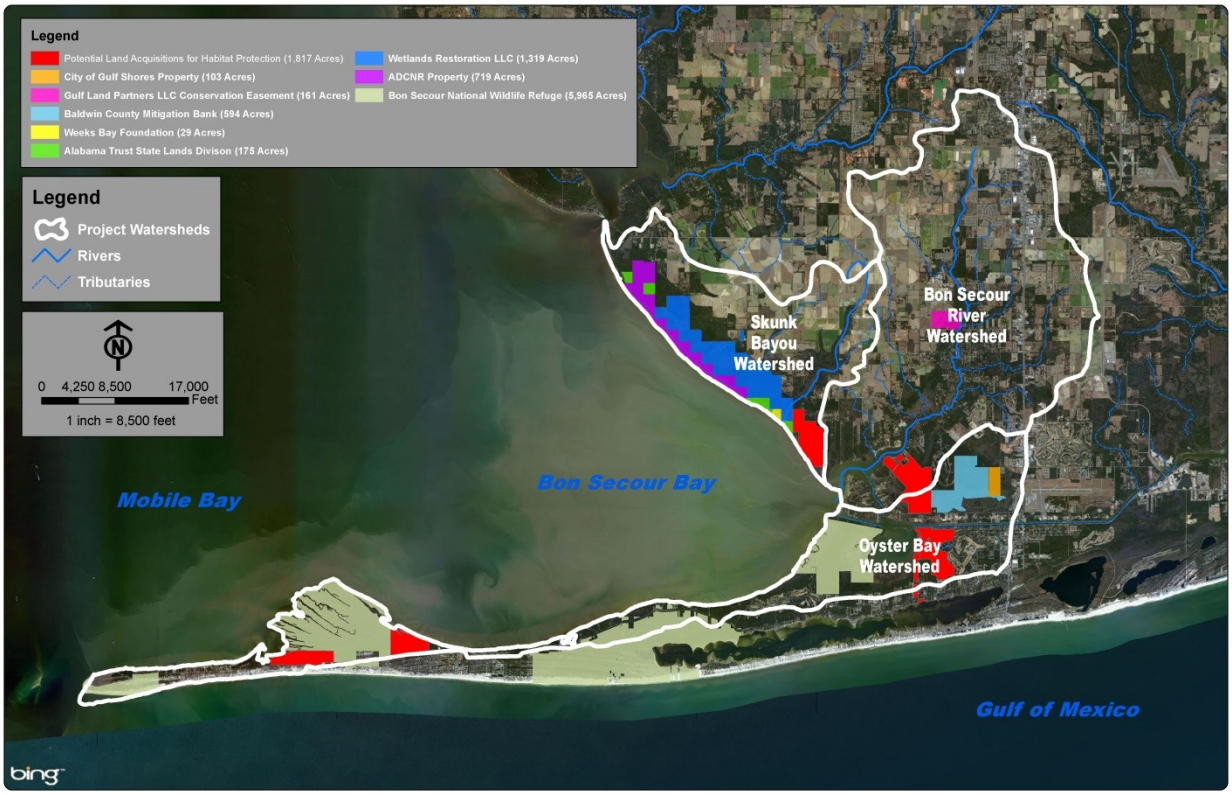

FIGURE 7-2: PROTECTED LANDS IN THE WATERSHEDS

Initially identified parcels recommended for preservation include:

- **Bon Secour Wetland Acquisition Project**—This project will enhance and restore approximately 500 acres of diverse habitat located within the city limits of Gulf Shores, Alabama. The property consists of tidal marshes, bayhead swamps, and pine savannah areas. Public access will be provided in the form of low-impact recreational opportunities such as hiking trails, small parks, and canoe/kayak launches. The anticipated cost for this acquisition is $3.2 million.

- **Oyster Bay Wetland Acquisition Project**—This project will protect, enhance, and restore approximately 430 acres of diverse habitat located within the city limits of Gulf Shores, Alabama. The property consists of tidal marshes, maritime forests, pine savannah wetlands, and upland forested areas. Public access will be provided in the form of low-impact recreational opportunities such as hiking trails, small parks, and canoe/kayak launches. The anticipated cost for this acquisition is $6.5 million.
- **Little Point Clear Unit**—This acquisition will protect 251 acres of sensitive coastal lands adjacent to the Bon Secour National Wildlife Refuge. These lands include significant frontage along St. Andrews Bay, Bon Secour Bay, salt and freshwater wetlands, numerous tidal sloughs, and adjacent upland areas. The anticipated cost for this acquisition is $6 million.
- **Benton Tract (Skunk Bayou Watershed)**—This acquisition will preserve 507 acres within the Skunk Bayou Watershed. The property contains high-quality maritime forest, saltwater, and freshwater wetland habitat. The anticipated cost for this acquisition is $2.5 million.
- **Little Point Clear Unit, Bon Secour National Wildlife Refuge, Three Rivers Tract Acquisition (Oyster Bay Watershed)**—The measure will provide permanent protection for approximately 237 acres that consist of coastal habitats, including beaches and sand dunes, scrub forest, fresh and saltwater marshes, fresh water swamps, and uplands. More than 370 species of birds have been identified on the refuge during migratory seasons, and many shorebirds and wetland-dependent species use the habitats for resting, wintering, and nesting. The anticipated cost for this acquisition is $4.75 million.

In addition to these acquisitions for preservation, the natural resources and developmental pressures in each watershed should be assessed to identify and prioritize additional target areas for preservation and public access. The product of this effort is a Conservation and Preservation Plan that will be updated annually and documents conservation opportunities and captures the success of the program. This information will be integrated with the Communications Plan, described above.

7.1.4 Install Living Shorelines (Bon Secour River, Oyster Bay, and Skunk Bayou Watersheds)

As described in Section 4.3, unprotected shorelines in all three watersheds have retreated slightly over time, likely related to a combination of wave action/high flows and sea level rise. An effective and ecologically beneficial approach to interrupting this process of shoreline erosion is employing a natural bank stabilization technique called “living shorelines,” which uses plants, sand, and a limited amount of rock to provide shoreline protection and maintain valuable habitat. While the scope of this WMP did not include an assessment of all shorelines to identify priority areas where this treatment could be effective in altering the process of shoreline erosion, the map below identifies initial locations in the Oyster Bay Watershed that might benefit from installation of the living shoreline (**Figure 7-3**). **Figure 7-4** illustrates a shoreline under existing conditions and a rendering of the same shoreline with living shoreline installed.

FIGURE 7-3: INITIALLY IDENTIFIED LIVING SHORELINE CANDIDATE SITE LOCATIONS IN THE OYSTER BAY WATERSHED

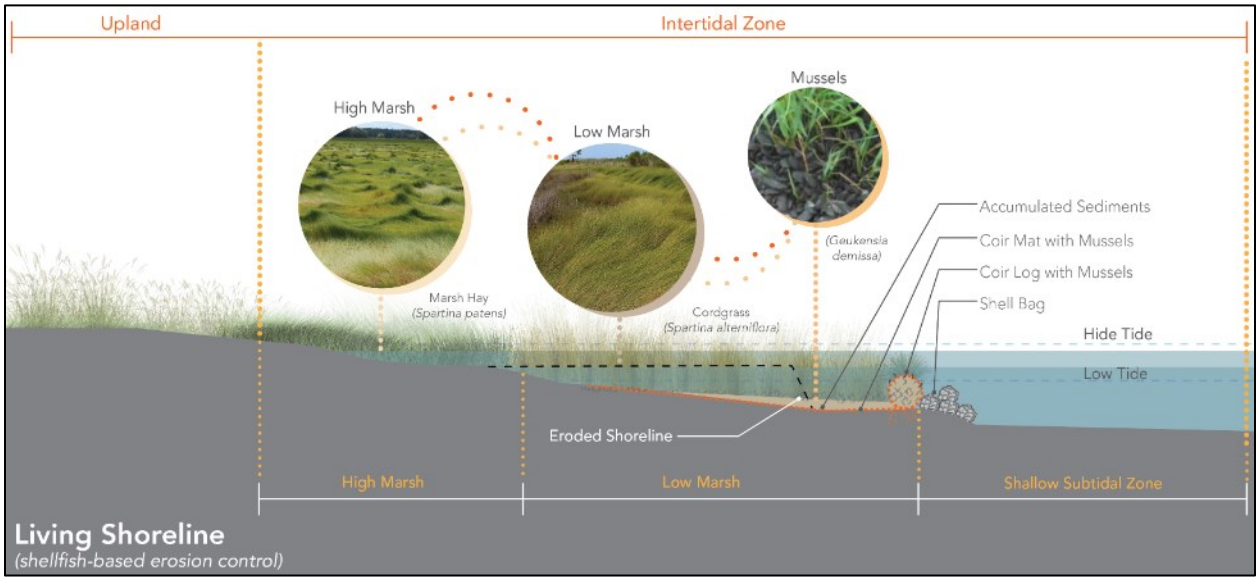

FIGURE 7-4: SHORELINE IN THE OYSTER BAY WATERSHED UNDER EXISTING CONDITIONS AND A RENDERING OF THE SAME SHORELINE WITH LIVING SHORELINE INSTALLED

7.1.5 Increase Vegetated Buffers (Bon Secour River and Skunk Bayou Watersheds)

Establishing vegetated buffers along waterways is a simple and inexpensive way to protect and improve water quality. Buffers typically range from 50 to 200 feet wide and are planted with native shrubs, trees, and plants. The vegetation filters sediments, nutrients, pesticides and other pollutants; stabilizes soil; and slows stormwater runoff. Trees and shrubs also provide shade,

keeping water cool, thereby improving habitat for aquatic organisms and cover and habitat for wildlife. This measure entails identifying and approaching landowners who might be willing to take agricultural land adjacent to waterways out of production for the creation of vegetation buffers. Once willing landowners have agreed, the buffer strips will be planted with native vegetation. Concurrent with this effort, educational outreach will be implemented as part of the Public Education and Outreach effort described above to inform landowners about the benefits of establishing vegetated buffers on water quality within the watershed. The cost to prepare the area and establish vegetation varies greatly depending on the existing conditions, the width of the buffer, and the vegetation planted.

Figure 7-5 illustrates a well-established buffer strip and opportunities for creating additional buffers. **Figure 7-6** depicts the establishment of a vegetated buffer in an agricultural field currently denuded of vegetation.

FIGURE 7-5: EXAMPLE OF EXISTING VEGETATED BUFFERS AND OPPORTUNITIES FOR VEGETATED BUFFERS

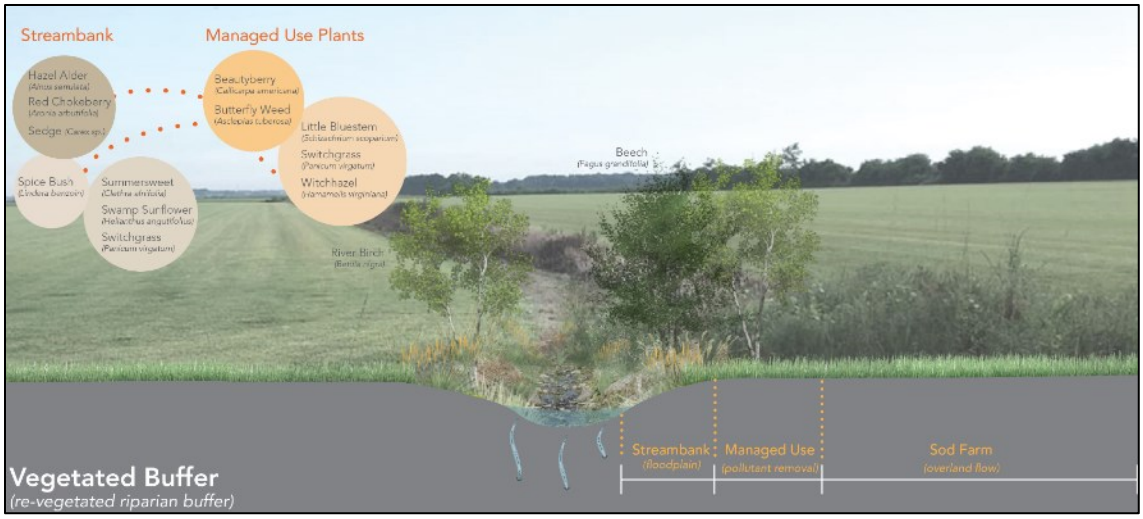

FIGURE 7-6: RENDERING DEPICTING THE ESTABLISHMENT OF A VEGETATED BUFFER IN AN AGRICULTURAL FIELD CURRENTLY DENUDED OF VEGETATION

7.1.6 Implement Invasive Species Treatment and Monitoring (Bon Secour River, Oyster Bay, and Skunk Bayou Watersheds)

The presence and expansion of invasive species are recognized as important factors contributing to ecosystem change and instability in all three watersheds. Invasive species have the ability to displace native species, diminish quality of wildlife habitat, damage infrastructure, and affect agriculture production. Without the implementation of control measures, vulnerable areas in each watershed can become homogenous stands of invasive species, totally eradicating native vegetation and eliminating biodiversity in some habitats. An invasive species management program that has the following elements should be created and implemented:

- Inventory and monitoring of invasive species throughout the three watersheds
- Collaboration between federal, state, county, and local governments
- Prevention through early detection of the presence of invasive species and rapid response
- Control using both physical and chemical treatments
- Restoration of native species within treated areas

7.1.7 Protect Continued Use of Biological Resources to Preserve Culture, Heritage, and Knowledge of the Watersheds (Bon Secour River and Oyster Bay Watersheds)

Historically, commercial fishing, in particular shell fishing, was the main economic driver of the Bon Secour region. While growth of the seafood industry has slowed in recent years, many small family-owned businesses still process and ship Gulf of Mexico seafood from the Bon Secour region. To preserve this cultural heritage, it is important to educate and secure consensus from all watershed stakeholders on potential methods to recognize the contribution

of the biological resources that helped build this region. Input from the community should be solicited through surveys and public involvement events. Meaningful opportunities for citizen engagement should be identified, and strategic partnerships will be established to assist in recognizing and maintaining this heritage based on the use of biological resources.

Photo Credit: Charley and Meme Wakeford, "Food, Fun, and Fable."

Bon Secour shrimp boats

An important element of this management measure will be to record oral histories of individuals who have lived in these watersheds for decades and have memories of how resources in the watersheds have been and continue to be used. This management measure should also include a public education component, such as a Heritage Day to be conducted in collaboration with schools.

7.1.8 Water Quality Monitoring (Bon Secour River and Skunk Bayou Watersheds)

Limited water quality data are available for the watersheds. Developing and implementing a water quality monitoring program will be important to establish baseline conditions so that watershed management efforts can be focused and progress measured. The program will be structured to define the impairment status (including pollutant sources), estimate the impairment pollution loading, and measure load reductions achieved as a result of management measures. The program will include a schedule with interim milestones, criteria to track progress, and citizen monitoring. Additional detail is provided in Section 11.

7.1.9 Alabama-Mississippi Clean Marina Program (Bon Secour River and Oyster Bay Watersheds)

Marinas and recreational boating are recognized as potential sources of nonpoint source pollution in coastal watersheds. The Alabama-Mississippi Clean Marina Program (AMCMP) is a voluntary, incentive-based program developed and implemented by Mississippi-Alabama Sea Grant Consortium and partners to promote environmentally responsible and sustainable marina and boating practices.

This program, created to reduce water pollution and erosion in state waterways and coastal zones, helps marina operators protect the resource that provides their livelihood—clean water. The AMCMP promotes boater education, coordination among state agencies, and better communication of existing regulations and offers incentives to creative and proactive marina operators.

The AMCMP focuses on the following seven management measures identified by marina operators as priorities:

- Marina siting, design, and maintenance
- Sewage management
- Fuel management
- Solid waste and petroleum recycling and disposal
- Vessel operation, maintenance, and repair
- Stormwater management and erosion control
- Marina management and public education

Marinas in the watersheds should be encouraged to participate in the AMCMP. Through participation, marina operators will receive technical assistance and promotional items identifying their facilities as "Clean Marinas." Studies have shown that the most important criteria in choosing a marina for boat owners is cleanliness, so a designated "Clean Marinas" status may appeal to a more environmentally conscious consumers.

Another objective of the AMCMP includes the establishment of a cost-share program to provide incentives to marinas for retrofitting existing infrastructures (including stormwater and waste management systems to meet the "Clean Marina" standards). Potential sources of funding for cost-share funds are discussed in Chapter 10.

7.2 Long-term Management Measures (implemented in 2+ years)

7.2.1 Install Regional Stormwater Management Facilities (Bon Secour River Watershed)

The management of runoff generated in each watershed during storm events is a fundamental element to improving water quality of the receiving waterbodies and protecting and enhancing the valuable natural resources present in all three watersheds. Several studies have been conducted within the Bon Secour River to characterize runoff and identify strategies for management. A significant amount of development has occurred since those studies were conducted, and some areas experiencing developmental pressure are not included in these assessments. Therefore, conducting a comprehensive assessment is recommended to identify the sub-watersheds that are the greatest contributors of stormwater runoff and to determine the most effective approach for managing the runoff generated in these areas. A range of stormwater retrofit and low impact design alternatives exist, and multiple resources have been developed to support this effort, including ADEM's *Low Impact Development Handbook for the State of Alabama* (ADEM 2016b).

In addition to developing a comprehensive stormwater management program, four potential locations for constructing regional stormwater management facilities have been identified (**Figure 7-7**).

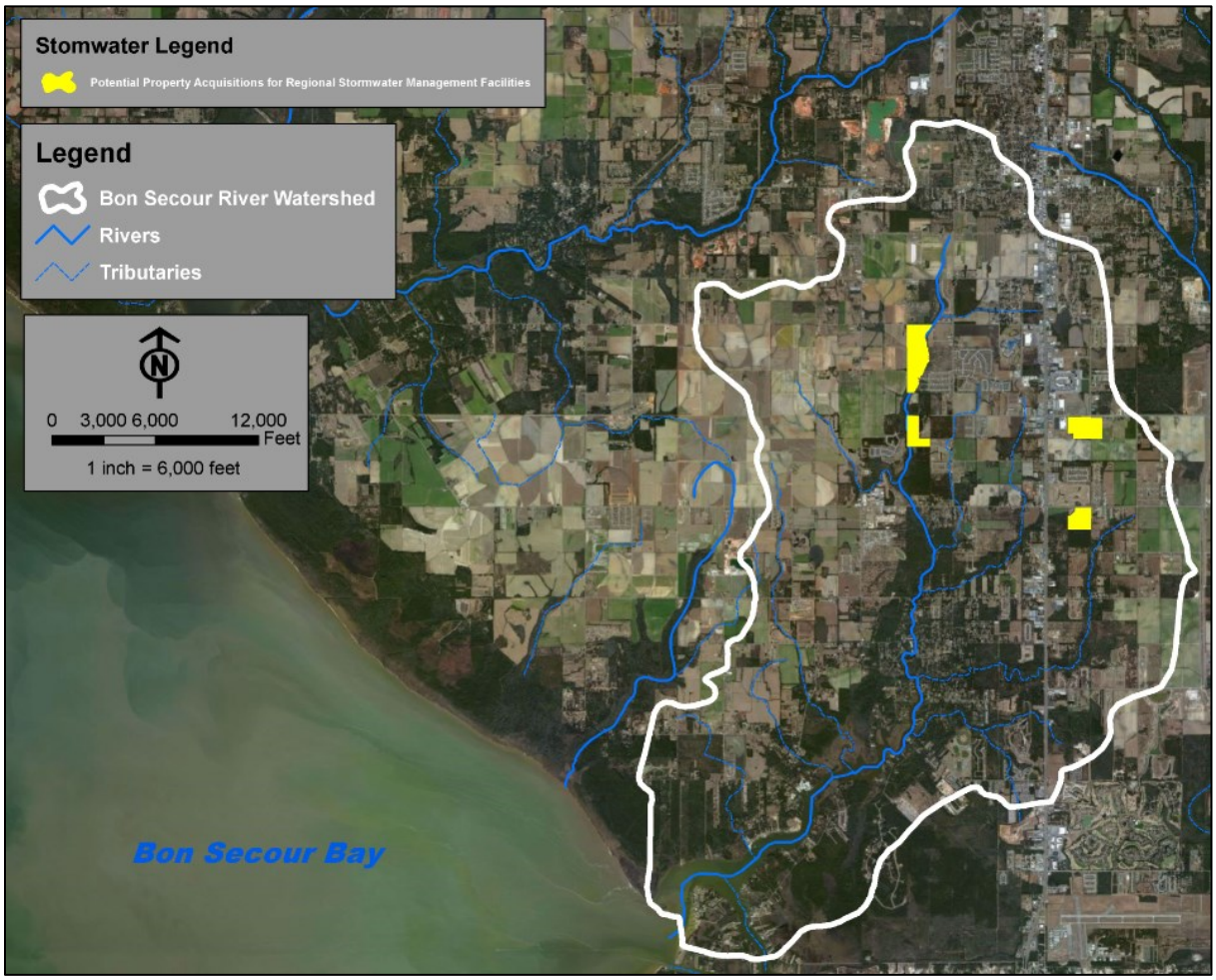

FIGURE 7-7: POTENTIAL REGIONAL STORMWATER MANAGEMENT FACILITY LOCATIONS

Two of these locations have been preliminarily vetted:

- **Bon Secour River Headwater Restoration/Stormwater Detention Project**—This project involves acquiring a property in the headwaters of the Bon Secour River and constructing three main components: 1) streamside flow diverters, physical treatment devices, and forebays for the removal of floatables, sediment, and other coarse debris; 2) a 70-acre, multi-bay constructed stormwater wetland for the biological treatment of urban runoff prior to discharge into the Bon Secour River, and 3) a multi-media outreach program to explain and promote low impact design techniques for use in new construction and redevelopment within the region. Permanent educational kiosks will be installed at key locations to raise public awareness about the threats to the ecosystem from urban runoff and the need for and methods of treating these discharges. The estimated cost to execute this engineering project is $6,177,160.
- **City of Foley Regional Stormwater Wetland**—This project involves acquiring property and constructing three main components: 1) a stormwater conveyance channel with integrated runoff quantity control and physical treatment devices for the removal of floatables and other debris; 2) a 30-acre constructed stormwater wetland for the biological treatment of urban runoff prior to discharge into a tributary of the Bon Secour River, and 3) the retrofit of an existing stormwater pond to provide additional volume control in the basin. Educational kiosks will be installed at key locations to enhance public awareness about the threats to the ecosystem from urban runoff and the need for and methods of treating these discharges. The estimated cost to execute this engineering project is $1,515,600.

Figure 7-8 depicts a regional stormwater management facility.

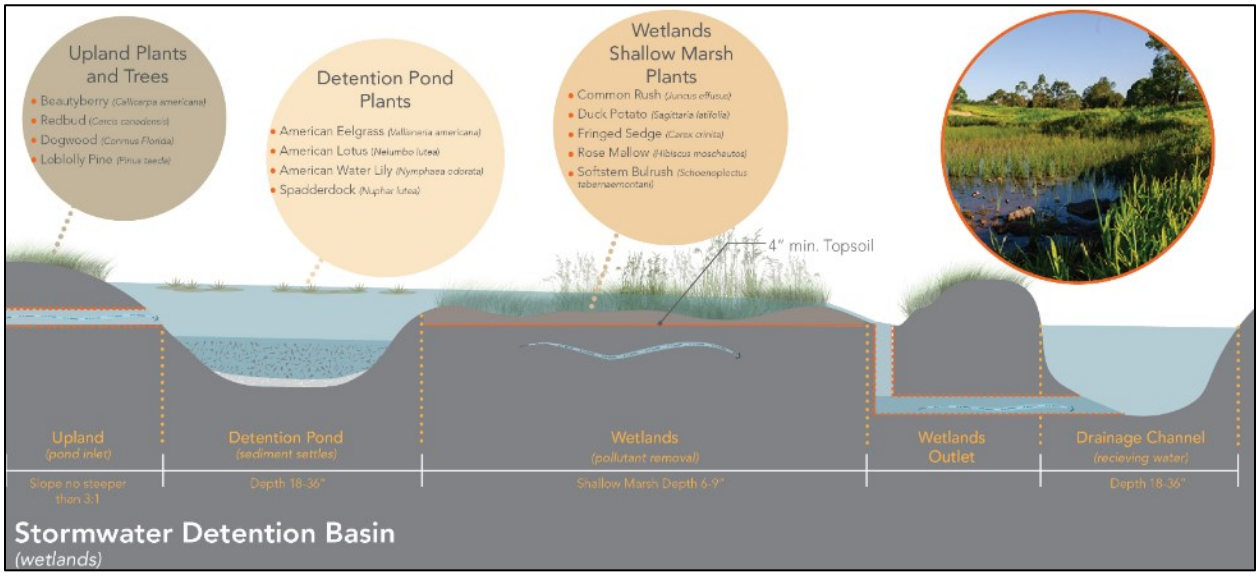

FIGURE 7-8: RENDERING OF A REGIONAL STORMWATER MANAGEMENT FACILITY

7.2.2 Implement Stream Restoration Projects (Bon Secour River Watershed)

The drainage channels and streams within the Bon Secour River Watershed are eroding because of increased stormwater runoff generated by impervious surfaces in the watershed basin. As the volume of water transported by these waterways increases, the drainage channels and streams respond by eroding the bed and banks to create a larger cross section, thereby increasing capacity and potential for excessive sediment delivery to receiving waters. During field reconnaissance surveys, raw and actively eroding banks were observed in the watershed. It is recommended that stream bank stabilization measures and stream restoration efforts be implemented following or concurrent with efforts to reduce and manage the volume of stormwater generated by the watershed. If restoration projects are implemented prior to managing the processes causing the degradation, the restoration projects are more likely to fail.

The initial activity associated with this management measure is to inventory the stream networks in the watershed to identify and prioritize stream reaches in need of intervention. Based on results of the field reconnaissance conducted as part of this WMP, one unnamed tributary to the Bon Secour River was accessed and identified as an area where massive bank erosion was observed (**Figure 7-9**).

FIGURE 7-9: BANK EROSION EXPOSED AN INACTIVE NATURAL GAS PIPE

The specific stream restoration techniques applied will depend on site-specific conditions, including the presence of hydraulic conditions contributing to the instability of the stream banks and the presence of adjacent infrastructure. While the specific elements will vary, likely components will include regrading and vegetation planting on eroding slopes.

7.2.3 Conduct Studies to Determine the Effects of Expanding Impervious Cover on Groundwater Recharge (Bon Secour River Watershed)

A literature search did not reveal any historical groundwater monitoring data for the Bon Secour River Watershed. Additional studies should be conducted to determine the effects from development and the expansion of impervious cover on groundwater recharge. Groundwater monitoring stations should be installed and base flow monitoring should be conducted in streams to collect watershed-specific data.

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8.0 REGULATORY REVIEW

8.1 Introduction

The Bon Secour River, Oyster Bay, and Skunk Bayou watersheds span across a number of topographic boundaries and political districts in south Baldwin County. The northern reach of the Bon Secour River watershed, including the headwaters, is located within the jurisdiction of the city of Foley. Likewise, the southeastern most reaches are subject to municipal ordinances within the city of Gulf Shores. Baldwin County maintains jurisdictional authority over the remaining land areas identified in **Figure 8-1**. As a result, overlapping jurisdictional authority exists across the vast majority of lands covered under this WMP. Federal and state laws carry primary jurisdictional authority over county and municipal regulations throughout the watershed.

