Draft

St. Andrew Bay Surface Water Improvement and Management Plan

September 2017

NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT

Headquarters
81 Water Management Drive
Havana, Florida 32333-4712
(850) 539-5999
www.nwfwater.com

Crestview
180 E. Redstone Avenue
Crestview, Florida 32539
(850) 683-5044

Econfina
6418 E. Highway 20
Youngstown, FL 32466
(850) 722-9919

Milton
5453 Davisson Road
Milton, FL 32583
Tel. (850) 626-3101

Acknowledgements

This document was developed by the Northwest Florida Water Management District under the auspices of the Surface Water Improvement and Management (SWIM) Program and in accordance with sections 373.451-459, Florida Statutes. The plan update was prepared under the supervision and oversight of Brett Cyphers, Executive Director and Carlos Herd, Director, Division of Resource Management. Funding support was provided by the National Fish and Wildlife Foundation's Gulf Environmental Benefit Fund. The assistance and support of the NFWF is gratefully acknowledged.

The authors would like to especially recognize members of the public, as well as agency reviewers and staff from the District and from the Ecology and Environment, Inc., team that contributed to the development of this plan. Among those that contributed considerable time and effort to assist in the development of this plan are the following. Their assistance and thoughtful comments were invaluable and are gratefully acknowledged.

Plan Development

Ecology and Environment, Inc.

Rick Harter
Jade Marks
Tom Singleton
Scott Jackson
Emma Witherington
Nicole Jeter
Paul Johnson
Doug Heatwole
Heather Fowler

Northwest Florida Water Management District

Paul Thorpe
Karen Kebart
Christina Coger
Jesse Gray
Elaine McKinnon
Brittany Wood
Nick Wooten

Technical and Public Review

[to be added for final]

Cover Photograph: ___________________

Executive Summary

[to be added for final]

Table of Contents

List of Tables

List of Figures

Appendices

Abbreviations and Acronyms List

AFB	Air Force Base
ARPC	Apalachee Regional Planning Council
AWT	Advanced Wastewater Treatment
BEST	Bay Environmental Study Team
BMAP	Basin Management Action Plan
BMP	best management practice
cfs	cubic feet per second
CWA	Clean Water Act
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
ERP	Environmental Resource Permitting
ESA	Endangered Species Act
°F	Degree Fahrenheit (temperature)
F.A.C.	Florida Administrative Code
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FIRMs	Flood Insurance Rate Maps
FGS	Florida Geological Survey
FNAI	Florida Natural Areas Inventory
F.S.	Florida Statutes
FOSB	Friends of St. Andrew Bay
FWC	Florida Fish and Wildlife Conservation Commission
FWRI	Fish and Wildlife Research Institute
GEBF	Gulf Environmental Benefit Fund
GEMS	Gulf Ecological Management Site
GIS	Geographic Information Systems
HAB	harmful algal blooms
I-10	Interstate 10
IWR	Impaired Surface Waters Rule
LOST	local option sales tax
MFLs	minimum flows and minimum water levels
mgd	million gallons per day
MS4s	municipal separate storm sewer systems
NFWF	National Fish and Wildlife Foundation
NPS	nonpoint source
NRC	National Research Council
NRCS	Natural Resources Conservation Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRDA	Natural Resource Damage Assessment
NWFWMD	Northwest Florida Water Management District
OFWs	Outstanding Florida Waters
OSTDS	onsite sewage treatment and disposal systems
RESTORE	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States (Act)
RMA	St. Andrew Bay Resource Management Association
SAV	submerged aquatic vegetation
SEAS	Shellfish Environmental Assessment Section
SHCA	Strategic Habitat Conservation Area
SIMM	Seagrass Integrated Mapping and Monitoring
SMZs	Special Management Zones
SWIM	Surface Water Improvement and Management
SWTV	Surface Water Temporal Variability
TMDL	total maximum daily load
TN	total nitrogen
TNC	The Nature Conservancy
UF-IFAS	University of Florida Institute of Food and Agricultural Sciences
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WBID	Waterbody identification number
WFRPC	West Florida Regional Planning Council
WMA	water management area
WWTF	wastewater treatment facility

1.0 Introduction

The St. Andrew Bay watershed includes the interconnected St. Andrew, West, North, and East bays; St. Joseph Bay; and Deer Point Lake Reservoir, as well as the respective surface water basins of each of these waterbodies. For planning purposes, the watershed also includes Lake Powell and other coastal dune lakes. Primarily in Bay and Gulf counties, the watershed also includes portions of Washington, Walton, Jackson, and Calhoun counties.

Major stakeholders in the St. Andrew Bay watershed include:

- Northwest Florida Water Management District
- Florida Department of Environmental Protection
- Florida Fish and Wildlife Conservation Commission
- Florida Department of Agriculture and Consumer Services
- Florida Department of Economic Opportunity
- Apalachee Regional Planning Council
- West Florida Regional Planning Council
- U.S. Department of Agriculture
- U.S. Fish and Wildlife Service
- Tyndall Air Force Base
- The Nature Conservancy
- National Fish and Wildlife Foundation
- Bay, Gulf, Washington, Walton, Jackson, and Calhoun counties
- Municipalities and unincorporated communities in Bay and Gulf counties
- St. Andrew Bay Resource Management Association
- Friends of St. Andrew Bay
- Florida LakeWatch
- And many others

The St. Andrew Bay watershed provides important environmental functions with numerous benefits and services for surrounding communities. Among watershed services are water storage and flood attenuation, groundwater recharge, regulation of discharge to receiving waters, water quality protection, cycling of energy and nutrients, erosion control, and stream bank stabilization. Additional human benefits are usable surface and ground waters, fish and wildlife resources, recreational opportunities, aesthetic characteristics, and associated economic benefits.

1.1 Purpose and Scope

The St. Andrew Bay watershed Surface Water Improvement and Management (SWIM) plan is intended to provide a framework for resource management, protection, and restoration using a watershed approach. The SWIM program is administered through the Northwest Florida Water Management District (NWFWMD or District) and includes management actions to address water quality, natural systems, and watershed functions and benefits. This plan is an update to the original plan developed in 2000 (NWFWMD 2000), which incorporated the 1998 St. Andrew Bay Environmental Study Team (BEST) management plan.

Development of the 2017 St. Andrew Bay watershed SWIM Plan update (hereafter the 2017 SWIM Plan) is funded by a grant from the National Fish and Wildlife Foundation's (NFWF) Gulf Environmental Benefit Fund (GEBF), with the intent to further the purpose of the GEBF to remedy harm and eliminate or reduce the risk to Gulf resources affected by the Deepwater Horizon oil spill.

This 2017 SWIM Plan continues planning efforts initiated in the 2000 Plan, while also addressing new issues, ongoing challenges, and opportunities for achieving watershed protection and restoration. Further, the 2017 SWIM Plan describes the watershed's physical characteristics and natural resources, provides an assessment of the watershed's current condition, and identifies priority challenges affecting watershed resources and functions. The 2017 SWIM Plan also prescribes a set of management actions and projects to meet those challenges and needs. Management actions are generally limited to those within the mission and scope of the NWFWMD SWIM program, recognizing the ongoing initiatives and needs of local communities and other agencies. The projects outlined are intended to leverage funding from many sources; integrating the efforts of local governments, state and federal agencies, and private entities to achieve mutual objectives and goals; and to present innovative solutions to watershed issues.

1.2 SWIM Program Background, Goals, and Objectives

Surface Water Improvement and Management plans have been developed pursuant to the SWIM Act, enacted by the Florida Legislature in 1987 and amended in 1989 through sections 373.451-373.459, Florida Statutes (F.S.). Through this Act, the Legislature recognized threats to the quality and function of the state's surface water resources. The Act authorized the state's five water management districts to:

- Develop plans and programs to improve management of surface waters and associated resources;
- Identify current conditions and processes affecting the quality of surface waters;
- Develop strategies and management actions to restore and protect waterbodies; and
- Conduct research to improve scientific understanding of the causes and effects of the degradation of surface waters and associated natural systems.

In addition to the SWIM Act of 1987, the following Florida Statutes and administrative codes support and complement the SWIM program:

- Chapter 259, F.S.: Florida Forever Act: Land Acquisitions and Capital Improvements for Conservation or Recreation
- Chapter 375, F.S.: Land Acquisition Trust Fund
- Section 403.067(7)(A)4, F.S.: Total Maximum Daily Loads (TMDLs)
- Section 373.042, F.S.: Minimum Flows and Minimum Water Levels
- Chapter 62-43, Florida Administrative Code (F.A.C.): Surface Water Improvement and Management Act
- Chapter 62-302, F.A.C.: Surface Water Quality Standards
- Chapter 62-303, F.A.C.: Identification of Impaired Surface Waters
- Chapter 62-304, F.A.C.: TMDLs

For the purposes of SWIM, watersheds are the hydrological, ecological, and geographical units for planning and managing restoration efforts along Florida's Gulf Coast. Successful watershed management requires coordination and implementation of complementary programs and projects with jurisdictions, agencies, and other stakeholders across the watershed. Among these are local, state, and federal agencies; conservation land management organizations; non-governmental organizations; and other interested stakeholders.

The SWIM program addresses watershed priorities by identifying management options and supporting cooperative project implementation. Projects may include stormwater retrofits for water quality improvement, wetland and aquatic habitat restoration, resource assessments, and wastewater management improvements, among others. Surface Water Improvement and Management plans integrate complementary programs and activities to protect and restore watershed resources and functions. They are also designed to address water quality and natural systems challenges to address the District's goal and strategic priorities outlined in the District's strategic plan.

2.0 Watershed Description

2.1 Geographic and Geological Characteristics

St. Andrew Bay watershed attributes:

- ✓ Entirely within Florida
- ✓ Two estuarine systems, with five named bays
- ✓ Major groundwater recharge area for Econfina Creek and Deer Point Lake Reservoir
- ✓ Six Florida counties
- ✓ 36 distinct natural communities
- ✓ 1,154 square miles

The St. Andrew Bay watershed spans approximately 740,000 acres of the central Florida Panhandle adjacent to the Gulf of Mexico. The watershed includes the interconnected estuarine system of St. Andrew, West, North, and East bays; St. Joseph Bay; Econfina Creek and the groundwater contribution area for springs discharging into the creek. The watershed also includes Deer Point Lake Reservoir, Lake Powell and several other coastal dune lakes, and contributing basins and tributaries of all of these waterbodies.

Approximately 62 percent of the watershed is within Bay County. Its northern reaches extend into Jackson and Washington counties, while Walton County encompasses a portion of the coastal region west of Bay County and adjacent to the Gulf of Mexico. Southwestern Jackson County includes the headwaters of Econfina Creek, which discharges into Deer Point Lake Reservoir. Walton County's portion of the watershed drains into the Gulf Intracoastal Waterway (GIWW), the Gulf of Mexico, and several coastal dune lake drainages. St. Joseph Bay is entirely within Gulf County, with connection to the GIWW through the Gulf County Canal. Lake Powell and its contributing watershed include portions of southern Walton and Bay counties. The proportional breakdown of the watershed by county is depicted by Figure 2-1, and the overall watershed is illustrated by Figure 2-2.

The cities of Lynn Haven, Parker, Springfield, Callaway, and Panama City are proximate to St. Andrew Bay, along with unincorporated coastal communities. The City of Panama City Beach and Tyndall Air Force Base (AFB) are within the barrier peninsula separating St. Andrew Bay from the Gulf of Mexico. The City of Port St. Joe borders St. Joseph Bay, and the City of Mexico Beach is located on the Gulf of Mexico north of the bay. Among unincorporated communities within the watershed are upper and lower Grand Lagoon, Laguna Beach, Rosemary Beach, Overstreet, Youngstown, and Fountain. The eastern extent of the watershed also intersects with the City of Wewahitchka and the community of White City.

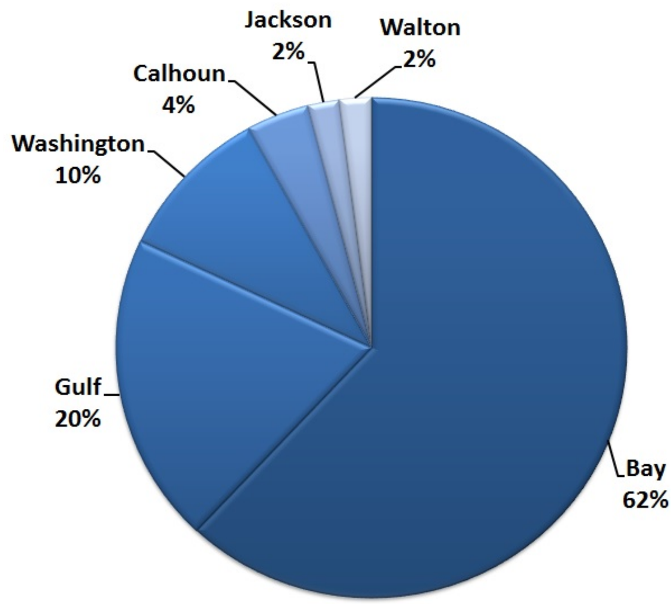


Figure 2-1 Proportion of the St. Andrew Bay Watershed by County

Figure 2-2 **St. Andrew Bay Watershed**

The St. Andrew Bay watershed lies within the Gulf Coastal Plain physiographic region, which is characterized by gently rolling hills, ridges, prairies, and alluvial floodplains, underlain by sediments of sand, gravel, porous limestone, chalk, marl, and clay (NWFWMD 2000; USDA 1984). Within the Gulf Coastal Plain, the watershed is within the Gulf Coastal Lowlands physiographic region. Terraces of the Gulf Coastal Lowlands formed during the Pleistocene Epoch (Great Ice Age) when fluctuating sea levels were associated with the expansion and retreat of continental ice. Many of the watershed's topographic features are products of prehistoric marine deposition during periods when sea level was higher than the present. Dunes, barrier islands, and beach ridges were stranded inland as seas receded. Eight separate terraces range in elevation from about 10 feet above sea level near the coast to nearly 300 feet above sea level in the northernmost portion of the watershed (USDA 1984; USGS 2013).

The St. Andrew Bay watershed follows the general stratigraphy of the Florida Panhandle. Near-surface formations include dolomitic limestones, sandy clayey limestones, shell beds, clayey sands, and sands. Overlying most formations are unconsolidated Holocene (from approximately 2.6 million years ago to present day) siliciclastic sediments consisting of nearly pure quartz sands with minor heavy mineral sands. These were deposited during sea level fluctuations and are presently found on the barrier islands (Shell Island and Crooked Island) and St. Joseph Peninsula. In the upper watershed, limestone karst landscapes maintain hydrologic connectivity to the Floridan aquifer.

Many soils adjacent to St. Andrew Bay are heavily leached with distinct horizon development which forms in coastal forests with a pine overstory (Collins 2010; USDA 2014). Hydric soils are common throughout the watershed. In eastern Bay and western Gulf counties, weathered, clay-rich soils dominate. Younger poorly developed soils are found along the coastline and barrier peninsulas where depositional processes are still active (Collins 2010).

Additional details on the geology and soils of these physiographic regions are found in Appendix C.

2.2 Hydrologic Characteristics

2.2.1 Major Streams, Springs, and Tributaries

The St. Andrew Bay watershed is unique among northwest Florida watersheds in that it has no major rivers (Figure 2-3). As a result, estuarine waters are comparatively deep, clear, and of relatively high and consistent salinity (Saloman *et al.* 1982; Keppner and Keppner 2001b). The major tributary, Econfina Creek, begins in southwestern Jackson County and flows through Washington and Bay counties before discharging into Deer Point Lake Reservoir. From 1936-2016, Econfina Creek had an average annual discharge of 529 cubic feet per second (cfs) at the USGS gauge at Bennett, Florida. According to Crowe *et al.* (2008), on average, approximately 800 cfs are discharged from the reservoir into North Bay.

As described by Crowe *et al.* (2008), Econfina Creek has a relatively high and consistent baseflow, attributable to groundwater discharge along its middle reach. In this area, the creek is incised into the Floridan aquifer, resulting in formation of numerous springs along the creek. During low-to-moderate flow conditions, groundwater makes up the majority of stream flow. Barrios and Chelette (2004) identified 11 springs or spring groups with more than 36 individual vents within the middle reach of Econfina Creek. These springs are characterized as having either fissure-type vents (where groundwater percolates upward into pools and runs) or vents that discharge laterally at or near the surface level of the creek. One first magnitude spring – the Gainer Springs Group – and five second magnitude springs or spring groups discharge to Econfina Creek in Washington and Bay counties. The primary groundwater contribution area for the springs discharging into Econfina Creek encompasses approximately 129,000 acres within southern Washington and northern Bay counties (Figure 2-3). This area is internally drained and defined by karst topography and numerous lakes.

Among other tributaries of the estuary, Burnt Mill Creek and Crooked Creek together discharge approximately 60 cfs into West Bay, and Sandy and Wetappo Creek discharge approximately 232 cfs to East Bay (Crowe *et al.* 2008). Bear Creek, Bayou George, and Cedar Creek together discharge approximately 402 cfs into Deer Point Lake Reservoir.

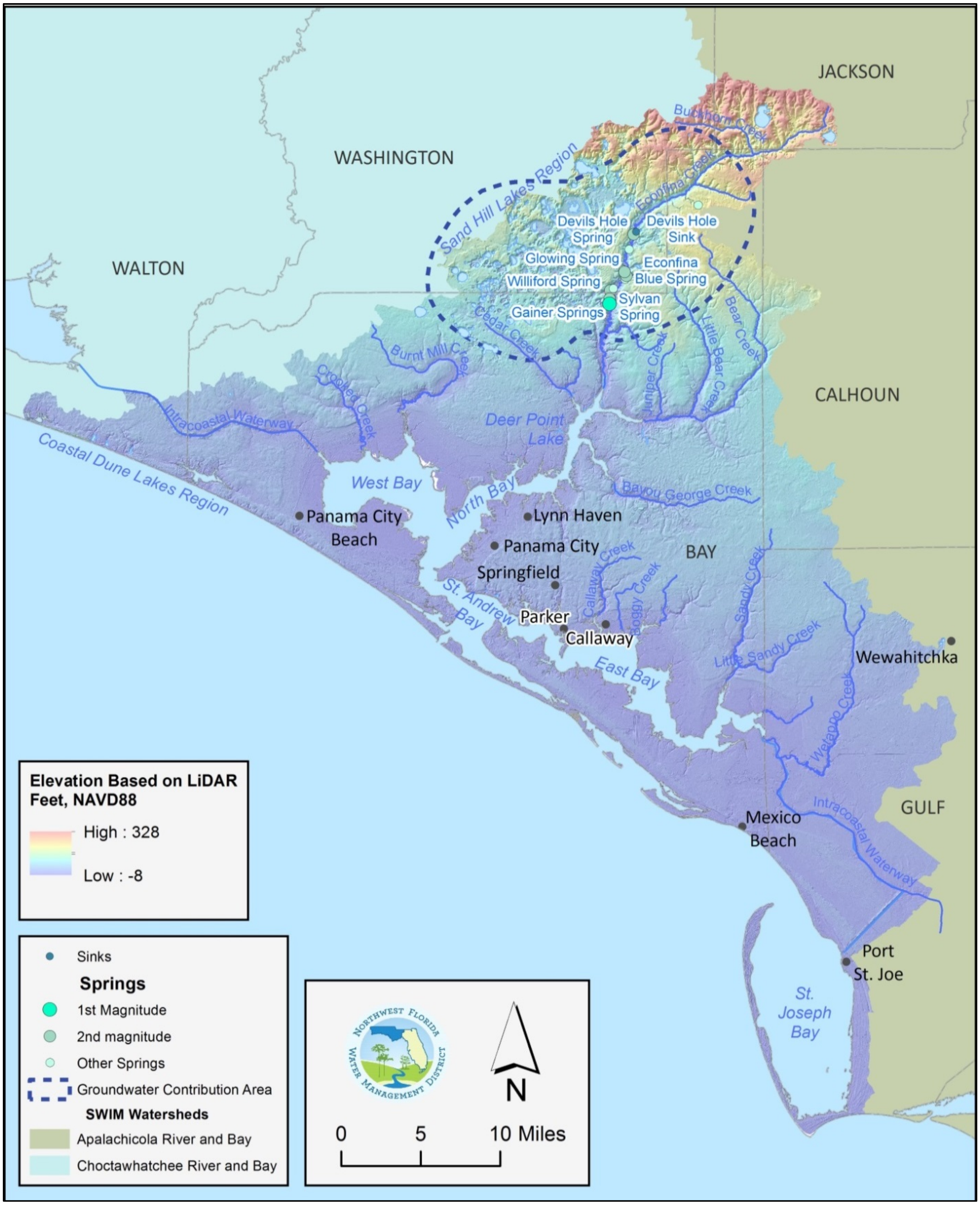


Figure 2-3 **General Topography and Hydrology**

2.2.2 Lakes

The northern portion of the St. Andrew Bay watershed includes much of the Sand Hill Lakes region (Figure 2-4), which, as noted above, is a major recharge area for the Floridan aquifer and springs discharging into Econfina Creek. The region includes more than 200 lakes. Vernon (1942) described two general types of sinks in the region. The first was described as "the normal, steep-walled, round-bottom sink, which may or may not be filled with water," with the second being sinks with "broad, flat bottoms." The lake basins are internally drained, and lake volumes and levels are largely functions of groundwater inflow and leakage (Grubbs 1995; Richards 1997).