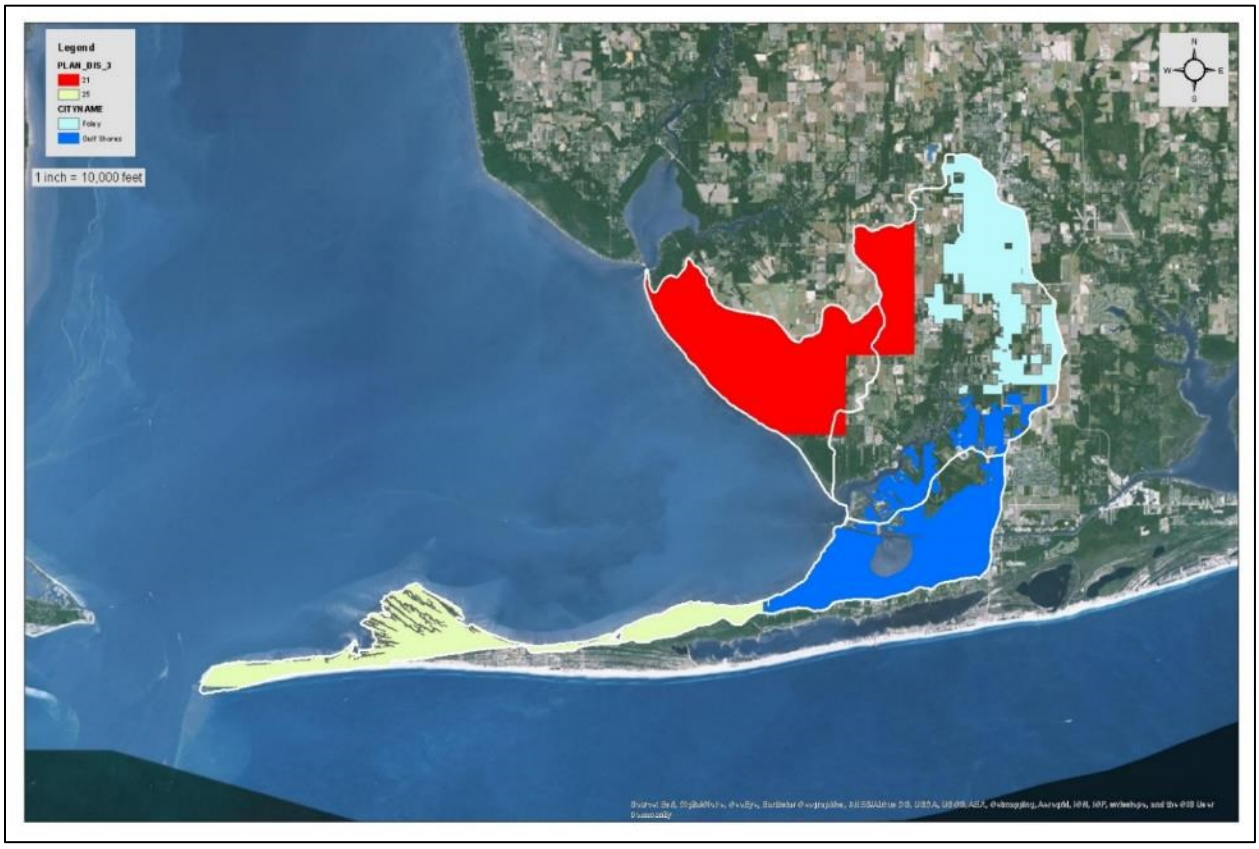

FIGURE 8-1: 2016 BALDWIN COUNTY PLANNING DISTRICTS

Several regulatory drivers manage water resources impairment in the three watersheds. These laws establish compliance standards for erosion and sediment control, stormwater treatment, impacts to "waters of the U.S.," including wetlands, coastal development, other development or construction related land disturbance. **Table 8-1** provides a more comprehensive overview of laws and ordinances that relate to water resources. Regulatory requirements that govern activities in the Bon Secour River, Oyster Bay and Skunk Bayou watersheds include:

- Clean Water Act, 33 USC § 1251, et seq.
- Alabama Water Pollution Control Act, Alabama Code § 22-22-1, et seq.
- ADEM Administrative Code 335-6 (Water Quality Program)
- ADEM Administrative Code 335-8 (Coastal Area Management Program)
- Baldwin County Zoning Ordinance (October 7, 2014)
- Baldwin County Subdivision Regulations (May 19, 2015)
- City of Foley Manual for Design and Construction (October 1, 2007)
- City of Foley Zoning Ordinances (November 2013)
- City of Foley Subdivision Regulations (February 2009)
- City of Foley Flood Hazard Ordinance (November 2013)
- City of Foley Ordinance Regulating Environmental Permits (March 16, 2015)
- City of Foley Ordinance for Shoreline Construction Activities (November 21, 2007)
- City of Gulf Shores Zoning Ordinances (August 22, 2016)
- City of Gulf Shores Subdivision Regulations (July 28, 2015)
- City of Gulf Shores Code of Ordinances (March 23, 2009)

Five primary drivers encompass the regulatory environment in the Bon Secour River, Oyster Bay and Skunk Bayou watersheds:

- Coastal area protection
- Construction phase stormwater management
- Flood damage prevention
- Protection of wetlands and riparian buffers
- Waters of the U.S. protection

The level of jurisdictional authority and interagency cooperation varies across each category. This section below is intended to provide a general overview of what standards apply in the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds. It does not include a comprehensive list accounting for every relevant statutory provision. For more specific information, please reference the regulatory requirements listed in **Table 8-1**. 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.

TABLE 8-1: WATER-RELATED REGULATORY STANDARDS IN THE BON SECOUR RIVER, OYSTER BAY AND SKUNK BAYOU WATERSHEDS		
Regulatory Requirement	**Regulatory Authority/Permitting Agency**	**Jurisdiction**
Alabama Coastal Area Act 534 (1976)	CAB	State
Alabama Coastal Area Management Program (ACAMP)	ADEM, Alabama Department of Conservation and Natural Resources, State Lands Division —Alabama code §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 §22-22-1	State
Baldwin County Flood Damage Protection Ordinance	Baldwin County Commission	Local
Baldwin County Subdivision Regulations	Baldwin County Commission	Local
Baldwin County Zoning Ordinances	Baldwin County Commission —Section 9 —Section 12 —Section 13 —Section 17 —Section 18	Local
City of Foley Manual for Design and Construction	City of Foley	Local
City of Foley Subdivision Regulations	City of Foley	Local
City of Foley Ordinance Regulating Environmental Permits	City of Foley —Construction Best Management Practices Req. —Erosion and Sediment Control Permit Req. —Environmental Permit Req. —Inspection, Maintenance, and Enforcement	Local

TABLE 8-1: WATER-RELATED REGULATORY STANDARDS IN THE BON SECOUR RIVER, OYSTER BAY AND SKUNK BAYOU WATERSHEDS		
Regulatory Requirement	**Regulatory Authority/Permitting Agency**	**Jurisdiction**
City of Foley Ordinance for Shoreline Construction Activities	City of Foley —Riparian Structure Permit Req. —Riparian Structure Repair Permit Req. —Piers, Decks, Wharves, and Bulkheads Req.	Local
City of Foley Zoning Ordinance	City of Foley —Stormwater Best Management Practices —Drainage Control Recommendations	Local
City of Gulf Shores Code of Ordinances	City of Gulf Shores —Chapter 7, Article II (Suppl. Req.) —Chapter 7, Article IV (Flood Damage)	Local
City of Gulf Shores Subdivision Regulations	City of Gulf Shores —Section 4-2 —Section 4-4 —Section 6–10	Local
City of Gulf Shores Zoning Ordinances	City of Gulf Shores —Stormwater Best Management Practices —Drainage Control Recommendations	Local
Clean Water Act: Section §303 (d) (1972)	USEPA and ADEM —Impaired Waters List/TMDLs	Federal and state
Clean Water Act: Section §401 (1972)	USEPA and ADEM —State Water Quality Criteria —ADEM Administrative Code 335-6-10	Federal and state
Clean Water Act: Section §402 (1972)	USEPA and ADEM —National Pollutant Discharge Elimination System (NPDES)	Federal and state
Clean Water Act: Section §404 (1972)	USACE —“Waters of the U.S.”	Federal

TABLE 8-1: WATER-RELATED REGULATORY STANDARDS IN THE BON SECOUR RIVER, OYSTER BAY AND SKUNK BAYOU WATERSHEDS		
Regulatory Requirement	**Regulatory Authority/Permitting Agency**	**Jurisdiction**
Coastal Zone Management Act (1972)	NOAA, USACE, and ACAMP —Form 166 – Coastal Consistency	Federal and state
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
Federal Water Pollution Control Act (1948, 1972, 1977)	Federal law	Federal
Foley Flood Hazard Area Ordinance	City of Foley —Ord. 13-1044	Local
Rivers and Harbors Act of 1899	Section 10 —33 U.S.C. 403	Federal

8.2 Discussion of Laws, Regulations and Ordinances

8.2.1 Federal

The U.S. government manages the nation's wetlands, groundwater, freshwater, and coastal resources under a variety of federal programs. USEPA, USACE, and NOAA all share regulatory oversight in one manner or another. In addition to these agencies, federal laws establish national standards that are enforced at all levels of government. Federal regulatory standards that govern water quality protection for waters discussed in this plan include:

Federal Water Pollution Control Act and the Clean Water Act

Originally enacted in 1948, the Federal Water Pollution Control Act was amended in 1972 and again in 1977. The legislation regulates discharges resulting from point and nonpoint pollution sources and protects wetlands, including all waters with a "significant nexus." The Clean Water Act (CWA) establishes regulatory standards and permitting authority for stormwater management, erosion control and sedimentation.

Clean Water Act § 404

Section 404 authorizes a permitting program to ensure adequate wetland protection. It contains specific guidance pertaining to discharges associated with dredged or fill material into all "waters of the U.S." The legislation established USACE as the permitting authority to administer permits for any authorized dredging or discharges impacting "waters of the US. USEPA guidelines require that permits must also be consistent with all state water quality standards and coastal program requirements that may apply.

Clean Water Act § 402

Section 402 establishes a program to regulate discharges under the NPDES. Under the program, USEPA is authorized to grant permits pertaining to municipal separate storm sewer systems (MS4), concentrated animal feeding operations, publically-owned treatment works, combined sewer overflows, sanitary sewer overflows, construction, non-coal/non-metallic mining and dry processing less than five acres, and other land disturbance activities. ADEM shares permitting authority and helps administer programs in compliance with federal standards.

Clean Water Act § 303 (d)

Section 303 (d) provides a list of federally impaired waters within the United States. The legislation requires that TMDL limits are established for these waters. TMDLs are used by resource managers during conservation planning. A TMDL establishes the allowable loading of pollutants that a given receiving water can handle without experiencing a greater degree of impairment.

Coastal Zone Management Act

NOAA helps administer the Coastal Zone Management Act. Enacted in 1972, the legislation directed coastal states to develop coastal zone management programs. The Coastal Zone Management Act's "federal consistency" provision requires that federal actions (i.e., USACE

permit) that have a reasonable effect on any land or water use or natural resource of the coastal zone should be consistent with enforceable policies of the state's coastal management program.

8.2.2 State

ADEM is the central environmental regulatory agency in the state. The agency monitors pollutant loading to state waterways, construction site erosion from land disturbances, stormwater runoff, and discharges from municipal wastewater treatment facilities. Through its regulatory divisions, ADEM works to ensure that state resources are adequately protected from development and natural resource degradation. State regulatory standards that govern water quality protection for waters discussed in this plan include the following:

Clean Water Act and Alabama Water Pollution Control Act

Alabama Code § 22-22-1 under the Alabama Water Pollution Control Act ensures that all activities permitted under CWA § 404 occur in accordance with the state's water quality standards. ADEM receives federal match funds to maintain compliance with many of the federal standards discussed above, including the Safe Drinking Water Act, CWA, Clean Air Act, and laws related to solid and hazardous waste. The Alabama Water Pollution Control Act provides ADEM with the regulatory framework to administer permits that are concurrent with federal standards and that meet state water quality criteria.

Clean Water Act § 401 (a) Water Quality Certification

Alabama Code § 335-6-10 provides state water quality standards to which permit applicants must comply. ADEM regulatory staff ensures approved permit applications are consistent with these standards. CWA § 401(a) requires that any permitted dredging, discharge, or fill material must not violate the state's water quality program established in Alabama Code § 335-6-10.

Construction Site Stormwater

As mentioned in the Federal section, National Pollutant Discharge Elimination (NPDES) permit coverage is required for land disturbances and stormwater discharges to state waterways. ADEM administers Construction General Permits as required under CWA § 402. The General Permit authorizes discharges from construction activities for land disturbances that are equal to or greater than one acre, and activities that are less than one acre but considered part of a larger common development. ADEM Administrative Code 335-6-6 authorizes ADEM to administer the NPDES program consistent with federal standards.

MS4 General Permit

Section 402 of the CWA covers the MS4 NPDES program that is administered by ADEM. The legislation requires a Phase I program option for "large" municipalities with a population of at least 100,000 people. Phase II wastewater permit programs extend coverage of the NPDES stormwater program to regulated "small" MS4s. In 2012, Baldwin County completed a stormwater management plan (NPDES No. ALR040042) in accordance to the USEPA's NPDES requirements. The city of Foley and the city of Gulf Shores are among the municipalities that qualify for an exemption under the NPDES MS4 program. The same status applies to the

smaller unincorporated villages within the watershed, including Bon Secour, Fort Morgan and Gasque.

Clean Water Act § 303 (d)

Under Section 303 (d), ADEM helps USEPA designate state waters to be included on the federally impaired waters list. The list is updated on each consecutive even numbered year. TMDLs are developed for each listed waterway and cover point and non-point pollutant discharges (i.e., nutrients, pesticides, pathogens, heavy metals). Turkey Branch of the Bon Secour Watershed was listed on the 303 (d) list in 2009 for pathogens (fecal coliform) under assessment unit ID # AL03160205-0310-702.

Coastal Zone Management

Another important function of ADEM is the Coastal Program established under Alabama Code § 9-7-1 et seq. The Division 8 Office in Mobile issues Coastal Permits for new commercial and residential development projects greater than 5 acres. “The enforceable policies of the program regulate various activities on coastal lands and waters seaward of the continuous 10-foot contour in Baldwin and Mobile Counties” (Alabama Department of Environmental Management 2016). ADEM Administrative Code 335-8 stipulates that any dredging and/or filling of wetlands, or adverse impacts to adjacent coastal waters will require a coastal permit. The Alabama Coastal Area Management Program (ACAMP) is a cooperative program. The Alabama Department of Conservation and Natural Resources, State Lands Division, provides additional planning oversight.

8.2.3 County Authority

Baldwin County became an organized governing authority in 1809, ten years before Alabama entered the Union. Today it remains the largest and among the fastest growing counties in the state. The Baldwin County Commission comprises four county commissioners. The Commission is tasked with assisting “the State in carrying out the authorized functions necessary to protect the health & welfare of the citizenry” (Baldwin County Commission 2016). Protecting water quality is essential to safeguarding the health and welfare of Alabama’s coastal communities.

Four Baldwin County waterbody segments are designated as “Outstanding Alabama Waters.” Two exist in south Baldwin County in proximity to the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds. Wolf Bay (and all connecting coves and bayous) is located directly to east of the watersheds. The Magnolia River (from its headwaters to Weeks Bay) is located to the north and west. The Bon Secour National Wildlife Refuge is another exceptional regional reserve contributing to tourism and recreation within the watershed. The Baldwin County Commission understands that sustaining these resources is vital to maintaining quality of life along the Gulf Coast. The county helps protect surface water in several different manners including:

Baldwin County Zoning Ordinances (January 2015)

All proposed commercial or residential development must comply with the Baldwin County Zoning Ordinances. Planning district 25 (Fort Morgan) is the only zoned county district in the watersheds covered under this WMP. The Planning and Zoning Commission requires that all zoning district developments shall adhere to ADEM and USEPA air and noise pollution standards and requirements of the Clean Air Act and CWA. The development standards outlined in Section 9.6.4 require that a 50-foot-wide buffer be maintained whenever the perimeter of a planned industrial development abuts a wetland area. Where the distance between property lines is greater than1,000 feet, the buffer requirement increases to 100 feet.

Section 12 of the general provisions requires that no developments are exempt from conforming to the stormwater and erosion control provisions of the ordinance. Section 13 details the specific requirements of standard buffers and the stormwater management plan and erosion control plan. This includes requirements for drain inlet protection, disturbed ground, storage piles, prevention of wetland degradation and dust control.

Baldwin County Subdivision Regulations (May 2015)

Similar to the zoning ordinance, the subdivision regulations help establish procedures and standards for the development of subdivisions or proposed additions to existing subdivisions within Baldwin County. Article 5 details all applicable provisions relating to development standards within subdivided areas. Wetlands delineated as jurisdictional by the USACE are discussed in § 5.2.2. Building standards specify that a 30-foot setback line from jurisdictional wetlands must be maintained within which a minimum 5-foot natural buffer shall be provided upland of the wetland line. Article 5 references CWA Section 404(b)(1) guidelines regarding fill material disposal and requires USACE approval for such action.

Several other portions of these regulations also include provisions relating to water quality protection. Section 4 requires that a professional engineer prepare and include a storm drainage plan and erosion control plan as part of the larger construction plans. Section 5.11 covers drainage system requirements and states that the storm water drainage system shall be separate and independent of any sanitary sewer system. Section 5.16 includes special provisions for development in flood prone areas.

Baldwin County Flood Damage Protection Ordinance (September 2010)

The Baldwin County Flood Damage Protection Ordinance helps regulate activities in flood hazard zones. Section 5 outlines the “general standards” that pertain to new construction in these areas. Section 5 also details “specific standards” for residential and non-residential construction in areas that have been identified as special flood hazards. The special flood hazard area established in Section 3.2 includes areas identified by FEMA in its Flood Insurance Study, dated January 12, 1973. The FEMA Flood Map Service Center provides free flood zone maps for these determinations.

8.2.4 Municipal Oversight

City of Foley

City of Foley Manual for Design and Construction

General design standards are described in Article 3 of the Manual for Design and Construction. Standards for wetlands, floodplains, waterways, sanitary sewer, and green space are discussed in this section. Provision 3.2.3 requires that if activity occurs near a watercourse the waterway shall remain in an undisturbed natural state with at least 50 feet of buffer protection. The erosion and sediment control ordinance, stormwater management criteria, and additional drainage/grading requirements are covered in Article 4. Appendix 1 of the manual stipulates that Best Management Practices permits are required for any land disturbance of an area greater than 500 square feet. Agricultural operations and emergency action required for the protection of life, property, or natural resources are among the only exceptions to this requirement.

Zoning Ordinances (November 2013)

Section 6 of the Foley Zoning Ordinance provides an overview of landscaping and buffer requirements that help protect local waterways, and 6.15.3 E requires that stormwater management and drainage controls shall be coordinated with landscaping improvements and integrated into the overall site design. Table 6.15.4 establishes minimum buffer requirements. These requirements vary substantially depending on land-use. Table 6.15.5 provides additional requirements based upon buffer type and site acreage. Section 8, Article VIII, also contains additional special provisions.

City of Foley Ordinance Regulating Environmental Permits (March 2015)

All land disturbances within the jurisdiction of the City of Foley are regulated under ORD. NO. 15-1003. The new ordinance, adopted in 2015, repealed the former Erosion and Sediment Control Ordinance, and the Tree Ordinance. The updated provisions include regulatory standards pertaining to stormwater/drainage management, tree protection/restoration, and construction best management practices for residential building projects. The ordinance also provides minimum standards that apply for activities resulting in more than 500 square feet of land disturbances. The permit application, plan submittals and fee requirements are discussed extensively in Section VI. Inspection and maintenance is covered in Section VIII.

City of Foley Ordinance for Shoreline Construction Activities (November 2007)

The regulatory requirements included in this ordinance provide oversight for all construction activities that occur on riparian properties. The guidelines are intended to promote coordination between federal, state and local governing agencies. A riparian structure permit is required for any of the following new construction activities: piers, docks, marginal docks, boathouses, retaining walls wharves, and bulkheads. A riparian structure repair permit is also required if any of the above structures have been damaged less than 50% and, therefore, are subject to repair. Application requirements and fees are discussed in Section VII. An overview of enforcement is provided in Section X.

Subdivision Regulations (March 2015)

The subdivision regulations adopted by the city of Foley stipulate land-use requirements for lands subject to flooding, provide guidance on drainage, sewage disposal, and retention ponds, and covers stabilization requirements for riparian properties. Article III of the ordinance defines a "floodway." The definition includes all lands lying within 25 feet of the top of the bank of the channel (measured horizontally), unless the developer specifies a lesser distance (but not less than 15 feet) is adequate based on the watershed characteristics and probable storm runoff for the base flood.

Flood Hazard Area Ordinance (November 2013)

Foley amended local flood ordinances in 2013. The new ordinance was passed to "promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions" (FloodOrd 13-1044). The ordinance helps protect water quality by controlling filling, grading, and dredging, which may increase flood damage. It also regulates flood barriers, the control and alteration of natural floodplains, stream channels, and natural protective barriers. Article 4 discusses provisions for flood hazard reduction and maintains that new and replacement water supply systems and sanitary sewerage systems must be designed to minimize or eliminate infiltration of flood waters into the system. Section B of Article 4 also discusses additional elevated building requirements.

City of Gulf Shores

Zoning Ordinances (August 2016)

The Gulf Shores Zoning Ordinances describe how individuals can obtain a building permit and land disturbing activity permit. Regarding area and dimensional requirements, Article 9-3-B specifies that no structure shall have a height greater than its setback from the nearest property line. However, if the nearest property line abuts a waterbody or jurisdictional wetland, no part of any structure shall have a height greater than two times its setback from that property line. Zoning districts are discussed more extensively in Article Five and supplemental regulations outlined in Article 6.

In addition to the base zoning districts, the Zoning Ordinances establish "overlay districts" to protect and preserve special areas within the city. These areas include the Fort Morgan Peninsula Overlay District (Section §10-6) and the Plash Island/Bon Secour River Overlay District (Section §10-7). A 10-foot undeveloped pervious buffer between the wetland line and any impervious improvements must also be maintained in these districts. Required buffers cannot be disturbed during construction except as necessary to provide any landscaping, fencing or walls required as a part of the buffer. Landscaping, screening and buffer requirements are discussed in greater detail under Article 12.

Subdivision Regulations (July 2015)

Similar to Foley, subdivision regulations adopted by the city of Gulf Shores stipulate land-use requirements for lands subject to flooding, provide guidance on drainage, sewage disposal, and retention ponds, and cover stabilization requirements for riparian properties. Article VI describes

design and improvement standards that are required under the ordinance. Section 6-3 specifically addresses requirements associated with landscaping, buffering and fencing. Section 6-6 includes drainage plan requirements and fill guidelines for building sites. Section 2-2 maintains that the subdivider is responsible for the installation of all necessary improvements, including streets, water and sewer systems, drainage facilities, utilities, and other improvements set forth under the ordinance. Section 4-4 requires the submittal of a completed Subdivision Roadway and Drainage Improvement Acceptance Agreement.

Flood Damage Protection Ordinances (March 2009)

In Gulf Shores, building in the flood zone requires that applicants submit a break away wall certificate that includes a proposed enclosure below the base flood level. This is required in addition to other materials requested for the permit application. A special 30-day public comment period is also required for beach front property proposals. Article IV of Chapter 7 within the Code of Ordinances covers flood damage control more extensively. Division 3 Sec. 7-90 outlines permitting procedures for the application phase and construction phase of a prospective building project. Sec. 7-91 also details the duties and responsibilities of the floodplain administrator and includes specific provisions regarding base flood elevation and on-site inspections in special flood hazard areas.

8.3 Regulatory Overlap

8.3.1 Regulatory Inconsistencies and Recommended Actions

During the regulatory review the team worked to distinguish regulatory gaps that could be addressed by state and local officials. Several issues were identified despite the fact that the majority of land in each watershed falls under multiple jurisdictions. Although not particularly critical, the factors identified in **Figure 8-2** are among the most concerning inconsistencies.

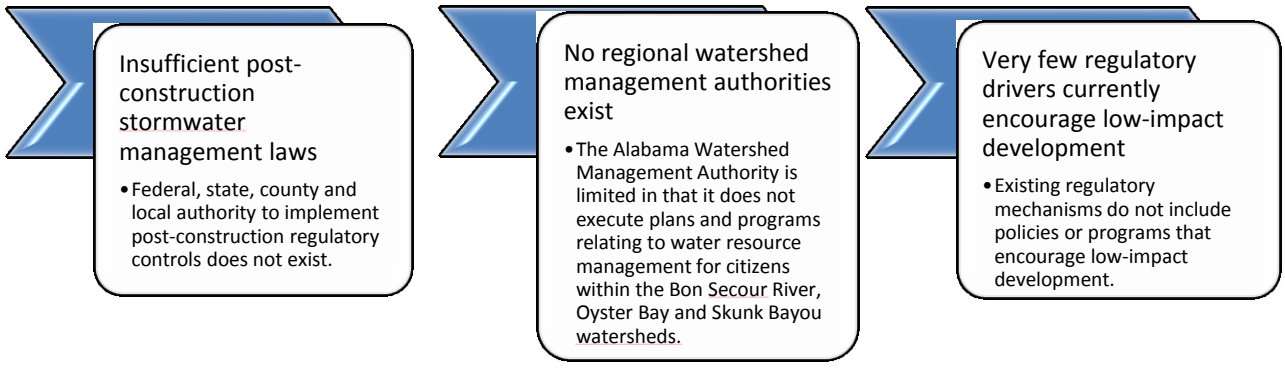

FIGURE 8-2: TOP REGULATORY SETBACKS IN THE BON SECOUR RIVER, OYSTER BAY AND SKUNK BAYOU WATERSHEDS

The Watershed Management Team proposes the following recommendations:

- The Baldwin County Commission work with the Alabama Water Resources Commission, ADEM, and local municipalities to:
  - Establish regional watershed management authorities
  - Update regulatory ordinances so as to incorporate post-construction stormwater controls
  - Provide financial and regulatory incentives to upgrade stormwater infrastructure and pursue low impact development alternatives

The Alabama Watershed Management Authority is a great model for implementing the proposed improvement. The Choctawhatchee-Pea Rivers Watershed Management Authority became the first watershed management authority in 1991 when "the Alabama State Legislature passed a law (Act No. 91-602) authorizing the establishment of watershed management authorities with the intent of protecting and managing the watersheds of the State of Alabama" (Choctawhatchee-Pea Rivers Watershed Management Authority n.d.). A similar citizen advisory group representing rural and urban areas could oversee protection of the Bon Secour River, Oyster Bay and Skunk Bayou watersheds. For example, the stakeholder group could work with a newly established WMTF to direct community engagement, secure funding for priority watershed projects, and increase wetland protection within the watershed. Pursuing legislative authority also will provide special powers as a regional coordinating advisory agency specifically tasked with monitoring and oversight of water quality improvement.

Such an authority will provide additional regulatory structure without any unnecessary burden on business or local developers. The watershed management commission could provide strategic direction on a variety of water-related issues in each of the three watersheds. If such a group were to emerge, two regulatory priorities that should be considered are incorporating post-construction stormwater controls and managing growth through low impact development. While none of the recommended actions are of immediate need, it is reasonable to assume that strengthening local ordinances and crafting policies that encourage low impact design alternatives will have a considerable impact on water quality. Implementing these actions is also consistent with the 5-year strategy included in the MBNE's *2013–2018 Comprehensive Conservation and Management Plan*.

8.3.2 Enforcement

Environmental compliance is another concern that was identified during the review of rules, regulations and ordinances. Local municipalities generally do not have sufficient staffing resources to ensure formal enforcement on a regular basis. As a result, maintaining enforcement provisions is often left to federal and state agencies. Despite their best efforts, most implementing agencies are faced with very similar constraints. The absence of a timely and meaningful enforcement regime was identified as a persistent regulatory challenge within the Bon Secour River, Oyster Bay and Skunk Bayou watersheds.

Recommendation: The Baldwin County Commission should develop zoning districts for all remaining unzoned lands within the Bon Secour, Oyster Bay and Skunk Bayou watersheds. These zoning districts should enforce regulations that are consistent with the Baldwin County Zoning Ordinance and Subdivision Regulations. The newly formed district regulations should also contain policies that adequately protect environmental resources that are especially vulnerable to climate change impacts from sea level rise.

8.3.3 Protection of Wetlands and Riparian Buffers

Tidal and non-tidal freshwater and saltwater wetland systems exist throughout the land area covered in this plan. Pine savanna wetlands and bottomland hardwood swamps also abound the three coastal watersheds. The quality of these wetland systems is directly linked to the condition of the surrounding watersheds. This reciprocal dependence is particularly important from a regulatory standpoint. Coastal wetlands provide important ecosystem services, including water quality treatment, erosion control, and flood protection to commercial and residential areas. Wetlands are also vital to the commercial fishing and shellfish industry and provide important habitat benefits for waterfowl and shorebirds.

Quantifying economic water quality benefits attributed to wetlands in a given watershed is an extremely taxing endeavor. For example, in addition to the benefits listed above, anaerobic soils typical to coastal wetland ecosystems have the ability to sequester carbon very slowly over time. Unfortunately, ADEM does not require wetland buffer or setback requirements in riparian areas. When permits are issued in these areas the compensatory mitigation usually occurs away from the impacted watershed at a regionally approved mitigation bank. This is especially important in Baldwin County where setback requirements only apply in zoned planning districts.

Recommendation: Federal and state agencies should make an effort to include buffer and setback requirements in wetlands and riparian areas. Additionally, Baldwin County Zoning Ordinances should be updated to maintain at minimum a 30-foot setback requirement for unzoned lands excluded from the existing wetland overlay district. When permits are issued near streams or wetlands, efforts should be made to preserve the ecological integrity of the impacted area. Newly established setback requirements should be crafted specifically for the type of wetland/riparian area that is disturbed with the intended goal to protect the natural function of the system. Setback widths may range widely as a result. Requirements should vary according to the land gradient, soils, adjacent land use, and other contributing factors related to the disturbance.

9.0 IMPLEMENTING STRATEGIES

Addressing the watershed management challenges within the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds requires a pallet of management measures with varying scales and intents, as described in Section 7. Successful implementation of these management measures calls for a clear and concise approach executed by a collaborative group of stakeholders, including community members and local, state, and federal agencies.

This chapter provides a strategy to address the critical issues identified for each watershed by implementing recommended management measures, identifies associated costs, and presents a two-phased implementation approach (short-term phase and long-term phase) to achieve success for those management measures. Components for completing this WMP were reviewed during its preparation, and a checklist of these components is presented as Appendix C.

9.1 Formation of Watershed Management Task Force

Successfully addressing the critical issues and areas identified in this WMP will require an entity who will champion watershed management, building off the momentum generated through developing the WMP. Since many of the critical issues extend beyond political and jurisdictional boundaries and will need the cooperation of landowners and the general public, the initial implementation strategy is establishing a WMTF. The primary responsibility of the WMTF will be overseeing implementation of the management measures, many of which can be implemented simultaneously, and providing a platform for coordination on matters that affect local watershed conditions and natural and recreational resources.

Many leaders and stakeholders in the three watersheds have been identified through the process of developing this WMP, and many are already involved with the Steering Committee. The task for the future is not necessarily to identify additional leaders but rather to determine how the leaders should structure the existing group moving forward into a WMTF. While the MBNEP has led the effort to initiate the work, future efforts and project implementation must be rooted within the community of stakeholders. The mission of the MBNEP is to promote wise stewardship of the water quality and natural resources of Mobile Bay. As part of this mission, the MBNEP has supported development of this WMP. The MBNEP recognizes the critical importance of preserving the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds, but an independent leadership organization will need to coordinate WMP implementation

The first activity of the WMTF will be develop a vision, mission statement, leadership structure, and operating procedures. It should work with local governmental officials and regulatory agencies to implement WMP recommendations for all three watersheds. The WMTF should provide opportunities for public involvement and membership, host meetings with community groups to equip them with the knowledge and materials necessary for promoting the WMP goals and objectives, and collaborate with citizen groups to promote stewardship efforts in preserving

and restoring the three watersheds. The WMTF should collaborate with area media to educate the general public about watershed management and provide information regarding upcoming events and updates on opportunities for public engagement. The WMTF will also explore funding opportunities, including grants and partnerships.

Initially, all three watersheds will be implemented by the same task force entity. However, as the implementing task force matures, the Oyster Bay watershed may benefit from a separate task force because of the differences in issues confronting this watershed versus the Bon Secour River and Skunk Bayou watersheds.

9.2 Phase One Implementation: Short Term

Feedback gained through the stakeholder and public outreach efforts associated with this WMP stressed the need for short term wins or tangible successes promptly following WMP adoption to gain the confidence of the stakeholders 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 watersheds. With these considerations in mind, management measures were grouped into two phases. The short-term management measures described in this section were chosen based on their likelihood of successful implementation within the next 2 years.

Table 9-1 describes each measure and provides a rough order-of-magnitude cost estimate to implement each measure. It should be noted that preparation of detailed cost estimates was not possible due to the conceptual level of planning that guided development of this WMP. The cost estimates are intended for preliminary budgetary considerations. A more detailed description of each recommended management measure is provided in Section 7.

TABLE 9-1: SHORT-TERM MANAGEMENT MEASURES (0–2 YEARS)

 **Public education and outreach** (Bon Secour River, Oyster Bay, and Skunk Bayou watersheds)	This management measure will build upon the momentum generated during the WMP development process. This measure is to *Develop and Execute a Communications Plan* and to *Host and Participate in Educational and Outreach Events*	$20,000 per year
 **Litter reduction** (Bon Secour River, Oyster Bay, and Skunk Bayou watersheds)	This management measure is intended to reduce the volume of litter generated within the three watersheds. This project involves the implementation of *Signage, Litter Traps*, *Maintaining Good Housekeeping Practices,* and *Education and Outreach.*	$510,000 to $960,000

TABLE 9-1: SHORT-TERM MANAGEMENT MEASURES (0–2 YEARS)		
 **Increase conservation easements and protected habitat** (Bon Secour River, Oyster Bay, and Skunk Bayou watersheds)	The purpose of this management measure is to preserve land to reduce the impact of future development. Five recommended parcels include *Bon Secour and Oyster Bay Wetland Acquisition Projects, Little Point Clear Unit, Benton Tract, and Little Point.* Another purpose of this measure is to assess and prioritize additional target areas for preservation.	$14 million to $20 million
 **Install living shorelines** (Bon Secour River, Oyster Bay, and Skunk Bayou watersheds)	This intent of this management measure is to protect shorelines from erosion by employing natural bank stabilization. This measure will be implemented using *Living Shoreline* strategies on prioritized unprotected shorelines.	$250 per linear foot of shoreline
 **Increase vegetative buffers** (Bon Secour River, Oyster Bay, and Skunk Bayou watersheds)	This management measure involves the implementation of vegetative buffers along the riparian corridor of disrupted streams. This measure is intended to *restore and protect the riparian corridors of prioritized streams*.	$13,000 to $30,000 per acre
 **Implement invasive species treatment and monitoring** (Bon Secour River, Oyster Bay, and Skunk Bayou watersheds)	The purpose of this management measure is to control invasive species in all three watersheds. The measure involves frequent implementation of controls to *eradicate invasive species in prioritized areas*.	$100 to $300 per acre treated
 **Protect continued use of biological resources to preserve culture, heritage, and knowledge of the watersheds** (Bon Secour River and Oyster Bay watersheds)	This measure aims at preserving the cultural heritage of the watersheds and recognizing the contribution of the biological resources that helped build this region. This includes recording oral histories of individuals who have lived in the watershed for decades and have memories of how resources within the watershed have been and continue to be used.	$25,000

TABLE 9-1: SHORT-TERM MANAGEMENT MEASURES (0–2 YEARS)		
 **Implement water quality monitoring—ongoing project** (Bon Secour River and Skunk Bayou watersheds)	The management measure is intended to implement ongoing water quality monitoring in the Bon Secour River and Skunk Bayou watersheds. *Defining an implementation program* to manage defined impairments and pollutant sources.	TBD, based on program requirements
 **Initiate and implement the Alabama-Mississippi Clean Marina Program (or AMCMP)** (Bon Secour and Oyster Bay watersheds)	This management measure is intended to encourage marinas in the Bon Secour River and Oyster Bay watersheds to participate in the AMCMP, which is designed to promote environmentally-responsible and sustainable marina and boating practices with the goal of reducing nonpoint source pollution.	TBD, based on program requirements

9.3 Phase Two Implementation: Long Term

It is understood that not all of the critical issues identified within this WMP can be addressed within two years of WMP implementation. Stormwater management within the watersheds will require coordination with private landowners and securing funding to implement actions that will have the greatest economic value. As described in Section 7, the location of four potential stormwater detention facilities have been potentially identified; however, screening, siting, designing, permitting, and constructing the projects will take substantial time, and funding has not been fully secured to advance these projects. Although stream restoration opportunities have been identified within the watersheds, mechanically altering the impaired stream reaches will be ineffective until the root cause of the degradation (likely the increase in stormwater runoff conveyed) have been addressed, which will occur years following initial plan implementation. Securing the funding and implementing and gathering meaningful data from a monitoring program may take years to develop and mature.

Table 9-2 summarizes the long-term management measures and includes a rough order-of-magnitude cost estimate to implement each measure.

TABLE 9-2: LONG-TERM MANAGEMENT MEASURES (2+ YEARS)		
 **Install regional stormwater management facilities** (Bon Secour River Watershed)	The purpose of this management measure is to reduce stormwater runoff and contamination in Bon Secour River Watershed. This project involves the installation of *wetland detention pond facilities* in the Bon Secour River Watershed.	$9.4 million to $12.5 million
 **Implement stream restoration projects** (Bon Secour River Watershed)	The intent of this management measure is to restore degraded streams that interrupt valuable ecosystem services in the Bon Secour River watershed. This project involves *prioritizing stream lengths for restoration* and *implementing restoration techniques*.	$100,000 to $400,000 per stream mile
 **Conduct studies to determine the effects of expanding impervious cover on groundwater recharge** (Bon Secour River Watershed)	The purpose of this management measure is to collect watershed-specific groundwater data which can be correlated with streamflow data to determine the effects of expanding impervious cover due on water resources.	TBD Based on program

9.4 Accountability and Reporting

On a routine basis (e.g., annually) the WMTF should assess progress towards meeting WMP goals and objectives for each of the three watersheds (see Chapter 1). Results of performance monitoring as discussed 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 need to be made. Additionally, the WMTF needs to develop criteria for use in judging success with input from stakeholders and the general public. On an annual basis a report card should be prepared documenting accomplishments and success stories and reporting on conditions within the watershed.

A regular reporting schedule is necessary to archive and track monitoring data and assess the overall success of management actions. Progress reports for each 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 success of specific management actions. Annual reports should include at a minimum: a summary of watershed conditions including field results from monitoring and sampling activities, an update on the status of management measures implemented to date, and a summary of anticipated management measures to be implemented during the next 12 months.

10.0 FINANCIAL, PLANNING, AND IMPLEMENTATION SOURCES

10.1 Introduction

A variety of federal, state, and local funding sources should be considered to implement the Bon Secour River, Oyster Bay and Skunk Bayou WMP. Leveraging multiple funding opportunities simultaneously will maximize the implementation potential of the WMP. The funding component of planned acquisition, restoration, and project improvements is arguably the most important priority included in the WMP. Ultimately, success will be linked to the degree of coordination and level of financial resources available.

Funding numerous watershed restoration initiatives at the same time is not without challenges, especially because the three watersheds fall under different governmental and planning jurisdictions; therefore, efforts to organize a multi-year funding strategy should rank highly among other important WMTF priorities. Most of the recommended management measures will require a significant, long-term commitment and support from community stakeholders. Federal cooperative grant programs and state revolving funds should be considered highly among the other finance alternatives discussed in this section.

Recommended funding priorities include projects that:

- Eliminate trash and debris through the installation of litter traps
- Implement living shoreline projects in targeted areas
- Improve coastal resilience and community connectedness
- Improve water quality conditions by implementing stream restoration and installing riparian buffers
- Increase ecosystem functions and services
- Treat invasive species where public access is available
- Monitor water quality data (e.g., dissolved oxygen, temperature, pH, and turbidity); develop strategy for groundwater monitoring
- Preserve habitat through land acquisition and conservation easements
- Promote citizen volunteerism
- Provide financial incentives for stormwater management improvements and low impact development
- Strengthen watershed literacy through inclusive information and education efforts
- Track changes and evaluate implementation over time

10.2 Funding and Regional Planning

10.2.1 Collaborative Opportunities for Multi-organizational Partnerships

Public-private partnerships are an important piece of the overall funding strategy for this WMP. Multi-organizational partnerships that incorporate stakeholders across all sectors are effective because of their ability to strengthen local capacity and eliminate duplicative efforts. The challenge is that multi-stakeholder watershed initiatives require a structure to streamline collaboration, planning, and evaluation. The Watershed Management Team recommends that a structural framework called Collective Impact (CI) be employed in each of the three watersheds to leverage local expertise, find common ground, and improve environmental performance. This approach allows for significant collaboration across government, business, philanthropy, non-profit organizations, educational institutions, and citizens.

CI principles can help guide the WMTF during the financial planning process through the formation of a backbone support organization. Aligning efforts and increasing program efficiency under the CI model will require: 1) a common agenda, 2) shared measurement system, 3) mutually reinforcing activities, 4) continuous communication, and 5) backbone support organizations (**Table 10-1**). Under this approach, the backbone organization is absolutely essential to sustaining funding resources. The WMTF should strive to organize coordinated actions (e.g., fundraising, grant writing, implementing priority watershed projects) that target water quality goals (see Implementing Strategies section), and involve a diverse group of local and regional partners.

TABLE 10-1: FIVE CONDITIONS OF COLLECTIVE IMPACT IN WATERSHED PLANNING

Common agenda	All participants have a **shared vision for change**, including a common understanding of the problem and a joint approach to solving it through agreed upon actions.
Shared measurement system	**Collecting data and measuring results consistently** across all participants ensures efforts remain aligned and participants hold each other accountable.
Mutually reinforcing activities	Participant activities must be **differentiated while still being coordinated** through a mutually reinforcing plan of action.
Continuous communication	**Consistent and open communication** among watershed stakeholders is necessary to build trust and ensure mutual objectives and common motivations.
Backbone support	Organizing and managing CI requires a separate organization or organizations with a specific set of skills to serve as the backbone for watershed-wide, multi-scale initiatives and inter-agency cooperation.

Adapted from the Stanford Social Innovation Review

For implementation resources on the CI framework and coordinating a multi-sector financial strategy please reference the *Stanford Social Innovation Review* article on CI (Kania and Kramer 2011). The WMTF should consider including the following potential partners in the strategic financial planning and implementation process. Additional resources are also provided in **Appendix B.**

- Alabama Coastal Foundation
- Alabama Department of Conservation and Natural Resources
- Alabama Department of Environmental Management
- Alabama Forest Commission
- Alabama Forest Resources Center
- Alabama Water Watch
- Alabama Wildlife Federation
- Auburn University Marine Extension and Research Center
- Baldwin County Commission
- Baldwin County-Alabama Cooperative Extension
- Baldwin County Public Schools
- Bon Secour National Wildlife Refuge
- Dauphin Island Sea Lab
- City of Foley
- City of Gulf Shores
- Gulf Coastal Plains and Ozarks Landscaped Conservation Coop.
- Gulf Coastal Plains Ecosystem Partnership
- Mississippi-Alabama Sea Grant
- Mississippi State Coastal Research and Extension Center
- Mobile Bay National Estuary Program
- Mobile Bay Sierra Club
- Mobile Baykeeper
- Southeast Aquatic Resources Partnership
- The Conservation Fund
- The Gulf of Mexico Regional Alliance
- The Nature Conservancy
- The Ocean Conservancy
- University of South Alabama
- U.S. Department of Agriculture, Natural Resources Conservation Service, Field Office (Bay Minette)
- U.S. Fish and Wildlife Service
- U.S. Forest Service
- Weeks Bay National Estuarine Research Reserve
- Weeks Bay Foundation

10.3 Financial Strategy

10.3.1 Federal Funding Programs

A number of federal agencies provide financial support to state and local governments, schools, and non-profit organizations interested in working to improve water resources. The Section 319 (non-point source management) and Section 106 (water pollution control) grant programs from USEPA provide financial assistance that supports non-point source and pollution control measures implementation projects. The Section 319 grant, in particular, can help address historical impairments to the Turkey Branch of the Bon Secour River and Oyster Bay watersheds. Another USEPA program that could augment ongoing wetland and habitat conservation efforts is the National Wetland Program Development Grant. The Gulf of Mexico Program should also be considered highly among the other federal funders. The program leverages state and local partnerships to provide environmental education, restore habitat, improve water quality and strengthen coastal resilience. Each USEPA grant opportunity is discussed further in **Appendix B**.

NOAA is another federal agency that provides financial resources to conserve and manage coastal and marine ecosystems. The Community-based Marine Debris Removal Program grant and the Marine Debris Prevention, Education and Outreach grant are two funding resources that can support litter reduction efforts in the Bon Secour River and Skunk Bayou watersheds. Similar to the Gulf of Mexico Program, NOAA's Community-based Restoration Program leverages local resources and promotes community involvement in habitat restoration activities. NOAA staff help grant recipients prioritize potential projects and offer technical expertise during restoration efforts. The funding opportunity is suitable for all the watersheds included in this plan. See **Appendix B** for more information regarding NOAA-specific funding resources.

In addition to USEPA and NOAA, USFWS has a number of conservation initiatives that are funded through the Department of the Interior. For example, several wildlife and fisheries habitat grants listed in **Table 10-2** (below) could support habitat protection actions recommended in the WMP. The USFWS Coastal Program is among the most prominent of these programs. The WMTF should consider the Coastal Program as a viable funding alternative to protecting fish and wildlife habitat in priority coastal areas. The USFWS Boating Infrastructure Grant program is an example of a federal program that could provide ADCNR maintenance funding to improve the quality of boat landings, piers and other public-access related facilities within each watershed. **Appendix B** contains more detailed information on each USFWS funding program that is available.

The WMTF should promote the Baldwin County Environmental Quality Incentives Program (EQIP), Conservation Stewardship Program (CSP), and Agricultural Conservation Easement Program (ACEP) to all rural producers and riparian landowners in each watershed. The Baldwin County Soil and Water Conservation District office in Bay Minette cooperatively coordinates these federally funded programs. The U.S. Department of Agriculture financial resources provide selected applicants with technical and financial assistance to address state and local

natural resource concerns. Erosion control, soil quality, grazing lands, forestry/ wildlife health, and irrigation water management and invasive species control are all priorities.

The Baldwin County District Conservationist works with agricultural producers to determine specific qualifications (e.g., conservation tillage requirements) and the level of financial assistance available within each program. The EQIP is a priority funding source for implementing grassed waterways (i.e., agricultural ditches stabilized by vegetation) in recommended buffer zones and can also provide financial assistance for invasive species treatment in riparian areas. A 5-year funding program is also available under the CSP to help landowners finance riparian buffers. The WMTF and local U.S. Department of Agriculture, Natural Resources Conservation Service, staff should work to identify landowners in each watershed who want to support the WMP by participating in the voluntary easement program, treating invasive plants, and/or installing buffers on highly erodible riparian lands. **Appendix B** presents additional information about the EQIP, CSP, and ACEP.

10.3.2 State Funding Programs

The ACAMP provides funding opportunities related to coastal planning. The program is intended to assist local government planning agencies in providing education and addressing coastal habitat protection, wetland protection and coastal nonpoint source pollution control measures. Therefore, the WMTF should consider the annual ACAMP RFP as a top financial resource on the state level. Another ADEM program called the Clean Water State Revolving Fund should be considered for stormwater/non-point source projects. For example, the WMTF might consider financing streambank restoration and buffer projects by using an SRF loan. Financial resources provided by the State of Alabama are also covered in **Appendix B.**

10.3.3 Private Funding Programs

A multitude of private programs fund WMPs across the United States. The WMTF should consider the NFWF's grants when working with partners to implement watershed restoration measures. The NFWF is a nonprofit organization (with a board under federal oversight) that has already funded WMP implementation throughout Baldwin County through the Gulf Environmental Benefit Fund. **Appendix B** presents a full list of private, and private/public partnership funding resources.

The Five Star Urban Waters Program is intended to fund shoreline erosion, streambank stabilization, and stormwater runoff projects. The Gulf Coast Conservation Grants Program supports conservation projects that preserve threatened coastal ecosystems. These NFWF grants provide invaluable opportunities to craft cross-sector conservation partnerships in the Bon Secour River, Oyster Bay and Skunk Bayou watersheds. The Southwest Aquatic Resources Partnership, Healthy Watersheds Consortium Grant Program, and the Gulf Star Grants Program are other notable opportunities included in **Table 10-2**, presented at the end of this section.

10.3.3.1 Environmental Education

Improving public understanding through education and outreach efforts is important to changing the behavior of individual watershed actors. The WMTF should consider how local schools can work with regional partners to improve environmental literacy and citizen engagement in each watershed. A watershed-literate person is someone who recognizes the essential principles about the function of rivers and wetlands within a watershed and, therefore, understands the conservation resources that are available to protect and enhance coastal resources. Educational grants from NOAA and private foundations are discussed in **Appendix B**.

Directly involving citizens through public education and volunteerism is important because it multiplies the outcome of existing restoration efforts. When people become more informed, they are more likely to provide supporting actions that are consistent with implementing the WMP. The Gulf Research Program's Capacity Building Grant program is one prominent example of a funding alternative that could support such work. Compiling an oral history in the Bon Secour River watershed is another environmental education-related action specifically included among the recommended management actions. The National Endowment for the Humanities offers the Common Heritage Grant Program. The WMTF should work with Baldwin County and cities of Foley and Gulf Shores to coordinate a regional event intended to preserve the maritime history and culture of the region. For more information on financial and technical assistance related to the digitization of cultural heritage materials please see **Appendix B**.

10.3.3.2 Stormwater Programs

In 2010, the Baldwin County Commission proposed a stormwater referendum to address the water quality and drainage issues. Despite the Commission's effort to manage stormwater at the watershed scale, residents strongly opposed the new plan. The referendum was unpopular among voters and became referred to locally as a "rain-tax" plan. Despite local criticism watershed-scale stormwater management is a growing trend throughout the United States. Stormwater drain fees, property taxes, general funds, and special assessment districts are just a few examples of regional funding mechanisms that have successfully financed stormwater initiatives in other areas of the country. These options should be considered as viable alternatives for financing a regional stormwater program in south Baldwin County.

Table 10-2 presents an overview of financial resources that could support implementing the recommendations included in the WMP. Four different types of funding categories are presented in the table: 1) financial assistance, 2) information and education, 3) technical assistance, and 4) water quality monitoring. The column on the far right provides the targeted watershed for each specific relevant funding opportunity. Funding opportunities that are bolded in the table should be referenced when pairing financial resources with the specific implementation measures recommended in Section 7. The WMTF should use **Appendix B** as a guide when evaluating potential partners to involve during the competitive grant process. Links to federal and state revolving funds, and private grant programs are available.

TABLE 10-2: FUNDING AVAILABLE TO SUPPORT PLAN IMPLEMENTATION				
Funding Source	**Description**	**Type**	**Actions Funded**	**Targeted Watershed**
Alabama Coastal Area Management Program	**Annual Grant Program**	State	Financial assistance, water quality monitoring	Bon Secour River, Oyster Bay, Skunk Bayou
Alabama Department of Environmental Management	**Section 319 Grant Funds**	Federal/state		Bon Secour River
	Clean Water SRF	State	Financial assistance, water quality monitoring	Bon Secour River, Oyster Bay, Skunk Bayou
Conservation Alabama Foundation	Watershed Management Plan Outreach Program	Private-public partnership	Information and education	Bon Secour River, Oyster Bay, Skunk Bayou
Cornell Douglas Foundation Grants	Cornell Douglas Foundation Grants	Private	Information and education, financial assistance	Bon Secour River, Oyster Bay, Skunk Bayou
Department of the Interior	Land and Water Conservation Fund	Federal	Financial assistance	Bon Secour River, Oyster Bay, Skunk Bayou
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	Bon Secour River, Oyster Bay
Gulf of Mexico Alliance	**Gulf Star Grants Program** (1 – Coastal Resiliency, 2 – Data and Monitoring, 3 – Education and Engagement, 4 – Wildlife and Fisheries)	Public-private partnership	Information and education, financial assistance, water quality monitoring	Bon Secour River, Oyster Bay, Skunk Bayou
Gulf of Mexico Research Initiative	RFP-IV	Private	Financial assistance	Bon Secour River
Gulf Research Program	**Capacity Building Grants**	Private	Information and education	Bon Secour River, Oyster Bay, Skunk Bayou
Legacy Partners in Environmental Education	Environmental Education Grants	Private	Financial assistance, information and education	Bon Secour River, Oyster Bay, Skunk Bayou
National Education Association Foundation	Captain Planet Foundation Grants for the Environment	Private	Financial assistance, information and education	Bon Secour River, Oyster Bay, Skunk Bayou

TABLE 10-2: FUNDING AVAILABLE TO SUPPORT PLAN IMPLEMENTATION				
Funding Source	**Description**	**Type**	**Actions Funded**	**Targeted Watershed**
National Environmental Education Foundation	Every Day Capacity Building Grants	Private	Financial assistance, information and education	Bon Secour River, Oyster Bay, Skunk Bayou
National Endowment for the Humanities	**Common Heritage Grant Program**	Private	Financial assistance, technical assistance	Bon Secour River
National Fish and Wildlife Foundation	Conservation Partners Program	Private	technical assistance, information and education	Bon Secour River
	Gulf Environmental Benefit Fund	Private	Financial assistance	Bon Secour River, Oyster Bay, Skunk Bayou
	National Wildlife Refuge Friends Program (project specific grants)	Private	Financial assistance, information and education	Bon Secour River, Oyster Bay
National Fish and Wildlife Foundation	**Five Star & Urban Waters Restoration Program**	Private	Financial assistance, information and education, water quality monitoring	Bon Secour River, Oyster Bay
	Gulf Coast Conservation Grant Program	Private	Financial assistance	Bon Secour River, Oyster Bay, Skunk Bayou
National Oceanic and Atmospheric Administration	**Community-based Marine Debris Removal**	Federal	Financial assistance	Bon Secour River, Skunk Bayou
	NOAA Marine Debris Prevention, Education and Outreach Partnership Grant	Federal	Financial assistance, information and education	Bon Secour River, Skunk Bayou
	NOAA Gulf of Mexico Bay-Watershed Education and Training (B-WET) Program	Federal	Financial assistance, information and education	Bon Secour River, Oyster Bay, Skunk Bayou
	RESTORE Act Science Program	Federal	Financial assistance	Bon Secour River
	FY2017 Broad Agency Announcement	Federal	Information and education, financial assistance	Bon Secour River, Oyster Bay, Skunk Bayou
	Environmental Literacy Grants	Federal	Financial assistance, information and education	Bon Secour River
	Community-based Restoration Program	Federal	Financial assistance, technical assistance	Bon Secour River, Oyster Bay, Skunk Bayou

TABLE 10-2: FUNDING AVAILABLE TO SUPPORT PLAN IMPLEMENTATION				
Funding Source	**Description**	**Type**	**Actions Funded**	**Targeted Watershed**
National Park Service	National Maritime Heritage Grant	Federal	Information and education, financial assistance	Bon Secour River
National Science Foundation	**Environmental Engineering R&D Grant**	Federal	Technical assistance, water quality monitoring	Bon Secour River
Royal Bank of Canada	Blue Water Project	Private	Financial assistance	Bon Secour River
Southeastern Aquatic Resources Partnership	**Aquatic Habitat Restoration Program**	Federal	Financial assistance	Bon Secour River. Oyster Bay, Skunk Bayou
The Home Depot	Community Impact Grants Program	Private	Financial assistance	Bon Secour River, Oyster Bay, Skunk Bayou
The Kresge Foundation	Environment: (1 – Climate Resilience in Coastal Cities and Regions, 2 –Sustainable Water Resource Management in Changing Climate)	Private	Financial assistance	Bon Secour River
U.S. Department of Agriculture, Natural Resources Conservation Service	**Environmental Quality Incentives Program**	Federal	Financial assistance, technical assistance, water quality monitoring	Bon Secour River, Oyster Bay, Skunk Bayou
	Conservation Stewardship Program	Federal	Financial assistance, technical assistance	Bon Secour River, Oyster Bay, Skunk Bayou
	Agricultural Conservation Easement Program	Federal	Financial assistance, technical assistance	Bon Secour River, Oyster Bay, Skunk Bayou
United States Endowment for Forestry and Communities, Inc.	**Healthy Watersheds Consortium Grant Program**	Private-public partnership	Financial assistance, information and education, water quality monitoring	Bon Secour River, Oyster Bay, Skunk Bayou
U.S. Environmental Protection Agency	**106 Grant Funds (Water Pollution Control)**	Federal/state	Financial assistance, water quality monitoring	Bon Secour River. Oyster Bay, Skunk Bayou
	National Wetland Program Development Grants	Federal	Financial assistance, technical assistance, water quality monitoring	Bon Secour River, Oyster Bay

TABLE 10-2: FUNDING AVAILABLE TO SUPPORT PLAN IMPLEMENTATION				
Funding Source	**Description**	**Type**	**Actions Funded**	**Targeted Watershed**
	State Water Protection Grants	Federal/state	Information and education, financial assistance, water quality monitoring	Bon Secour River, Oyster Bay, Skunk Bayou
	Urban Waters Small Grants	Federal	Technical assistance, water quality monitoring	Bon Secour River
	Gulf of Mexico Program (and the Gulf of Mexico Program Partnership Gulf Guardian Awards)	Federal	Financial assistance, water quality monitoring	Bon Secour River, Oyster Bay, Skunk Bayou
U.S. Fish and Wildlife Service	Partners for Fish and Wildlife Program	Federal	Financial assistance, technical assistance	Bon Secour River, Oyster Bay, Skunk Bayou
	Coastal Program	Federal	Financial assistance, technical assistance	Bon Secour River, Oyster Bay, Skunk Bayou
	National Coastal Wetlands Grant	Federal	Financial assistance	Bon Secour River, Oyster Bay
	Boating Infrastructure Grant Program (Tier 2—National)	Federal	Financial assistance	Bon Secour River, Oyster Bay, Skunk Bayou
	Boating Infrastructure Grant Program (Tier 1—State)	Federal	Financial assistance	Bon Secour River, Oyster Bay, Skunk Bayou
	Natural Resource Damage Assessment, Restoration and Implementation	Federal	Financial assistance	Bon Secour River, Oyster Bay
	State Wildlife Grants Program	Federal	Financial assistance	Bon Secour River, Oyster Bay
	Urban Wildlife Refuge Partnership	Federal	Financial assistance, information and education	Bon Secour River
	National Fish Habitat Action Plan	Federal	Technical assistance, financial assistance	Bon Secour River

Note: **Bold** type face indicates funding opportunities that should be referenced when pairing financial resources with the specific implementation measures recommended in Section 7.