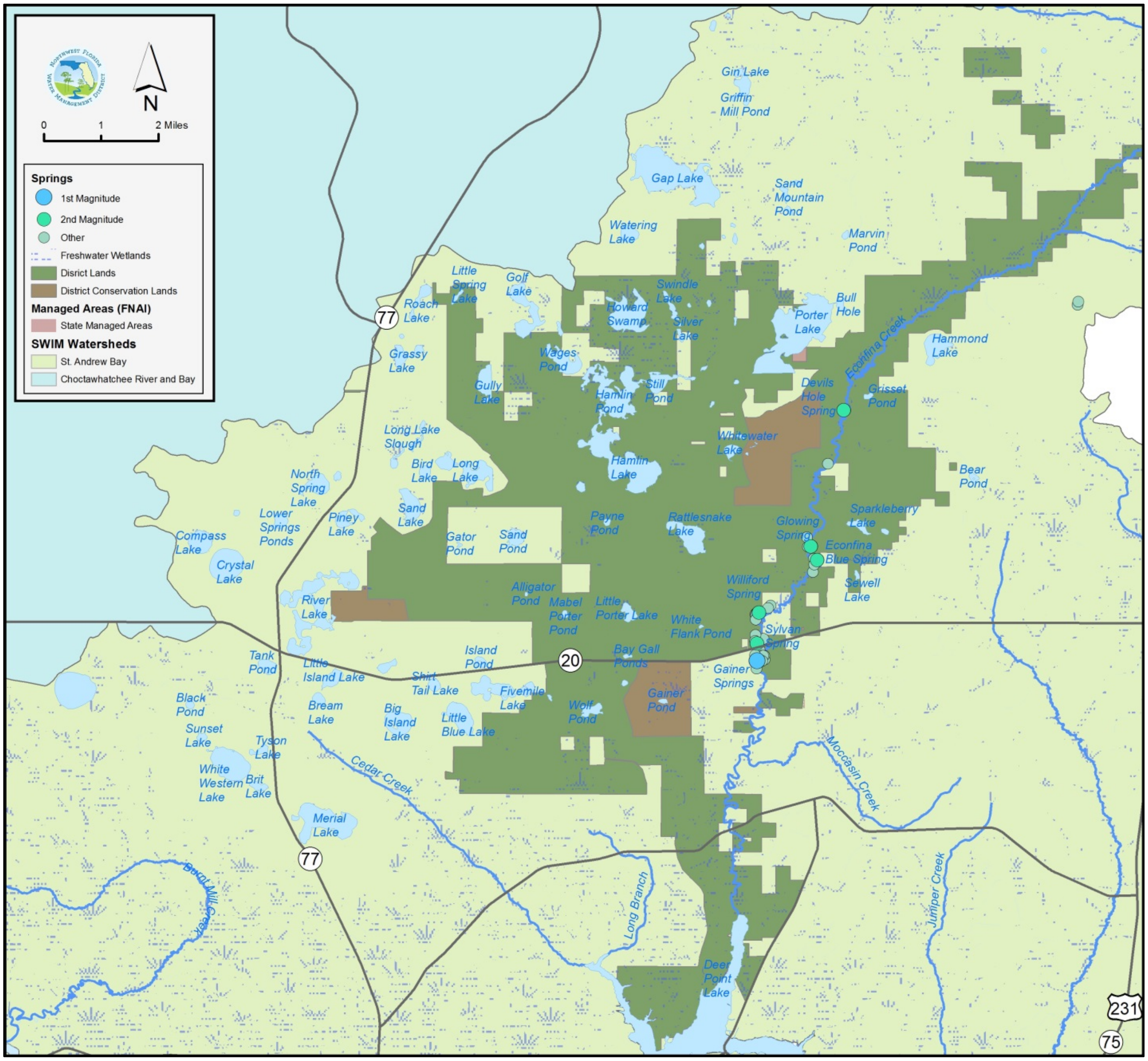


Figure 2-4 Sand Hill Lakes Region

Deer Point Lake Reservoir, a 5,000-acre impoundment located seven miles north of Panama City, is the major source of potable water for Bay County. The reservoir was created in 1961 through construction of a dam across North Bay at Deer Point. As described above, the reservoir receives inflow from Econfina, Bear, and Cedar creeks and Bayou George and discharges water to North Bay.

A distinctive feature of the St. Andrew Bay watershed is the series of coastal dune lakes located west of St. Andrew Bay, primarily in Walton and Bay counties (Figure 2-5). These are naturally-formed lakes, intermittently connected to the Gulf of Mexico. Salinity in the lakes can be variable due to irregular connectivity with the Gulf, and saltwater intrusion from salt spray and storm surge. When dune lakes experience critical pre-flood levels, breaching water forms outlets through the dunes and channels to the Gulf (Bhadha and Jawitz 2008).

Situated between Bay and Walton counties, Lake Powell is the largest coastal dune lake in the region. The lake, which periodically opens to the Gulf of Mexico via Philips Inlet, covers approximately 8,612 acres and has been designated by the state of Florida as an Outstanding Florida Water (OFW) (Keppner and Keppner 2000).

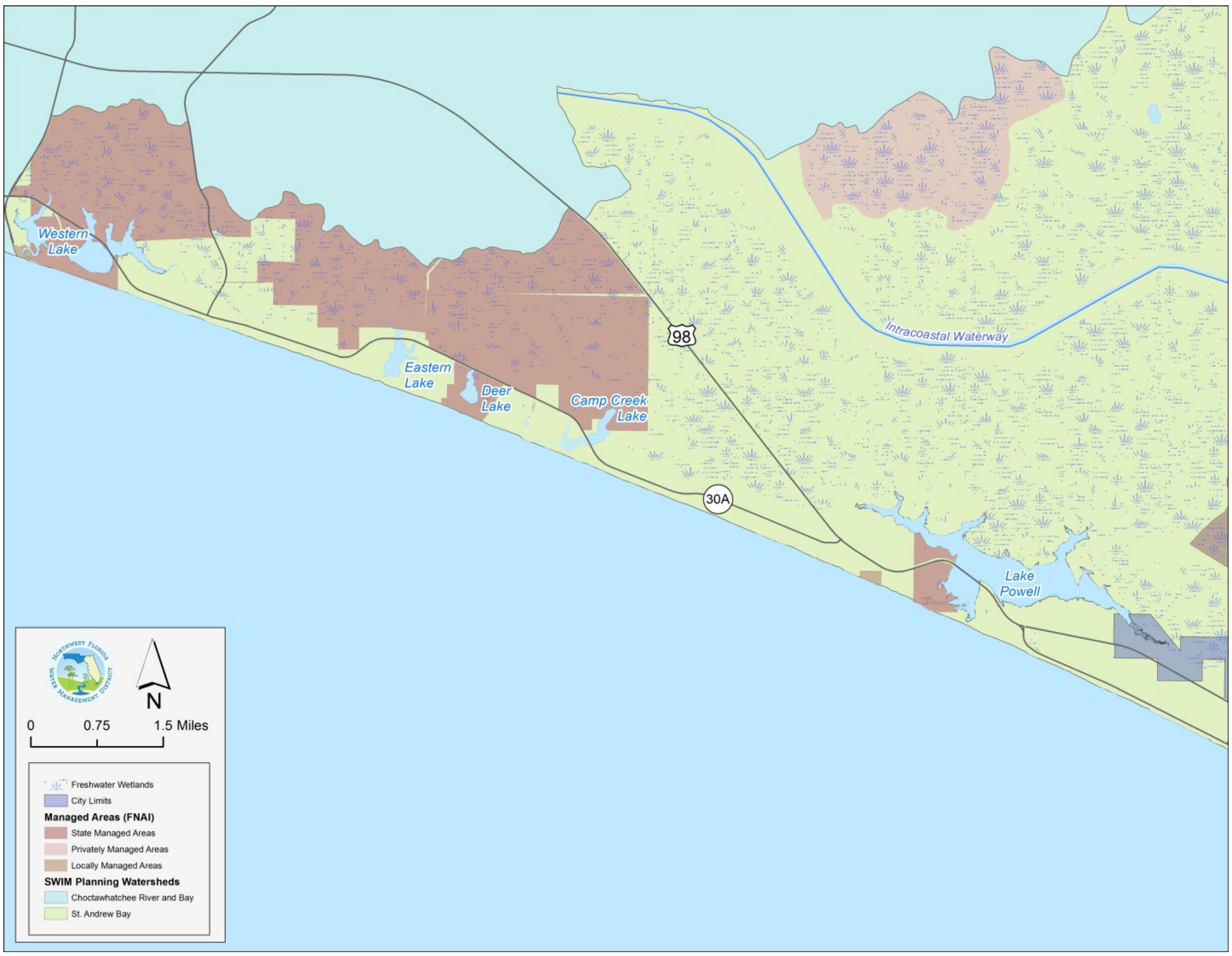


Figure 2-5 Coastal Dune Lakes in the St. Andrew Bay Watershed

2.2.3 Floodplains and Wetlands

As illustrated by Figure 2-6, extensive wetlands and corresponding floodplain area span the coastal extent of the watershed. Particularly large wetland systems border West Bay, including the Breakfast Point and West Bay Point peninsulas, and East Bay, including Allanton Peninsula and the Wetappo Creek basin, Wetlands also encompass the littoral region bordering St. Joseph Bay.

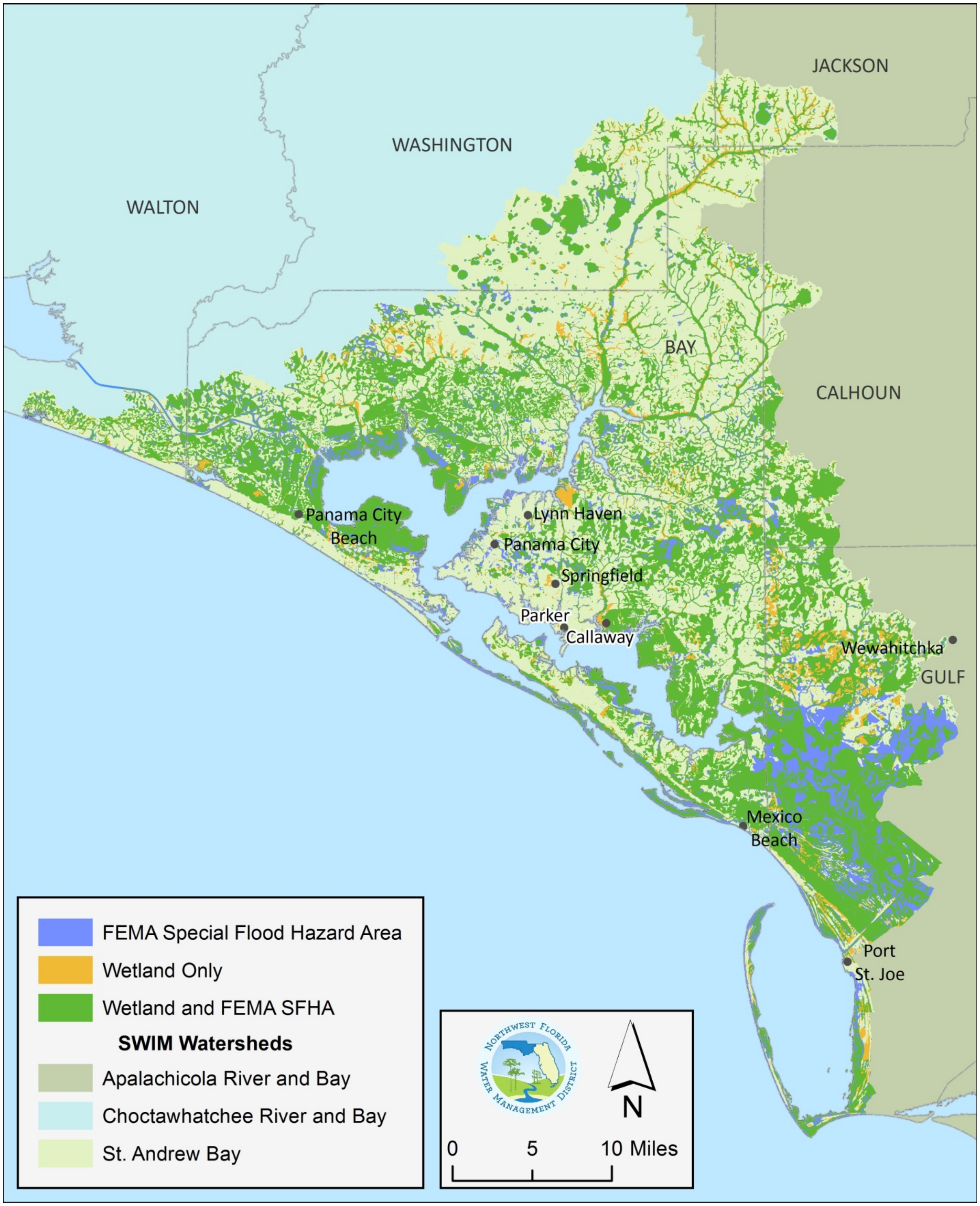


Figure 2-6 Floodplains and Wetlands

2.2.4 Coastal Waterbodies

The St. Andrew Bay estuary includes five open bay and lagoon segments, St. Andrew, North, West and East Bays, and Grand Lagoon (Figure 2-7). These have a combined surface area of approximately 59,568 acres (Brim and Handley 2006). The bay system has two coastal passes: West Pass and East Pass. West Pass was constructed in 1938 and is maintained as the primary shipping channel. East Pass, the historical outlet to the Gulf of Mexico at the eastern end of Shell Island, has been closed by the movement of shoreline sediments (Fitzhugh 2012a).

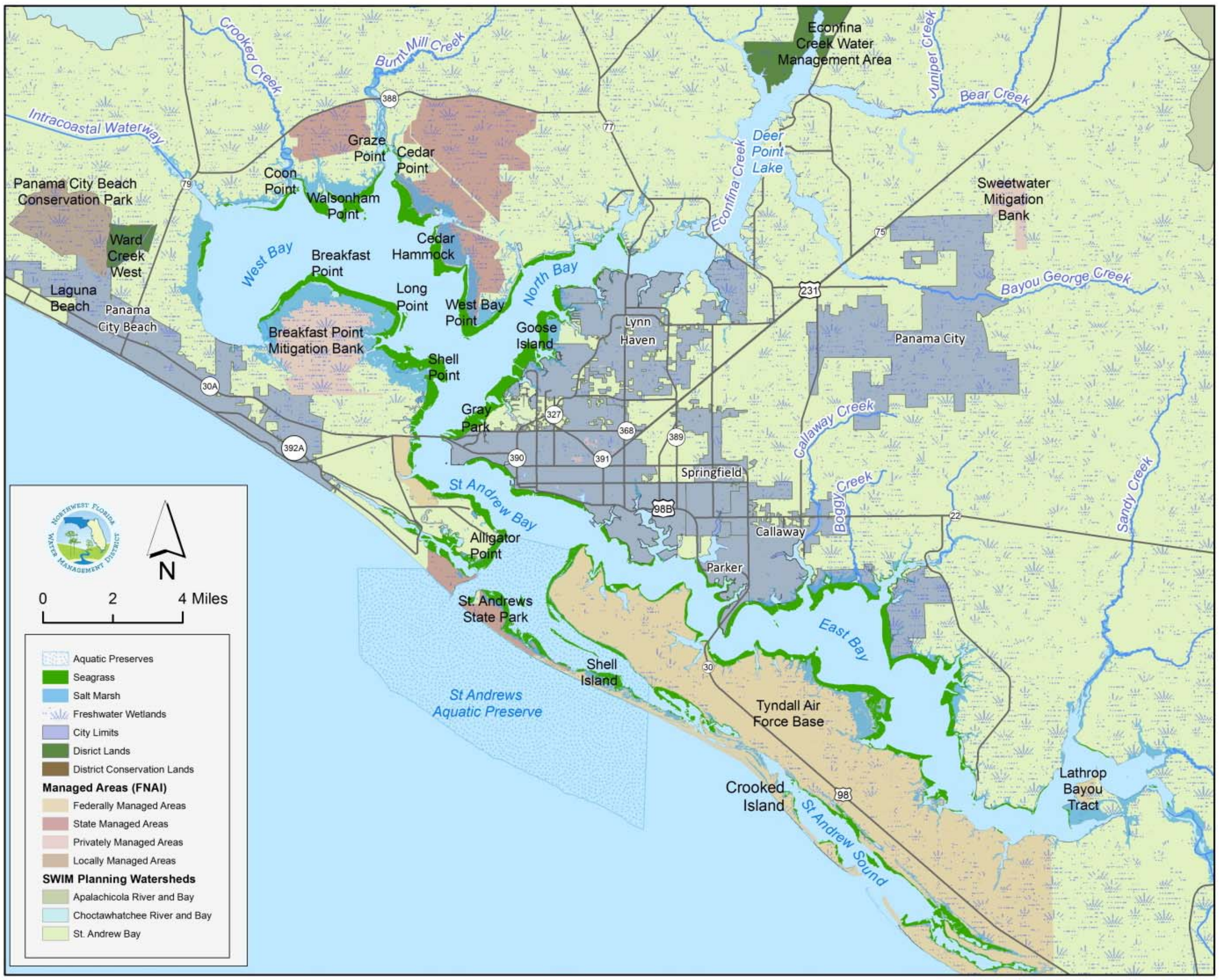


Figure 2-7 Coastal Features of St Andrew Bay

St. Andrew Bay is the lowest reach of the estuary, proximate to West Pass and Grand Lagoon, and the portion of the estuary most influenced by direct exchange with the Gulf of Mexico. Its waters tend to be relatively clear with primarily sandy sediments (FDEP 2017). West Bay covers roughly 17,576 acres and includes estuarine waters northwest of West Bay Point and Shell Point. In addition to Burnt Mill and Crooked Creeks, the GIWW enters West Bay from the west, connecting West Bay with the Choctawhatchee Bay system. North Bay encompasses waters between Deer Point Dam and the Hathaway Bridge and covers about 6,676 acres. The bay includes 16 bayous and is bounded on the northeast by the Deer Point Lake impoundment. East Bay is southeast of the DuPont Bridge and covers approximately 18,659 acres. In addition to Sandy and Wetappo creeks, ten bayous are found along East Bay's shoreline.

The GIWW enters East Bay along an alignment that cuts through Wetappo Creek and connects to Lake Wimico, then to the Apalachicola River.

Notable bayous and sloughs in the St. Andrew Bay estuary include Alligator Bayou, Harrison Bayou, Little Johnson Bayou, Massalina Bayou, Watson Bayou, Parker Bayou, Pitts Bayou, Callaway Bayou, Laird Bayou, and Turtle Slough. Grand Lagoon adjoins St. Andrew Bay adjacent to West Pass.

St. Andrew Sound is due south of East Bay and is a lagoon with no surface connection to St. Andrew Bay. The sound is roughly ten miles long and one mile wide and covers roughly 4,707 acres. St. Andrew Sound is bordered by Tyndall AFB and two barrier peninsulas separated by a pass to the Gulf of Mexico.

St. Joseph Bay (Figure 2-8) was formed by the outcropping of Cape San Blas shoals and the westward migration of sediments, including from the Apalachicola River (Stewart 1962, as cited in FDEP 2008). These shoals are part of a dynamic barrier island system that extends from the Big Bend of Florida westward to the Alabama state line. St. Joseph Peninsula encloses and forms St. Joseph Bay, a non-estuarine lagoon that is about 15 miles long and ranges from three to six miles in width. The surface area of the bay is approximately 43,872 acres (NRCS 2001a). St. Joseph Bay is the only large embayment in the eastern Gulf of Mexico not substantially influenced by freshwater inflow. It is connected to the GIWW by the Gulf County Canal.

2.2.5 Gulf Intracoastal Waterway

The GIWW is a 1,300-mile system of inland channels and tributaries traversing the Gulf Coast from Brownsville, Texas, to St. Marks, Florida, with the Florida portion spanning 374 miles (Florida Department of Transportation [FDOT] 2008). The waterway was constructed to provide a route for ships and imported cargo up the eastern coast of the U.S. The 5-foot deep and 65-foot wide channel connecting Apalachicola and St. Andrew Bay was constructed between 1911 and 1915 and upgraded to 9 feet by 100 feet in 1937 by the USACE. The channel runs from Wetappo Creek via Searcy Creek and Lake Wimico to the Apalachicola River, about five miles above its mouth (Alperin 1983).