11.0 MONITORING AND SAMPLING PLAN

11.1 Monitoring

Monitoring is an essential component to the success of this WMP. Routine monitoring of the watersheds will allow the WMTF to track progress over time to assess the effectiveness of implemented management measures and determine whether changes or additional actions are needed to achieve the goals and objectives of the WMP. Data collected during the monitoring phase will help establish baseline conditions for future assessments and identify new watershed issues which may not currently be known or which may arise in the future. Compared to other watersheds in the region, relatively little data exists for the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds, making a full assessment of current watershed conditions or comparison to historical conditions more challenging.

11.2 Watershed Conditions and Analytical Parameters

Monitoring criteria can be broken into two basic categories: watershed conditions and analytical parameters. Watershed conditions include quantitative and qualitative criteria such as changes in streambank or shoreline morphology, presence of litter, and presence of invasive species. Analytical parameters include quantitative criteria such as turbidity, temperature, conductivity, dissolved oxygen, pH, nitrogen, phosphorus, and pathogen loads, which can be measured directly in the field or lab. While these conditions may be measureable, monitoring of watershed conditions will rely heavily on field observations. Specific monitoring protocols should be developed according to guidance from state (ADEM) and federal (USEPA) authorities. The following watershed conditions and analytical parameters should be monitored:

- **Standard Field Parameters**—Standard field parameters are physical characteristics (abiotic factors) of water which should be measured each time sampling is conducted. These parameters include water temperature, specific conductivity (or salinity), dissolved oxygen, and pH. Standard field parameters can serve as indicators of watershed health, but also provide a context for interpreting other measured or observed field data. These parameters have many interactions with one another as well as biological factors within the system and have an important influence on the overall watershed. Baseline data provided by routine monitoring of standard field parameters will aid in rapid detection of future watershed issues, if data points fall well outside expected ranges (deviation from baseline). Standard field parameters can be easily measured on-site using a handheld device, such as YSI instrument.
- **Turbidity**—Turbidity is a measure of water clarity based on the amount of sediment or other materials suspended in the water. Elevated turbidity levels can degrade watershed conditions by disrupting primary production (plant and algal growth) and adversely impacting the health of fish and other aquatic organisms. Turbidity typically increases following rain events because loose sediments are transported to waterbodies by storm

runoff. Therefore, targeted measurements of turbidity can be a good indicator of non-point sources and may help to identify areas where improvements or additional management measures (such as buffer strips or retention basins) are needed. Turbidity can be easily measured on-site using a Secchi disk.

- **Nutrients**—Monitoring of nutrient loading in the watersheds should include measurements of dissolved nitrogen and phosphorus concentrations. Monitoring of nutrient inputs at various points in the watersheds can help identify sources such as lawns, farms, or septic sewer outfalls. Establishment of baseline nutrient data is critical because nutrient loading has been identified as a potential issue in some parts of the watersheds, but the current amount of available data is insufficient to effectively understand or address this issue. Nutrient concentrations cannot be easily measured in the field. Nutrient monitoring will consist of collecting water samples at identified sampling locations for analysis at a facility with appropriate laboratory instrumentation. Both nitrogen and phosphorus can be measured from the same water sample.
- **Pathogens**—Pathogen loading has been identified as an issue in portions of the watersheds, including Oyster Bay, Bon Secour Bay, and an unnamed tributary to the Bon Secour River which currently appear on Alabama's 303(d) list for pathogens. High pathogen concentrations pose a public health risk and for this reason can result in restricted uses of waterways (such as swimming or fishing). *E. coli* is a strain of bacteria that originates in the guts of humans and other animals and is typically used as an indicator for pathogen concentrations in water. Pathogen concentrations peak immediately after rainfall events because they usually enter waterbodies via stormwater runoff. Pathogen monitoring data can help identify certain types of sources, such as agriculture or faulty septic systems, and may guide decision makers in determining where improvements or additional management measures (such as buffer strips) are needed. Pathogen concentrations are measured by collecting water samples in the field for incubation in a laboratory to quantify bacterial growth. Pathogen concentrations cannot be easily measured in the field.
- **Groundwater Monitoring**—Groundwater monitoring should be conducted to determine the effects from development and the expansion of impervious cover on groundwater recharge. Groundwater monitoring stations (wells) should be installed in strategic locations in the watersheds to develop baseline data. Measurements should be taken at regular intervals, and immediately after heavy rainfall events to estimate recharge rate.
- **Invasive Species**—Invasive species have been identified as an issue in all three watersheds and can serve as a general indicator of watershed health. While quantitative assessments of invasive species throughout the watersheds may not be feasible, sampling teams should make visual assessments of the presence of invasive species during routine monitoring activities. These observations should be documented in field notes and photographed when possible. Sampling teams should be trained in the identification of the four major invasive plants (Cogon grass, kudzu, Chinese tallow, and Chinese privet) that are known to occur in the watersheds, as well as other species which may occur.

- **Litter Monitoring**—While litter can be difficult to quantify, field teams should make visual observations during routine monitoring and sampling to generally assess litter conditions at various points in the watersheds. These observations should be documented in field notes, and photographed when possible. Litter monitoring will offer insight into the effectiveness of management measures aimed at reducing litter, including educational programs, signage, and infrastructure improvements such as litter traps. Litter monitoring may also help identify areas within the watershed that should be targeted for future action.
- **Erosion Monitoring and Coastal Shoreline Assessment**—Erosion and loss of shoreline has been identified as a critical issue in certain areas of the watersheds. Erosion can result in the loss of land and habitat but also contributes to other watershed issues, such as high turbidity and phosphorus loading. Erosion monitoring and coastal shoreline assessments should include field observations, documented in notes and photographs, and periodic (at least annual) review of aerial photography or satellite imagery to track changes in shorelines through time. Areas where erosion or shoreline loss is recognized, such as the Fort Morgan Peninsula or the unnamed tributary to the Bon Secour River where an exposed gas pipe was discovered during field reconnaissance, should be specifically targeted for observation and monitoring.

11.3 Sample Collection Locations

Sample collection locations were identified in collaboration with members of the project Steering Committee and are intended to provide an overview of conditions within each watershed. Sample collection locations were strategically placed in known and accessible problem areas to allow successful monitoring of progress in addressing critical watershed issues. Proposed sample collection locations for each watershed are shown below in **Figures 11-1** through **11-3**.

11.4 Monitoring Program Approach and Schedule

Sampling should be conducted at each of the designated sample collection locations on a monthly basis, unless otherwise noted (less frequent monitoring is sufficient for coastal shoreline assessment). This sampling schedule should be sufficient to accurately monitor trends in watershed conditions and parameters without being overly burdensome for sampling teams, or cost prohibitive for managers. Because watershed conditions and parameters can change quickly and are affected by many factors, annual or quarterly sampling may not be sufficient to track changes and monitor overall trends. This is especially true for the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds where baseline data is limited or non-existent. It is important to note that each sampling data point represents a snapshot of watershed conditions at a certain point in time. A larger data set will provide context for each data point and help to identify outliers that may not be representative of overall watershed conditions. Sampling frequency could be adjusted at a point in the future after an adequate baseline data set have been established.

All monitoring activities should be conducted in accordance with Alabama Water Watch protocols. Alabama Water Watch is a statewide volunteer-based water quality monitoring program that focuses on training, educating, and empowering citizens.

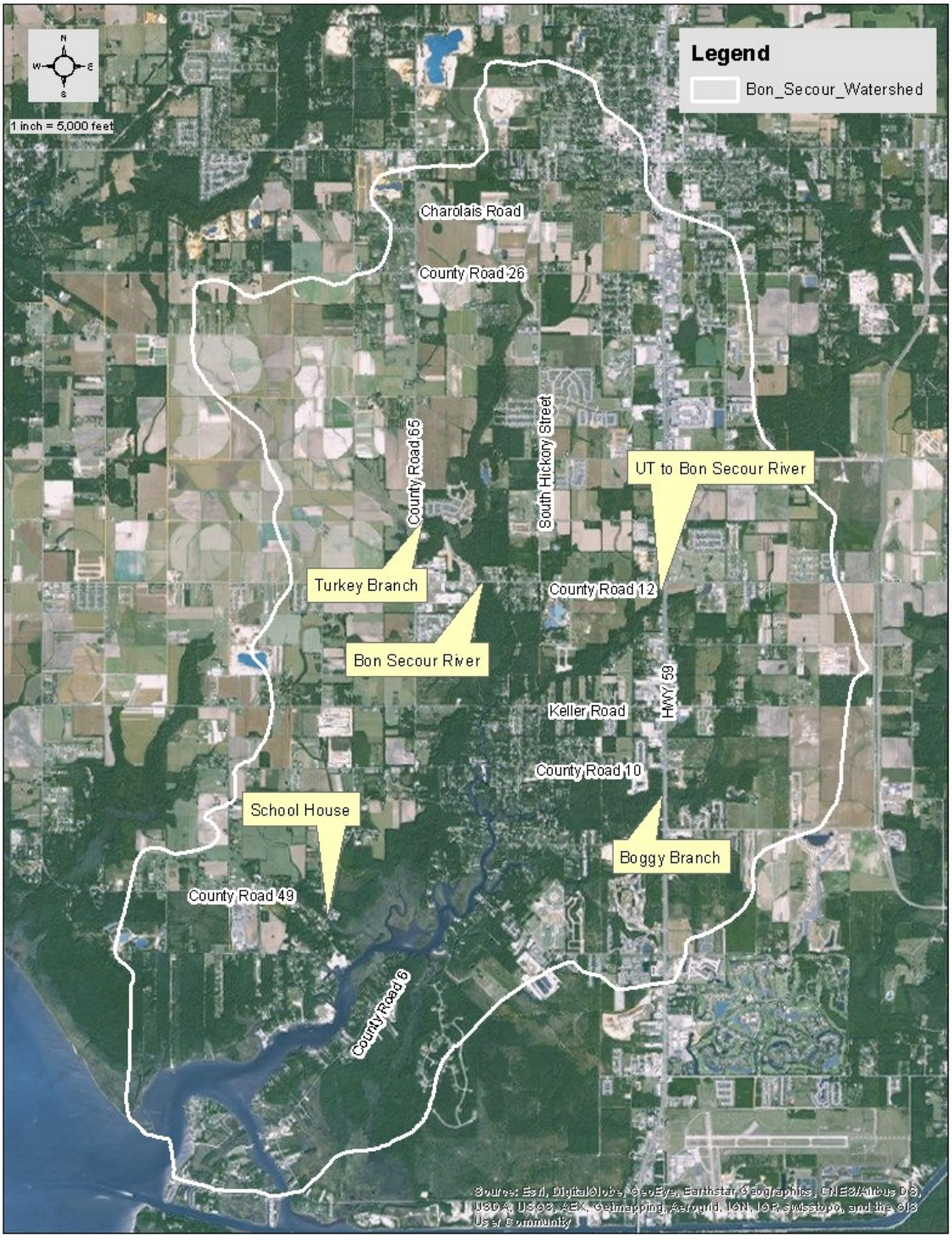

FIGURE 11-1: PROPOSED SAMPLE LOCATIONS IN BON SECOUR RIVER WATERSHED

FIGURE 11-2: PROPOSED SAMPLE LOCATIONS IN OYSTER BAY WATERSHED

FIGURE 11-3. PROPOSED SAMPLE LOCATIONS IN SKUNK BAYOU WATERSHED

11.5 Citizen Participation and Volunteering

Citizen participation through volunteering is a key element of the Watershed Monitoring and Sampling Plan. Community members will be encouraged to play an active role in watershed management by volunteering to collect data as members of field sampling teams and participating in public outreach events such as the annual Alabama Coastal Cleanup. Citizen participation in watershed monitoring and sampling will not only enable successful implementation but also will establish a sense of community ownership within the watersheds. Volunteer watershed monitoring networks have been established in the nearby Wolf Bay Watershed and Little Lagoon and have proven to be a successful model for long-term monitoring and community engagement in watersheds throughout the country.

11.6 Adaptive Management

Adaptive management will be implemented to maximize the effectiveness and efficiency of implemented management measures. Adaptive management will consist of an annual review of progress reports for each watershed and comparison of watershed conditions against goals and objectives identified in this WMP. This review and comparison will allow decision makers to evaluate the success of implemented management measures and recommend changes or additional management measures needed to achieve stated goals and objectives. Adaptive management will ensure that implementation strategies are constantly being evaluated and updated, based on the best available science, and adjusted according to changing watershed conditions. Adaptive management will also ensure that staff time and funding resources are used in the most efficient way possible to produce measureable results.

11.7 Anticipated Costs

Anticipated cost of monitoring and sampling would be roughly $10,000–$25,000 per year. Monitoring costs will be heavily dependent on parameters to be monitored, number of stations, and frequency of sampling.

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APPENDIX A:
PUBLIC INVOLVEMENT MATERIALS

Public Involvement Materials

Section I. Steering Committee Notes
Section II. Fact Sheets, Initial Survey, Initial Survey Results
Section III. Final Survey, Final Survey Results

Section I.

Steering Committee Notes

BON SECOUR RIVER/OYSTER BAY WATERSHED

STEERING COMMITTEE MEETING #1 NOTES

SEPTEMBER 23, 2015

I. Introductions – Project Team and Steering Committee Members

II. Project Overview

a. Goals: Project goals should be thought of as the "what" we wish to accomplish; e.g., improve water quality, reduce sediment loading, preserve wetland habitat.

b. Objectives: Project objectives should be thought of as the "how" goals will be achieved; e.g., implement best management practices to control non-point source runoff.

c. Development of goals and objectives will be an iterative process to be accomplished over the next 3-4 months.

III. Community Involvement

a. How stakeholder input will be integrated into Watershed Management Plan
   i. Education via press release and fact sheets.
   ii. Surveys.
   iii. Feedback from community meetings.

b. Community Involvement Opportunities
   i. Alabama Coastal Cleanup – Was held September 19, 2015.

   ii. Targeted Stakeholder Meetings/Small Groups Meetings – Meetings to be conducted in October and November 2015.

   iii. Large Community Meetings: First round of Large Community Meetings will be held December 2, 2015 in Foley from 5-7 at the Foley Civic Center and December 3, 2015 from 5-7 in Gulf Shores at the Gulf Shores Activity Center.

c. Steering Committee – Will meet on an as needed basis.

IV. Group Discussion on How to Engage Different Community Groups in the Watersheds

a. Monthly club meetings
b. One on one interaction
c. Community Cleanup days
d. Late afternoon socials
e. Church bulletins and services

V. Concerns of the watersheds identified by the Committee

a. Shoreline erosion/armored coastlines
b. Litter traps
c. Sedimentation
d. Flooding
e. Septic tanks
f. SAV habitat

BON SECOUR RIVER, OYSTER BAY, and SKUNK BAYOU WATERSHED MANAGEMENT PLAN
STEERING COMMITTEE MEETING #2
JANUARY 25, 2016
FOLEY CITY HALL CONFERENCE ROOM, 11:30 AM

I. Introductions - Project Team, Steering Committee Members, and Others.

II. Results from the first round of Public Involvement Meetings

a. Small target group meetings:

i. Five meetings held between the time period of October-December 2015. Locations included The Peninsula, Hugger's Landing Volunteer Fire Department, Bon Secour Volunteer Fire Department, Ginwright Center, and Enfinger Center (in cooperation with Baldwin County Soil and Water Conservation Septic Tank Workshop).

ii. Issues of concerns identified at the meetings included:

- Sedimentation
- Lack of watershed education
- Shoreline erosion
- Wildlife habitat and protection
- Water quality monitoring
- Seafood quality
- Litter
- Growth and Development
- Public access
- Drainage
- Stormwater runoff

b. Large community meetings:

i. Two meeting were held in December 2015. Locations included the City of Foley Civic Center and the Gulf Shores Activity Center.

ii. Issues of concern identified at the meetings included:

- Water quality improvement
- Habitat protection
- Lack of watershed education
- Growth management
- Invasive species control
- Seafood health
- Lack of public access
- Stormwater management

III. Field observations in the watersheds

- Litter
- Erosion
- Invasive plant species
- Sedimentation
- Evidence of flooding events

IV. Potential management actions to address identified watershed issues (this list is draft)

- Litter traps
- Regional detention
- Educational workshops
- Land preservation
- Buffer strips
- Living shorelines
- Stream restoration
- Water monitoring

V. Plans for second round of public outreach meetings

- Tentative dates for upcoming community meetings, April 19-20, 2016 – times to be determined.
- BBQ and Blues, March 19 – Project team to set up a booth.
- Meet with local civic clubs.
- Additional outreach/advertising opportunities:
  - Survey Monkey
  - NexDoor
  - Social Media
  - Uncle Henry Show
  - WHEP

VI. Schedule and path forward to complete the plan by November 2016

- June 6 – September 2, 2016 - Prepare draft document.
- Mid-July 2016 – Steering Committee meeting.
- September 5 – October 4, 2016 - Public Comment Period on draft plan.
- Mid-October 2016 - Steering Committee Meeting.
- October 2016 - Present final plan to Foley City Council, Gulf Shores City Council, Baldwin County Commission, Engineers and Mayors.

BON SECOUR RIVER, OYSTER BAY, and SKUNK BAYOU WATERSHED MANAGEMENT PLAN
STEERING COMMITTEE MEETING #3
JUNE 15, 2016
FOLEY CITY HALL CONFERENCE ROOM, 11:30 AM

I. Introductions - Project Team, Steering Committee Members.

II. Goals and Objectives

a) Review of Goals and Objectives

1) Improve water quality to support aquatic ecosystems, species diversity, and safe recreational activities in the Bon Secour River, Skunk Bayou, and Oyster Bay watersheds.
   - Define the impairment status
   - Design an implementation program to manage impairments and pollutant sources
   - Include a schedule with interim milestones, criteria to track progress, and a citizen monitoring component
   - Provide the necessary educational, technical, and financial support

2) Improve water quality to support aquatic ecosystems, species diversity, and safe recreational activities in the Bon Secour River, Skunk Bayou, and Oyster Bay watersheds.
   - Characterize the watersheds
   - Create natural and resource inventory and identify causes and sources of impairment
   - Estimate the impairment pollution loading and approximate reductions of recommended management actions
   - Document and recommend conservation opportunities

3) Protect continued use of biological resources to preserve culture, heritage, and knowledge of the watersheds.
   - Identify strategic partnerships and build consensus among important watershed stakeholders
   - Solicit community input and document concerns through participation in surveys, public involvement events, and milestone reporting
   - Establish meaningful roles for citizen engagement

4) Improve watershed resiliency to impacts of climate change, including sea level rise.
   - Determine primary issues and concerns
   - Calculate long-term goals and assign management targets
   - Concentrate management efforts in the areas of greatest concern
   - Foster a culture of mutual contribution so that residents understand how implementing the recommended actions will improve habitat conditions and sustain quality of life over time

5) Expand community access to resources.
   - Circulate an annual newsletter reporting watershed issues
   - Design and distribute educational materials for each watershed
   - Periodically host educational workshops
   - Develop baseline metrics to measure watershed success

b) *Steering Committee Feedback: Goals and Objectives*

I. Create goal and objective statements related to compiling an oral history of the Bon Secour Watershed from the 1700's onwards
   - Implement cultural history component by approaching longtime residents (i.e. Miss Ella)

II. Organize Goals and Objectives for Oyster Bay separately. Keep Bon Secour and Skunk Bayou Goals and Objectives grouped together because they share similarities from a management standpoint

III. Critical Management Issues

a) Review of actions taken that helped identify these issues: (public input, literature review, field reconnaissance, professional judgement)

b) Team Identified Management Issues in Bon Secour
1. Stormwater Management
2. Litter
3. Water Quality
4. Erosion Sedimentation
5. Invasive Species

c) Team Identified Management Issues in Oyster Bay
1. Habitat Protection
2. Shoreline Erosion
3. Water Quality
4. Invasive Species
5. Smart Growth

d) Team Identified Management Issues in Skunk Bayou
1. Water Quality
2. Lack of Agricultural Buffer Strips
3. Invasive Species

e) Steering Committee Feedback: Critical management issues

i. Make "Water Quality" an important management priority in all three watersheds

IV. Management Approach to Watershed Management Measures

a) Establish a Taskforce
- Develop process for selecting members
- Taskforce composition
- Governance
- Functions

b) Establish Communication Plan
- Celebrate wins, generate interest

c) Education/Engagement Plan
   - Interest → Action
   - Define what resonates in the community
   - Support emerging group focused on water stewardship
   - School engagement
   - Expand existing events
   - Public involvement in monitoring efforts

d) Tangible Management Measures

	Bon Secour	Oyster Bay	Skunk Bayou
Install litter traps	X		X
Increase conservation easements/protected habitat	X	X	X
Install living shorelines		X	X
Increase vegetated buffers	X	X	X
Implement invasive species treatment and monitoring	X	X	X
Install regional stormwater management facilities	X		
Implement stream restoration projects	X		
Water quality monitoring	X		X

e) Enhance Environmental Protection Policies
   - Low Impact Development
   - County Involvement/input

f) 5 Year Watershed Management Plan Update
   - Revisit goals/objectives
   - Are initial critical issues still applicable?
   - Document management measures that have been implemented
   - Have management measures been successful

g) <u>Steering Committee Feedback: Approach to watershed management measures</u>
   i. Funding is important → provide an implementation framework that allows municipalities to go after appropriate funding opportunities
   ii. Add a website detailing the plan, updates, opportunities etc. (or several web links to other existing websites {i.e. NEP})

V. Watershed Management Plan Approach & Implementation Strategy for the Report

a) **TECHNICAL APPROACH**
   - > 200 pages
   - Detailed discussion/characterization

- Extensive background on management measures and regulatory requirements
- Detailed outline of monitoring program

b) **CONCISE APPROACH**
   - 100 pages or less
   - Reliance on graphs, photos. Summary tables,
   - 4 page executive summary (used for brochure)
   - Summarized sections of watershed characterization, conditions,
   - Emphasis on implementation and public involvement
   - Summary tables for regulatory information and funding sources

c) **CATEGORICAL LISTING** of proposed management measures
   - Distinguishes between different categories of management measures
   - Does not provide prioritization among categories

     Categories include:
     - Task Force Development
     - Public Awareness and Education
     - Management Measures – Short-Term
     - Management Measures- Long-Term
     - Monitoring Accountability

d) **CONSOLIDATED LISTING**
   - Single list of proposed management measures addressed
   - Subject to application of different prioritized approaches
   - Provides a mechanism for comparison of all management measures

e) *Steering Committee Feedback: How should the project team approach management measures and the implementation strategy when preparing the plan?*

   i. Use the EPA's 9 Key Elements to Watershed Planning as a guiding framework for the document

   ii. Prefer a combination of approaches that would produce a document that is approximately 150 pages → **TECHNICAL AND CONCISE**

   iii. Prepare a document that is accessible to the average reader but integrates enough scientific and technical components that allow municipalities to remain competitive when seeking funding for implementation

   iv. Prefer an approach that distinguishes between different categories of management measures, and provides prioritization → **CATEGORICAL LISTING**

VI. Path Forward

a) Complete draft document by the end of August
b) Public review of draft Watershed Management Plan
c) Resolution of comments
d) Final Review by Steering Committee

Section II.

Fact Sheets, Initial Survey, Initial Survey Results

What is a Watershed?
A watershed is a topographically defined area of land where the water within it flows to a common point such as a lake, stream, river, bay, or estuary. We all live in a watershed, and we all play a role in protecting our watershed.

What are the Issues of Concern in the Bon Secour River, Oyster Bay, and Skunk Bayou Watersheds?
The geographical areas in coastal Alabama have experienced considerable growth and development. The trend toward urban sprawl is likely to continue in the future and could potentially impact the water quality in the Bon Secour River, Oyster Bay, and Skunk Bayou Watersheds, including increasing the levels of pollutants, nutrients, and sediments in the waterways. These changes to the tributaries, rivers and bays could threaten our way of life in the watersheds and impact the seafood industry, the ecological health, and recreational opportunities such as fishing, boating, kayaking, bird watching, and swimming. This project's goal is to develop a plan to help us better understand the condition of the watershed, to promote opportunities to ensure its long-term health, and to ensure that the public will enjoy it for generations to come.

What is a Watershed Management Plan (WMP)?
A WMP is the first step to improve water quality in a watershed and to correct negative impacts potentially linked to future development. It serves as a framework to restore and/or prevent water quality impairment due to point sources or non-point sources of pollution. The WMP serves as written documentation of existing ecological conditions and challenges, in addition to a vision and strategy for protecting the watershed.

Who is on the Steering Committee?
The process of promoting the long-term health of the watershed is community-driven. It is led by a Steering Committee comprised of citizens representing different geographic locations within the Bon Secour River, Oyster Bay, and Skunk Bayou Watersheds. The Steering Committee includes representatives from businesses, civic groups, environmental organizations, government agencies, residents, and others.

What is the Role of the Consultant Team?
The Mobile Bay National Estuary Program (MBNEP) awarded the WMP contract to the consulting firm of Volkert, Inc., who will work with Louis Berger and Allen Engineering and Science. The consultant team has extensive experience throughout the region and the United States in developing WMPs and similar plans. The consultant team will oversee the process, conduct scientific research within the watershed, build and coordinate public participation activities (stakeholder engagement), and draft the WMP for review and approval by the MBNEP, City of Foley, City of Gulf Shores, Baldwin County, and the Steering Committee.

How Can You Play a Role in the WMP Process?
The most important thing you can do is *Get Involved*. Share your thoughts and suggestions. Attend the community meetings scheduled in December and February. Complete the Bon Secour River, Oyster Bay and Skunk Bayou Watersheds Stakeholder Survey.