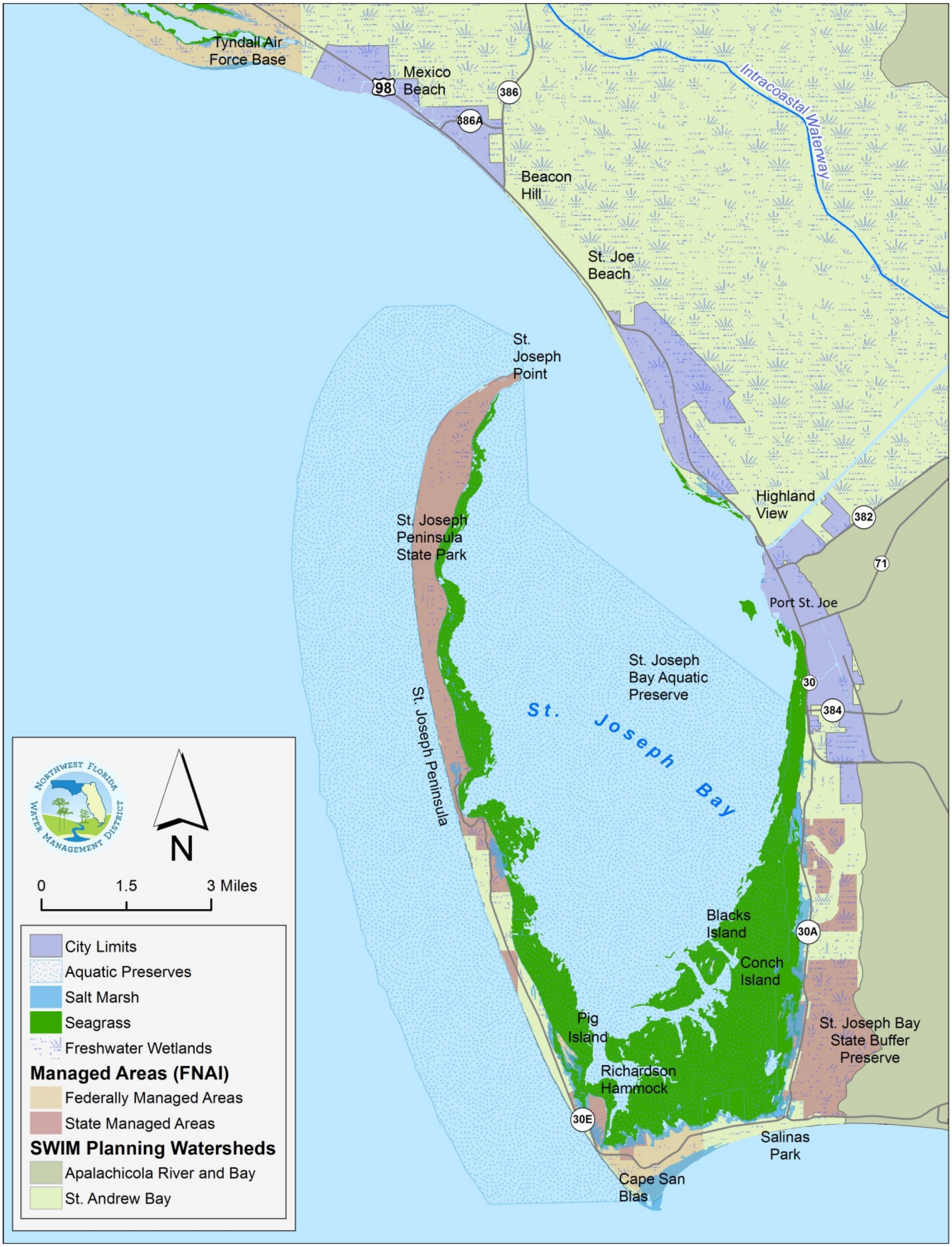
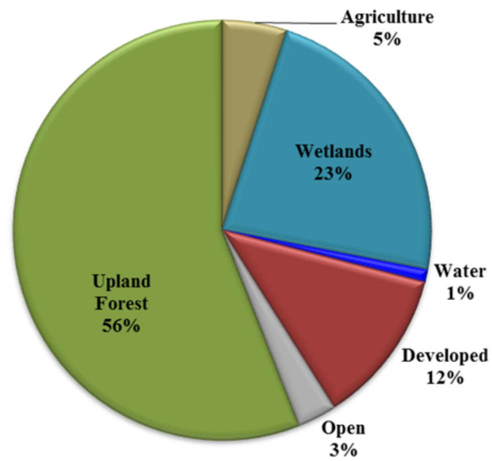


Figure 2-8 **Coastal Features of St Joseph Bay**

2.3 Land Use and Population

Land use and land cover within the watershed consist primarily of upland forest, wetlands, and developed areas (Figures 2-9 and 2-10). Most residential, commercial, industrial, and institutional land uses are concentrated in the urban center of Panama City and adjoining and nearby cities of Panama City Beach, Callaway, Springfield, Parker, and Lynn Haven, as well as within and near the cities of Port St. Joe and Mexico Beach.



Source: FDEP 2015a

Figure 2-9 Land Cover in the St. Andrew Bay Watershed

Public and conservation lands encompass approximately 107,000 acres of the watershed. These include the Econfina Creek Water Management Area (WMA), Tyndall AFB, and several state parks. The Econfina Creek WMA includes more than 43,000 acres in Bay and Washington counties and is owned and managed by the NWFWMD. The WMA protects the Econfina recharge area and provides a resource for public access and recreation.

State parks in the watershed include St. Andrews State Park, Camp Helen, Deer Lake State Park, and St. Joseph Peninsula State Park, which respectively help protect St. Andrew Bay, Lake Powell, Deer Lake, and St. Joseph Bay. The St. Joseph Bay State Buffer Preserve complements St. Joseph Peninsula State Park in protecting water quality in St. Joseph Bay and by directly protecting coastal and aquatic habitats. Federal lands include Tyndall AFB, the Naval Support Activity, and Eglin AFB lands on Cape San Blas. Additionally, the U.S. Fish and Wildlife Service manages the Pig Island Unit of St. Vincent National Wildlife Refuge within St. Joseph Bay.

As a local and regional initiative, the Bay County Comprehensive Plan and Bay-Walton Sector Plan define the West Bay Preservation Area, as well as additional conservation lands, for the purpose of protecting West Bay and other water and environmental resources. The City of Panama City Beach owns and manages the Panama City Beach Conservation Park west of West Bay (City of Panama City Beach 2016). These lands are complemented by regional general permits (SAJ 86 and 105) enacted by the U.S. Army Corps of Engineers and an ecosystem management agreement between FDEP and the St. Joe Company, establishing a permitting framework protective of wetlands and water resources within the West Bay and Lake Powell basins. Additional regulatory actions include the Breakfast Point, Sweetwater, and Sand Hill Lakes mitigation banks, which provide wetland resource enhancement, restoration, and protection.

Public and conservation lands are illustrated by Figure 2-11 and discussed in some detail in Appendix G.

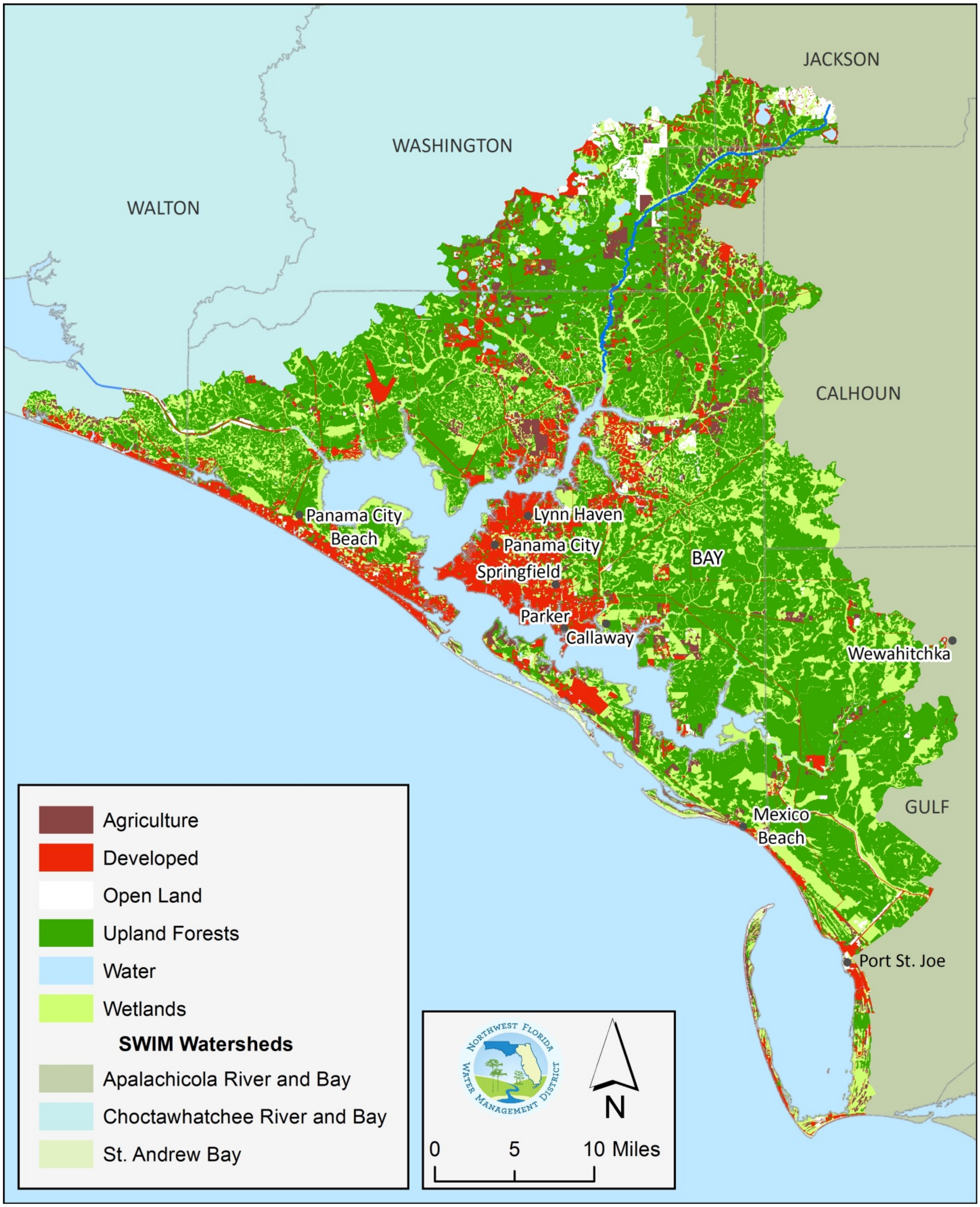


Figure 2-10 **2012-2013 Land Use and Land Cover for the St. Andrew Bay Watershed**

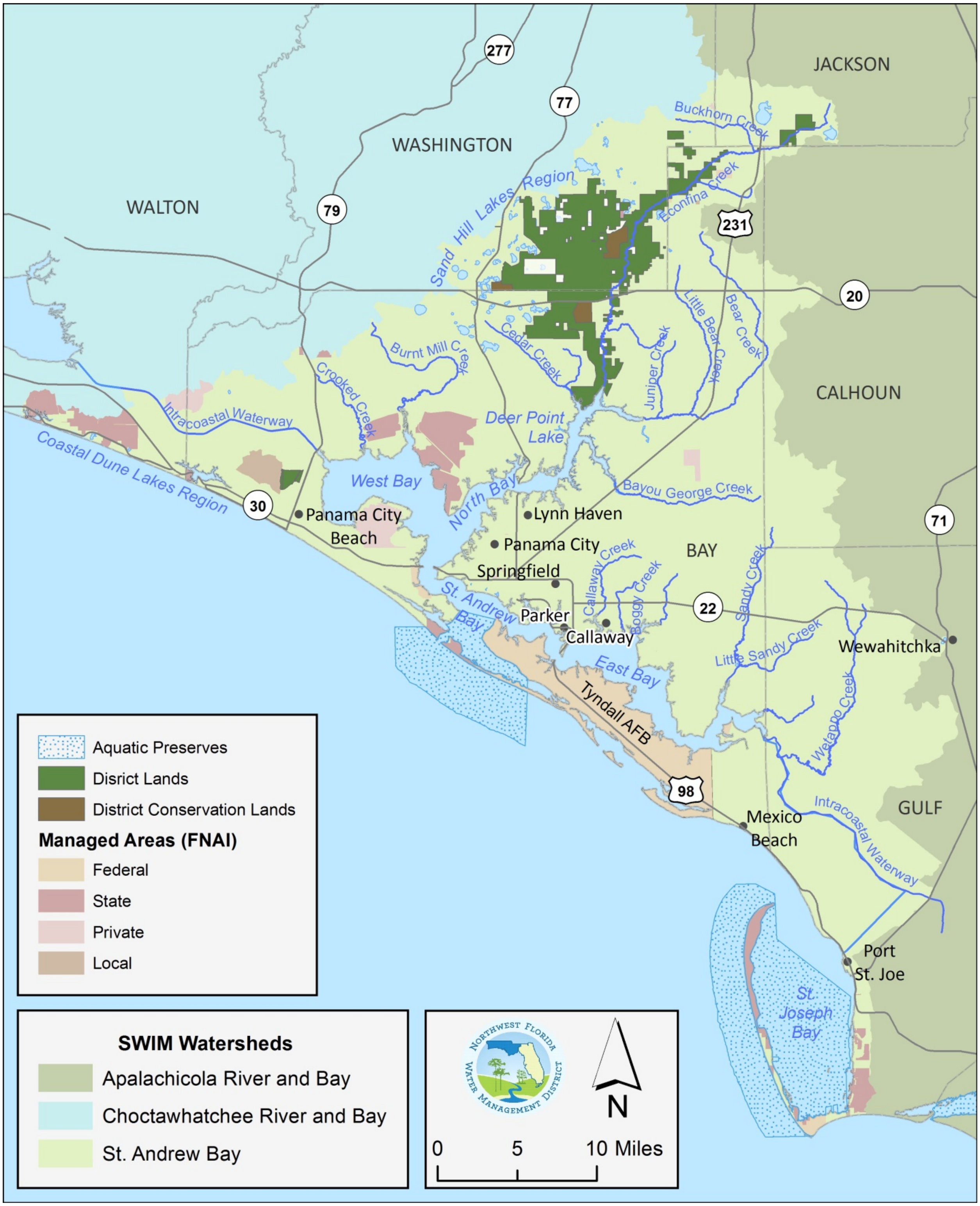


Figure 2-11 Public and Conservation Lands in the St. Andrew Bay Watershed

The largest concentration of population in the watershed is within Bay County. Table 2-1 displays population estimates for the watershed, based on spatial analysis of 2010 U.S. Census data, together with projections to 2030 calculated based on countywide population growth projections from the University of Florida's Bureau of Economic and Business Research (UF BEBR 2016).

Table 2-1 Watershed Population Estimates: 2010-2030

County	2010	2020	2030
Bay	167,975	183,741	201,647
Gulf	6,621	7,137	7,555
Walton	2,453	3,088	3,761
Washington	2,392	2,488	2,633
Jackson	790	812	827
Calhoun	65	66	68
Total	**182,306**	**197,333**	**216,492**

2.4 Natural Communities

The St. Andrew Bay watershed supports a wealth of biological diversity reflecting its mosaic of natural communities. Among these communities are expansive seagrass beds; tidal marshes; karst lakes and streams; coastal dune lakes; and other habitats collectively supporting populations of fish, invertebrates, migratory birds, and other flora and fauna. Keppner and Keppner (2008) identified 3,643 species of plants and animals resident within the watershed.

More detailed information on the habitats and natural communities observed in the watershed, as well as the species those habitats support, are described in Appendices D and E.

2.4.1 Terrestrial Communities

Terrestrial communities, including bluffs, mesic flatwoods, sandhill, scrub, scrubby flatwoods, upland hardwood forests, wet flatwoods, xeric hammocks, and coastal strand, provide important habitat, as well as economic and other resources. These and other communities are described in some detail in Appendix E. Federally listed species supported by terrestrial communities within the watershed include the gopher tortoise (*Gopherus polyphemus*), reticulated flatwoods salamander (*Ambystoma bishopi*), eastern indigo snake (*Drymarchon corais couperi*), and red-cockaded woodpecker (*Picoides borealis*).

2.4.2 Streams

Econfina Creek is a spring-run stream draining a combined surface water basin and groundwater contribution area of approximately 168,000 acres. As described above, Econfina Creek includes 11 major separate springs or spring groups and has a sandy bottom with exposed limestone in places. As the primary tributary to Deer Point Lake Reservoir, the creek is a Class I waterbody. The creek includes designated critical habitat for the endangered Gulf moccasinshell (*Medionidus penicillatus*) and oval pigtoe (*Pleurobema pyriforme*), and may also support the endangered shinyrayed pocketbook (*Lampsilis subangulata*) (U.S. Department of the Interior 2007).

Other tributary streams within the St. Andrew Bay watershed include Burt Mill, Crooked, Sandy, and Wetappo creeks. These streams drain forested uplands and wetlands and include tidal marsh within their lower reaches.

2.4.3 Riparian, Wetland, and Floodplain Habitats

Riparian habitats include those areas along waterbodies that serve as an interface between terrestrial and aquatic ecosystems. These areas provide important fish and wildlife habitats that promote ecological diversity and assist in mitigating or controlling NPS pollution. Riparian vegetation can be effective in removing excess nutrients and sediment from surface runoff and shallow groundwater and in shading streams to optimize light and temperature conditions for aquatic plants and animals. Riparian vegetation, especially trees, is also effective in stabilizing streambanks and slowing flood flows, resulting in reduced downstream flood peaks.

Expanses of interconnected palustrine wetlands define much of the landscape and ecology of the western portion of the West Bay watershed. Additionally, large wetland systems and floodplains encompass the drainage of East Bay, including along Wetappo Creek and Horseshoe Creek. Wet pine flatwoods, cypress strand, basin marsh, baygall, dome swamp, hydric hammock, floodplain swamp, and wet prairie are the prominent types of wetland habitats found in the St. Andrew Bay watershed (FNAI 2016a, 2016b). Notably, wet flatwoods within and proximate to the City of Panama City are home to the Panama City Crayfish (*Procambarus econfinae)*, a Species of Special Concern and species endemic to Bay County, Florida (FWC 2016g).

Marshes within the St. Andrew Bay watershed include both salt (brackish) marsh in the coastal reaches and freshwater emergent marsh along stream systems (FNAI 2010). Marsh species composition is influenced by a combination of salinity tolerance and differences in soil type, elevations, and competitive interactions. Salt marshes serve as a transition between terrestrial and marine systems. Generally, salt marshes are intertidal and develop along relatively low energy shorelines. Salt marshes in the Florida Panhandle are usually characterized by fairly homogeneous expanses of dense black needlerush (*Juncus roemerianus*). Often, they are accompanied on the water-ward side by smooth cordgrass (*Spartina alterniflora*). The *Juncus* and *Spartina* zones are distinctive and can be separated easily by elevation.

Large tidal marshes are present along the Breakfast Point peninsula and across much of the shoreline of West Bay, the southern and eastern shorelines of East Bay, and along the southern shoreline of St. Joseph Bay. Marsh vegetation is also an important component of the littoral zone within many of the bayous.

2.4.4 Seagrass Beds

Seagrasses support an abundance of fish and invertebrates, many of which are commercially and recreationally important (FDEP 2008). St. Andrew Bay and St. Joseph Bay are dominated by turtle grass (*Thalassia testudinum*), shoal grass (*Halodule wrightii*) and manatee grass (*Syringodium filiforme*). Due to limited freshwater influence and associated sedimentation, the waters of St. Andrew and St. Joseph bays tend be relatively clear and of high salinity compared to other coastal waterbodies in northwest Florida. These attributes make them an ideal habitat for seagrass communities (Figures 2-7 and 2-8). Data from 2010 indicate that seagrass beds covered approximately 12,193 acres in the St. Andrew Bay estuary and 7,166 acres in St. Joseph Bay (Yarbro and Carlson 2016).

2.4.5 Coastal Dune and Sand Hill Lakes

The St. Andrew Bay watershed contains several named coastal dune lakes (described in Section 2.2.2 and shown in Figure 2-5). Coastal dune lakes are adapted to the dynamic coastal environment and have been identified as globally rare and imperiled (FNAI 2010). They are ecologically distinct, given their position within the watershed and variable interaction with the Gulf of Mexico. The lakes provide an important stopover point for migrating neo-tropical birds, habitat for aquatic and marine animals, freshwater for aquatic plants, and recreational resources for residents and visitors. Migratory birds such as piping plovers

(*Charadrius nivosus*) and red knots (*Calidris canutus*) use lakeshore edges and outfalls for foraging during winter migrations. Snowy plovers (*Charadrius nivosus*) and least terns (*Sternula antillarum*) use dune habitats adjacent to the lakes for nesting and foraging habitat (FDEP 2014b).