BON SECOUR RIVER AND OYSTER BAY WATERSHEDS MANAGEMENT PLANNING

2015

What is a Watershed?

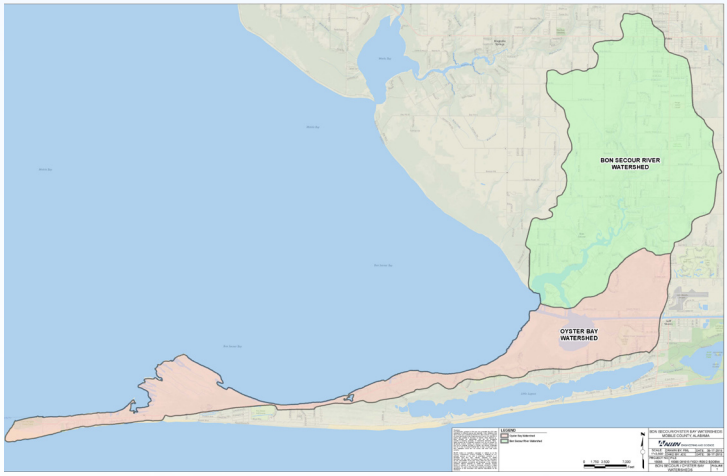
A watershed is an area that drains to a common waterway such as a lake, stream, river, bay, or estuary. We all live in a watershed, and we all play a role in protecting our watershed.

The Bon Secour River and Oyster Bay Watersheds Project

The purpose of the project is to develop a comprehensive targeted watershed management plan for both the Bon Secour River and Oyster Bay Watersheds.

The Watershed Planning approach will follow EPA guidance and address key elements and values deemed important to coastal Alabama.

The stakeholders in the communities of Bon Secour, Oyster Bay, Foley, Gulf Shores, and Baldwin County will be encouraged to participate in the first series of Community Meetings on December 2nd at 5 pm at the Foley Civic Center or December 3rd at 5pm at the Gulf Shores Adult Activity Center.



"Bon Secour River has a long, rich history for recreation and seafood so our goal is to restore and protect the river for our future generations. Local participation will be key as there are many diverse interests throughout the watershed."

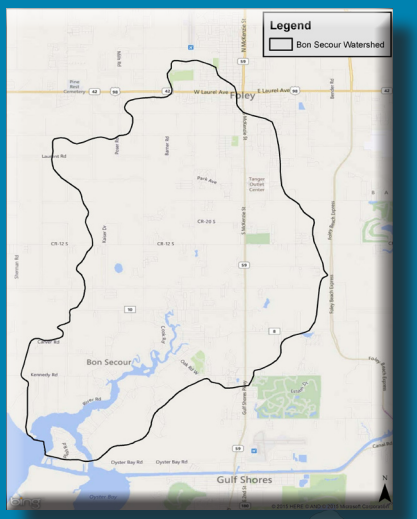
- Leslie Lassitter Gahagan
City of Foley

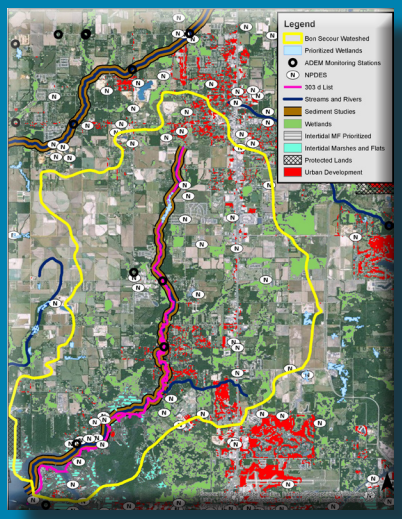
"Here in coastal Alabama, our natural resources are our most important asset. A clean, healthy environment is critical to our economy and way of life. Public input and community involvement are crucial to the development of comprehensive watershed management plans that can protect these resources."

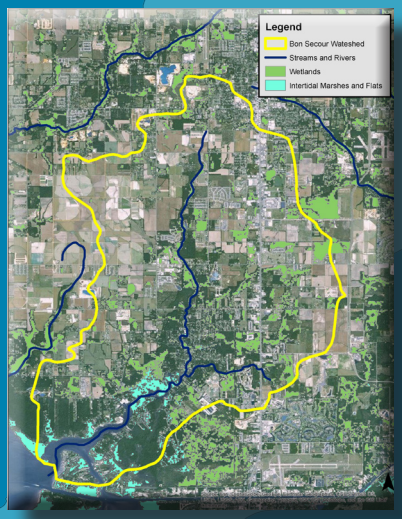
- Dan Bond
City of Gulf Shores

BON SECOUR RIVER WATERSHED

The Bon Secour River Watershed covers over 21,400 acres in southeast Baldwin County. The Bon Secour River originates in the City of Foley and flows southwesterly into Bon Secour Bay, the Intracoastal Waterway and Oyster Bay.







OYSTER BAY WATERSHED

The Oyster Bay Watershed cover over 12,900 acres in southwest Baldwin County. The Watershed originates at the mouth of the Bon Secour River and flows westerly to Fort Morgan.

GENERAL NON-POINT SOURCE POLLUTION TABLE

Type	Pollutant	Major Sources
Sediment	• Total Suspended Solids • Turbidity	• Construction Runoff • Dirt Roads • Soil Erosion • Dirt Pits • Agriculture • Silvicultural Activities
Nutrients	• Phophorous • Nitrogen	• Fertilizers • Yard Waste • Failed Septic Systems • Sewer System Overflows • Agriculture Runoff
Metals	• Copper • Lead • Zinc	• Vehicle Tires and Brake Wear • Paint
Oil and Grease	• Oil and Grease	• Vehicle Emissions • Vehicle Maintenance • Illegal Dumping
Toxics	• Pesticides • Herbicides • Cleaners	• Lawn Care • Vehicle Cleaning • Vehicle Maintenance • Illegal Dumping
Pathogens	• Bacteria • Viruses	• Failing Septic Systems • Sewer System Overflows • Pets • Birds • Wildlife
Thermal Modification	• Temperature	• Pavement • Rooftops

Bon Secour River/Oyster Bay/Skunk Bayou Watersheds Stakeholder Survey

1. **Do you live in one of the watersheds? Yes____ No____**
2. **If so, what watershed and zone do you leave in? (See attached maps)**

   _____

3. **How long have you lived in the watershed?**

   _____

4. **What do you think are the three most important things about this watershed?**

   _____ _____ _____

5. **Do you think there are any areas of cultural, historic, or environmental significance in the watershed? Where?**

   _____

   _____

   _____

6. **In your opinion, what is the overall condition of the watershed?**

   _____

   _____

7. **Are you on septic tank or sewer? _____**

8. **In your opinion, does the water quality in the watershed need to be improved? Yes_____ No_____**

9. **If yes, what environmental issues need attention?**

_____ _____ _____

10. **What are the three most significant threats facing the watershed?**

_____ _____ _____

11. **Do you, your family or friends use the watershed for recreational purposes?**

Yes_____ No_____

12. **If yes, do you?**

Fish_____ Walk-Hike_____ Canoe-Kayak _____

Swim_____ Observe Nature_____ Other: _____

13. **Do recreational opportunities need improvement? Yes_____ No_____**

14. **If yes, do you have suggestions for improvement?**

_____

_____

15. **Do you use the watershed for commercial or agricultural purposes such as Chartering, Oystering, Shrimping, Farming, or Fishing? Yes____ No ____**

16. **If yes, what commercial or agricultural purposes?**

_____

17. **What best management practices should be considered? (Example: instream litter traps, streambank stabilization at specific location, reduction of sediment via sediment traps at specific location)**

_____

_____

_____

_____

18. Would you support the following funding options?

Municipal Bonds _____ Increased Taxes _____

Permit or User Fees _____ Don't Know _____

No _____

19. Do you have any other concerns or comments?

_____

_____

20. Do you want to be informed of the project milestones and meetings?

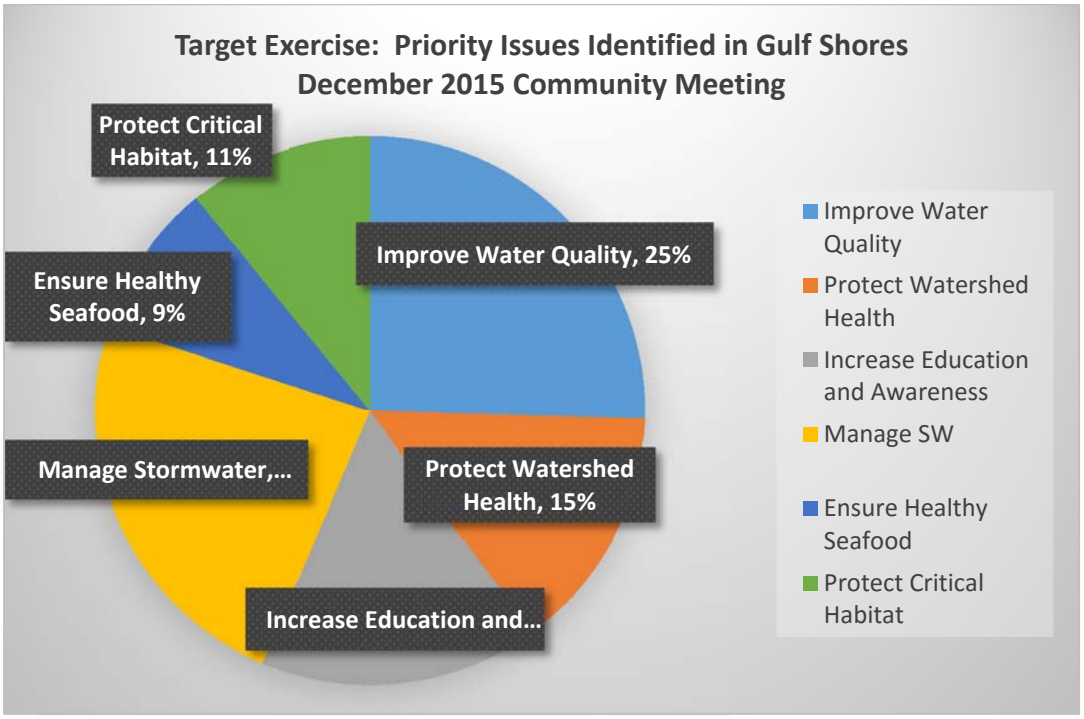
Yes _____ No _____

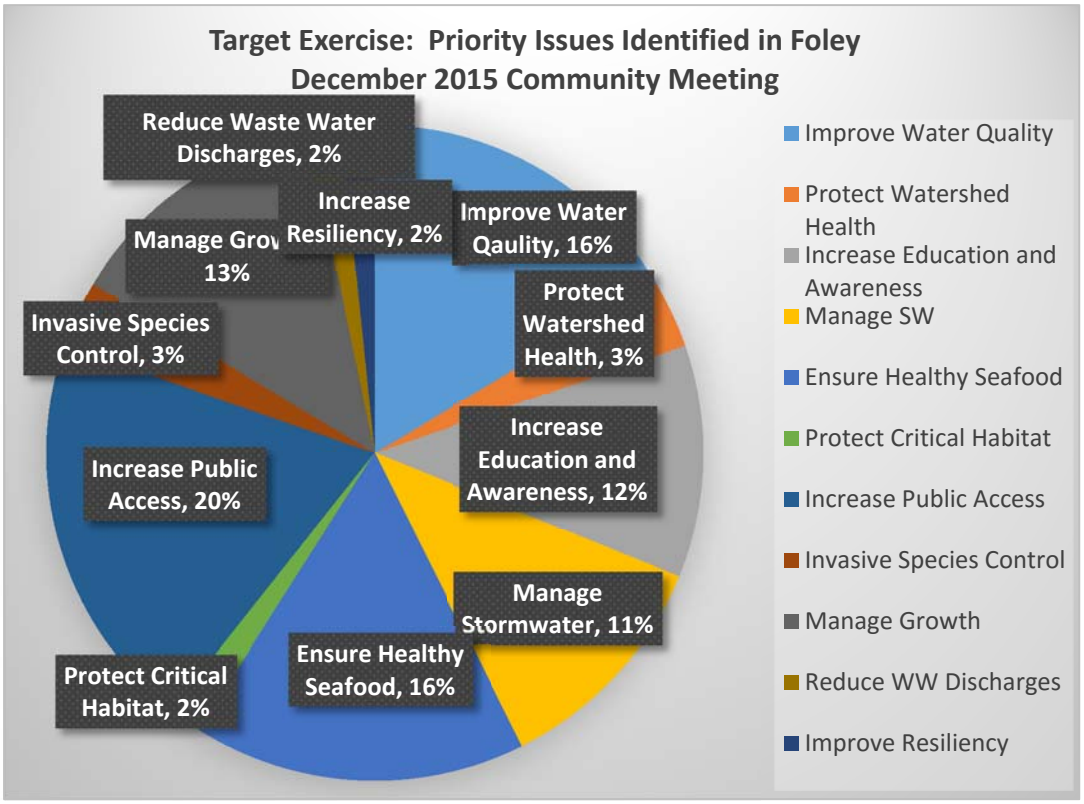
21. If yes, please provide your name, e-mail, or mailing address.

_____

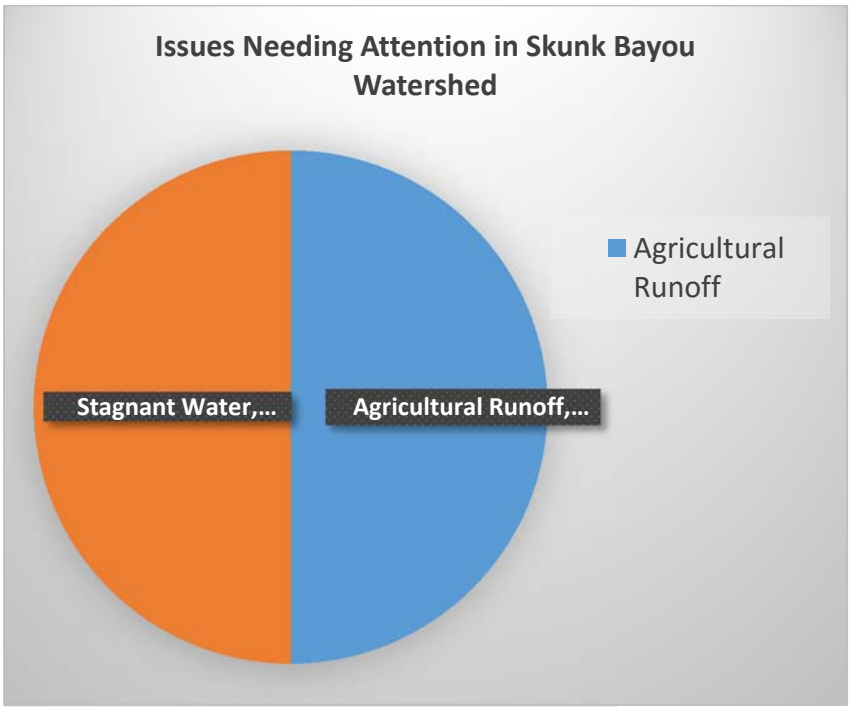
_____

2.3.3 Results

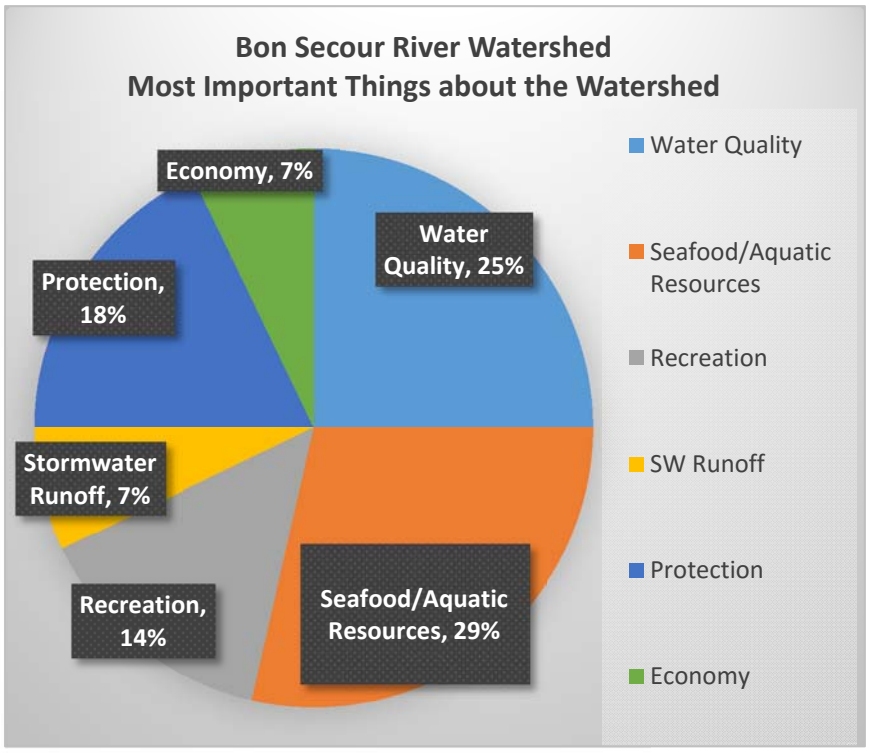

Target Exercise: Priority Issues Identified in Gulf Shores
December 2015 Community Meeting
Protect Critical Habitat, 11%
Improve Water Quality, 25%
Ensure Healthy Seafood, 9%
Manage Stormwater,…
Protect Watershed Health, 15%
Increase Education and…
Improve Water Quality
Protect Watershed Health
Increase Education and Awareness
Manage SW
Ensure Healthy Seafood
Protect Critical Habitat


Target Exercise: Priority Issues Identified in Foley
December 2015 Community Meeting
Reduce Waste Water Discharges, 2%
Increase Resiliency, 2%
Improve Water Qaulity, 16%
Manage Grov 13%
Protect Watershed Health, 3%
Invasive Species Control, 3%
Increase Education and Awareness, 12%
Increase Public Access, 20%
Manage Stormwater, 11%
Ensure Healthy Seafood, 16%
Protect Critical Habitat, 2%
Improve Water Quality
Protect Watershed Health
Increase Education and Awareness
Manage SW
Ensure Healthy Seafood
Protect Critical Habitat
Increase Public Access
Invasive Species Control
Manage Growth
Reduce WW Discharges
Improve Resiliency

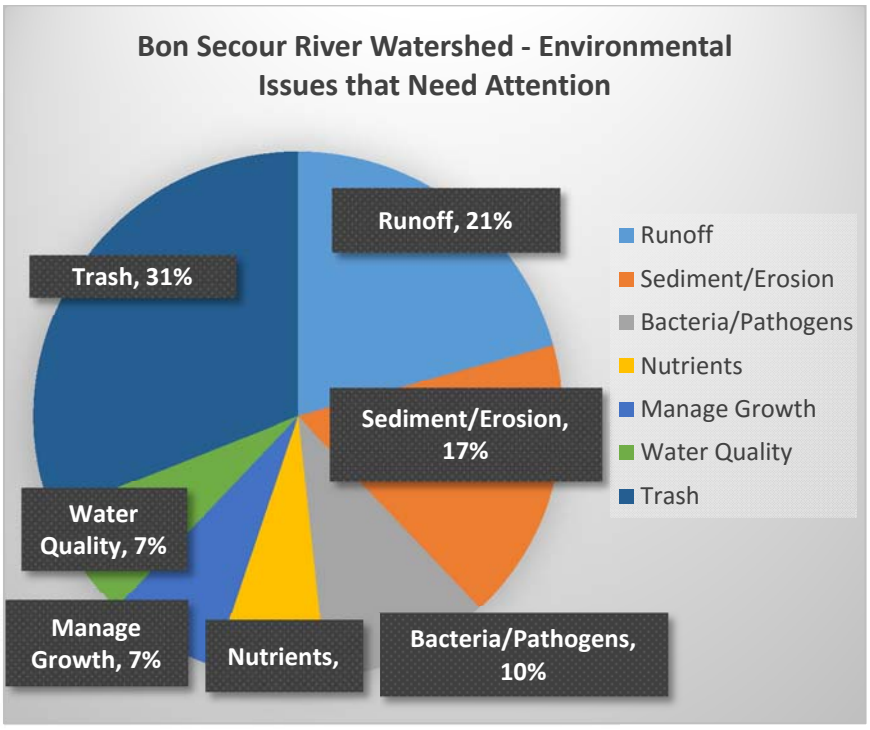
Skunk Bayou Target Meeting n ≈ 1



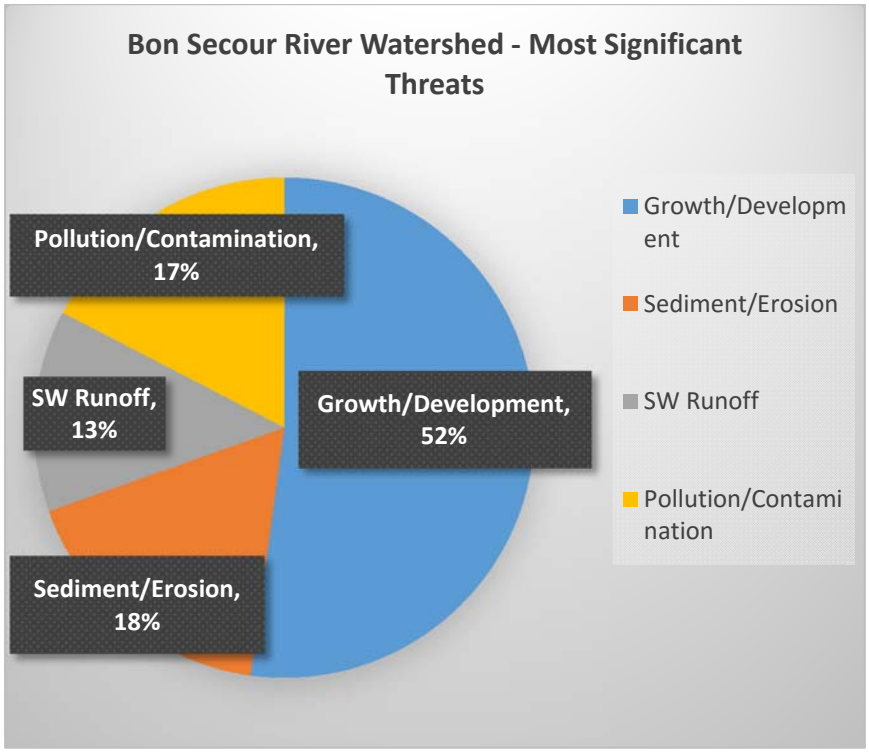
Bon Secour River Target Meeting n ≈ 15



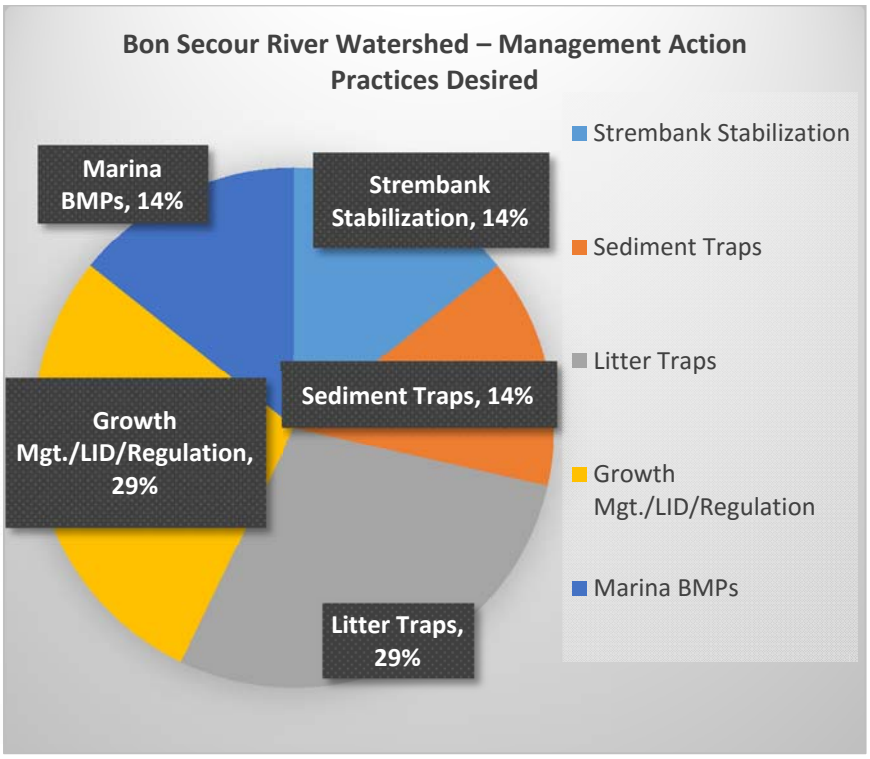
Bon Secour River Target Meeting n ≈ 15



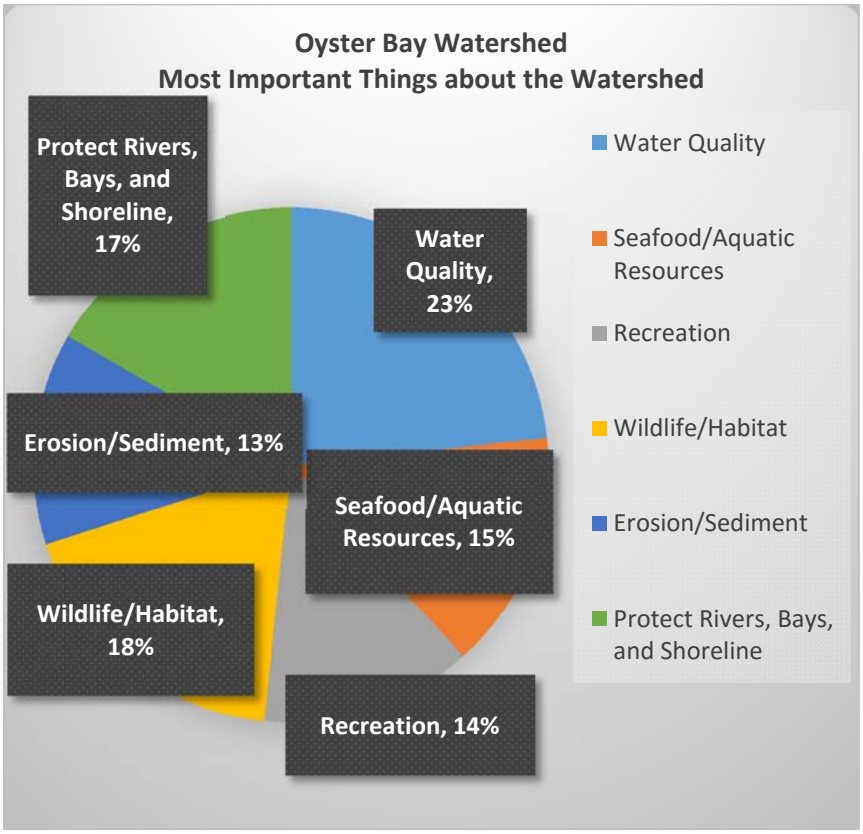
Bon Secour River Target Meeting n ≈ 15



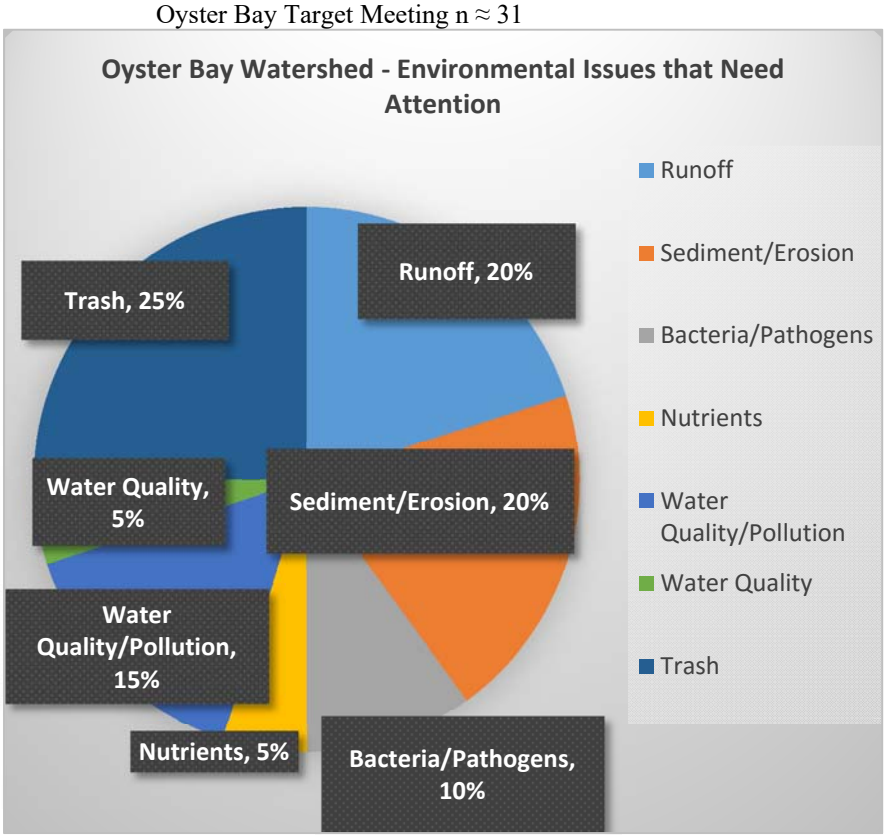
Bon Secour River Target Meeting n ≈ 15



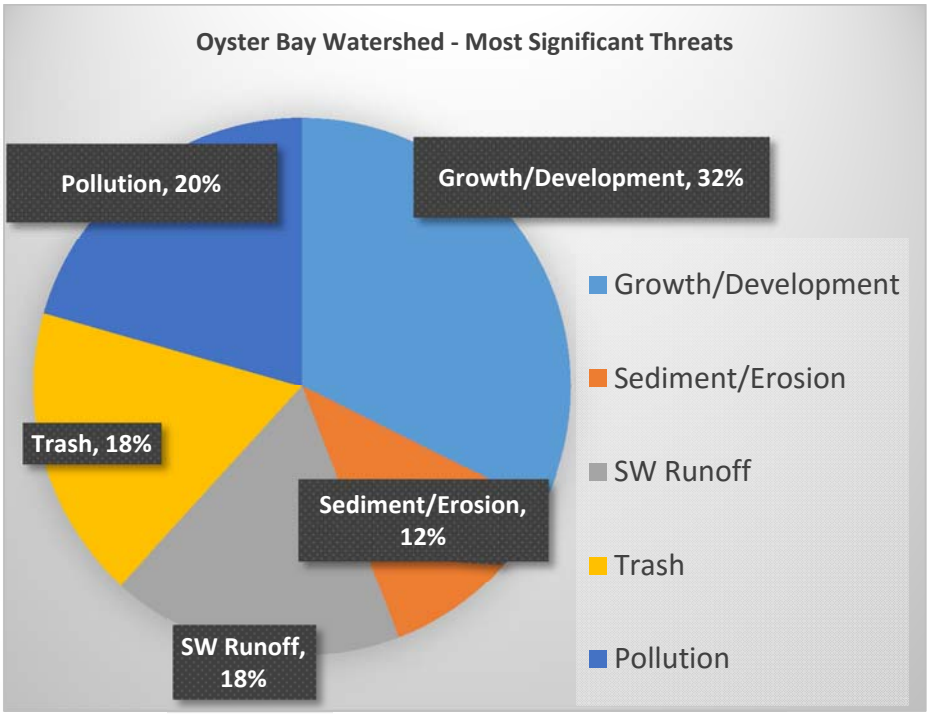
Oyster Bay Target Meetings n ≈ 31



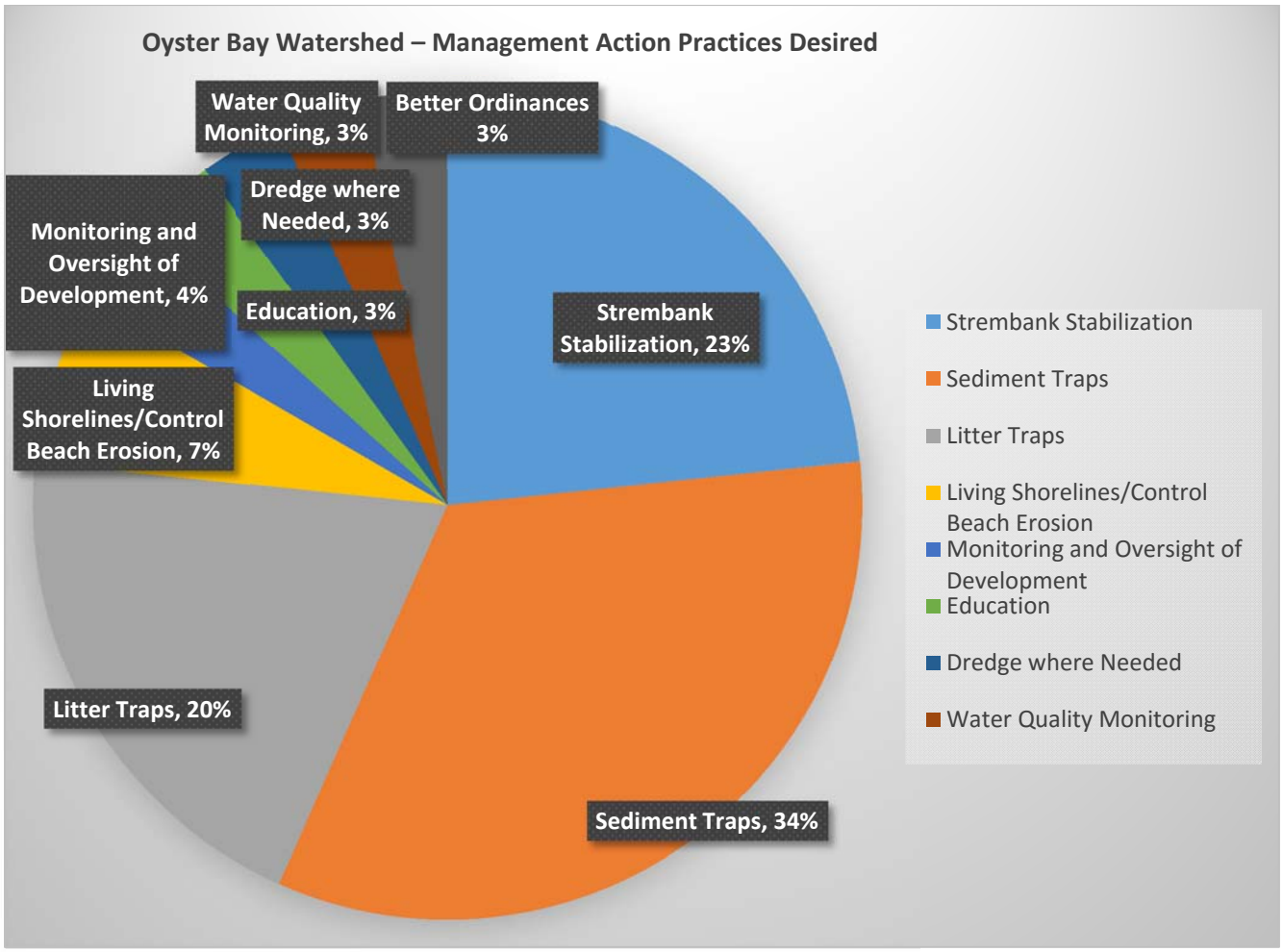
Oyster Bay Target Meeting n ≈ 31



Oyster Bay Target Meeting n ≈ 31



Oyster Bay Target Meeting ≈ 31


Oyster Bay Watershed – Management Action Practices Desired
Water Quality Monitoring, 3%
Better Ordinances 3%
Dredge where Needed, 3%
Monitoring and Oversight of Development, 4%
Education, 3%
Strembank Stabilization, 23%
Living Shorelines/Control Beach Erosion, 7%
Litter Traps, 20%
Sediment Traps, 34%
Strembank Stabilization
Sediment Traps
Litter Traps
Living Shorelines/Control Beach Erosion
Monitoring and Oversight of Development
Education
Dredge where Needed
Water Quality Monitoring

Section III.

Final Survey, Final Survey Results

Survey Monkey Questions

1. Prioritize the importance to you of the following identified watershed issues in the Bon Secour Watershed in order from 1 to 8 (1 being the most important, 8 being the least important)

A. Litter

B. Stormwater management/flooding

C. Erosion/sedimentation

D. Growth management

E. Water quality (i.e. nutrients, bacteria/pathogens)

F. Invasive plant species

G. Public access

H. Habitat protection

2. Prioritize the importance to you of the following identified watershed issues in the Oyster Bay Watershed in order from 1 to 7 (1 being the most important, 7 being the least important)

A. Stormwater management/flooding

B. Shoreline erosion

C. Growth management

D. Water quality (i.e. nutrients, bacteria/pathogens)

E. Invasive plant species

F. Habitat protection

G. Litter

3. Prioritize the importance to you of the following identified watershed issues in the Skunk Bayou Watershed in order from 1 to 4 (1 being the most important, 4 being the least important)

A. Stormwater management/flooding

B. Water quality (i.e. nutrients, bacteria/pathogens)

C. Invasive plant species

D. Litter

4. Prioritize Management Actions you would like to see implemented in the watersheds in order from 1 to 7 (1 being the most important, 7 being the least important).

A. Litter traps

B. Land preservation through purchase or easements

C. Regional detention basins for flood control

D. Living shorelines

E. Stream buffers

F. Stream restoration

G. Invasive species control

5. Would you use a public recreation access point if one was provided on the Bon Secour River? Yes /No

6. Would you be interested in volunteering to be a water monitor? Yes /No (A water monitor collects samples and evaluates physical, chemical and biological features of water)

7. Would you participate in a local watershed group? Yes /No (A watershed group is a grassroots organization whose mission is to protect and preserve resources in a watershed)

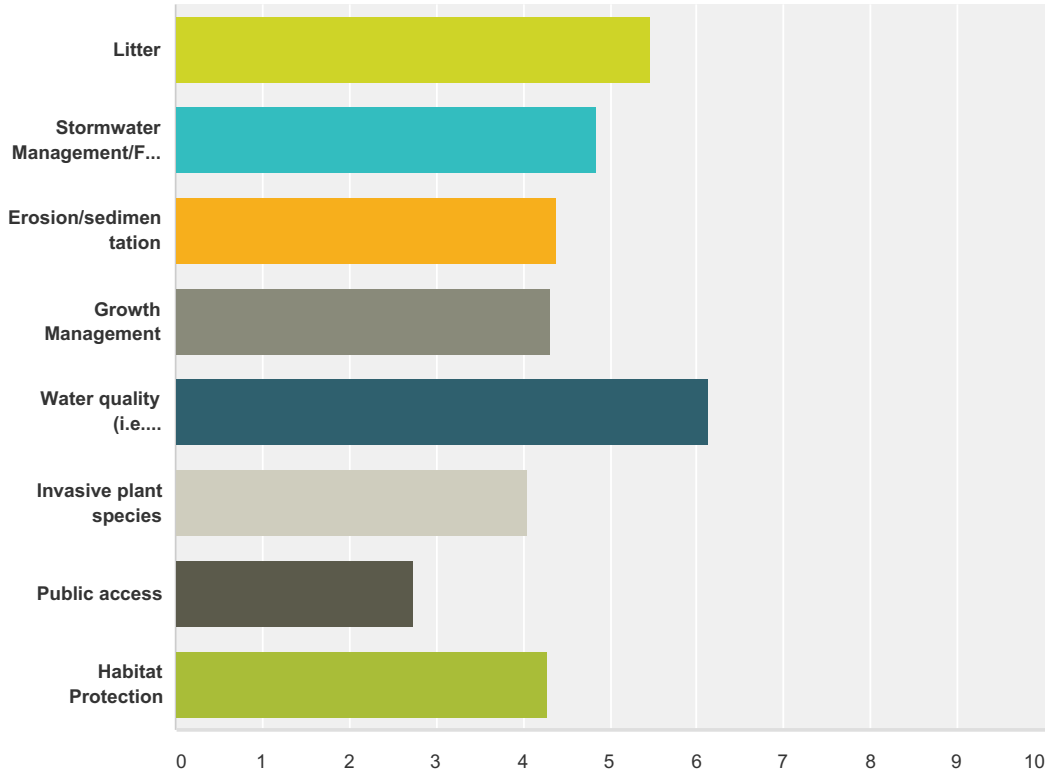
8. Would you participate in a watershed cleanup day? Yes /No

9. Would you be interested in serving on a committee to oversee implementation of the watershed management plan? Yes /No

10. Would you attend watershed educational workshops if they were provided? Yes /No

Q1 Prioritize the importance to you of the following identified watershed issues in the Bon Secour River Watershed in order from 1 to 8 (1 being the most important, 8 being the least important)

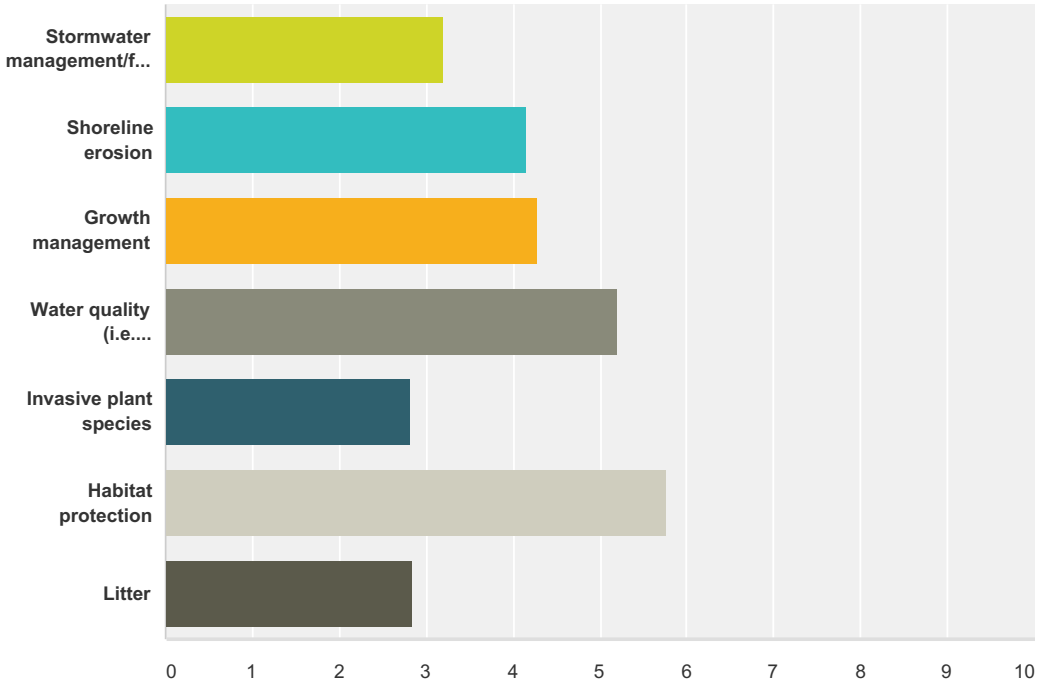
Answered: 244 Skipped: 2



	1	2	3	4	5	6	7	8	Total	Score
Litter	36.12% 82	10.13% 23	6.61% 15	10.13% 23	10.13% 23	10.13% 23	9.69% 22	7.05% 16	227	5.48
Stormwater Management/Flooding	9.65% 22	6.58% 15	10.96% 25	38.16% 87	14.91% 34	9.65% 22	6.58% 15	3.51% 8	228	4.85
Erosion/sedimentation	6.61% 15	9.69% 22	11.89% 27	12.33% 28	12.33% 28	40.97% 93	5.73% 13	0.44% 1	227	4.38
Growth Management	8.23% 19	9.96% 23	6.93% 16	10.82% 25	36.36% 84	7.36% 17	12.55% 29	7.79% 18	231	4.32
Water quality (i.e. nutrients, bacteria/pathogens)	15.45% 36	47.21% 110	11.16% 26	8.58% 20	5.58% 13	4.72% 11	6.44% 15	0.86% 2	233	6.14
Invasive plant species	0.43% 1	3.85% 9	36.32% 85	6.84% 16	8.97% 21	14.53% 34	14.96% 35	14.10% 33	234	4.06
Public access	5.70% 13	4.39% 10	5.26% 12	3.95% 9	5.26% 12	5.70% 13	37.72% 86	32.02% 73	228	2.73
Habitat Protection	20.75% 50	8.71% 21	9.96% 24	10.37% 25	6.64% 16	7.88% 19	4.15% 10	31.54% 76	241	4.29

Q2 Prioritize the importance to you of the following identified watershed issues in the Oyster Bay Watershed in order from 1 to 7 (1 being the most important, 7 being the least important)

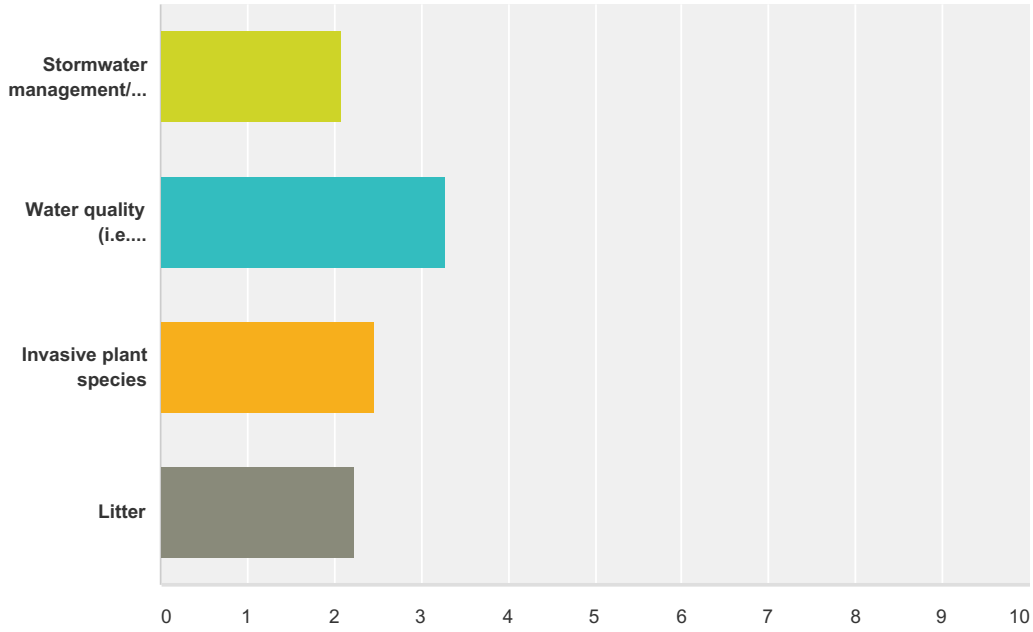
Answered: 241 Skipped: 5



	1	2	3	4	5	6	7	Total	Score
Stormwater management/flooding	6.73% 15	4.93% 11	10.76% 24	12.11% 27	16.59% 37	42.15% 94	6.73% 15	223	3.20
Shoreline erosion	6.58% 15	12.28% 28	15.35% 35	39.47% 90	12.72% 29	9.65% 22	3.95% 9	228	4.16
Growth management	5.63% 13	37.23% 86	9.09% 21	16.45% 38	6.06% 14	9.96% 23	15.58% 36	231	4.28
Water quality (i.e. nutrients, bacteria/pathogens)	20.43% 47	19.57% 45	39.13% 90	9.13% 21	5.65% 13	4.35% 10	1.74% 4	230	5.20
Invasive plant species	1.31% 3	3.93% 9	6.99% 16	7.42% 17	42.36% 97	18.78% 43	19.21% 44	229	2.81
Habitat protection	52.79% 123	15.45% 36	10.73% 25	7.30% 17	6.87% 16	4.29% 10	2.58% 6	233	5.77
Litter	9.36% 22	8.09% 19	8.51% 20	8.51% 20	8.51% 20	9.79% 23	47.23% 111	235	2.83

Q3 Prioritize the importance to you of the following identified watershed issues in the Skunk Bayou Watershed in order from 1 to 4 (1 being the most important, 4 being the least important)

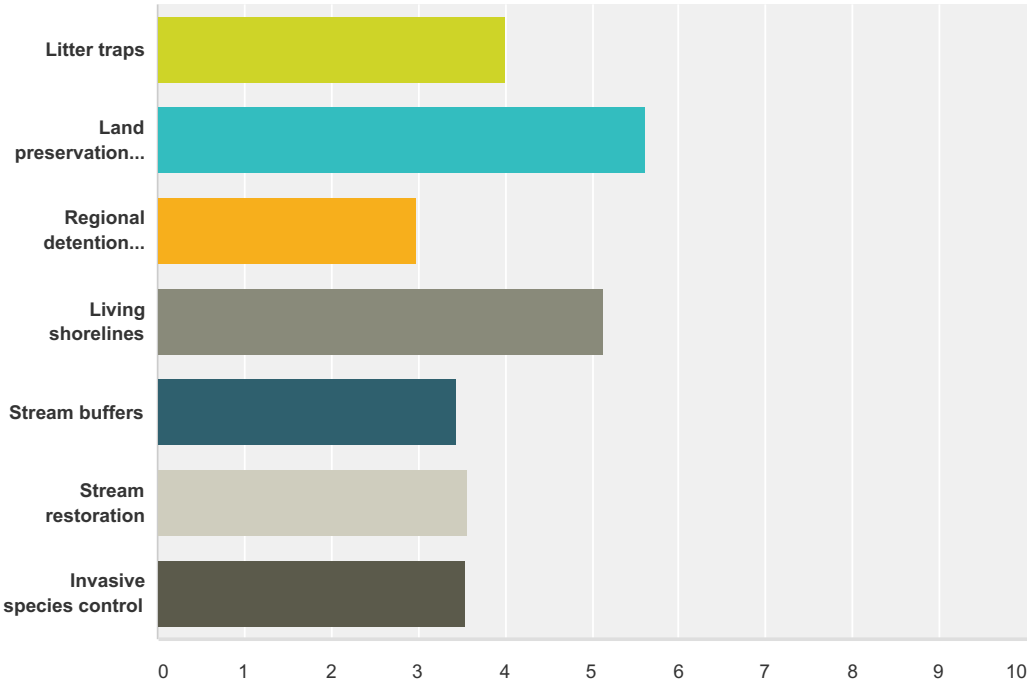
Answered: 239 Skipped: 7



	1	2	3	4	Total	Score
Stormwater management/ Flooding	**12.39%** 28	**26.11%** 59	**19.03%** 43	**42.48%** 96	226	2.08
Water quality (i.e. nutrients, bacteria/pathogens)	**40.00%** 92	**49.57%** 114	**8.70%** 20	**1.74%** 4	230	3.28
Invasive plant species	**32.47%** 75	**12.12%** 28	**24.68%** 57	**30.74%** 71	231	2.46
Litter	**17.30%** 41	**13.08%** 31	**46.41%** 110	**23.21%** 55	237	2.24

Q4 Prioritize Management Actions you would like to see implemented in the watersheds in order from 1 to 7 (1 being the most important, 7 being the least important).

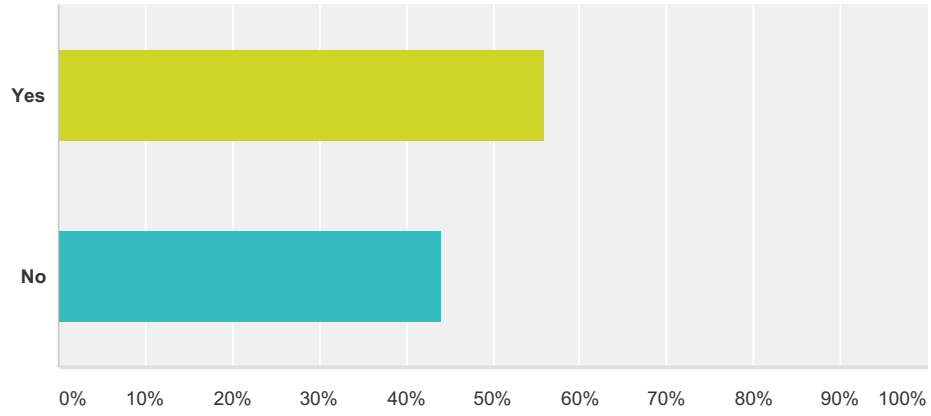
Answered: 242 Skipped: 4



	1	2	3	4	5	6	7	Total	Score
Litter traps	11.40% 26	12.72% 29	10.09% 23	32.46% 74	10.09% 23	10.09% 23	13.16% 30	228	4.00
Land preservation through purchase or easements	58.33% 133	10.96% 25	4.82% 11	6.14% 14	7.02% 16	5.70% 13	7.02% 16	228	5.62
Regional detention basins for flood control	8.37% 19	8.81% 20	10.57% 24	9.69% 22	11.89% 27	9.25% 21	41.41% 94	227	2.99
Living shorelines	8.37% 19	49.34% 112	12.33% 28	15.42% 35	7.49% 17	5.29% 12	1.76% 4	227	5.13
Stream buffers	2.59% 6	9.05% 21	12.07% 28	11.21% 26	44.40% 103	13.36% 31	7.33% 17	232	3.45
Stream restoration	9.96% 23	7.79% 18	12.99% 30	15.58% 36	9.09% 21	41.13% 95	3.46% 8	231	3.57
Invasive species control	5.06% 12	4.64% 11	36.71% 87	8.02% 19	8.44% 20	13.08% 31	24.05% 57	237	3.54

Q5 Would you use a public recreation access point if one was provided on the Bon Secour River?

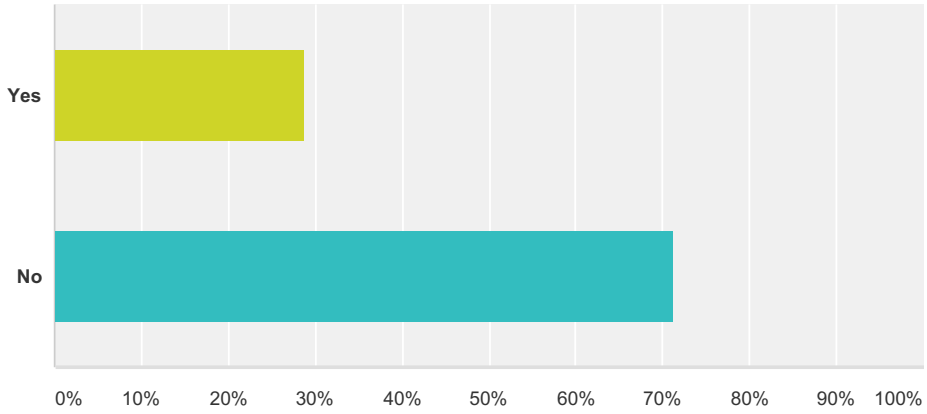
Answered: 245 Skipped: 1



Answer Choices	Responses	
Yes	**55.92%**	137
No	**44.08%**	108
Total		**245**

Q6 Would you be interested in volunteering to be a water monitor? (A water monitor collects samples and evaluates physical, chemical and biological features of water)

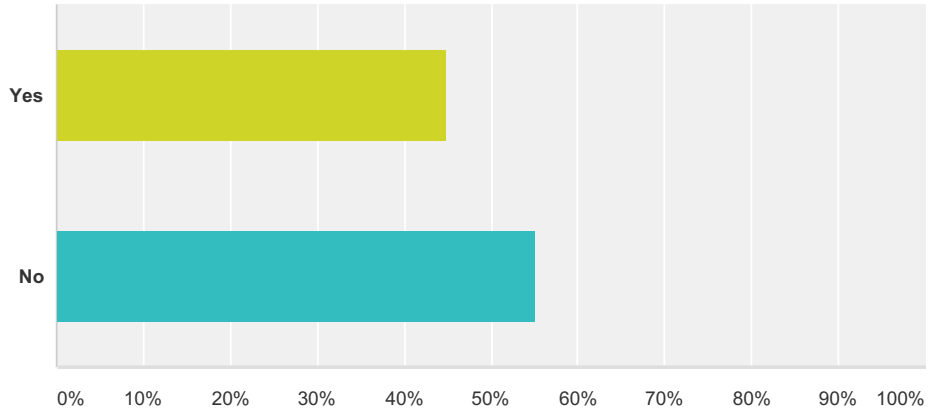
Answered: 239 Skipped: 7



Answer Choices	Responses	
Yes	**28.87%**	69
No	**71.13%**	170
Total		**239**

Q7 Would you participate in a local watershed group? (A watershed group is a grassroots organization whose mission is to protect and preserve resources in a watershed)

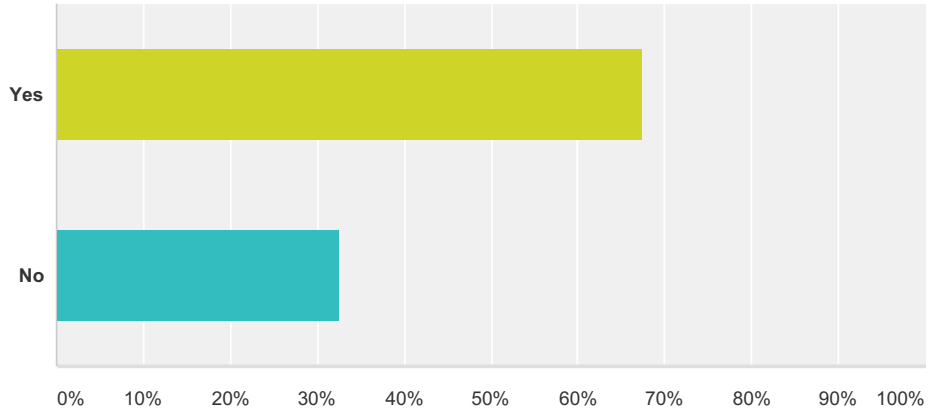
Answered: 238 Skipped: 8



Answer Choices	Responses	
Yes	**44.96%**	107
No	**55.04%**	131
Total		**238**

Q8 Would you participate in a watershed cleanup day?