Lake Powell is the largest coastal dune lake in the watershed. Depending on rainfall and whether or not the connection to the Gulf is open, water levels can fluctuate significantly. As a result, development around the lake has historically been subject to flooding during high lake levels before the ephemeral channel can adapt and drain the lake. To prevent flooding in developed areas, managing agencies have determined a maximum allowable lake water level, above which a channel is mechanically excavated.

As described by Keppner and Keppner (2008), the Sand Hill Lakes, found in the northern portion of the watershed, support an endemic plant community that includes a number of rare and listed species. Within and among the lakes are an array of aquatic, wetland, and upland habitats. The riparian zones host a distinctive botanical community that is well adapted to the continuous and sometimes dramatic water level fluctuations that affect most of these lakes. This community is anchored by the state-listed endangered and endemic smoothbark St. John's-wort (*Hypericum lissophloeus*), which is frequently associated with several other rare species (Keppner and Keppner 2005). The lakes themselves naturally fluctuate in response to rainfall and interaction with the water table and underlying aquifer.

2.4.6 Coastal Barrier Systems

St. Joseph Peninsula is a barrier peninsula characterized by multiple, coast-parallel beach or foredune ridges located in Gulf County (Rink and Lopez 2010). Cape San Blas is part of the Apalachicola Barrier Island Complex extending from the mouth of the Ochlockonee River in the east to the St. Joseph Bay in the west. The Apalachicola Barrier Island Complex exhibits a diverse set of natural coastline orientations due to variable hydrodynamic conditions over the past 6,000 years of deposition and peninsular formation, which began in the Late Holocene epoch (Rink and Lopez 2010).

The dynamic nature of the Apalachicola Barrier Island Complex over geologic time has resulted in the emergence of distinct habitat types along the peninsula. These habitats shape, and are shaped by, the flora and fauna inhabiting the peninsula. St. Joseph peninsula communities include flatwoods, interdunal swales, rosemary scrub, beachfront, and other communities supporting a wide array of resident and endemic and species, as well as migratory birds (Lamont *et al.* 2016). Important habitat types within this ecosystem include coastal scrub, beach dune, interdunal swale, and maritime hammock; as well as tidal marshes, seagrass beds, and other aquatic habitats within St. Joseph Bay. Protected species supported by these habitats include several species of sea turtles, piping plover (*Charadrius melodus*), and the least tern (*Sterna antillarum*), among others. The peninsula also provides a variety of habitats for neotropical migrants, shore birds, wading birds, and sea birds (Lamont *et al.* 2016).

3.0 Watershed Assessment and Water Resource Issues

3.1 Water Quality

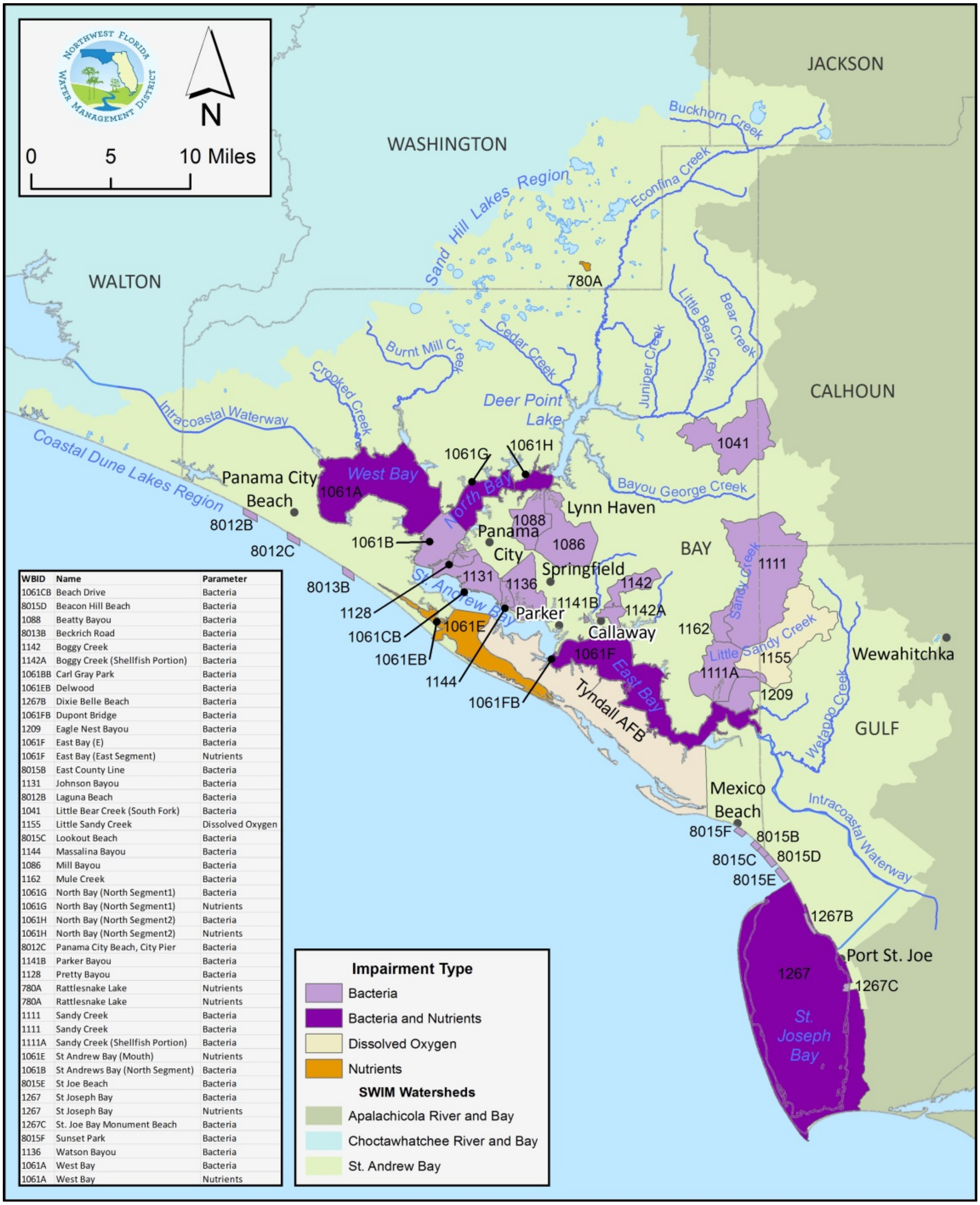
In the northern part of the watershed, the water quality is generally good. The District manages the Econfina Creek Water Management Area, which encompasses most of the recharge area for springs contributing to Econfina Creek and Deer Point Lake Reservoir, as well as the Sand Hill Lakes. Otherwise in this region, silvicultural activities, landscape erosion, and unpaved roads contribute to the NPS pollution. The St. Joseph Bay State Buffer Preserve complements St. Joseph Peninsula State Park in protecting water quality in St. Joseph Bay and by directly protecting coastal and aquatic habitats.

Generally, the surface water quality in the St. Andrew Bay Watershed varies by stream reach and contributing land uses. A concentration of NPS pollution sources is associated with the developed lands adjacent to the bays. Septic systems adjacent to the lakes, streams, bays, and coastal areas pose threats to water quality in the form of nutrients and other pollutants.

3.1.1 Impaired Waters

The FDEP has identified 37 waterbody segments in the St. Andrew Bay watershed as impaired (Figure 3-1). Most of the bays and estuaries are impaired for bacteria, and West Bay, East Bay, North Bay, St. Joseph Bay, Grand Lagoon, and Rattlesnake Lake are listed for nutrients. Sandy Creek is impaired for dissolved oxygen. The overall list of impaired waters can be found in Appendix F.

The 2016 updated list displayed a significant reduction in impaired waterbody segments. This is due in part to the adoption of an approved Total Maximum Daily Load (TMDL) for mercury. The FDEP adopted the statewide TMDL for reducing human health risks associated with consuming fish taken from waters impaired for mercury. Mercury impairments are based on potential human health risks, not exceedances of water quality criteria. The primary source of mercury is atmospheric deposition, with 30 percent from natural sources and 70 percent from anthropogenic international sources outside of North America. It is estimated that approximately 0.5 percent of mercury from anthropogenic sources is from Florida (FDEP 2013). Only a small part of mercury in the environment is in the form of methylated mercury, which is biologically available to the food chain. The statewide TMDL for mercury includes a reduction target for fish consumption by humans and by wildlife and an 86 percent reduction in mercury from mercury sources in Florida (FDEP 2013). While there are no other state adopted TMDLs in the St. Andrew Bay watershed, EPA has established TMDLs for multiple bayous surrounding Panama City and Lynn Haven. A full list of EPA established TMDLs is available in Appendix F.



WBID	Name	Parameter
1061CB	Beach Drive	Bacteria
8015D	Beacon Hill Beach	Bacteria
1088	Beatty Bayou	Bacteria
8013B	Beckrich Road	Bacteria
1142	Boggy Creek	Bacteria
1142A	Boggy Creek (Shellfish Portion)	Bacteria
1061BB	Carl Gray Park	Bacteria
1061EB	Delwood	Bacteria
1267B	Dixie Belle Beach	Bacteria
1061FB	Dupont Bridge	Bacteria
1209	Eagle Nest Bayou	Bacteria
1061F	East Bay (E)	Bacteria
1061F	East Bay (East Segment)	Nutrients
8015B	East County Line	Bacteria
1131	Johnson Bayou	Bacteria
8012B	Laguna Beach	Bacteria
1041	Little Bear Creek (South Fork)	Bacteria
1155	Little Sandy Creek	Dissolved Oxygen
8015C	Lookout Beach	Bacteria
1144	Massalina Bayou	Bacteria
1086	Mill Bayou	Bacteria
1162	Mule Creek	Bacteria
1061G	North Bay (North Segment1)	Bacteria
1061G	North Bay (North Segment1)	Nutrients
1061H	North Bay (North Segment2)	Bacteria
1061H	North Bay (North Segment2)	Nutrients
8012C	Panama City Beach, City Pier	Bacteria
1141B	Parker Bayou	Bacteria
1128	Pretty Bayou	Bacteria
780A	Rattlesnake Lake	Nutrients
780A	Rattlesnake Lake	Nutrients
1111	Sandy Creek	Bacteria
1111	Sandy Creek	Bacteria
1111A	Sandy Creek (Shellfish Portion)	Bacteria
1061E	St Andrew Bay (Mouth)	Nutrients
1061B	St Andrews Bay (North Segment)	Bacteria
8015E	St Joe Beach	Bacteria
1267	St Joseph Bay	Bacteria
1267	St Joseph Bay	Nutrients
1267C	St. Joe Bay Monument Beach	Bacteria
8015F	Sunset Park	Bacteria
1136	Watson Bayou	Bacteria
1061A	West Bay	Bacteria
1061A	West Bay	Nutrients

Figure 3-1 Impaired Waterbody Segments

3.1.2 Pollution Sources

Nonpoint source (NPS) pollution is generated when stormwater runoff collects pollutants from across the landscape (lawns, pavement, highways, dirt roads, buildings, farms, forestry operations, and construction sites, etc.) and carries them into receiving waters. Pollutants entering the water in this way include nutrients, microbial pathogens, sediment, petroleum products, metals, pesticides, and other contaminants. Typical sources of NPS pollution include stormwater runoff from urban and agricultural lands and erosion and sedimentation from construction sites, unpaved roads, and destabilized stream banks. Atmospheric deposition of nitrogen, sulfur, mercury, and other substances via fossil fuel combustion also contribute to NPS pollution.

Stormwater runoff is the primary source of NPS pollution, and it is closely associated with land use. Urban land use, especially medium- to high-density residential, commercial, and industrial areas has the highest NPS pollution per acre due to impervious surfaces that increase runoff. In urban areas, lawns, roadways, buildings, parking lots, and commercial and institutional properties all contribute to NPS pollution. Urban areas are concentrated around the Panama City metropolitan area, with additional development within Tyndall AFB and unincorporated communities along the bay. In the St. Joseph Bay basin, more intensive land use is centered on the City of Port St. Joe, with residential and commercial developments also occurring at Mexico Beach, St. Joe Beach, and along the peninsula north of Cape San Blas. In addition to these established areas, the urban-rural fringe hosts new development and construction sites, introducing new NPS pollution sources impervious surface area within the watershed.

In the St. Andrew Bay watershed, nine entities hold Municipal Separate Storm Sewer System (MS4) NPDES permits for stormwater conveyances that discharge to waters of the State, including: Tyndall AFB; the cities of Lynn Haven, Panama City, Callaway, Parker, Springfield, and Panama City Beach; and Bay and Walton counties.

Fertilizer application, ditching, road construction, and harvesting associated with agriculture and silviculture can also cause NPS pollution, erosion, sedimentation, and physical impacts to streams and lakes (Stanhope *et al.* 2008). Silviculture is widespread across non-urban areas of the watershed. Other agricultural uses are limited within the St. Andrew Bay watershed (Figure 2-10).

Onsite sewage treatment and disposal systems (OSTDS) are widespread sources of nutrients and other pollutants. Concentrations of OSTDS can degrade the quality of groundwater and proximate surface waters. While conventional OSTDS can control pathogens, surfactants, metals, and phosphorus, mobility in the soil prevents complete treatment and removal of nitrogen. Dissolved nitrogen is frequently exported from drainfields through the groundwater (NRC 2000). Additionally, OSTDS in areas with high water tables or soil limitations may not effectively treat other pollutants. Pollutants can enter surface waters as seepage into drainage ditches, streams, lakes, and estuaries (EPA 2015d; NRC 2000).

Florida Water Management Inventory data indicate approximately 44,000 known or likely septic systems in the watershed (FDOH 2016). Known septic is based on permit data combined with inspection records. Likely septic is based on results of the review of nine criteria, but without inspection verification. In the St. Andrew Bay watershed, most rural and unincorporated communities rely on OSTDS for wastewater treatment. Figure 3-2 shows the approximate locations of septic tanks as of 2015 (FDOH 2015b).

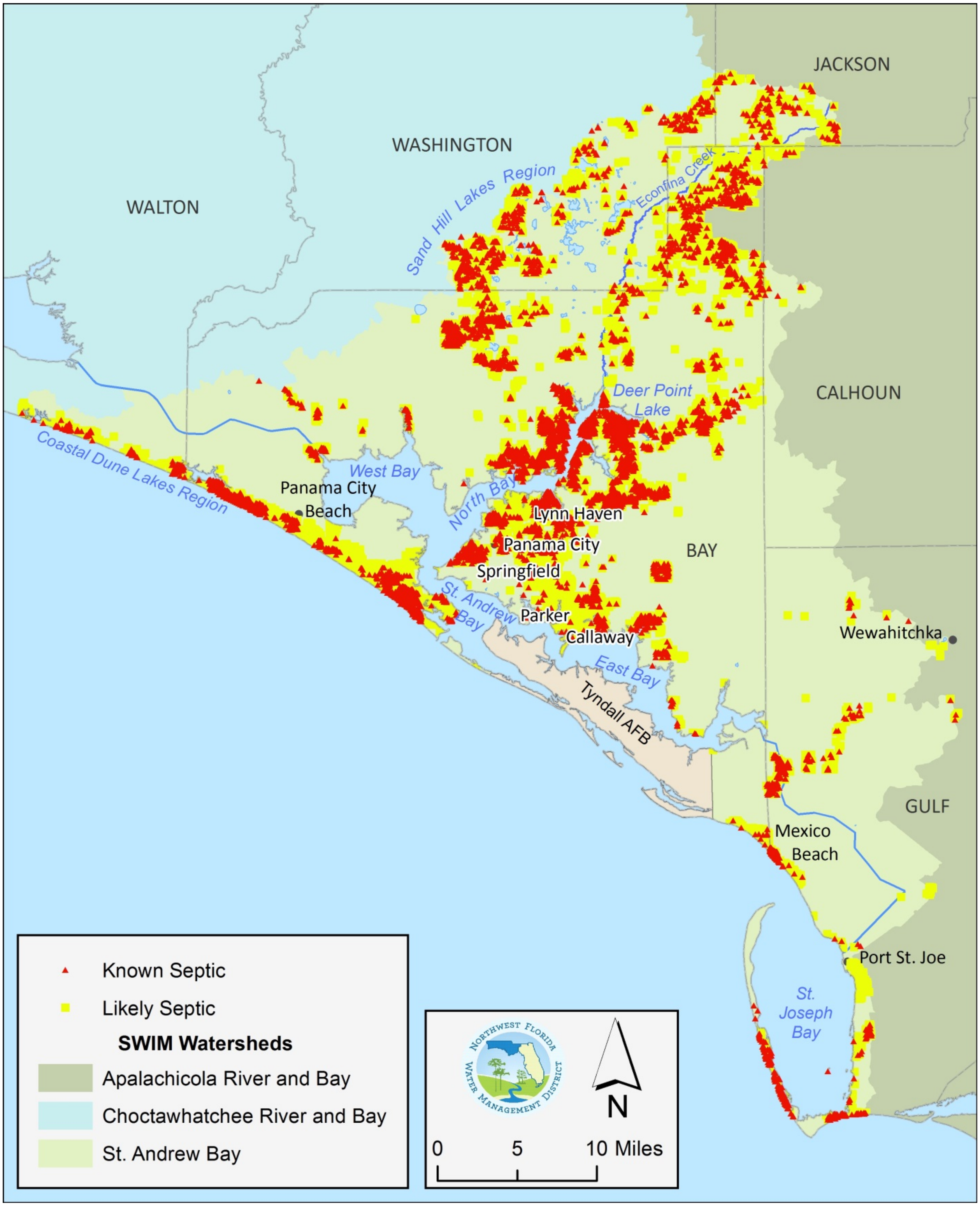


Figure 3-2 Septic Tank Locations in the St. Andrew Bay Watershed

Erosion and sedimentation are natural phenomena that can be accelerated by human activities with undesirable water quality consequences. Highly erodible soils, unstable slopes, and high rainfall intensities are important factors in erosion and sedimentation. Construction activities, unpaved roads, abandoned clay pits, and agricultural and silvicultural practices lacking proper BMPs are common sources of sedimentation. Accelerated stream bank erosion caused by runoff associated with impervious surfaces can also be a significant source of sedimentation into receiving waters.

Marinas may be sources of NPS pollution from activities such as boat maintenance, fueling, and marine sewage discharge, as well as runoff from parking lots. Pollution can depend on the availability of pump-out facilities and the level and consistency of marina BMP implementation. Major marinas are located at St. Joseph Peninsula State Park, Port St. Joe, the Naval Support Activity, Panama City Beach at Grand Lagoon, St. Andrews State Park, Panama City (on Harrison Avenue), and Sun Harbor near the Panama City Port Authority. Three of these seven marinas in the St. Andrew Bay watershed are clean marina certified (FDEP 2015f).

Some pollutants, such as nitrogen and mercury, are also contributed to the landscape and waterbodies by atmospheric deposition. Most oxidized-nitrogen emissions are deposited close to the emission source and can especially impact surface water proximate to urban areas (Howarth *et al.* 2002a, 2002b, 2002c; NRC 2000).

There are nine permitted domestic wastewater facilities and 17 industrial wastewater facilities within the watershed. Wastewater treatment facilities are located primarily in the vicinity of Panama City, Panama City Beach, Tyndall AFB, and Port St. Joe (Figure 3-3; Table 3-1). In 2011, the Panama City Beach WWTF ceased discharge into West Bay and re-routed its treated effluent to the city's 2,900-acre Conservation Park for release into treatment wetlands, with some reclaimed water also being used for landscape irrigation. The discharge is permitted at up to 14 million gallons per day (City of Panama City Beach 2016; NWFWMD 2014b).

The Sikes Sand Pit sand and gravel mine in Washington County is the only mine recognized by the USGS within the St. Andrew Bay watershed. Forty small-scale mines and borrow pits within the watershed have been identified by FDEP, with some located near streams, creeks, tributaries, and other waterbodies (FDEP 2014e). Within the watershed, sand is the predominant material mined, however, several limestone and clay mines also exist (FDEP 2014e).

In the St. Andrew Bay watershed, there are four hazardous waste producing facilities registered as EPA Biennial Reporter facilities. Additionally, 381 active sites are registered with the Storage Tank and Petroleum Contamination Monitoring (STCM) database. There are also five contaminated dry-cleaning sites eligible for the state-funded Dry-cleaning Solvent Cleanup Program. Most STCM and dry-cleaning sites are in historically developed areas, including Panama City, Panama City Beach, and Port St. Joe.

The EPA has identified one Superfund site in the watershed at Tyndall AFB. In the past, operations at the base resulted in contaminated soil, sediment, groundwater, and surface water. The EPA, Air Force, and FDEP signed an Interagency Agreement on September 20, 2013, to guide the cleanup of the base. A Site Management Plan was approved in 2014 and updated in September 2015 to address the schedule of investigation and cleanup at Tyndall AFB. Annual updates to the schedule are ongoing (EPA 2016b).

Other contaminated sites in the watershed include two facilities registered under the state-funded cleanup program: Town and Country Lake Estates in Springfield and Kamax, LLC, in Panama City. This program is designed to address sites where there are no viable responsible parties, the site poses an imminent hazard, and the site does not qualify for Superfund or is a low priority for the EPA. Town and Country

Lake Estates is a former landfill/dump located northeast of Lake Martin. Kamax, LLC, is a former landfill/dump located off County Road 390 near Minge Branch.

Figure 3-3 Permitted Wastewater Facilities within the St. Andrew Bay Watershed

Table 3-1 Domestic Wastewater Facilities

Facility Name	County	Permitted Flow (mgd)	2015 Flow (mgd)	Discharge Type*
Military Point Regional AWT Facility	Bay	7.0	3.80	Surface water; golf course irrigation; reuse at facility
Millville AWT Facility	Bay	5.0	1.90	Surface Water
St. Andrews WWTF (AWT)	Bay	5.0	2.30	Surface Water
Panama City Beach WWTP	Bay	14.0	5.99	Wetlands; landscape irrigation; residential irrigation; reuse at WWTP
Lynn Haven WWTF	Bay	2.5	1.41	Surface water; landscape irrigation; residential irrigation
North Bay WWTF	Bay	1.50	0.02	RIB
Rivercamps on Crooked Creek WWTP	Bay	0.07	0.02	RIB
Port St. Joe WWTF	Gulf	3.1	0.65	Sprayfield
Beaches Sewer System WWTP	Gulf	0.070	0.04	Sprayfield

Source: FDEP 2016a, 2017
*See Parts II-VII of Chapter 62-610, F.A.C. for more information.
** FDEP Annual Reuse Inventory only includes facilities permitted at 0.1 mgd or greater.

3.2 Natural Systems

In 2010, seagrasses coverage was estimated at 12,193 acres in St. Andrew Bay, which represents an increase of about nine percent bay wide since 2003 (Yarbro and Carlson 2012). The greatest area of increase was in West Bay (812 acres, or 32 percent). From the 1950s to early 1990s, extensive loss of seagrasses occurred in West Bay, totaling approximately 1,853 acres. A major portion of the loss was in the southern extent of the bay, which in the 1970s, was used for a commercial shrimp aquaculture operation. This area, termed "West Bay Bowl," remains substantially barren. Fitzhugh (2012b) identified turbidity and sediment resuspension among the likely barriers to recovery. Indicators of eutrophication, including nutrient enrichment and epiphyte growth, were also identified (Fitzhugh 2012b). Yarbro and Carlson (2016) also point out significant scarring of seagrass beds within the bay, particularly near the inlet to the Gulf of Mexico.

Seagrasses covered 7,166 acres in St. Joseph Bay in 2010 (Yarbro and Carlson 2016). This represents an increase of 494 acres from 2006 estimates, but a substantial decrease from the 9,740 acres mapped in 1992. Seagrass beds in St. Joseph Bay are likely stable in area and species composition, but seagrass cover (a measure of density) appears to be declining. Propeller scarring is extensive in St. Joseph Bay, particularly in the southern portion of the bay, and it appears to be increasing (Yarbro and Carlson 2016). Epiphyte growth on seagrass blades is increasing, potentially due to increasing nutrients in the water column (Yarbro and Carlson 2016; FDEP 2008).

Geselbracht *et al.* (2015) conducted an analysis of St. Andrew and Choctawhatchee bays using the Sea Level Affecting Marshes Model (SLAMM) to evaluate changes in community composition under five scenarios, ranging from 0.39 to 2.0 meters of sea level rise by the year 2100. The results indicate that coastal forests and marsh communities have the potential to be affected, including within the vicinity of West and East bays. Adaptation strategies, including living shorelines, oyster reefs, wetland and upland habitat restoration, water flow preservation, and sediment management to support vulnerable marsh, mangrove forest and dry land areas were suggested for planning consideration.

The FDEP (2008) noted that, beginning in the early 1990s, the salt marsh bordering St. Joseph Bay began showing signs of stress and decline. Causes of marsh die-off were undetermined, but potential factors identified included effects of drought, sediment starvation, or pathogens.

It should be noted that impacts of invasive species on native communities have been widely recognized. Proliferation of non-native species poses a threat to biodiversity as non-native species modify ecosystem structure and contribute to the decline of native species, particularly in aquatic systems (FWC 2015d; Mack *et al.* 2000; Vitousek 1986). The Florida Fish and Wildlife Conservation Commission, Invasive Plant Management Section is the lead agency for coordinating control of invasive aquatic and upland plants on public conservation lands and surface waters. Additionally, the introduced Indo-Pacific lionfish (*Pterois* sp.) has been reported in both St. Joseph and St. Andrew bays (USGS 2017). This species has caused impacts due to predation and an ability to outcompete native fish species, contributing to broader stressors on coastal ecosystems (Morris 2012).

3.3 Floodplains and Floodplain Management

Floodplains protect water quality by allowing storage of floodwaters, reducing runoff velocity and preventing erosion and sedimentation. Floodplains also attenuate potential flood effects while providing an ecological link between aquatic and upland ecosystems and habitat for many terrestrial and aquatic species. Development of and encroachment into floodplains, reduces water storage capacity, increases flood heights and velocities, and degrades natural systems in areas beyond the encroachment itself.

Maintaining the hydrological integrity of the floodplain can benefit surface water systems in drought conditions, as well as flood conditions. Floodplain vegetation reduces evaporation and increases soil water storage capacity. Riparian wetlands, marshes, and floodplain forests help to slow stormwater runoff, protecting water quality and regulating the release of water into streams and aquifers.

Federal Emergency Management Agency digital flood maps indicate that 357,852 acres (approximately 48 percent) of the watershed are delineated as Special Flood Hazard Area (Figure 2-6). Coastal areas in Bay and Gulf counties are subject to widespread flooding resulting from storm surges that accompany hurricanes and tropical storms. Among other significant floodplain areas are wetlands bordering and proximate to West Bay and East Bay and inland between East Bay and St. Joseph Bay.

4.0 Watershed Protection and Restoration

4.1 Management Practices

Watershed protection and restoration is inherently a collaborative effort on the part of state, regional, and federal agencies; local governments; nongovernment organizations; the business community; and the public. Implementation is conducted at the watershed, sub-watershed, and local scale. Recommended management strategies are described below.

4.1.1 Nonpoint Source Pollution Abatement

Addressing NPS pollution is a vital part of watershed management in the St. Andrew Bay watershed. As described above, stormwater runoff carries pollutants from the landscape that diminish water quality, and it can physically impact streams and aquatic habitats. Multiple strategies can be employed to collectively reduce NPS pollution and protect and improve water quality and watershed resources.

<u>Stormwater Retrofit</u>

Among the most effective means of reducing NPS pollution is to retrofit existing stormwater management systems to add treatment and improve, restore, or approximate natural hydrology. In addition to improving water quality, appropriately designed retrofit projects improve flood protection, reduce physical disturbance from erosion and sedimentation, and provide aesthetic and recreational use benefits.

Implementation may include a mixture of traditional and nonstructural approaches. There are numerous methods of stormwater management and treatment, some of which include wet and dry retention ponds, infiltration systems, stormwater harvesting, wetland treatment systems, stormwater separator units, vegetated swales and buffers, pervious pavement, green roofs, and chemical (alum) treatment. Specific measures employed depend on site-specific conditions, including soils, water table conditions, flow, intended uses, and land area available. Optimally, a treatment train approach would be employed, addressing hydrology and water quality treatment across a basin. Implementation should also be implemented within a wider, watershed context that incorporates initiatives such as Florida Friendly Landscaping (section 373.185, F.S.) and public outreach and awareness.

Within the St. Andrew Bay watershed, the greatest need and potential for stormwater retrofit efforts is within municipal and fringe areas with relatively dense development and significant areas of impervious surface. Examples include Panama City, Panama City Beach, Port St. Joe, Lynn Haven, Parker, and Springfield. Local governments normally take the lead in implementing stormwater retrofit projects, as they most commonly own, operate, and maintain stormwater management systems. Grant funding and planning assistance may be provided by state and federal agencies.

<u>Agricultural Best Management Practices</u>

Best management practices are individual or combined practices determined through research, field-testing, and expert review to be effective and practicable means for improving water quality, considering economic and technological constraints. Such measures can promote water use efficiency and protect fish and wildlife habitat. Such practices were pioneered for agriculture but have also been developed and effectively applied to silvicultural and urban land uses. Best management practices reduce soil loss, nutrient enrichment, sedimentation, discharge of chemical pollutants, and other adverse impacts (see, for example, Wallace *et al.* 2017, among many others). Implementation also often provides benefits for stream bank stability and fish and wildlife habitat. In addition to protecting water and habitat quality and conserving water, BMPs may reduce costs to producers by increasing operational efficiency and effectiveness.

Agricultural BMPs generally fall into two categories – structural and management. Structural BMPs, e.g., water-control structures and fencing, involve the installation of structures or changes to the land and are usually costlier than management BMPs. Management BMPs, such as nutrient and irrigation management, comprise the majority of the practices but may not be readily observable. Nutrient management addresses fertilizer type, amount, placement, and application timing, and it includes practices such as soil and tissue testing, application methods and rates, correct fertilizer formulations, and setbacks from water resources. Irrigation management addresses system maintenance, scheduling, and other measures that improve the overall efficiency of irrigation systems.

The Florida Department of Agriculture and Consumer Services has developed, evaluated, and approved BMPs that are specific to individual agricultural operations within Florida watersheds. As of August 2017, the DACS has adopted manuals for cow/calf, statewide citrus, vegetable and agronomic crops, nurseries, equine operations, specialty fruit and nut, sod, dairy, and poultry operations. A small farms manual is under development and adoption is expected in 2017. The sod and cow/calf manuals are currently under review and revision. Guidance for and assistance in enrolling in approved BMPs are provided by FDACS. Cost share programs are also conducted both by FDACS and the District. Additionally, FWC provides technical assistance to private landowners through its Landowner Assistance Program.

Implementation of approved BMPs or water quality monitoring is required in basins with adopted BMAPs. Whether required or not, however, implementation of BMPs are effective means of protecting and restoring watershed resources and functions and are recommended land use practices for implementation of this plan.

Agricultural land uses are limited within the St. Andrew Bay watershed; however, some agricultural uses are within Washington County, notably including the Econfina Creek sub-basin (Figure 2-10).

<u>Silviculture Best Management Practices</u>

The Florida Forest Service (FDACS 2008) defines silviculture BMPs as “the minimum standards necessary for protecting and maintaining the State’s water quality as well as certain wildlife habitat values, during forestry activities.” These practices are protective of water resources, including streams, downstream receiving waters, sinkholes, lakes, and wetlands. The FFS provides specific guidance on BMPs (FDACS 2008) and has established compliance monitoring requirements and procedures. FDEP (1997) evaluated the effectiveness of silviculture BMPs and concluded that forestry operations conducted in accordance with the BMP manual resulted in no major adverse habitat alterations.

The primary BMPs established for forestry are special management zones (SMZs). These zones provide buffering, shade, bank stability and erosion-control, as well as detritus and woody debris. They are intended to protect water quality by reducing or eliminating sediment, nutrients, logging debris, chemicals, and water temperature fluctuations. They also maintain forest attributes that provide wildlife habitat. Widths of SMZs vary depending on the type and size of the waterbody, soils, and slope. Specific SMZs are described as follows.

1) The **Primary Zone** varies between 35 and 200 feet and applies to perennial streams, lakes, and sinkholes, OFWs, Outstanding Natural Resource Waters (ONRW), Class I Waters, and, in some cases, wetlands. A primary zone generally prohibits clear-cut harvesting within 35 feet of perennial waters and within 50 feet of waters designated OFW, ONRW, or Class I. Other operational prescriptions also apply to forestry practices to protect water and natural resources.

2) The **Secondary Zone** applies to intermittent streams, lakes, and sinkholes. Unrestricted selective and clear-cut harvesting is allowable, but mechanical site preparation, operational fertilization, and aerial application or mist blowing of pesticide, are not. Loading decks or landings, log bunching points, road construction other than to cross a waterbody, and site preparation burning on slopes exceeding 18 percent are also prohibited. These zones vary in width between 0 and 300 feet.

3) The **Stringer** provides for trees to be left on or near both banks of intermittent streams, lakes, and sinkholes to provide food, cover, nesting, and travel corridors for wildlife.

Other BMPs detailed in the Florida silviculture BMP manual include practices for forest road planning, construction, drainage, and maintenance; stream crossings; timber harvesting; site preparation and planting; fire line construction and use; pesticide and fertilizer use; waste disposal; and wet weather operations. The BMP manual further includes specific provisions to protect wetlands, sinkholes, and canals. Associated with the BMP manual are separate forestry wildlife best management practices for state imperiled species (FDACS 2014).

Given that the St. Andrew Bay watershed is substantially forested (Figure 2-9; Figure 2-10), silviculture BMPs are some of the most important tools for protecting water quality and wetland and aquatic habitat quality within the watershed. The significant relief that exists within the upper watershed (Figure 2-3) suggests application of SMZs are important for protecting downstream aquatic habitats from further impacts.

<u>Low Impact Development</u>

Inclusive of green infrastructure, urban best management practices, and Florida Friendly Landscaping, low impact development (LID) represents a framework for implementing innovative stormwater management, water use efficiency, and other conservation practices during site planning and development. Benefits include reduced runoff and NPS pollution, improved flood protection, and reduced erosion and sedimentation. Specific practices include some of those referenced above for stormwater retrofit, among these are the following.

- Minimized effective impervious area
- Vegetated swales and buffers
- Bioretention cells
- Rain gardens
- Infiltration and exfiltration systems
- Community greenways
- Green roofs
- Certification programs, such as Florida Water Star^{SM}, and the Florida Green Building Coalition

For transportation infrastructure, practices recommended to protect water quality and floodplain and wetland functions include incorporating bridge spans that accommodate bank-full stream flows while maintaining intact floodplain, wetland, and wildlife passage functions.

<u>Riparian Buffers</u>

A riparian buffer zone is an overlay that protects an adjoining waterbody from effects of adjacent development, such as runoff, NPS pollution, erosion, and sedimentation. A buffer zone in this context refers to an area along the shoreline that is maintained in or restored to generally natural vegetation and habitat. In this condition, an intact buffer zone helps to simultaneously achieve three important goals: water quality protection, shoreline stability, and fish and wildlife habitat. Associated with these are other benefits, including aesthetic improvements and public access and recreation. These benefits are achievable for riparian areas along all types of waterbodies: stream/riverine, estuarine, lacustrine, wetlands, and karst features.

In general, the wider the buffer zone, the better these goals may be achieved, although specific requirements are defined based on community goals. Limited areas, for example, might be developed into recreational sites, trails, or other access points. Table 4-1 is a representation of generalized buffer zones, adapted from USFWS documentation, listing benefits provided by buffers of successively larger widths. Complicating buffer zone design is the fact that different sites have different ecological and physical characteristics. These characteristics (type of vegetation, slope, soils, etc.), when accounted for, would lead to different buffer widths for any given purpose. Alternatives to fixed-width buffer policies include tiered systems that can be adapted to multiple goals and site-specific characteristics and uses. Wenger (1999) and Wenger and Fowler (2000) provide additional background, detail, and guidance for the design of buffer zone systems and policies.

Table 4-1 Generalized Buffer Zone Dimensions

	Buffer Width:					
Benefit Provided:	**30 ft**	**50 ft**	**100 ft**	**300 ft**	**1,000 ft**	**1,500 ft**
Sediment Removal	💧	💧	💧	💧	💧	💧
Maintain Stream Temperature	🐟	🐟	🐟	🐟	🐟	🐟
Nitrogen Removal		💧	💧	💧	💧	💧
Contaminant Removal		💧	💧	💧	💧	💧
Large Woody Debris for Stream Habitat		🐟	🐟	🐟	🐟	🐟
Effective Sediment Removal			💧	💧	💧	💧
Short-Term Phosphorus Control			💧	💧	💧	💧
Effective Nitrogen Removal			💧	💧	💧	💧
Maintain Diverse Stream Invertebrates			🐟	🐟	🐟	🐟
Bird Corridors				🐦	🐦	🐦
Reptile and Amphibian Habitat					🐦	🐦
Habitat for Interior Forest Species					🐦	🐦
Flatwoods Salamander Habitat – Protected Species						🦎

Key
Water quality protection 💧 *Terrestrial riparian habitat* 🐦
Aquatic habitat enhancement 🐟 *Vulnerable species protection* 🦎

Adapted from USFWS 2001

<u>Basinwide Sedimentation Abatement</u>

Unpaved roads frequently intersect and interact with streams, creating erosion and runoff conditions that transport roadway materials directly into streams, smothering habitats and impacting water quality and the physical structure of the waterbodies. Borrow pits have also caused progressive erosion conditions that smother streams, severely damaging or destroying habitats and diminishing water quality. Existing impacts and future risks are most pronounced in the Sand Hill Lakes portion of the watershed, given the slopes and prevalent soils.

Given the site specific and physical nature of the impacts, efforts taken at the local and regional level can lead to significant restoration of aquatic habitat conditions and improved water quality. Corrective actions may include replacing inadequate culverts with bridge spans to maintain floodplains and flows, hilltop-to-hilltop paving, use of pervious pavement, establishment of catch basins to treat and manage stormwater, and establishment of vegetated or terraced basins to eliminate gulley erosion.

In addition to addressing unpaved roads and gully erosion sites, application of construction BMPs, to include sediment and erosion controls, protects water and habitat quality, as well as the physical structure of streams and other waterbodies. Extremely heavy and sustained precipitation events are common in northwest Florida; thus, for large-scale construction and transportation projects, BMPs should be designed to accommodate and prevent erosion and sedimentation during large storm systems, which frequently overwhelm conventional erosion controls.

4.1.2 Ecological Restoration

A wide array of measures may be employed to restore natural and historic functions to former or degraded wetland, aquatic, stream, riparian, and estuarine habitats. Enhancement actions, such as improving vegetation conditions, invasive exotic plant removal, and prescribed fire, are also often discussed in the context of restoration. Wetland, hydrologic, floodplain, shoreline, spring, and stream restoration are discussed further below.

Wetland, Hydrologic and Floodplain Restoration

Wetland restoration includes actions to reestablish wetland habitats, functions, and hydrology. It frequently involves substrate composition and profile restoration and vegetation community reestablishment, including shrub reduction, exotic species removal, application of prescribed fire, and replanting.

Hydrologic and floodplain restoration include actions to reestablish pathways and the timing of surface water flow. Actions include removing fill, replacing bridges and culverts with appropriate designs, establishing low-water crossings, restoring pre-impact topography and vegetation, and abandoning unneeded roads through fill removal and replanting. Restoration activities can have broad water resource benefits, including improved water quality, enhanced fish and wildlife habitat, and other restored wetland functions.

There is significant potential for hydrologic restoration of urban wetlands, including habitat enhancements and vegetation restoration. Potential areas for hydrologic restoration in the watershed include the tidal stream discharges locations and bayous along the St. Andrew Bay estuary, as well as within wetlands in the southern portion of the St. Joseph Bay basin, at roadway causeway crossings, and within the West Bay drainage basin.

Shoreline Restoration

Shoreline restoration refers to measures taken to restore previously altered shorelines and to protect eroding or threatened shorelines. Such restoration is accomplished using “living shorelines” techniques, which are a set of evolving practices that incorporate intertidal and shoreline habitats to protect shorelines while also enhancing or restoring natural communities, processes, and productivity. When planned and implemented appropriately, such efforts result in direct and tangible benefits for residents and the larger community, including fish and wildlife, improved water quality, shoreline protection, and aesthetic improvements.

Shoreline restoration in this context is particularly applicable as a strategy for extensive segments of altered and hardened shorelines on St. Andrew Bay and St. Joseph Bay. Some of the urbanized bayous of the bay may offer restoration opportunities along relatively low-energy shorelines.

Spring Restoration

Springs support regionally distinct ecosystems that are important to the character and quality of the larger system. Additionally, springs often have cultural, recreational, and historical significance. Springs are direct links to underlying aquifers and are vulnerable to effects of nutrient applications within groundwater contribution areas, as well as sedimentation and NPS pollution from land use and activities proximate to the springs. Restoration activities include implementing enhanced agricultural BMPs, connection of residences and other structures to central sewer service, deployment of advanced onsite treatment systems, and implementation of BMPs to treat stormwater runoff and restore spring bank habitats.

Stream Restoration

Stream restoration includes actions to restore the hydrology and aquatic habitat and riparian habitat that may have been impacted by inadequate culverts, road crossings, instream impoundments, erosion and sedimentation, runoff or other hydrologic effects of adjacent or upstream developments. This may also include establishing more natural hydrology, wetlands, storage/treatment, and riparian vegetation along stormwater conveyances. In-stream restoration actions include efforts to reestablish natural channel and floodplain process and should accompany efforts to address offsite processes (runoff, erosion, sedimentation, etc.) that created the original impacts.