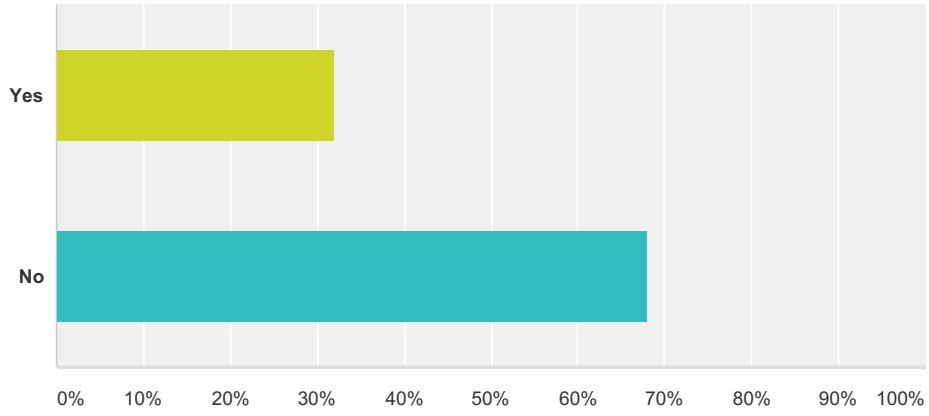
Answered: 239 Skipped: 7



Answer Choices	Responses	
Yes	**67.36%**	161
No	**32.64%**	78
Total		**239**

Q9 Would you be interested in serving on a committee to oversee implementation of the watershed management plan?

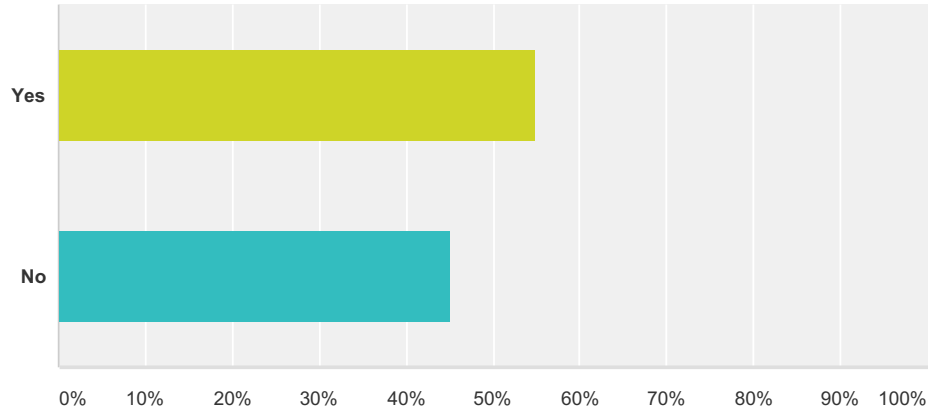
Answered: 235 Skipped: 11



Answer Choices	Responses	
Yes	**31.91%**	75
No	**68.09%**	160
Total		**235**

Q10 Would you attend watershed educational workshops if they were provided?

Answered: 237 Skipped: 9



Answer Choices	Responses	
Yes	**54.85%**	130
No	**45.15%**	107
Total		**237**

Q11 Please share any other comments you have about the Bon Secour River, Oyster Bay & Skunk Bayou Watersheds!

Answered: 93 Skipped: 153

#	Responses	Date
1	Beautiful	6/15/2016 9:59 AM
2	The permanent protection of the Bon Secour Wildlife Refuge lands and boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat and public recreation.	6/10/2016 7:09 PM
3	The permanent protection of the Bon Secour boundary at the Little Point Clear Unit should be the top priority for both public recreation and wildlife habitat.	6/10/2016 6:37 PM
4	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Lottle Pointe Clear Unit should be the top priority under this plan for both wildlife habitat, as well as public recreation.	6/10/2016 6:29 PM
5	Protection of land within the Bon Secour National Wildlife refuge at the Little Point Clear Unit is of paramount importance and should be addressed under this plan, for both wildlife habitat and public recreation purposes.	6/10/2016 5:50 PM
6	The protection of Bon Secour/Little Point Clear is very important.	6/10/2016 5:45 PM
7	we need to preserve habitat	6/10/2016 5:44 PM
8	The Bon Secour National Wildlife refuge boundary at the Little Point Clear Unit should be the primary priority. Protecting these lands benefits the neighboring areas and the wildlife habitat.	6/10/2016 5:28 PM
9	There is little public access. a simple kayak launch would be good.	6/2/2016 1:35 PM
10	we need permanent protection for the Bon Secour National Wildlife Refuge. The boundary at the Little Point Clear Unit deserves special consideration and protection	4/29/2016 8:50 AM
11	THE PERMANENT PROTECTION OF LANDS WITHIN THE BON SECOUR NATIONAL WILDLIFE REFUGE BOUNDRY AT THE LITTLE POINT CLEAR UNIT SHOULD BE THE TOP PRIORITY UNDER THIS PLAN, FOR BOTH WILDLIFE HABITAT, AS WELL AS PUBLIC RECREATION.	4/28/2016 8:20 PM
12	A top priority for this plan should be the permanent protection of lands within the Bon Secour W.R. Boundary (L.P.C. Unit).	4/27/2016 8:47 PM
13	Do not develope the three rivers area it should be maintained as a natural resource.	4/27/2016 6:51 PM
14	Permanent protection of lands within the Bon Secour National Wildlife Refuge Boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation .	4/27/2016 4:29 PM
15	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation.	4/27/2016 3:41 PM
16	Very excited this is being funded and implemented	4/27/2016 3:21 PM
17	Good for our community	4/27/2016 3:05 PM
18	Would like to see the prioritization of habitat protection and land/inholding acquisition in the Oyster Bay Watershed	4/27/2016 2:46 PM
19	N/A	4/27/2016 2:39 PM
20	Let keep it clean and protected	4/27/2016 1:50 PM
21	work on getting better snapper season	4/27/2016 1:43 PM
22	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation.	4/27/2016 12:13 PM
23	These are important locations on the Mobile Bay system- they need to be protected from development and habitat destruction.	4/27/2016 10:49 AM
24	I would like to assist with all of this, However I live in Birmingham. I will be retiring in 4-5 years and will participate at that time.	4/27/2016 10:15 AM
25	These are beautiful areas and I do not want to see them ruined by further development.	4/27/2016 8:27 AM

26	Land preservation through acquisition or conservation easements should be a priority across Southwest Alanama.	4/27/2016 7:57 AM
27	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation.	4/27/2016 7:38 AM
28	Permanent protection of lands within the Bon Secour Wildlife Refuge boundary at the little point clear unit should be top priority.	4/27/2016 6:50 AM
29	Permanent protection of the land at Bon Secour and Little point Clear Unit should be a top priority, for all involved both the species that live in the habitat and the humans that visit!	4/27/2016 5:49 AM
30	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the little point clear unit should be the top priority under this plan, for both wildlife habitat as well as public recreation.	4/26/2016 10:27 PM
31	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation.	4/26/2016 10:16 PM
32	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation.	4/26/2016 10:15 PM
33	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should b top priority under this plan, for both wildlife habitat, as well as public recreation.	4/26/2016 10:08 PM
34	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation.	4/26/2016 9:57 PM
35	Permanent protection for the Bon Secour National Wildlife Refuge to Little Point Clear.	4/26/2016 9:08 PM
36	Little Point Clear should be a top priority under this plan.	4/26/2016 9:04 PM
37	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation.	4/26/2016 8:51 PM
38	I would ask that this plan prioritize land preservation, specifically within Bon Secour NWR.	4/26/2016 8:46 PM
39	living shorelines is a must and is very important for the fish habitat	4/26/2016 8:33 PM
40	The permanent protection of lands within the Bon Secour National Wildlife boundary at The Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation	4/26/2016 8:28 PM
41	enough is enough on the developement	4/26/2016 7:51 PM
42	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation.	4/26/2016 7:50 PM
43	The permanent protection of land with the wildlife refuge of Bon secour wildlife refuge boundary at the little point clear unit should be top priority under this plan, for both wildlife habitat, as well as public recreation.	4/26/2016 7:40 PM
44	Must be protected. Much more important than the governors wall	4/26/2016 7:13 PM
45	These areas are highly important ecosystems and need protection.	4/26/2016 6:56 PM
46	Permanently protecting the lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan,for both wildlife habitat and public recreation.	4/26/2016 6:21 PM
47	I have concerns of future development of the areas mentioned above. Specifically the land that is West of the Bon Secour Wildlife Refuge on Ft. Morgan road. I currently use it as a kayak launch anh would hate to lose it.	4/26/2016 6:14 PM
48	The permanent protection ot the lands within the Bon secor wildlife refuge boundary at the little point clear unit should be a top priority under a this plan for both wildlife as well as public recreation	4/26/2016 5:17 PM
49	Emerging groups like this may not be highly functional right away. They probably won't be a 501 (c) 3 organization anytime soon. However, supporting these grassroots efforts increases the visibility of your plan and will ensure education and outreach is ongoing. Hopefully for this and many other reasons you will end up with a more robust implementation plan as a result of the effort. Also, elected officials (State, Regional and Local) are not providing adequate support for programs and policies that ensure natural resources in Southern Baldwin County are managed and protected for future generations. Implementing managed growth and sustainable development is critical to future protection of the watershed, and each surrounding coastal community.	4/26/2016 4:50 PM
50	Restoration of natural flows and aquatic environment	4/26/2016 4:41 PM
51	Some much different issues than fish river!	4/26/2016 4:36 PM
52	Pathogen/Biological/Chemical contamination is a concern for Bon Secour	4/26/2016 4:32 PM

53	Thanks for Caring	4/26/2016 4:12 PM
54	Would like to learn more about all	4/26/2016 4:00 PM
55	Habitat protection/land acquisition Key to managing growth and improving water quality	4/26/2016 3:56 PM
56	Litter and Stormwater Management	4/26/2016 3:47 PM
57	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation.	4/26/2016 3:25 PM
58	A primary issue it seems to me is how you can, dispite all the surveys & studies, impact the growth; i.e. the economic issues v.s. the watershed issues. Sadly growth and money seems to override and result in continuing development at the cost of preserving the watersheds and water sources.	4/26/2016 2:59 PM
59	Don't see anything about local legislation to set standards for growth and development - particularly with construction practices and land use.	4/26/2016 2:51 PM
60	I live in west mobile that's why it would be hard to participate in some activities.	4/26/2016 2:50 PM
61	I would request land protection identified at Bon Secour National Wildlife Refuge - Little Point Clear Unit be prioritized as a critical outcome with the final plan.	4/26/2016 2:46 PM
62	Oyster Bay- septic tanks and sewer plant run-off into oyster bay	4/26/2016 2:42 PM
63	The permanent protection of lands within Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, of both wildlife habitat, as well as public recreation.	4/26/2016 2:29 PM
64	protect Bon Secour National Wildlife Refuge boundary at the Little Point Clear unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation	4/26/2016 2:28 PM
65	the permanent protection of land within the Bon Secour National Wildlife Refuge boundary at the little point clear unit should be the top priority under this plan, both for wildlife habitat and well as public recreation	4/26/2016 2:27 PM
66	a permanent protection of land in the Bon Secour National Wildlife Refuge	4/26/2016 2:11 PM
67	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation	4/26/2016 2:03 PM
68	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation.	4/26/2016 1:27 PM
69	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation.	4/26/2016 12:51 PM
70	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation.	4/26/2016 12:35 PM
71	Let's keep our water clean.	4/26/2016 12:31 PM
72	well done surveys	4/26/2016 10:23 AM
73	Grateful for what you are doing. Wish there was access to Oyster Bay.	4/26/2016 10:17 AM
74	Maintain high water quality and biodiversity of wildlife, suitable habitat are critical to maintaining the quality of life in SW Alabama. Second is controlling development in sensitive areas.	4/26/2016 10:06 AM
75	Very concerned about boast traffic, shoreline/estuary erosion from oyster bay on intercoastal to Mobile Bay area.	4/26/2016 9:42 AM
76	With all these locations, protecting the existing resources is far better than restoration or creation of new areas. Land protection is better.	4/26/2016 9:34 AM
77	No attention to waste water disposal!	4/26/2016 8:56 AM
78	Ecological goldmine and it should be protected!	4/26/2016 8:43 AM
79	More public access while preserving and protecting their unique environments through land acquisitions and public education.	4/24/2016 9:33 AM
80	Keep them clean	4/20/2016 2:30 PM
81	needs protection from unorganized or over development.....	4/20/2016 2:18 PM
82	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation.	4/20/2016 1:24 PM

83	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation.	4/20/2016 11:17 AM
84	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation.	4/20/2016 8:50 AM
85	The permanent protection of lands within the Bon Secour Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority of the plan, for both wildlife habitat, as well as public recreation.	4/19/2016 6:25 PM
86	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation.	4/19/2016 10:46 AM
87	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation	4/19/2016 8:53 AM
88	The permanent protection of lands within the Bon Secour National Wildlife Refuge boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation.	4/18/2016 4:46 PM
89	The permanent protection of lands within the Bon Secour Nation Wildlife Refugee boundary at the Little Point Clear Unit should be the top priority under this plan, for both wildlife habitat, as well as public recreation.	4/18/2016 4:23 PM
90	I think land acquisition is critical.Fee simple property acquisition is just as important as the purchase of conservation easements. ex the Little Point Clear Unit Bon Secour Refuge land acquisition project. A qualified holder for the conservation easements will have to be identified. A good portion of Baldwin County is unzoned. If ecologically sensitive tracts are acquired for conservation or establishment of riparian buffers this could serve as a mechanism to ensure a high quality of life and provide balance	4/18/2016 3:41 PM
91	I think with the speed that this area is growing, LAND PROTECTION is our biggest concern. No matter how many restoration and wetland creation projects we do, nothing can beat intact natural habitat.	4/18/2016 12:10 PM
92	Little Point Clear Unit should be top Priority under this plan, for both wildlife habitat, as well as public recreation.	4/15/2016 7:33 PM
93	This survey should be publicized and shared among local stakeholders or interests in order to have widespread community input.	4/14/2016 2:56 PM

APPENDIX B:
FINANCIAL RESOURCES

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FEDERAL FUNDING PROGRAMS

Department of the Interior's Land and Water Conservation Fund

The Land and Water Conservation Fund (LWCF) program supports the protection of federal public lands and waters—including national parks, forests, wildlife refuges and recreation areas—and voluntary conservation on private land. LWCF investments secure public access, improve recreational opportunities, and preserve ecosystem benefits for local communities.

The state side of the LWCF provides matching grants to states and local governments for the acquisition and development of public outdoor recreation areas and facilities. Over its first 49 years (1965–2014), LWCF provided more than $16.7 billion to acquire new federal recreation lands as grants to state and local governments. The fund has provided 40,400 grants to state and local governments over 40 years.

Gulf Coast Ecosystem Restoration Council (RESTORE) Funded Priorities

The Deepwater Horizon oil spill led to passage of the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States (RESTORE) Act. The RESTORE Act dedicates 80% of all CWA administrative and civil penalties related to the Deepwater Horizon oil spill to the Gulf Coast Restoration Trust Fund (Trust Fund). The RESTORE Act also created the Council, an independent federal entity comprised of the five Gulf Coast states and six federal agencies. The Council will administer a portion of the Trust Fund known as the Council-Selected Restoration Component to undertake projects and programs, using the best available science, which would restore and protect the natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches, coastal wetlands, and economy of the Gulf Coast.

In 2015, it was reported that the Funded Priorities List funds approximately $156.6 million in restoration activities, such as hydrologic restoration, land conservation, and planning for large-scale restoration projects, and prioritizes 12 restoration activities for possible funding in the future, subject to environmental compliance and further Council review. The Council is reserving approximately $26.6 million for implementing priority activities in the future. The Council intends to play a key role in helping to ensure that the Gulf's natural resources are sustainable and available for future generations.

https://www.restorethegulf.gov/sites/default/files/FPL_FINAL_Dec9Vote_EC_Library_Links.pdf

National Fish Habitat Action Plan

The mission of the National Fish Habitat Action Plan is to protect, restore, and enhance the nation's fish and aquatic communities through partnerships that foster fish habitat conservation and improve the quality of life for the American people. This mission will be achieved by: 1) supporting existing fish habitat partnerships and fostering new efforts, 2) mobilizing and focusing national and local support for achieving fish habitat conservation goals, 3) setting national and regional fish habitat conservation goals, 4) measuring and communicating the status and needs of fish habitats, and 5) providing national leadership and coordination to conserve fish habitats.

https://www.fws.gov/midwest/fisheries/nfhap.html

National Park Service National Maritime Heritage Grant

The National Maritime Heritage Grant program provides funding for education or preservation projects. Education projects can request $15,000–$50,000 and preservation projects can request $50,000–$200,000. Funding from the Maritime Heritage Grant is competitive and requires a one-to-one match with non-federal assets from non-federal sources. Project funds are disbursed from the Maritime Heritage Program directly to the State Historic Preservation Offices that make sub-grants to applicants.

https://www.nps.gov/maritime/grants/apply.htm

National Oceanic and Atmospheric Administration's Community-based Marine Debris Removal Grant Program

The National Oceanic and Atmospheric Administration's (NOAA) Marine Debris Program offers funding that supports driven, community-based marine debris prevention and removal projects. These projects benefit coastal habitats, waterways, and wildlife including migratory fish.

https://marinedebris.noaa.gov/funding/funding-opportunities

National Oceanic and Atmospheric Administration's Marine Debris Prevention, Education and Outreach Partnership Grants

NOAA's Marine Debris Program offers funding to support activities to educate the public about the issue of marine debris that: 1) encourage changes in behavior to reduce and address marine debris; 2) develop and implement activities to reduce and prevent marine debris working with students, teachers, industries, and the public; and, 3) engage the public in active, personal participation (e.g., a small-scale shoreline cleanup with students or other hands-on activities). This grant's purpose is to involve audiences in measurable behavior changing activities and limit the increase of marine debris in the world's oceans.

https://marinedebris.noaa.gov/funding/funding-opportunities

National Oceanic and Atmospheric Administration's Gulf of Mexico Bay-Watershed Education and Training Program

NOAA Gulf of Mexico Bay-Watershed Education and Training (Gulf B-WET) Program is an environmental education program that promotes locally relevant, authentic, experiential learning focused on K–12 audiences. The primary delivery of Gulf B-WET is through competitive funding that promotes Meaningful Watershed Educational Experiences, which are multi-stage activities that include learning both outdoors and in the classroom and aim to increase the environmental literacy of all participants. Teachers should support students to investigate topics both locally and globally that are of interest. Students should strive to identify actions that are available to address the environmental issues within their focus area.

http://sero.nmfs.noaa.gov/outreach_education/gulf_b_wet/

National Oceanic and Atmospheric Administration's RESTORE Act Science Program (FFO 2017)

This funding opportunity focuses on living coastal and marine resources and their habitats and continues the Science Program's commitment to producing timely and high-quality scientific findings and products to support the management and sustainability of the Gulf of Mexico ecosystem, including its fisheries. The funding competition has two priorities. A research priority directed at six specific areas of living coastal and marine resource research, and a decision-support tool priority directed at improving the tools available for resource management. To receive funding, applicants need to directly address a resource management need and have a clear plan for how their research findings or decision-support tool will be used by specific resource managers.

https://restoreactscienceprogram.noaa.gov/funding/ffo-2017

National Oceanic and Atmospheric Administration's FY2017 Broad Agency Announcement

The Broad Agency Announcement is a mechanism to encourage research, education and outreach, innovative projects, or sponsorships that are not addressed through NOAA's competitive discretionary programs. Project proposals included in RFPs must address one or more of the following four long-term mission goal descriptions contained in the NOAA Strategic Plan: 1) climate adaptation and mitigation, 2) weather-ready nation, 3) healthy oceans, 4) resilient coastal communities and economies.

https://coast.noaa.gov/funding/_pdf/NOAA-BAA-NOAA-NFA-NFAPO-2016-2004791-posted-12.30.2015-closing-09.30.2017.pdf

National Oceanic and Atmospheric Administration's Community-based Restoration Program

The NOAA Restoration Center's Community-based Restoration Program invests money and technical expertise in high-priority habitat restoration projects that instill strong conservation values and engage citizens in hands-on activities. Through this program, NOAA, its partners, and thousands of volunteers are actively restoring coastal, marine, and migratory fish habitat

across the nation. In 2007, NOAA's Community-based Restoration Program and the Southeast Aquatic Resources Partnership (SARP) formed a long-term partnership to fund, implement and monitor restoration projects benefitting marine and anadromous fish habitat in the nine southeastern states. The program: 1) invests millions of dollars annually in restoration, 2) leverages double and triple the outcome by working with partner organizations, 3) provides restoration science and technical guidance, including assistance with environmental compliance, and monitoring, 4) promotes community involvement and stewardship of local projects, and 5) implements special initiatives to remove marine debris and re-open coastal river habitat to fish that migrate inland from the ocean.

http://www.habitat.noaa.gov/restoration/programs/crp.html

National Oceanic and Atmospheric Administration's Environmental Literacy Program

The Environmental Literacy Program supports long-term partnerships that enable the education community to incorporate and deliver the latest scientific information on the topics of the ocean, coasts, weather, and climate. NOAA's Office of Education regularly offers the Environmental Literacy Grant competition. In 2015 and 2016 the competition focused on helping communities build the environmental literacy necessary for resilience to extreme weather events and environmental hazards. Annual environmental literacy grants are creating new models for how education can improve community resilience.

http://www.noaa.gov/office-education/elp/grants

Natural Resource Damage Assessment Restoration and Implementation

The objective of the Natural Resource Damage Assessment Restoration and Implementation Program is to restore natural resources injured by oil spills or hazardous substance releases. Assistance is provided to individuals and groups to fund assessments, implementation, recovery of damages, or any related restoration activity necessary to meet the intent of the Natural Resource Damage Assessment and Restoration Program.

https://www.cfda.gov/index?s=program&mode=form&tab=core&id=ef73ed282bf391495edb6b77777a5635

National Science Foundation's Environmental Engineering R&D Grant Program

The goal of the Environmental Engineering Program is to encourage transformative research which applies scientific and engineering principles to avoid or minimize solid, liquid, and gaseous discharges resulting from human activities on land, inland and coastal waters, and air, while promoting resource and energy conservation and recovery. The program also fosters cutting-edge scientific research for identifying, evaluating, and monitoring the waste assimilative capacity of the natural environment and for removing or reducing contaminants from polluted air, water, and soils. Major areas of interest include: 1) enhancing the availability of high quality water supplies, and 2) fate and transport of contaminants of emerging concern in air, water, and soils.

http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=501029

Southeast Aquatic Resources Partnership's Aquatic Habitat Restoration Program

SARP is the largest Fish Habitat Partnership in the Southeast and works with local partners to address regional habitat objectives and national conservation priorities. Through these grant programs and collaboration with partners, SARP is integral to the identification and implementation of restoration projects throughout the region. SARP, with funding from the U.S. Fish and Wildlife Service (USFWS)/National Fish Habitat Partnership, supports projects in or associated with watersheds in conservation focus areas throughout the SARP geography (the Bon Secour River, Oyster Bay and Skunk Bayou watersheds were included in the focus area for 2016). National Fish Habitat Partnership funding provides an opportunity for individuals, organizations and institutions to participate in the ongoing process of conservation, management, and restoration.

http://southeastaquatics.net/about/funding-opportunites/fy-2016-sarp-usfws-nfhp-funding-opportunity/fy-2016-sarp-usfws-nfhp-funding-opportunity

U.S. Department of Agriculture, Natural Resources Conservation Service's Environmental Quality Incentives Program (Baldwin County)

The Environmental Quality Incentives Program (EQIP) is a voluntary program that provides financial and technical assistance to agricultural producers to plan and implement conservation practices that improve soil, water, plant, animal, air and related natural resources on agricultural land and non-industrial private forestland. The EQIP may also help producers meet federal, state, tribal, and local environmental regulations. Contact the Baldwin County District Conservationist for more information.

http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/

http://www.nrcs.usda.gov/wps/portal/nrcs/detail/al/about/?cid=nrcs141p2_022706

U.S. Department of Agriculture, Natural Resources Conservation Service's Conservation Stewardship Program

The Conservation Stewardship Program (CSP) helps landowners build on existing conservation efforts while strengthening their farming operation. Financial and technical assistance can help improve grazing conditions, increase crop yields, or develop wildlife habitat. The U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), office works directly with producers to design a custom CSP plan. Bundles have enhancements grouped according to land use—crop, pasture, range and forest-as well as our agency initiatives. Bundles receive a higher level of financial assistance to encourage the holistic approach to generate additional conservation benefits.

http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp/#

http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/financial/csp/?cid=nrcseprd1288624

U.S. Department of Agriculture, Natural Resources Conservation Service's Agricultural Conservation Easement Program

The Agricultural Conservation Easement Program (ACEP) provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits. Under the Agricultural Land Easements component, NRCS helps Indian tribes, state and local governments and non-governmental organizations protect working agricultural lands and limit non-agricultural uses of the land. Under the Wetlands Reserve Easements component, NRCS helps to restore, protect, and enhance enrolled wetlands. Wetland Reserve Easements provide habitat for fish and wildlife, including threatened and endangered species; improve water quality by filtering sediments and chemicals; reduce flooding; recharge groundwater; protect biological diversity; and provide opportunities for educational, scientific and limited recreational activities.

http://www.nrcs.usda.gov/wps/portal/nrcs/detail/al/programs/easements/acep/?cid=stelprdb1256043

U.S. Endowment and U.S. Environmental Protection Agency's Healthy Watersheds Consortium Grant Program

The Healthy Watersheds Consortium Grant Program goal is to accelerate strategic protection of healthy, freshwater ecosystems and their watersheds. This goal will be achieved by: 1) funding key projects identified in existing watershed protection or conservation plans, 2) building the sustainable organizational infrastructure, social support, and long-term funding commitments necessary to implement large-scale protection of healthy watersheds, and 3) supporting innovative or catalytic projects that may accelerate or broadly advance the field of practice for watershed protection efforts.

http://www.usendowment.org/healthywatersheds.html

U.S. Environmental Protection Agency's Water Pollution Control (Section 106) Grant Program

Under Section 106 of the CWA (33 U.S. Code §1256), the U.S. Environmental Protection Agency (USEPA) provides assistance to states (including territories and the District of Columbia), interstate agencies, and eligible tribes to establish and implement ongoing water pollution control programs. Each state and territory has established programs to protect and restore fresh waters, coastal waters, and wetlands as outlined in the CWA. Section 106 grants support the implementation of these CWA programs including: 1) monitoring and assessing ambient water quality, 2) developing and reviewing water quality standards, 3) developing total maximum daily loads, 4) providing permits to dischargers through the NPDES, 5) overseeing and enforcing NPDES permits, 6) developing watershed and groundwater plans; and 7) providing training and public information.

https://www.epa.gov/water-pollution-control-section-106-grants/grants-state-and-interstate-agencies-under-section-106

U.S. Environmental Protection Agency's Wetland Program Development Grants

The Wetland Program Development Grants provide eligible applicants an opportunity to conduct projects that promote the coordination and acceleration of research, investigations, experiments, training, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, reduction, and elimination of water pollution. The program is meant to build the capacity of state/tribal/local governments to increase the quantity and quality of wetlands in the U.S. by conserving and restoring wetland acreage and improving wetland condition. Core elements must include one or more of the following: 1) monitoring and assessment, 2) voluntary restoration and protection, 3) regulatory approaches including CWA 401 certification, and 4) wetland-specific water quality standards.

https://www.epa.gov/wetlands/wetland-program-development-grants

U.S. Environmental Protection Agency's Urban Waters Small Grants

The mission of USEPA's Urban Waters Program is to help local residents and their organizations, particularly those in underserved communities, restore their urban waters in ways that also benefit community and economic revitalization. Urban Waters Small Grants are expanding the ability of communities to engage in activities that improve water quality in a way that also advances community priorities.

https://www.epa.gov/urbanwaters/urban-waters-small-grants

U.S. Environmental Protection Agency's Gulf of Mexico Program

Since its inception in 1988, the Gulf of Mexico Program has developed multiple jurisdictional agreements with federal and state partners as well as international partners. With the cooperation of its partners, the Gulf of Mexico Program successfully implements and funds projects that lead to a thriving ecosystem. The projects center on: 1) improving and/or restoring water and habitat quality to meet water quality standards in watersheds throughout the five Gulf States and the Mississippi River Basin, 2) promoting and supporting environmental education and outreach to the inhabitants of the Gulf of Mexico watershed, 3) strengthening community resilience by promoting and supporting environmental education and outreach to the general public and vulnerable communities, 4) protecting, enhancing, or restoring coastal and upland habitats within the Gulf of Mexico watershed.

https://www.epa.gov/aboutepa/about-gulf-mexico-program-gmp

U.S. Environmental Protection Agency's State Water Protection Grants

The program goal is to support the coordination and acceleration of research, investigations, experiments, training, demonstrations, surveys, and studies relating to the causes, effects (including health and welfare effects), extent, prevention, reduction, and elimination of water pollution. Funding priorities include, but are not limited to, training, surveys, studies, investigations, and demonstration projects to support water quality improvement, watershed planning and management, nonpoint source planning, wetlands protection, coastal and estuarine planning, treatment technologies, water efficiency, and environmental management systems.

https://www.cfda.gov/index?s=program&mode=form&tab=step1&id=70786832898a9a93350c31c6bb7260c8

U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program

Through voluntary agreements the Partners program provides expert technical assistance and cost-share incentives directly to private landowners to restore fish and wildlife habitats. Field biologists work one-on-one with landowners and partners to plan, implement, and monitor activities. Working together with more than 45,000 landowners and 3,000 conservation partners, the Program has successfully restored over 1,000,000 acres of wetland habitat; 3,000,000 acres of upland habitat and 11,000 miles of streams.

https://www.fws.gov/partners/

U.S. Fish and Wildlife Service Coastal Program

The Coastal Program is one of USFWS's most effective resources for restoring and protecting fish and wildlife habitat on public and privately owned lands. Working with partners, locally-based staff provide technical assistance for habitat conservation design and planning and financial assistance for habitat restoration and protection projects.

https://www.fws.gov/coastal/

U.S. Fish and Wildlife Service National Coastal Wetlands Grant

The National Coastal Wetlands Grant annually delivers conservation dollars to help coastal states and U.S. territories to protect and restore coastal wetlands. Funding is provided through the Sport Fish Restoration and Boating Trust Fund. State and local governments, private landowners, conservation groups and other partners contribute additional funds to these projects, which acquire, restore, or enhance coastal wetlands and adjacent uplands to provide long-term conservation benefits to fish and wildlife and their habitats.

https://www.fws.gov/coastal/coastalgrants/

U.S. Fish and Wildlife Service Boating Infrastructure Grant Program

The Boating Infrastructure Grant Program provides grant funds to the states, the District of Columbia, and insular areas to construct, renovate, and maintain tie-up facilities with features for transient boaters in vessels 26 feet or more in length and to produce and distribute

information and educational materials about the program. The Boating Infrastructure Grant Program includes two funding tiers: Tier One (non-competitive) and Tier Two (nationally competitive). Under Tier One, each state, the District of Columbia, and insular areas may receive funding for eligible projects up to $200,000 annually. Tier Two funds are made available through a nationally competitive process. Tier Two proposals received are reviewed, evaluated, and ranked by a national panel, with the final decision for funding made by the Director of USFWS. The ranking criteria, eligible projects, and regulations are listed in 50 CFR 86.

https://wsfrprograms.fws.gov/Subpages/GrantPrograms/BIG/BIG.htm

U.S. Fish and Wildlife Service State Wildlife Grant Program

The State Wildlife Grant Program provides federal grant funds to state fish and wildlife agencies for developing and implementing programs that benefit wildlife and their habitats, including species that are not hunted or fished. Grant funds may be used to address a variety of conservation needs, such as research, fish and wildlife surveys, species restoration, habitat management, and monitoring, that are identified within a state's Wildlife Action Plan. These funds may also be used to update, revise, or modify a state's Wildlife Action Plan.

https://wsfrprograms.fws.gov/Subpages/GrantPrograms/SWG/SWG.htm

U.S. Fish and Wildlife Service Urban Wildlife Refuge Program

The goal of the Urban Wildlife Refuge Program is to engage urban communities as partners in wildlife conservation. Excellence may be achieved through the eight standards that serve as a framework for collaboration among the Service and urban communities, whether such collaboration is on or off USFWS lands. The eight standards are: 1) know and relate to the community, 2) connect urban people with nature via stepping stones of engagement, 3) build partnerships, 4) be a community asset, 5) ensure adequate long-term resources, 6) provide equitable access, 7) ensure visitors feel safe and welcome, and 8) model sustainability.

https://www.fws.gov/urban/soe.php

STATE FUNDING PROGRAMS

Alabama Clean Water State Revolving Fund

The Clean Water State Revolving Fund and the Drinking Water State Revolving Fund are low interest loan programs intended to finance public water and wastewater infrastructure improvements and stormwater/nonpoint source projects in Alabama. Stormwater/nonpoint source projects can include decentralized wastewater treatment, streambank restoration, green roofs, permeable pavements, rain gardens, and bio-infiltration practices.

http://www.adem.state.al.us/programs/water/srfreports/SRFbrochure.pdf

Alabama Coastal Area Management Program

Annual Alabama Coastal Area Program (ACAMP) activities include Coastal Cleanup, implementation of public access construction projects, planning support for local governments, and providing grant 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, resiliency, and preparedness of coastal communities and economies.

http://www.outdooralabama.com/alabama-coastal-area-management-program

Alabama Department of Environmental Management Section 319 Grant Funds

Alabama Nonpoint Source Implementation Grants are to fund projects in support of Alabama's Nonpoint Source Management Program. Funding is distributed via a competitive process to projects that will lead to direct reductions in pollutant loads and measurable water quality improvements.

http://adem.alabama.gov/programs/water/nps/319grant.cnt

Private Funding Programs

Conserve Alabama Foundation Watershed Management Outreach Program

In partnership with The Nature Conservancy in Alabama and the Mobile Bay National Estuary Program, Conservation Alabama Foundation develops information and materials to distribute to coastal communities that are involved in the watershed management planning process. Conservation Alabama Foundation's role is to make sure the community is kept up to date and aware of the plan itself and its progress.

http://www.conservationalabamafoundation.org/watershed-plans/

Cornell Douglas Foundation Grant Program

The Cornell Douglas Foundation provides grants to organizations that advocate for environmental health and justice, encourage stewardship of the environment, and further respect for sustainability of resources. The average grant amount is $10,000. Watershed protection and land conservation are among several other areas of interest. Environmental focus areas must include one or more of the following: 1) animals/wildlife, 2) biodiversity, 3) conservation, 4) environmental health, 5) environmental justice, 6) habitats/ecosystems, 7) plants, 8) pollution, 9) stormwater, 10) sustainability, 11) trees/forests, 12) water, and 13) watersheds.

http://eeinalabama.org/resource/about.aspx?s=107141.0.0.37934

http://www.cornelldouglas.org/apply/

Gulf of Mexico Research Initiative RFP Opportunities

The objectives of the Gulf of Mexico Research Initiative are to investigate the impacts of the oil, dispersed oil, and dispersant on the ecosystems of the Gulf of Mexico and affected Gulf coastal states in a broad context of improving fundamental understanding of the dynamics of such events, the associated environmental stresses, and the public health implications. The Gulf of Mexico Research Initiative will also develop improved spill mitigation, oil and gas detection, characterization, and remediation technologies. The ultimate goal is to improve society's ability to understand and respond to the impacts of petroleum pollution and related stressors to the marine and coastal ecosystems, with an emphasis on conditions in the Gulf of Mexico.

Research themes include: 1) physical distribution, dispersion, and dilution of petroleum (oil and gas), its constituents, and associated contaminants (e.g., dispersants) under the action of physical oceanographic processes, air-sea interactions, and tropical storms; 2) chemical evolution and biological degradation of the petroleum/dispersant systems and subsequent interaction with coastal, open-ocean, and deep-water ecosystems; 3) environmental effects of the petroleum/dispersant system on the sea floor, water column, coastal waters, beach sediments, wetlands, marshes, and organisms; and the science of ecosystem recovery; 4) technology developments for improved response, mitigation, detection, characterization, and remediation associated with oil spills and gas releases, and 5) impact of oil spills on public health, including behavioral, socioeconomic, environmental risk assessment, community capacity, and other population health considerations and issues.

http://gulfresearchinitiative.org/request-for-proposals/

Gulf Research Program Capacity Building Grants

These grants support projects conducted by community and/or regionally-focused organizations that seek to advance understanding of how science can serve community needs and to extend the use of such information to address coastal challenges. Proposed projects should seek to improve the capacity of organizations by supporting the development, expansion, testing, and/or evaluation of strategies, programs, and approaches for achieving these goals. For the purposes of these grants, "community and/or regionally-focused organizations" are defined as nonprofit and nonacademic entities that support educational, service, and/or coordination activities and that typically include some engagement of community residents, decision-makers, and/or leaders at a regional, state, or local level.

http://www.nationalacademies.org/gulf/grants/capacitygrants/index.htm

Gulf Star Grants Program

Gulf Star is a public-private partnership administered by the Gulf of Mexico Alliance, a 501c3 public charity with flexibility to collaborate with others in the Gulf region. Gulf Star partners are agencies, businesses, private organizations, and citizens that provide funding for projects that are tied directly to Gulf economies, such as sustainable seafood, loss of critical habitats, coastal resilience, water resources, living marine resources, and monitoring. Priority issues include: Coastal Resiliency, Data & Monitoring, Education & Engagement, and Wildlife & Fisheries.

http://www.gulfofmexicoalliance.org/tools-and-resources/gulf-star-overview/

Legacy Environmental Education Grants

Legacy provides environmental education grants annually through the Legacy Grants Program. Funds for this program are allocated specifically to assist with helping to create environmentally responsible citizens through education. Any non-profit, tax-exempt Alabama organization or school planning a community based environmental program is encouraged to apply. Grants are available in any amount up to $10,000.

http://legacyenved.org/legacy-grants/

National Endowment for the Humanities Common Heritage Grant Program

The Common Heritage Program recognizes that members of the public, in partnership with libraries, museums, archives, and historical organizations, have much to contribute to the understanding of our cultural mosaic. Together, such institutions and the public can be effective partners in the appreciation and stewardship of our common heritage. The program supports day-long events organized by community cultural institutions, which members of the public will be invited to attend. At these events experienced staff will digitize the community historical materials brought in by the public. Project staff will also record descriptive information provided by community attendees about the historical materials. Projects must also present public programming that would expand knowledge of the community's heritage.

http://www.neh.gov/grants/preservation/common-heritage

National Education Association Foundation Captain Planet Foundation Grants for the Environment

The Captain Planet Foundation funds hands-on environmental projects that encourage innovative programs that empower children and youth around the world to work individually and collectively to solve environmental problems in their neighborhoods and communities. The maximum award is $2,500.

https://www.neafoundation.org/pages/resources-other-grant-opportunities

National Environmental Education Foundation Every Day Capacity Building Grants

Every Day Capacity Building Grants provide "Friends Groups" with grant funds of up to $5,000 to help build their capacity to serve public lands. That help often comes from nonprofit organizations whose missions are focused on serving public land sites in the nation and the improvement and responsible use of those sites. Sometimes these organizations are called Friends Groups, sometimes Cooperating Associations, and sometimes, simply, a partner. They are invaluable in supporting, promoting and helping maintain public lands.

http://www.publiclandseveryday.org/grants/capacity-building-grants

National Fish and Wildlife Foundation's Conservation Partners Program

The Conservation Partners Program is a collaborative effort between the U.S. Department of Agriculture's NRCS, National Fish and Wildlife Foundation (NFWF), and other regional/initiative-specific partners.

The purpose of the partnership is to provide grants on a competitive basis to increase technical assistance capacity to advance the implementation of three complementary programs: NRCS's Landscape Conservation Initiatives, NFWF's Conservation Priorities, and the NRCS-USFWS partnership—Working Lands for Wildlife. To maximize benefits to these three programs, the program also seeks to target investments in certain identified Program Priority Areas.

http://www.nfwf.org/conservationpartners/Pages/2016rfp.aspx

National Fish and Wildlife Foundation's Gulf Environmental Benefit Fund (Alabama)

To date, the NFWF has awarded nearly $52 million from the Gulf Environmental Benefit Fund for 13 restoration projects in the state of Alabama. These projects were selected for funding following extensive consultation with the Alabama Department of Conservation and Natural Resources, USFWS, and NOAA. The Alabama projects address high-priority conservation needs tied to damage from the Deepwater Horizon oil spill. They represent important efforts to protect and enhance natural and living resources, as well as significant planning efforts to develop future projects for consideration under the Gulf Environmental Benefit Fund.

http://www.nfwf.org/gulf/Pages/GEBF-Alabama.aspx

National Fish and Wildlife Foundation's National Wildlife Refuge Friends Grant Program

National Wildlife Refuge Friends organizations play an important role in building critical community support for their local National Wildlife Refuges. The Program funds projects that assist organizations in being effective co-stewards of important natural resources within the National Wildlife Refuge System. The program's goals are to assist refuge Friends organizations in developing projects, expanding and increasing their capacity and skills, meeting local refuge conservation challenges, and gaining and building community recognition.

http://www.nfwf.org/refugefriends/Pages/home.aspx

National Fish and Wildlife Foundation's Five Star and Urban Waters Restoration Program

The Five Star and Urban Waters Restoration Program seeks to develop nationwide-community stewardship of local natural resources, preserving these resources for future generations and enhancing habitat for local wildlife. Projects seek to address water quality issues in priority watersheds, such as erosion due to unstable streambanks, pollution from stormwater runoff, and degraded shorelines caused by development. Funded priorities include: 1) on-the-ground wetland, riparian, in-stream and/or coastal habitat restoration; 2) meaningful education and training activities, either through community outreach, participation and/or integration with K-12 environmental curriculum; 3) measurable ecological, educational, and community benefits; and 4) partnerships (Five Star projects should engage a diverse group of community partners to achieve ecological and educational outcomes).

http://www.nfwf.org/fivestar/Pages/home.aspx

National Fish and Wildlife Foundation's Gulf Coast Conservation Grant Program

The NFWF is soliciting proposals to support conservation projects that enhance coastal habitats of the Gulf of Mexico and bolster priority fish and wildlife populations, while strengthening resilience within the coastal region. The Gulf Coast Conservation Grants Program supports priority conservation needs of the Gulf that are not otherwise expected to be funded under the NFWF's Gulf Environmental Benefit Fund or other funding opportunities associated with the Deepwater Horizon oil spill (e.g., RESTORE Act, Natural Resource Damage Assessment, Gulf of Mexico Research Initiative, etc.). The program seeks to advance innovative restoration concepts and approaches and fund species and habitat projects benefitting Gulf coastal ecosystems and communities.

http://www.nfwf.org/gulfconservation/Pages/home.aspx

The Home Depot's Community Impact Grants Program

The Home Depot Foundation offers grants up to $5,000 to IRS-registered 501c designated organizations and tax-exempt public service agencies in the U.S. using the power of volunteers to improve the physical health of their community. Grants are given in the form of The Home Depot gift cards for the purchase of tools, materials, or services.

The Kresge Foundation's Environmental Grant Program

The program is offered to assist communities that address climate change mitigation measures. Focus areas include: 1) climate resilience and urban opportunity, 2) climate resilience in coastal cities and regions, 3) sustainable water resources management in a changing climate, and 4) urban energy resilience.

http://kresge.org/programs/environment

The Royal Bank of Canada Blue Water Project

The Royal Bank of Canada Blue Water Project is involved in partnerships and initiatives that promote responsible water use and raise awareness about the economic value of water. The intent is to build a shared understanding between business, government, and others about the broad economic and environmental impacts of water in an effort to create a shared agenda for water sustainability.

http://www.rbc.com/community-sustainability/environment/rbc-blue-water/business-of-water.html

RECOMMENDED RESOURCES ON COLLECTIVE IMPACT

Hanleybrown, F., Kania, J., and Kramer, M.

2012 Channeling Change: Making Collective Impact Work. Stanford Social Innovation Review 1-8.

Kania, J. and Kramer, M.

2011 Collective Impact. Stanford Social Innovation Review. Accessed September, 2016. http://ssir.org/articles/entry/collective_impact.

Kania, J. and Kramer, M.

2013 Embracing Emergence: How Collective Impact Addresses Complexity. Stanford Social Innovation Review 1–7.

Nagurka, P., Orr, J., Picat, I., Smith, J., and Thompson-Deahl, C.

2013 Collective Impact for Environmental Conservation. Global Impact 1–27.

Turner, S., Merchant, K., Kania, J., and Martain, E.

2012 Understanding the Value of Backbone Organizations in Collective Impact. Stanford Social Innovation Review. Parts 1-4.

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APPENDIX C:
Watershed Management Plan Checklist

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Watershed Management Plan Component Checklist
Watershed Management Plan Title: Bon Secour River, Oyster Bay, Skunk Bayou Watershed Management Plan
Waterbody ID, Hydrologic Unit Code, Watershed Boundary Data Set, or Hydrologic Response Unit: Mobile Bay - 03160205
River Basin: Bon Secour River, Oyster Bay, and Skunk Bayou watersheds
County(ies): Baldwin
Title of TMDL: Total Maximum Daily Load for Unnamed Tributary to Bon Secour River a) A TMDL for This Watershed is ("X" as applicable): (X) Approved ( ) In Draft b) No TMDL Has Been Developed to Date: (X) c) The Watershed Plan Addresses a Non-Impaired or Threatened Waterbody: (X) Yes ( ) No
Comments: This plan includes all waters within the Bon Secour River, Oyster Bay, and Skunk Bayou watersheds. These watersheds include 303(d) listed (impaired) waters, one of which has an approved TMDL (unnamed tributary to Bon Secour River). The watersheds also include non-impaired or threatened waters.

Component (A) Watershed Conditions	Yes	No	N/A	Chapter, Section, Table, List, etc.	Page No.(s)
I. The plan assesses the conditions of shorelines, wetlands, and riparian areas. (If "No" or "N/A" provide comments below.) Comments:	X			Sections 3.4.4, 3.4.5, 4.6	3-14–3-18; 4-20–4-24
II. The plan characterizes watershed biological resources, including fauna, flora, invasive species, and threatened and endangered species. (If "No" or "N/A" provide comments below.) Comments:	X			Section 4.5, Chapter 5	4-15–4-19; 5-1–5-6
III. The plan characterizes customary uses of biological resources. (If "No" or "N/A" provide comments below.) Comments:	X			Sections 3.9, 4.1.1	3-34–3-38; 4-1–4-3
IV. The plan identifies vulnerabilities on the watershed from increased sea level rise, storm surge, temperature increases, and precipitation. (If "No" or "N/A" provide comments below.) Comments:	X			Sections 3.4.1, 4.6.4, 4.6.5	3-8–3-10; 4-24–4-28
V. The plan characterizes existing opportunities for public access, recreation, and ecotourism. (If "No" or "N/A" provide comments below.) Comments:				Section 3.8	3-33–3-34

Component (B) Identification of Pollutant Causes and Sources	Yes	No	N/A	Chapter, Section, Table, List, etc.	Page No.(s)
I. The plan identifies the pollutant *causes* and *sources* or groups of similar sources that will need to be managed to achieve the load reductions identified in a TMDL, or elsewhere in this plan. (If "No" or "N/A" provide comments below.) Comments:	X			Section 4.4	4-7–4-15
II. The plan addresses *other* watershed/natural resource/stakeholder issues and concerns that *may be* problematic, but are *not* addressed by a TMDL. (If "No" or "N/A" provide comments below.) Comments:	X			Chapters 5, 6	5-1–5-6; 6-1–6-6

Component (C) Pollutant Load Reduction Estimates	Yes	No	N/A	Chapter, Section, Table, List, etc.	Page No.(s)
I. The plan provides estimates of load reductions needed to achieve a TMDL. (If "No" or "N/A" provide comments below.) Comments: This is provided in the TMDL. This WMP identifies critical issues and areas and recommends management measures to address each. Goals outlined in this WMP are not limited to the goals of the TMDL.		X			
II. The plan provides *estimates* of potential load reductions for each pollutant cause or source, or groups of similar sources that need to be managed. (If "No" or "N/A" provide comments below.) Comments: This WMP identifies critical issues and areas and recommends management measures to address each in a broad context (Chapter 6). The WMP does not attempt to quantify nutrient/pollutant loads, due to a lack of baseline data needed to develop such specific estimates. The "Water Quality Monitoring" management measure described in Section 7.1.8 notes that establishing baseline data will allow estimates of pollution loads and reductions to be made and progress to be measured.		X		Chapter 6, Section 7.1.8	6-1–6-6; 7-10
III. The plan provides locations where *potential* BMPs may be implemented. (If "No" or "N/A" provide comments below.) Comments:	X			Chapter 7	7-1–7-15
IV. A reasonable approach is used to *estimate* pollutant load reductions (assumptions and limitations should be stated). (If "No" or "N/A" provide comments below.) Comments: This WMP identifies critical issues and areas and recommends management measures to address each in a broad context (Chapter 6). The WMP does not attempt to quantify nutrient/pollutant loads, due to a lack of baseline data needed to develop such specific estimates. The "Water Quality Monitoring" management measure described in Section 7.1.8 notes that establishing baseline data will allow estimates of pollution loads and reductions to be made and progress to be measured.		X		Chapter 6, Section 7.1.8	6-1–6-6; 7-10

Component (D) Best Management Practices	Yes	No	N/A	Chapter, Section, Table, List, etc.	Page No.(s)
I. The plan identifies *potential* BMPs to be installed in "critical" areas. Comments; (If "No" or "N/A" provide comments below.)	X			Chapters 6, 7	6-1–6-6; 7-1–7-14
II. The plan identifies actions to improve habitats necessary to support healthy populations of fish and shellfish. (If "No" or "N/A" provide comments below.) Comments:	X			Chapter 7	7-1–7-15
III. The plan identifies actions to reduce the incidence and impacts of invasive flora and fauna. (If "No" or "N/A" provide comments below.) Comments:	X			Section 7.1.6	7-9
IV. The plan identifies actions to preserve culture, heritage, and traditional ecological knowledge of the watershed. (If "No" or "N/A" provide comments below.) Comments:	X			Section 7.1.7	7-9–7-10
V. The plan recommends strategies to remediate effects of environmental degradation. (If "No" or "N/A" provide comments below.) Comments:	X			Chapter 7	7-1–7-15
VII. The plan identifies strategic areas for shoreline stabilization, wetland and stream restoration/conservation, and fishery enhancements. (If "No" or "N/A" provide comments below.) Comments:	X			Sections 7.1.4, 7.2.2	7-6–7-7; 7-14–7-15
VIII. The plan provides recommendations to improve watershed resiliency through adaptation strategies. (If "No" or "N/A" provide comments below.) Comments:	X			Chapter 7, Section 11-6	7-1–7-15; 11-7
IX. The plan identifies potential sites to expand access to open spaces and waters within the watershed. (If "No" or "N/A" provide comments below.) Comments:	X			Section 7.1.3	7-5–7-6

Component (D) Best Management Practices	Yes	No	N/A	Chapter, Section, Table, List, etc.	Page No.(s)
X. The plan incorporates established programs in implementation strategies (Clean Marina, Alabama Water Watch, Community Ratings System, Smart Yards, etc). (If "No" or "N/A" provide comments below.) Comments:	X			Section 11.4	11-3–11-6

Component (E) Financial and Technical Assistance	Yes	No	N/A	Chapter, Section, Table, List, etc.	Page No.(s)
I: The plan provides estimates of the financial and technical assistance that will be needed to implement the plan. (If "No" or "N/A" provide comments below.) Comments:	X			Chapter 10	10-1–10-10
II: The plan identifies sources and authorities that will be relied upon to implement the plan. (If "No" or "N/A" provide comments below.) Comments:	X			Chapters 8, 9	8-1–8-14; 9-1–9-6
III. The plan contains a strategy for driving regulatory change. (If "No" or "N/A" provide comments below.) Comments:	X			Section 8.3	8-12–8-14

Component (F) Education and Outreach	Yes	No	N/A	Chapter, Section, Table, List, etc.	Page No.(s)
I. The plan provides an information/education component that will enhance public understanding of the plan and encourage their early and continued participation in project development. (If "No" or "N/A" provide comments below.) Comments:	X			Chapter 7	7-1–7-15

Component (G) Plan Implementation Schedule	Yes	No	N/A	Chapter, Section, Table, List, etc.	Page No.(s)
I. The plan provides a reasonably expeditious schedule for implementing management measures. (Should base implementation timetable on BMPs in "C" above.) Comments: (If "No" or "N/A" provide comments below.)	X			Chapters 7, 9	7-1–7-15; 9-1–9-6

Component (H) Interim Milestones	Yes	No	N/A	Chapter, Section, Table, List, etc.	Page No.(s)
I. The plan provides a list or description of interim milestones for determining whether NPS management measures are being implemented. (If "No" or "N/A" provide comments below.) Comments:	X			Section 9.4, Chapter 11	9-6; 11-1–11-7

Component (I) Monitoring and Assessment	Yes	No	N/A	Chapter, Section, Table, List, etc.	Page No.(s)
I. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards, and if not, the criteria for determining whether the watershed plan needs to be revised - or if a NPS TMDL has been established - whether the NPS TMDL needs to be revised. (If "No" or "N/A" provide comments below.) Comments:	X			Chapter 11	11-1–11-7
The plan identifies key locations for volunteer water monitoring. (If "No" or "N/A" provide comments below.) Comments:	X			Section 11.3, Figures 11-1–11-3	11-3–11-6

Component (J) Plan Implementation Effectiveness	Yes	No	N/A	Chapter, Section, Table, List, etc.	Page No.(s)
I. A monitoring component to evaluate the effectiveness of the implementation efforts over time measured against the criteria established under item (I). (If "No" or "N/A" provide comments below.) Comments:	X			Chapters 9, 11	9-1–9-6; 11-1–11-7