Although the watershed has no major rivers, tidal creeks draining to West Bay and North Bay, and many of the urban bayou basins appear to have potential for stream restoration activities.

Estuarine Habitat Restoration

Wetland and shoreline restoration, as described above, as well as aquatic habitat restoration and enhancement can be implemented in a complementary manner to improve and restore estuarine habitat and productivity. Well-established, contiguous marshes; seagrass beds; and oyster reefs provide habitat for a wide range of marine species, including recreational and commercially valuable seafood species.

Emergent marshes and oyster reefs serve as an important buffer between uplands and estuaries, filtering pollutants and consuming nutrients before they enter the water and reducing waves before they reach land. These communities promote sediment accumulation and shoreline stabilization, attenuate wave energy, and buffer upland areas against wind and wave activity that expedite erosion. Each oyster can also filter vast quantities of water, removing plankton and suspended particles that would otherwise reduce sunlight penetration needed for healthy seagrass beds.

4.1.3 Wastewater Management and Treatment Improvements

Septic to Sewer Connections

Among the promising approaches for correcting current impacts and impairments are actions to improve the management and treatment of domestic wastewater. While expensive and engineering-intensive, such actions are technically feasible, proven approaches to improving water quality and aquatic habitat conditions, as well as public uses and benefits.

Extending sewer service to areas that currently rely on conventional onsite treatment and disposal systems for wastewater treatment and disposal is effective in reducing nutrient loading to ground and surface waters. As outlined above, there are over 44,000 known or likely conventional septic systems in the St. Andrew Bay watershed. As illustrated by Figure 3-2, these are particularly concentrated around Deer Point Lake reservoir, in the North Bay basin, Panama City Beach, the Panama City area, and along the St. Joseph Peninsula. Connecting residences and businesses in these areas to centralized wastewater treatment systems has the potential to substantially improve wastewater treatment and reduce loading of nutrients and other pollutants to these waterbodies and to downstream receiving waters.

Advanced Onsite Systems

Where extension of sewer service is not economically feasible due to the spatial distribution of rural populations, there is potential for installation of advanced onsite systems. These systems achieve water quality treatment that significantly exceeds that provided by conventional systems. In particular, advanced passive systems are being developed to provide cost-effective and practical systems for reducing nitrogen and other pollutants from onsite sewage systems (FDOH 2015a). Pilot projects are underway in different regions of the state.

Water Reclamation and Reuse

For the purposes of this plan, water reuse refers to the deliberate application of reclaimed water for a beneficial purpose, with reclaimed water being water that has received at least secondary treatment and basic disinfection (Chapter 62-10, F.A.C.; Section 373.019, F.S.). Beneficial purposes include reusing reclaimed water to offset a current or known future potable water demand or other documented watershed and water resource challenges. Specific purposes include landscape and golf course irrigation, industrial uses, and other applications (FDEP 2015h). Water reuse can be a key strategy in reducing or eliminating wastewater discharges and associated pollution of surface waters.

There are significant opportunities for water reclamation and reuse in the St. Andrew Bay watershed. In particular, these include expanding reuse opportunities to facilitate reduced discharges of treated wastewater into surface waters, including through the Military Point facility and the Panama City and Lynn Haven facilities. The cooperative effort between Bay County and Gulf Power to reuse wastewater from Bay County's North Bay facility represents an opportunity to expand reuse while also connecting numerous septic systems in the North Bay area to central sewer. Panama City Beach and Lynn Haven have developed reuse systems and may have opportunities to further expand these systems and further advance integrated water management and water quality protection.

Centralized Wastewater Treatment Upgrade and Retrofit

For centralized wastewater treatment systems, conversion to advanced wastewater treatment has proven to be an effective means of reducing the discharge of nutrients and other pollutants into surface and ground waters. Additionally, in many areas there are significant needs to rehabilitate existing sewer systems, including to correct inflow and infiltration problems and to reduce the number and severity of sanitary sewer overflow incidents. Accomplishing these actions can be expensive and difficult, given the need to retrofit existing systems in often highly developed areas. Upon completion, however, notable improvements can be achieved for water quality, public recreational uses, and fisheries.

4.1.4 Land Conservation

While the St. Andrew Bay watershed benefits from extensive public land areas that protect water quality and wetland and aquatic habitats and provide for public access and use, there are still opportunities to further protect water resources through the conservation of sensitive areas, including riverine, stream-front, and estuarine shorelines. Conservation can be achieved through less than fee, as well as fee simple acquisition. Additionally resource conservation can be accomplished at a sub-basin or project-level scale to augment other strategies, including stormwater retrofit and hydrologic restoration, and to provide for compatible public access and recreation.

As demonstrated through the Florida Forever program and other state, federal, local, and private initiatives, preserving sensitive lands can be an effective part of protecting water quality and habitat, as well as preserving floodplain and wetland functions. Where land is acquired fee simple by public agencies, other benefits, such as public access and recreation, are also achieved.

4.1.5 Public Awareness and Education

Public awareness and education efforts span multiple purposes and are an essential component of many of the other actions described here. Among the purposes of awareness and education efforts are:

- Technical outreach to assist in implementing specific programs (for example, best management practices);
- Informing members of the public about the purpose and progress of implementation efforts;
- Providing opportunities for public engagement and participation, as well as public feedback and program accountability; and
- Providing broad-based educational efforts to inform members of the public and specific user groups about watershed resources, their benefits, and personal practices to ensure their protection.

Examples of educational activities include technical training for BMPs, school programs (e.g., Grasses in Classes), public events, citizen science and volunteer programs, and project site visits.

Watershed stewardship initiatives can bring together multiple partners such as federal, state, and local agencies; non-profit groups; and citizen volunteers by identifying common program goals and intended outcomes. Having a variety of participants may offer important insight and expertise, shared experiences through lessons learned, and pooling of available resources to implement projects. Specific program examples include, but are not limited to: Walk the WBIDs; Grasses in Classes; homeowner oyster gardening program; rain garden/rain barrel workshops; storm drain labeling; marina BMPs; landowner cost-share assistance programs for living shorelines; elected official information and training sessions; spring break restoration projects; and messaging through outlets such as public service announcements, social media, events, and festivals.

4.1.6 Options for Further Study and Analysis

Additional work is needed to further advance the scientific understanding of resource conditions and restoration needs and opportunities. Additional analytical work can also support improved project planning and application of innovative methods for improved resource management.

- Develop improved and more detailed assessments of environmental conditions and trends, to include water quality, biology, and habitat.
- Develop a watershed-wide NPS pollution potential assessment, at the 12-digit HUC level, to include analysis of land uses, applied loading rates, and potential BMP application.
- Identify estuarine sites with the potential for seagrass or other benthic habitat restoration through improved water quality treatment and water management within specific contributing basins.

- Complete a current, basin-wide analysis and prioritization of sedimentation sources and sites, to include unpaved road stream crossings, borrow pits, gulley erosion sites, and other erosion and sedimentation sources.
- Develop a spatial analysis of OSTDS, to include pollutant loading estimates and estimates of potential pollutant load reduction and average receiving waterbody pollutant concentrations following connection to central sewer and/or conversion to advanced onsite systems. Delineate target areas for central sewer connections and for advanced onsite systems.
- Develop a hydrodynamic model to improve the understanding of estuarine circulation, with application for estuarine and littoral restoration planning.
- Develop updated, regionally specific storm surge, floodplain, and sea level rise models to support project planning, floodplain protection, and adaptation planning, and to further the understanding of drivers of coastal habitat change.
- Conduct data collection and analysis to better understand to the effects of the Gulf County Canal and interconnection with the GIWW on St. Joseph Bay, and to develop management alternatives.
- Evaluate the feasibility and potential benefits of proposed innovative and large-scale projects. Also identify and evaluate the potential for unintended adverse effects. Examples of such projects may include, but are not limited to:
  - Pumped and tidal flow-through circulation systems
  - Regional-scale shoreline habitat development proposals
  - Stream channel reconfiguration
  - Dredged material removal and disposal
  - Benthic dredging
- Conduct an analysis of the potential for additional introduction of marine invasive species within St. Andrew Bay and St. Joseph Bay, and develop responsive management approaches.
- Develop improved metrics for monitoring and evaluating projects, programs, and environmental conditions and trends.
- Evaluate integrated water resource management approaches with application to specific water resource challenges in northwest Florida, potentially further developing plans for the reuse of reclaimed water and stormwater harvesting.
- Develop analysis of oyster/shellfish habitat, conditions, and trends.
- Establish a framework for detecting the effects of climate change and ocean acidification on coastal marine resources in the region.
- Conduct monitoring and evaluate potential effects of herbicides, pharmaceuticals, endocrine disruptors, and other contaminants of emerging concern.
- Review of past projects completed, identifying specific project outcomes and lessons learned.
- Identify locally sensitive indicators of biological condition for dominant diversity-building habitats.
- Develop online consolidation of past and present environmental information, including natural resource coverages, research activities, restoration progress, monitoring results, TMDL updates, and regulatory actions.

4.2 Implementation

Table 4-2 outlines the planning progression of priorities, objectives, and selected management options and approaches for the St. Andrew Bay watershed. These, in turn, inform and guide specific SWIM projects listed in Section 4.3.

Table 4-2 Watershed Priorities, Objectives, and Management Options

Watershed Priorities	Objectives	Management Options
Water Quality		
Degraded Water Quality Water quality impairments for listed stream and estuarine waters, to include nutrients, dissolved oxygen, and bacteria Water quality problems in Grand Lagoon, West Bay and declining water quality in St. Joseph Bay Vulnerability of sensitive habitats, including springs and coastal dune lakes Vulnerability of Deer Point Lake Reservoir Historic seagrass losses and vulnerability	Protect water quality basin-wide, and restore water quality in impaired waters. Protect and, as needed, restore water quality in impacted or designated priority areas: - Urban bayous - West Bay - OFWs - Deer Point Lake Reservoir - Sand Hill Lakes - St. Joseph Bay - Coastal dune lakes	• Stormwater retrofit projects • Comprehensive and integrated basin-wide stormwater management plans • Conversion of septic systems to central sewer • Evaluation and deployment of advanced passive onsite systems • Upgrades to wastewater infrastructure • Agricultural and silvicultural BMPs • Fee simple and less-than-fee protection of spring contribution areas, floodplains, riparian habitats, and other sensitive lands • Floodplain and wetland restoration • Riparian buffer zones • Water reclamation and reuse • Evaluate, prioritize, and address unpaved roads and associated erosion at stream crossings. • Evaluate and address other erosion sites, such as borrow pits and gullies
Wastewater Management Needs and opportunities for improved wastewater collection and treatment Point source discharges Inadequate treatment from conventional OSTDS	Reduce loading of nutrients and other pollutants from OSTDS.	
Nonpoint Source Pollution Stormwater runoff Sedimentation and turbidity from unpaved roads and other erosion sources	Improve treatment of urban stormwater, including from: - Urban bayou basins - Grand Lagoon basin - Other developed areas Reduce basinwide NPS pollution. Reduce sedimentation from unpaved roads and erosion.	

Watershed Priorities	Objectives	Management Options
Natural Systems		
Wetland Systems Wetland loss and degradation	Protect and where needed restore wetland area and functions. Restore wetland hydrology, vegetation, and functions.	• Restoration of wetland hydrology and vegetation communities • Hydrologic restoration in Tates Hell Swamp, M-K Ranch within the Apalachicola River floodplain • Restoration of riparian habitats and sloughs • Shoreline habitat restoration, integrated across multiple habitats where possible • Restoration of impacted seagrasses and tidal marsh areas • Oyster reef restoration • Fee simple and less-than-fee protection of floodplains, riparian habitats, and other sensitive lands • Development of enhanced modeling tools (such as suitability models for estuarine habitat restoration and enhancement) • Coastal infrastructure retrofits to enhance adaptation capacity and habitat resiliency • Development and dissemination of detailed elevation (LiDAR) data • Coastal adaptation and land use planning • Water quality improvement actions described above • Agricultural, forestry, and construction best management practices • Enhanced monitoring of hydrologic and water quality data • Prioritization and abatement of sedimentation from unpaved road stream crossings and other sources
Estuarine and Coastal Habitat Vulnerability of seagrasses, coastal dune lakes, and other estuarine and coastal habitats Saltwater intrusion that could alter brackish and freshwater habitats Indications of eutrophication affecting seagrasses Seagrass scarring, particularly in St. Joseph Bay Shoreline destabilization and erosion Need for improved understanding of current and potential effects of sea level rise	Restore and enhance estuarine benthic habitats, including seagrasses. Ensure restoration projects are compatible with coastal change. Protect and restore the function of vegetated riparian buffers on public and private lands.	
Riverine and Stream Habitats Vulnerability of springs Altered floodplains, riparian habitats, and tributary streams	Reduce sedimentation from spoil sites, unpaved roads, and landscape erosion. Evaluate and correct hydrological alterations, if necessary. Reduce erosion and sedimentation. Protect and restore riparian habitats.	

Watershed Priorities	Objectives	Management Options
Floodplain Functions		
Impacts to Floodplains Headwater degradation and channelization Diminished or disconnected floodplain area Riparian buffer loss	Protect and reestablish functional floodplain area. Evaluate and correct hydrological alterations where necessary. Protect or restore stream, lacustrine, wetland, and coastal floodplain functions. Continue to make publicly available data and information to enable communities to reduce flood risk.	• Natural channel stream restoration • Fee simple and less-than-fee protection of floodplains, riparian habitats, and other sensitive lands • Protection and enhancement of riparian buffer zones • Development and dissemination of detailed elevation (LiDAR) data • Stormwater retrofit • Continued flood map updates and detailed flood risk studies • Hydrologic restoration
Education and Outreach		
Public Education and Outreach Expanded public understanding of practices to protect water resources Expanded opportunities for public participation Enhanced BMP technical support opportunities	Create long-term partnerships among stakeholders, including government, academic institutions, non-governmental organizations, businesses, residents, and others, to maximize effectiveness of project implementation. Conduct education and outreach about watershed resources and personal practices to protect water and habitat quality. Build the capacity of landowners, agricultural producers, and others to protect watershed resources, functions, and benefits. Support agricultural, silvicultural, and urban BMPs.	• Disseminate information about watershed resources and benefits via multiple approaches – Internet, publications, school programs, and workshops • Disseminate information about resource programs, outcomes, and opportunities for participation • Demonstration projects • Opportunities for volunteer participation in data collection and project implementation • Technical BMP education and training • Collaborative community initiatives, with opportunities for business participation and sponsorship • Internet applications for public participation and to make program information and resource data continually available • Classroom programs, including hands-on restoration activities • Community awareness and education events and programs • Hands-on, citizen science, including volunteer participation monitoring and restoration programs • Education and technical training workshops and resources for local government officials

4.3 Priority Projects

Projects proposed to address above-described priorities and objectives are listed below and described in more detail on the following pages. Priority projects, as described herein, comprise strategies intended to address identified issues that affect watershed resources, functions, and benefits. These projects are intended to support numerous site-specific tasks and activities, implemented by governmental and nongovernmental stakeholders for years to come. Most address multiple priorities, as indicated in Table 4-3. The projects included are limited to those within the scope and purview of the SWIM program; resource projects outside the scope of surface water resource protection and restoration are not included. With each project, conceptual scopes of work are presented, as are planning level cost estimates. Specific details, tasks, and costs will be developed and additional actions may be defined to achieve intended outcomes as projects are implemented. No prioritization or ranking is implied by the order of listing. Project evaluation and ranking will occur in multiple iterations in the future and will vary based on funding availability, specific funding source eligibility criteria, and cooperative participation.

Table 4-3 Recommended Projects: St. Andrew Bay SWIM Plan

PROJECT	WATERSHED PRIORITIES			
	WQ	FLO	NS	EDU
Stormwater Planning and Retrofit	✓	✓	✓	
Septic Tank Abatement	✓			
Advanced Onsite Treatment Systems	✓			
Agriculture and Silviculture BMPs	✓	✓	✓	✓
Basinwide Sedimentation Abatement	✓	✓	✓	
Riparian Buffer Zones	✓	✓	✓	✓
Aquatic, Hydrologic and Wetland Restoration	✓	✓	✓	
Estuarine Habitat Restoration	✓		✓	✓
Strategic Land Conservation	✓	✓	✓	✓
Watershed Stewardship Initiative	✓	✓	✓	✓
Sub-basin Restoration Plans	✓	✓	✓	✓
Wastewater Treatment and Management Improvements	✓		✓	
Analytical Program Support	✓	✓	✓	✓
Comprehensive Monitoring Program	✓	✓	✓	✓

WQ – Water Quality
FLO – Floodplain Functions
NS – Natural Systems
EDU – Education and Outreach

Stormwater Planning and Retrofit

Description:

This strategy consists of planning and retrofitting stormwater management systems to improve water quality, as well as to improve flood protection and accomplish other associated benefits. In addition to constructing new facilities, the project includes evaluation and improvement of existing systems and adding additional BMPs within a treatment train to improve overall performance within a given basin.

Strategic Priorities:
✓ Water Quality ✓ Floodplain Functions ✓ Natural Systems
Supporting Priorities:
✓ Stormwater runoff and NPS pollution ✓ Water quality impairments for listed stream and estuarine waters ✓ Vulnerability of estuarine habitats
Objectives:
✓ Improve treatment of urban stormwater. ✓ Protect and, as needed, restore water quality in impacted or designated priority areas. ✓ Restore water quality in impaired riverine, stream, and estuarine waters to meet state standards.
Lead Entities:
✓ Local governments ✓ Estuary Program
Geographic Focus Areas:
Developed areas of the watershed, including but not limited to : ✓ St. Andrew Bay estuary ✓ St. Joseph Bay ✓ Coastal dune lakes ✓ Grand Lagoon ✓ Urban bayous
Planning Level Cost Estimate:
>$60,000,000

Scope of Work:

1. Prioritize basins and sites based on water quality, hydrologic, and land use data, together with consideration of local priorities, opportunities for partnerships, and other factors.
2. Support stormwater master planning at the local and regional level.
3. Develop project-specific implementation targets and criteria, to include pollutant load reductions, success criteria, and measurable milestones.
4. Develop a public outreach and involvement plan to engage citizens in the project's purposes, designs, and intended outcomes. The plan should include immediate neighbors that would be affected by the proposed project and other interested citizens and organizations.
5. Develop detailed engineering designs, with consideration of regional and multipurpose facilities, innovative treatment systems, and treatment train approaches for basin-level stormwater management and treatment.
6. Install/construct individual retrofit facilities.
7. Monitor local water quality, including upstream/downstream and/or before and after implementation, as well as trends in receiving waters.
8. Analyze data to identify water quality trends in receiving waters.

Outcomes/Products:

1. Comprehensive stormwater management plans
2. Completed stormwater retrofit facilities
3. Improved water quality and flood protection
4. Data evaluation and system validation, with lessons applicable to future projects

Septic Tank Abatement

Description:

This strategy consists of converting OSTDS to central sewer to reduce pollutant export and improve surface and ground water quality. To facilitate accomplishment, among the project goals is to reduce or eliminate connection costs to homeowners.

Scope of Work:

1. Prioritize areas of need through spatial analysis of OSTDS distribution, proximity to karst and other sensitive resources, proximity to existing infrastructure, and resource monitoring data.
2. In cooperation with local governments and utilities, complete alternatives analysis, considering sewer extension, advanced onsite systems, and other approaches as appropriate.
3. Develop project-specific implementation targets and criteria, to include pollutant load reductions, success criteria, and measurable milestones.
4. Initiate a public outreach and involvement plan to engage the public in the project's purposes, designs, and intended outcomes.
5. Work with directly affected residents throughout the project; coordinate with neighborhoods and individual homeowners.
6. Install sewer line extensions, connect residences and businesses, and abandon septic tanks.
7. Monitor bacteria, nutrients, and other parameters in nearby groundwater and surface waterbodies.
8. Analyze data to identify changes in trends of target pollutants.

Outcomes/Products:

1. Completed implementation plans, prioritizing areas for septic-to-sewer conversion
2. Improved surface and groundwater quality

.

Strategic Priority:
✓ Water Quality ✓ Natural Systems
Supporting Priorities:
✓ Inadequate treatment from conventional OSTDS ✓ Aging infrastructure ✓ Vulnerability of estuarine habitats and springs ✓ Indications of negative water quality trends in St. Joseph Bay ✓ Improved wastewater collection and treatment ✓ Water quality impairments for listed stream and estuarine waters ✓ Water quality in the groundwater contribution area for Econfina Creek and springs ✓ Special resource waters, including OFWs, coastal dune lakes, Floridan aquifer springs, and Class I waters
Objectives:
✓ Protect and, as needed, restore water quality in impacted or designated priority areas. ✓ Restore water quality in impaired stream and estuarine waters to meet state standards.
Lead Entities:
✓ Utilities, local governments
Geographic Focus Areas:
✓ North Bay basin ✓ Panama City Beach ✓ Panama City area ✓ St. Joseph Bay and Peninsula ✓ Deer Point Lake Reservoir ✓ Econfina Creek groundwater contribution area ✓ Grand Lagoon basin
Planning Level Cost Estimate:
>$50,000,000

Advanced Onsite Treatment Systems

Description:

This strategy consists of installation of advanced OSTDS to reduce pollutant loading. This approach is most appropriate in areas remote from existing central sewer infrastructure or likely extensions. It may be considered an adjunct to the Septic Tank Abatement project.

Scope of Work:

1. Prioritize areas of need through spatial analysis of OSTDS distribution, proximity to karst and other sensitive resources, proximity to existing infrastructure, and resource monitoring data.
2. In cooperation with FDOH and FDEP, evaluate passive technology onsite systems.
3. In cooperation with local governments, conduct outreach to property owners to facilitate installation of advanced onsite systems as an alternative to conventional OSTDS.
4. Develop project-specific implementation targets and criteria, to include pollutant load reductions, success criteria, and measurable milestones.
5. Install/construct advanced OSTDS based on prioritization of sites and funding availability.
6. Monitor bacteria, nutrients, and other parameters in nearby groundwater and surface waterbodies.
7. Analyze data to identify changes in trends of target pollutants.

Outcomes/Products:

1. Improved surface and groundwater quality

Strategic Priority:

- ✓ Water Quality
- ✓ Natural Systems

Supporting Priorities:

- ✓ Inadequate treatment from conventional OSTDS
- ✓ Aging infrastructure
- ✓ Vulnerability of estuarine habitats and springs
- ✓ Indications of negative water quality trends in St. Joseph Bay
- ✓ Improved wastewater collection and treatment
- ✓ Water quality impairments for listed stream and estuarine waters
- ✓ Water quality in the groundwater contribution area for Econfina Creek and springs
- ✓ Special resource waters, including OFWs, coastal dune lakes, Floridan aquifer springs, and Class I waters

Objectives:

- ✓ Protect and, as needed, restore water quality in impacted or designated priority areas.
- ✓ Restore water quality in impaired stream and estuarine waters to meet state standards.

Lead Entities:

- ✓ Utilities, local governments

Geographic Focus Areas:

- ✓ Rural or fringe areas remote from access to central sewer service
- ✓ North Bay basin
- ✓ St. Joseph Bay and Peninsula
- ✓ Deer Point Lake Reservoir
- ✓ Econfina Creek groundwater contribution area

Planning Level Cost Estimate:

$15,000,000 (initial implementation)

Agriculture and Silviculture BMPs

Description:

This strategy consists of development and implementation of agriculture and silviculture BMPs to reduce basinwide NPS pollution, protect habitat, and promote water use efficiency.

Scope of Work:

1. In consultation with FDACS, FWC, and NRCS, develop a comprehensive inventory of employed agriculture and silviculture BMPs and identify potential gaps and/or potential improvements for implementation in the watershed.
2. In cooperation with FDACS FFS, evaluate relationships between forest management practices and hydrologic and water quality effects.
3. Based on funding resources, develop plans for cost-share or other assistance for implementation.
4. Develop an outreach plan to engage agricultural producers and forestry practitioners; supporting technical training and participation in developing implementation strategies.
5. Conduct program outreach to support implementation of property-specific approved BMPs, potentially including annual cost-share grant cycles as defined by funding sources.
6. Work with FDACS to offer free technical assistance in the design and implementation of property- and resource-specific BMPs.
7. Monitor local water quality, including upstream/downstream and/or before and after project implementation, as well as trends in receiving waters. Additionally, conduct monitoring of participant experiences, encouraging feedback throughout and following implementation.
8. Analyze data to identify water quality trends.

Outcomes/Products:

1. Improved water quality
2. Improved capacity on the part of landowners to implement practices protective of water quality and watershed resources

Strategic Priorities:

- ✓ Water Quality
- ✓ Floodplain Functions
- ✓ Natural Systems
- ✓ Education and Outreach

Supporting Priorities:

- ✓ Stormwater runoff and NPS pollution
- ✓ Sedimentation and turbidity from unpaved roads and other erosion sources
- ✓ Water quality impairments for listed stream and estuarine waters, to include nutrients, dissolved oxygen, and bacteria
- ✓ Headwater degradation and channelization
- ✓ Riparian buffer loss
- ✓ Needs to protect special resource waters – OFWs, aquatic preserves, coastal dune lakes, Class I waters

Objectives:

- ✓ Protect and, as needed, restore water quality in priority areas.
- ✓ Restore water quality in impaired waters to meet state standards.
- ✓ Reduce basinwide NPS pollution from agricultural areas and erosion sites.
- ✓ Reduce sedimentation from unpaved roads and landscape erosion.
- ✓ Protect and restore riparian habitats.
- ✓ Protect or restore stream, lacustrine, wetland, and floodplain functions.

Lead Entities:

- ✓ NWFWMD
- ✓ FDEP
- ✓ FDACS
- ✓ FWC
- ✓ Private landowners
- ✓ NRCS
- ✓ IFAS
- ✓ Estuary Program

Geographic Focus Areas:

For silviculture BMPs, the focus is basinwide. For agriculture, the primary focus is within the northern section of the watershed within Washington County.

Planning Level Cost Estimate:

250,000 annually

Basinwide Sediment Abatement

Strategic Priorities:
✓ Water Quality ✓ Floodplain Functions ✓ Natural Systems
Supporting Priorities:
✓ Stormwater runoff and NPS pollution ✓ Sedimentation and turbidity from unpaved roads and other erosion sources
Objectives:
✓ Protect and, as needed, restore water quality in impacted or designated priority areas ✓ Restore water quality in impaired riverine, stream, and estuarine waters to meet state standards ✓ Reduce sedimentation from unpaved roads, erosion, and construction sites. ✓ Protect and restore riparian and littoral habitats along streams, lakes, and estuarine shorelines.
Lead Entities:
✓ Local governments ✓ State and federal agencies ✓ Estuary Program
Geographic Focus Areas:
✓ Watershed-wide, particularly within rural areas
Planning Level Cost Estimate:
$1,500,000 annual cost

Description:

This strategy consists of development and implementation of activities related to sedimentation abatement to improve surface water and aquatic habitat quality. It may include any or all activities aimed at preventing and mitigating sedimentation and restoring impacted sites.

Scope of Work:

1. Review existing inventories of sedimentation sites and identify gaps.
2. Prioritize sites based on inventory and site evaluation, as well as consideration of water quality, other resource data, severity of impacts, and cumulative sub-basin effects.
3. Consider annual grant program for local governments to address high priority sites.
4. Develop individual site plans; detail proposed improvements and cost estimates.
5. Execute on-the-ground construction projects.
6. Implement complementary initiatives that may include education and outreach, development of new/improved BMPs, inspection programs, cost-share programs, training, demonstration projects, and maintenance.
7. Incorporate individual site improvements within geodatabase.
8. Monitor local water quality and habitat quality, including upstream/downstream and/or before and after implementation.
9. Analyze data to identify water quality trends.

Outcomes/Products:

1. Improved water quality, both onsite and in receiving riverine and estuarine waters
2. Improved aquatic habitat quality

Riparian Buffer Zones

Description:

This strategy consists of protection and restoration of riparian buffers to protect or improve water quality, habitat, and shoreline stability.

Scope of Work:

1. Coordinate planning and implementation with other projects to achieve overarching objectives.
2. Conduct screening evaluation of riparian areas; classify sites based on character and function and geomorphologic stresses.
3. Prioritize sites based on potential for protection or restoration of riparian habitat and function.
4. Conduct outreach to local governments and private landowners to identify sites for implementation. Develop site specific implementation options, including streamside enhancements, overlay zones and vegetation restoration.
5. Develop individual site plans, which detail proposed improvements and cost estimates.
6. Coordinate and support implementation by property owners and local governments.
7. Implement complementary initiatives that may include education and outreach, inspection programs, training, demonstration projects, and maintenance.
8. Conduct outreach by providing signage, tours, public access amenities, or similar for specific sites.
9. Monitor local water quality and habitat quality, including upstream/downstream and/or before and after project implementation.
10. Analyze data to identify water quality trends.

Outcomes/Products:

1. Improved protection of water quality, habitat, and shoreline stability
2. Establishment of demonstration sites to promote additional implementation of buffer zone concepts by private landowners, local governments, and state and federal agencies

Strategic Priorities

- ✓ Water Quality
- ✓ Floodplain Functions
- ✓ Natural Systems
- ✓ Education and Outreach

Supporting Priorities:

- ✓ Stormwater runoff and NPS pollution
- ✓ Sedimentation and turbidity of unpaved roads and other erosion sources
- ✓ Headwater degradation and channelization
- ✓ Riparian buffer loss
- ✓ Vulnerability of estuarine habitats
- ✓ Shoreline destabilization and erosion

Objectives:

- ✓ Protect and, as needed, restore water quality in impacted or designated priority areas
- ✓ Protect and if necessary restore major wetlands and floodplains.
- ✓ Protect and restore riparian and littoral habitats along streams and estuarine shorelines.
- ✓ Support agricultural, silvicultural, and urban BMPs.
- ✓ Ensure restoration projects are compatible with coastal change.
- ✓ Restore and enhance estuarine benthic habitats.

Lead Entities:

- ✓ Private landowners
- ✓ Local governments
- ✓ USFWS (Partners for Fish and Wildlife)
- ✓ FWC
- ✓ Southeast Aquatic Resources Partnership
- ✓ Estuary program and/or other watershed or non-profit initiatives

Geographic Focus Areas:

- ✓ West Bay
- ✓ St. Joseph Bay
- ✓ East Bay
- ✓ Headwater and tributary streams
- ✓ Karst and coastal dune lakes

Planning Level Cost Estimate:

TBD*

*Variable; includes passive implementation by property owners.

Aquatic, Hydrologic and Wetland Restoration

Description:

This strategy consists of a broad array of hydrologic and wetland protection and restoration measures to improve and protect surface water quality and to restore aquatic and wetland habitats. Such measures include but are not limited to vegetation reestablishment, restoration and enhancement of hydrologic connectivity, stream channel restoration, and floodplain reconnection and restoration.

Target areas include sites where floodplain storage has been diminished or where wetland hydrology has been disrupted. Additional focus areas include sites containing impediments to hydrological function such as culverts, dikes, levees, barriers to tidal flow, and barriers to freshwater exchange.

Scope of Work:

1. Conduct a site inventory and evaluation, to include channelized streams, drained/filled wetlands, road fill, and other areas conveying water. Evaluate freshwater and tidal drainage patterns and any restrictions in tidal flow. This includes initial desktop data collection and analysis, together with field data collection and site evaluation.
2. Identify restoration options, to include hydrologic reconnection (e.g., fill removal, low water crossings), tidal creek restoration, natural channel stream restoration, floodplain reestablishment, vegetation community reestablishment, tidal and riparian marsh restoration, and other options based on site characteristics and historic habitats.
3. Prioritize sites based on inventory and site evaluation, as well as consideration of water quality, other site and resource data, severity of impacts, cumulative effects, land ownership, and accessibility.
4. Conduct public outreach adaptable to specific project sites. Characterize individual projects with a list of stakeholders for each site. For project sites adjacent to communities or private property, as well as those with significant public visibility, consider demonstration sites, public meetings, site visits, project website, and other forms of engagement.
5. Develop detailed site restoration designs for priority sites, taking into account public input and preferences.
6. Execute on-the-ground restoration projects.

Strategic Priorities:

- ✓ Water Quality
- ✓ Floodplain Functions
- ✓ Natural Systems

Supporting Priorities:

- ✓ Water quality impairments for listed stream and estuarine waters, to include nutrients, dissolved oxygen, and bacteria
- ✓ Headwater degradation and channelization
- ✓ Diminished or disconnected floodplain area
- ✓ Wetland loss and degradation
- ✓ Physically altered and impacted tributary streams

Objectives:

- ✓ Restore water quality in impaired riverine, stream, and estuarine waters to meet state standards.
- ✓ Protect and reestablish functional floodplain area.
- ✓ Prioritize and correct hydrological alterations, including channelized streams.
- ✓ Protect and if necessary restore major wetlands and floodplains
- ✓ Ensure restoration projects are compatible with coastal change

Lead Entities:

- ✓ FWC
- ✓ NWFWMD
- ✓ FDEP
- ✓ USFWS
- ✓ Estuary Program

Geographic Focus Areas:

- ✓ Coastal dune lakes
- ✓ West Bay basin
- ✓ St. Joseph Bay basin
- ✓ Altered tidal creeks
- ✓ Urbanized drainage basins

Planning Level Cost Estimate:

TBD*

*Costs variable depending on specific sites.

7. Monitor local water quality and physical and biological site characteristics, including before and after implementation.
8. Analyze data to identify water quality trends.
9. Communicate results to watershed stakeholders and participating agencies.

Outcomes/Products:

1. Restored wetland, aquatic, and floodplain habitats and functions
2. Improved protection of water quality and natural systems
3. Established demonstration sites to promote additional implementation by private landowners and local governments

.

Estuarine Habitat Restoration

Description:

This strategy consists of activities related to estuarine habitat restoration to improve surface water quality, aquatic habitats, and coastal resiliency. Implementation should be coordinated with other project options, to include stormwater retrofits and other NPS pollution abatement, and upstream wetland and hydrologic restoration.

Scope of Work:

1. Conduct a site inventory and evaluation, to include evaluation of such factors as need for stabilization, habitat stability, stressors impacting shorelines, projected sea level rise, shoreline profile, ecosystem benefits, property ownership, public acceptance, and feasibility.
2. Identify project options, which may include, but are not limited to:
   a) Restoration/establishment of riparian and littoral vegetation communities;
   b) On previously altered shorelines, establishment of integrated living shorelines and estuarine habitats;
   c) Restoration/reconnection of tidal marsh;
   d) Integrated restoration of multiple shoreline/estuarine habitats;
   e) Restoration of seagrass beds;
   f) Restoration/creation of oyster reefs or other benthic habitats.
3. Identify and evaluate estuarine shorelines susceptible to erosion and at risk of hardening or other alteration.
4. In cooperation with resource agencies, develop BMPs for living shoreline projects.
5. Implement public outreach and education on options for protecting and restoring functional and resilient littoral habitats.
6. Prioritize sites based on inventory and site evaluation, as well as consideration of water quality, other site and resource data, modeling tools, severity of impacts, cumulative effects, land ownership, and accessibility. Coordinate directly with riparian landowners.
7. Consider development of demonstration projects on public lands.

Strategic Priorities:

- ✓ Water Quality
- ✓ Floodplain Functions
- ✓ Natural Systems

Supporting Priorities:

- ✓ Stormwater runoff and NPS pollution
- ✓ Inadequate treatment from conventional OSTDS
- ✓ Aging infrastructure
- ✓ Needs and opportunities for improved wastewater collection and treatment
- ✓ Historic seagrass losses
- ✓ Vulnerability of estuarine habitats
- ✓ Seagrass scarring, particularly in St. Joseph Bay
- ✓ Indications of eutrophication affecting seagrasses

Objectives:

- ✓ Protect and restore water quality in impacted or designated priority areas.
- ✓ Improve treatment of urban stormwater.
- ✓ Ensure restoration projects are compatible with coastal change.
- ✓ Restore and enhance estuarine benthic habitats.
- ✓ Restore and enhance estuarine habitats.
- ✓ Protect and reestablish functional floodplain area.
- ✓ Prioritize and correct hydrological alterations.

Lead Entities:

- ✓ FWC
- ✓ FDEP
- ✓ USFWS
- ✓ St. Andrew Bay RMA
- ✓ Estuary Program

Geographic Focus Areas:

- ✓ West Bay
- ✓ St. Joseph Bay
- ✓ Other areas of the St. Andrew Bay estuary
- ✓ Tidal tributaries

Planning Level Cost Estimate:

TBD*

*Cost estimates will await completion of site inventory and evaluation.

8. Conduct public outreach adaptable to specific project sites. For project sites adjacent to communities or private property, as well as those with significant public visibility, consider demonstration sites, public meetings, site visits, volunteer participation, project website, and other forms of engagement. Extend opportunities for participation to property owners, local governments, and other stakeholders.
9. Develop detailed site restoration designs for priority sites, taking into account public input and preferences.
10. Execute on-the-ground restoration projects as identified under Paragraph 2 above.
11. Monitor and evaluate habitat coverage, water quality, and habitat conditions before and after implementation
12. Compile and evaluate data to determine trends and to objectively measure project benefits and outcomes.

Outcomes/Products:

1. Restored wetland and estuarine habitats and functions
2. Improved protection of water quality and natural systems
3. Establishment of demonstration sites to promote additional implementation by private landowners and local governments
4. Increased resiliency of estuarine habitats to anticipated sea level rise and extreme weather events

Strategic Land Conservation

This strategy supports protection of floodplains, riparian areas, and other lands with water resource value to protect and improve surface water quality, with additional benefits for floodplain function and fish and wildlife habitat.

Scope of Work:

1. Use approved management plans and lists (such as the Florida Forever Work Plan) to complete an inventory of potential acquisition projects.
2. Evaluate whether potential sites augment other projects.
3. Identify potential funding sources that allow land acquisition as a component of achieving stated goals.
4. Where landowners have expressed interest, conduct a site analysis to include potential for achieving intended outcomes and potential for augmenting other projects.
5. Accomplish acquisition in accordance with statutory requirements.
6. Develop and implement restoration/ enhancement plans if appropriate.
7. Implement long-term monitoring program for conservation easements.

Outcomes/Products:

1. Improved long-term protection of water quality, habitat, and floodplain functions

Strategic Priorities:

- ✓ Water Quality
- ✓ Floodplain Functions
- ✓ Natural Systems

Supporting Priorities:

- ✓ Stormwater runoff and NPS pollution
- ✓ Sedimentation and turbidity from unpaved roads and other erosion sources
- ✓ Water quality impairments for listed stream and estuarine waters, to include nutrients, dissolved oxygen, and bacteria
- ✓ Headwater degradation and channelization
- ✓ Diminished or disconnected floodplain area
- ✓ Riparian buffer loss
- ✓ Wetland loss and degradation
- ✓ Vulnerability of estuarine habitats
- ✓ Shoreline destabilization and erosion
- ✓ Special resource waters, including OFWs, aquatic preserves, coastal dune lakes, Class I waters, and the groundwater contribution area for Econfina Creek and springs

Objectives:

- ✓ Protect and water quality in impacted or designated priority areas.
- ✓ Protect and if necessary restore major wetlands and floodplains.
- ✓ Protect and restore riparian and littoral habitats along streams, lakes, and estuarine shorelines.

Lead Entities:

- ✓ FDEP
- ✓ Private landowners and working forests
- ✓ Local governments

Geographic Focus Areas:

- ✓ West Bay Preservation Area
- ✓ Bear Creek Forest
- ✓ St. Joseph Bay Buffer
- ✓ Springs and groundwater contribution areas

Planning Level Cost Estimate:

$27,000,000*

*Generally 50% of DEP-estimated land value for designated projects

Watershed Stewardship Initiative

Description:

The purpose of the watershed stewardship initiative is to create experiences that result in action-oriented tasks leading to improvements in water quality, tangible improvements in habitat quality, and public knowledge of and appreciation of watershed resources and functions. Outreach activities should be well structured, project-oriented, and include hands-on activities, as well as education about personal practices to protect watershed resources.

Scope of Work:

1. Develop a comprehensive inventory of current watershed stewardship and education efforts underway within the watershed, including funding sources for each.
2. Evaluate initiatives ongoing elsewhere within the state and the country.
3. Analyze the feasibility of combining efforts and resources, where practical and beneficial, with existing community-based initiatives.
4. Identify potential gaps and/or additional areas of focus.
5. Continue existing programs and implement new individual programs based on availability of funding.
6. Include hands-on activities, such as vegetation planting, invasive species removal, site tours, project demonstrations, and monitoring.
7. Implement technical training for landowners, including for implementation of agricultural and silvicultural BMPs, as well as urban BMPs and pollution prevention practices.
8. Monitor program accomplishments and outcomes, including through feedback from participant and citizen surveys.

Outcomes/Products:

1. Improved long-term protection of water quality, habitat, and floodplain functions
2. Improved capability on the part of property owners to implement BMPs
3. Improved public understanding of watershed resources, functions, and public benefits
4. Improved public understanding of, and participation in, resource programs and projects

Strategic Priorities:
✓ Water Quality ✓ Floodplain Functions ✓ Natural Systems ✓ Education and Outreach
Supporting Priorities:
✓ Water quality impairments for listed stream and estuarine waters ✓ Vulnerability of springs and estuarine habitats ✓ Needs for improved public understanding and participation; as well as for improved BMP technical support
Objectives:
✓ Restore water quality in impaired riverine, stream, and estuarine waters to meet state standards. ✓ Expand education and outreach about watershed resources and personal practices to protect water and habitat quality ✓ Create long-term partnerships among stakeholders, including government, academic institutions, non-governmental organizations, businesses, residents, and others, to maximize effectiveness of project implementation. ✓ Supports agricultural, silvicultural, and urban BMPs ✓ Build the capacity of landowners, agricultural producers, and others to protect watershed resources, functions, and benefits.
Lead Entities:
✓ St. Andrew Bay RMA ✓ Local governments ✓ Estuary Program ✓ IFAS ✓ FDEP ✓ FDACS ✓ NWFWMD ✓ FWC
Geographic Focus Areas:
Watershed-wide
Planning Level Cost Estimate:
$200,000 annually

Sub-basin Restoration Plans

Description:

1. Evaluate and identify priority sub-basins in cooperation with local initiatives, state and federal agencies, and local governments.
2. Develop a scoping document outlining actions to be undertaken, customized for specific areas and needs.
3. Develop a public outreach and engagement plan to facilitate participation by affected neighborhoods and stakeholders.
4. With public and agency participation, identify specific goals for waterbody protection and restoration.
5. Incorporate separate strategies, including stormwater retrofit planning; OSTDS abatement; floodplain, wetland and hydrologic restoration; monitoring; and public outreach and engagement.
6. Identify separate actions and project types that can cumulatively achieve identified goals.
7. Implement public outreach and engagement by conducting field visits, public meetings, and providing innovative hands-on engagement opportunities. Coordinate with established watershed groups.
8. Implement selected actions.
9. Monitor program accomplishments and outcomes, including through feedback from participants and surveys of affected residents. Conduct monitoring pre- and post-implementation and of environmental trends within affected waterbodies.

Strategic Priorities:
✓ Water Quality ✓ Floodplain Functions ✓ Natural Systems ✓ Education and Outreach
Supporting Priorities:
✓ All supporting priorities
Objectives:
✓ All identified objectives
Lead Entities:
✓ Local governments ✓ St. Andrew Bay RMA ✓ Estuary Program ✓ FDEP ✓ FWC ✓ NWFWMD
Geographic Focus Areas:
Targeted sub-basins within the watershed, including, but not limited to: ✓ Bayou sub-basins ✓ St. Joseph Bay ✓ Lake Powell ✓ Other coastal dune lakes ✓ Grand Lagoon
Planning Level Cost Estimate:
TBD* *Costs depend on specific projects included

Outcomes/Products:

1. Focused restoration plans, specific to priority waterbodies and basins
2. Improved water quality and aquatic and wetland habitat quality

Wastewater Treatment and Management Improvements

Description:

This strategy consists of development and implementation of upgrades to centralized wastewater treatment collection systems to reduce pollutant loading within the watershed. Additional opportunities exist for water reclamation and reuse.

Scope of Work:

1. In cooperation with utilities and local governments, evaluate existing wastewater systems to identify areas and components with upgrade opportunities, as well as sewer service extension needs.
2. Prioritize systems based on factors such as age, pollutant discharge, apparent leakage, capacity, and access.
3. Develop detailed cost estimates. Show cost estimates for areas with outdated sewer systems that need to be upgraded, areas with a high density of septic tanks that can connect to a central water system, and areas where upgrades are needed, but are determined to be lower in priority.
4. Implement/construct enhanced wastewater treatment and water reclamation and reuse systems.
5. In accordance with wastewater permits, monitor water quality in proximate surface and ground waters.
6. Evaluate data to identify trends of target pollutants.

Strategic Priorities:
✓ Water Quality
Supporting Priorities:
✓ Inadequate treatment from conventional OSTDS ✓ Point source discharges ✓ Aging infrastructure ✓ Needs and opportunities for improved wastewater collection and treatment
Objectives:
✓ Protect and, as needed, restore water quality in impacted or designated priority areas. ✓ Restore water quality in impaired stream and estuarine waters to meet state standards.
Lead Entities:
✓ Local governments ✓ Utilities
Geographic Focus Areas:
✓ Watershed-wide ✓ Wastewater utilities with opportunities for water reclamation and reuse and integrated water resource management Systems proximate to coastal drainages ✓ Panama City ✓ Lynn Haven ✓ Bay County ✓ Port St. Joe
Planning Level Cost Estimate:
>$60,000,000

Outcomes/Products:

1. Improved water and aquatic habitat quality
2. Reduced wastewater discharges into the environment, coupled with improved conservation of potable water resources

Analytical Program Support

Strategic Priorities:	
✓ All identified program priorities	
Supporting Priorities:	
✓ All identified program priorities	
Objectives Addressed:	
✓ All watershed objectives	
Management Approaches:	
✓ All identified management approaches	
Lead Entities:	
✓ FWC ✓ FDEP ✓ US EPA ✓ USFWS ✓ FWC ✓ NWFWMD	✓ Estuary Program ✓ St. Andrew Bay RMA ✓ Educational and research institutions
Geographic Focus Areas:	
✓ Watershed-wide	
Planning Level Cost Estimate:	
TBD* *Costs highly variable	

Description:

This strategy is intended to support dedicated scientific assessment and analysis to improve watershed management, protection, and restoration. The tasks involved are inherently progressive and will therefore change and be redefined as information is developed and in response to ongoing and future conditions and management actions.

Scope of Work:

Integral components of this strategy include but are not limited to the actions presented below.

1. For specific resource functions and at the sub-basin level, develop and refine metrics for evaluating conditions and guiding implementation.
2. In support of Urban Stormwater Retrofits, develop a stormwater pollutant loading analysis to include NPS pollutant loading estimates at the sub-basin level and pollutant load reduction estimates based on proposed or potential BMPs and facilities. Develop planning level estimates of potential water quality effects (pollutant concentrations) for receiving waterbodies.
3. Also in support of Urban Stormwater Retrofits, evaluate existing stormwater management systems to identify potential or needed improvements.
4. Evaluate innovative methods and designs to improve stormwater treatment, wastewater treatment and management, and ecological restoration.
5. In support of Septic Tank Abatement and implementation of Advanced Onsite Systems, develop a spatial analysis of OSTDS to include pollutant loading estimates and estimates of potential pollutant load reduction following connection to central sewer and/or conversion to advanced onsite systems. In cooperation with local governments and utilities, delineate proposed target areas for central sewer connections and for advanced onsite systems.
6. In support of Agricultural and Silvicultural BMPs, develop an agricultural NPS pollution abatement plan. For this purpose, develop nonpoint source pollutant loading estimates at the sub-basin level for watershed areas that are substantially agricultural in land use, and develop pollutant load reduction estimates and targets based on application of proposed or potential BMPs. Develop planning level estimates of water quality effects (pollutant concentrations) for receiving waterbodies.
7. Identify research needs that would quantify the water quality benefits of BMP implementation, provide outreach and training, and strategies for implementing BMPs.
8. Inventory, evaluate, and prioritize unpaved road stream crossings and other sedimentation sites in support of Basinwide Sedimentation Abatement.
9. Evaluate the site-specific feasibility and potential benefits and impacts of proposed innovative and/or large-scale projects, which may include but are not necessarily limited to:
   a. Regional-scale shoreline habitat development proposals

   b. Passive and/or pumped estuarine flushing systems
   c. Proposals for major hydrologic alterations, such as causeway alterations, locks and dams, and barrier island pass alteration and maintenance
   d. Stream channel reconfiguration
   e. Benthic dredging
   f. Dredged material removal and disposal

10. Identify estuarine sites with the potential for seagrass or other benthic habitat restoration through improved water quality treatment and water management within specific contributing basins.

11. Identify and describe the conditions, status, and trends of oyster and shellfish habitats.

12. Develop and refine hydrodynamic and water quality modeling tools. Develop specific management applications in cooperation with resource agencies and other public and nonprofit initiatives.

13. Evaluate effects of land use and management, to include forest management practices, on water quality. Identify and/or refine management options to protect and improve water quality.

14. Identify and describe long-term trends with respect to wetland and aquatic habitats, aquatic plants, and water chemistry. Identify management implications and recommendations.

15. Develop improved quantitative and qualitative metrics, to include biocriteria, for evaluating conditions and guiding program and project implementation.

16. Conduct a review of past projects completed, identifying specific project outcomes and lessons learned.

17. Develop an updated baseline study of current environmental conditions by conducting a one-time, multi-seasonal, multi-metric, and system-wide environmental analysis. Include evaluation of areas and metrics for which current information is lacking, inadequate or outdated.

18. Establish a research and monitoring framework for detecting the effects of climate change and ocean acidification on coastal marine resources in the region.

Outcomes/Products:

1. Improved understanding of watershed challenges and opportunities
2. Updated project priorities
3. Innovative project planning
4. Improvement in scientific basis for management strategies and actions
5. Improved understanding of quantitative potential of and expectations for environmental change in response to resource management
6. Improved metrics for evaluating conditions and guiding and tracking program implementation
7. Reduced risks of unintended adverse environmental or economic effects

Comprehensive Monitoring Program

Strategic Priorities:
✓ All identified program priorities
Supporting Priorities:
✓ All identified program priorities
Objectives:
✓ All watershed objectives
Lead Entities:
✓ St. Andrew Bay RMA ✓ State resource agencies ✓ NWFWMD ✓ Federal resource agencies ✓ Local governments ✓ Community-based watershed monitoring initiatives ✓ Estuary Program ✓ Institutions of higher education; other environmental and watershed organizations
Geographic Focus Areas:
✓ Watershed-wide
Planning Level Cost Estimate:
$300,000 annually

Description:

This strategy provides for monitoring of program and project implementation, project outcomes, water quality, and habitat quality.

Scope of Work:

1. Identify appropriate parameters, to include environmental conditions and trends, and program parameters.
2. Establish a comprehensive and cumulative geodatabase of projects.
3. Further clarify and incorporate indicators at the watershed and sub-watershed level.
4. Delineate sensitive/priority areas, e.g., proximity to surface waters and karst.
5. Develop public outreach application/website to communicate program implementation, outcomes, and trend data.
6. Develop updated inventory of organizations (and associated contacts) that currently or previously conducted field monitoring within the watershed, including funding sources for each. Evaluate the feasibility of combining efforts and resources, where practical and beneficial.
7. Identify potential gaps and/or additional areas of focus.
8. Develop core sampling designs for field monitoring. Determine optimal site distribution.
9. If appropriate, develop and implement a volunteer pool and volunteer training program.
10. Establish cooperative efforts with existing community initiatives and state and local agencies.
11. Support equipment acquisition where needed.
12. Where existing initiatives are not in place, consider developing a citizen water quality monitoring volunteer pool for target areas within the watershed.
13. Periodically conduct a comprehensive evaluation, at the watershed level, of program implementation, outcomes, and resource trends.

Outcomes/Products:

1. Improved long-term protection of water quality, habitat, and floodplain functions
2. Evaluations of project and program effectiveness, facilitating feedback and adaptive management
3. Improved public understanding of watershed resources, functions, and public benefits
4. Communication of program accomplishments to the public, elected officials, and stakeholders
5. Improved program accountability to the public and stakeholders
6. Improved public understanding of, and participation in, resource programs and projects

4.4 Project Criteria and Guidelines

This section outlines recommended guidelines to be applied to project development and prioritization. These items are not intended to be pass-fail for projects, but rather identify provisions that should receive consideration in project development and evaluation. Criteria specific to any given prioritization or funding decision are often defined, at least in part, by the funding resources under consideration. Individual sources of funding often are guided by criteria and guidelines established by statute or program documentation.

Generally suggested criteria include the following:

1. Projects with responsible parties that will implement, operate, and maintain the completed facilities;
2. Projects that achieve multiple, complementary objectives;
3. Restoration that is substantially self-sustaining;
4. Responsible parties that support long-term monitoring to facilitate verification, lessons learned, and adaptive management;
5. Sites and systems that reflect and are adaptable to natural variability; and
6. Cost effectiveness, technical feasibility, and regulatory factors are criteria to be considered in prioritization and funding.

Natural variability, for example, would include a habitat restoration project that is adaptable to cyclic climatic conditions (e.g., seasonal, hydrologic), discrete events (e.g., coastal storms), and long-term changes in the environment (e.g., climate change and sea level rise).

4.5 Funding Sources

Funding sources change over time. An outline of current funding sources, including descriptions of eligibility and project types contemplated, is provided in Table 4.4. These include Deepwater Horizon related sources and state, federal, and local government programs. Private funding sources, including from nonprofit organizations and private grant programs, may also be available.

Table 4-4 Funding Sources and Eligibility

Funding Source	Eligibility[1]	Project Types
RESTORE Act		
Equal State Allocation (also known as Direct Component or Bucket/Pot 1)	75% of funds allocated to the eight disproportionately affected Panhandle coastal counties: Bay, Escambia, Franklin, Gulf, Okaloosa, Santa Rosa, Wakulla, and Walton. Remainder of funds allocated to the 15 non-disproportionately affected Gulf Coast counties, including Jefferson County in northwest Florida.	• Restoration and protection of the natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches and coastal wetlands; • Mitigation of damage to fish, wildlife and natural resources; • Implementation of a federally-approved conservation management plan; • Workforce development and job creation; • Improvements to state parks located in coastal areas affected by the *Deepwater Horizon* oil spill; • Infrastructure projects benefitting the economy or ecological resources; including port infrastructure; • Coastal flood protection and related infrastructure; • Promotion of tourism and Gulf seafood consumption; or • Administrative costs and planning assistance.
Gulf Coast Ecosystem Restoration Council (also known as The RESTORE Council or Bucket/Pot 2)	Project selection based on Comprehensive Plan developed by the RESTORE Council with input from the public.	The Initial Comprehensive Plan adopts five goals: • Restore and Conserve Habitat; • Restore Water Quality; • Replenish and Protect Living Coastal and Marine Resources; • Enhance Community Resilience; or • Restore and Revitalize the Gulf Economy.
Oil Spill Restoration Impact Allocation (also known as The Gulf Consortium, or Bucket/Pot 3)	The Gulf Consortium, consisting of 23 Gulf Coast counties, is developing the State Expenditure Plan for Florida that must be submitted by the Governor to the RESTORE Council for its review and approval.	All projects, programs, and activities in the State Expenditure Plan that contribute to the overall ecological and economic recovery of the Gulf Coast (same project types as listed under the Equal State Allocation above).
NOAA RESTORE Act Science Program (also known as Bucket/Pot 4)	• Institutions of higher education; • Non-profit organizations; • Federal, state, local and tribal governments; • Commercial organizations; and • U.S. territories.	Research, observation, and monitoring to support the long-term sustainability of the ecosystem, fish stocks; fish habitat; and the recreational, commercial, and charter fishing industry in the Gulf of Mexico, including: • Marine and estuarine research; • Marine and estuarine ecosystem monitoring and ocean observation; • Data collection and stock assessments; • Pilot programs for fishery independent data and reduction of exploitation of spawning aggregations; • Cooperative research; or • Administrative costs.

Funding Source	Eligibility[1]	Project Types
Centers of Excellence (also known as Bucket/Pot 5)	University of South Florida, Florida Institute of Oceanography is administering Florida's Centers of Excellence Program.	• Coastal and deltaic sustainability, restoration, and protection, including solutions and technology that allow citizens to live in a safe and sustainable manner in a coastal delta in the Gulf Coast Region; • Coastal fisheries and wildlife ecosystem research and monitoring in the Gulf Coast Region; • Offshore energy development, including research and technology to improve the sustainable and safe development of energy resources in the Gulf of Mexico; • Sustainable and resilient growth, economic and commercial development in the Gulf Coast Region; and • Comprehensive observation, monitoring, and mapping of the Gulf of Mexico.
Other Deepwater Horizon Funding		
Natural Resource Damage Assessment (NRDA)	Trustee Implementation Groups develop restoration projects guided by the programmatic restoration plan finalized in 2016. Public may submit project ideas & comment on plans.	The final plan takes a comprehensive and integrated ecosystem-level approach to restoring the Gulf of Mexico: • Restore and Conserve Habitat • Restore Water Quality • Replenish and Protect Living Coastal and Marine Resources • Provide and Enhance Recreational Opportunities
National Fish and Wildlife Foundation (NFWF)	NFWF manages the Gulf Environmental Benefit (GEBF) fund established in 2013. In consultation with FWC and FDEP, NFWF identifies priority restoration and conservation projects for GEBF funding.	Projects that: • Restore and maintain the ecological functions of landscape-scale coastal habitats, including barrier islands, beaches & coastal marshes; • Restore and maintain the ecological integrity of priority coastal bays and estuaries; and • Replenish and protect living resources including oysters, red snapper and other reef fish, Gulf Coast bird populations, sea turtles and marine mammals.
Federal Sources		
NOAA Coastal Resilience Grants	• Non-profit organizations • Institutions of higher education • Regional organizations • Private entities • States, territories and federally recognized Indian tribes • Local governments	• Strengthening Coastal Communities: activities that improve capacity of coastal jurisdictions (states, counties, municipalities, territories, and tribes) to prepare and plan for, absorb impacts of, recover from, and/or adapt to extreme weather events and climate-related hazards. • Habitat Restoration: activities that restore habitat to strengthen the resilience of coastal ecosystems and decrease the vulnerability of coastal communities to extreme weather events and climate-related hazards.
NOAA Office of Education Grants	Educational institutions and organizations for education projects and programs	• Environmental Literacy Program provides grants and in-kind support for programs that educate and inspire people to use Earth systems science to improve ecosystem stewardship and increase resilience to environmental hazards. • Bay Watershed Education and Training (B-WET) provides competitive funding to support meaningful watershed educational experiences for K–12 audiences • Cooperative Science Centers provide awards to educate and graduate students who pursue degree programs with applied research in NOAA mission-related scientific fields.

Funding Source	Eligibility[1]	Project Types
US EPA Environmental Education Grants	• Local education agencies • State education or environmental agencies • Colleges or universities • Non-profit organizations • Noncommercial educational broadcasting entities • Tribal education agencies	Environmental education projects that promote environmental awareness and stewardship and help provide people with the skills to take responsible actions to protect the environment. This grant program provides financial support for projects that design, demonstrate, and/or disseminate environmental education practices, methods, or techniques.
US EPA – Exchange Network Grant Program	States, territories and federally recognized Indian tribes	Promotes improved access to, and exchange of, high-quality environmental data from public and private sector sources.
US EPA - Water Infrastructure Finance and Innovation Act (WIFIA) Program	• States, territories and federally recognized Indian tribes • Partnerships and joint ventures • Corporations and trusts • Clean Water and Drinking Water State Revolving Fund (SRF) programs	Accelerates investment in water infrastructure by providing long-term, low-cost supplemental loans for regionally and nationally significant projects.
State Sources		
FDEP (WMDs) Spring Restoration Program	•Local governments •Public and non-profit utilities •Private landowners	State Spring Restoration funding efforts include land acquisition and restoration, septic to sewer conversion, and other projects that protect or restore the quality or quantity of water flowing from Florida's springs.
FDEP Special Management Area Grants	State agencies and water management districts	Research or coordination efforts in areas of special management. Examples of areas of special management would include, but not be limited to Areas of Critical State Concern, Critical Wildlife Areas, Aquatic Preserves, National Estuary Programs, and Surface Water Improvement and Management waterbodies
FDEP Coastal Partnership Initiative	Coastal counties and municipalities within their boundaries required to include a coastal element in the local comprehensive plan	Coastal resource stewardship and working waterfronts projects.
FDEP Beach Management Funding Assistance (BMFA) Program	• Local governments • Community development districts • Special taxing districts	Beach restoration and nourishment activities, project design and engineering studies, environmental studies and monitoring, inlet management planning, inlet sand transfer, dune restoration and protection activities, and other beach erosion prevention related activities consistent with the adopted Strategic Beach Management Plan.
FDEP Florida Communities Trust	Local governments and eligible non-profit organizations	Acquisition of land for parks, open space, greenways and projects supporting Florida's seafood harvesting and aquaculture industries.
Florida Forever	Funding is appropriated by the legislature distributed by the FDEP to state agencies	Acquisition of public lands in the form of parks, trails, forests, wildlife management areas, and more.
FDEP Coastal and Estuarine Land Conservation Program	States that have a coastal zone management program approved by NOAA or a National Estuarine Research Reserve (NERR)	Acquisition of property in coastal and estuarine areas that have significant conservation, recreation, ecological, historical, or aesthetic values, or that are threatened by conversion from a natural or recreational state to other uses.

Funding Source	Eligibility[1]	Project Types
FDEP Clean Vessel Act Grants	Facilities that provide public access to pump-out equipment	Construction, renovation or installation of pump out equipment or pump out vessels.
FDEP Clean Water State Revolving Fund Loan Program (CWSRF)	Project sponsors	Planning, designing, and constructing water pollution control facilities.
FDEP Clean Water State Revolving Fund Program Small Community Wastewater Construction Grants	Small communities and wastewater authorities	This grant program assists in planning, designing, and constructing wastewater management facilities. An eligible small community must be a municipality, county, or authority with a total population of 10,000 or less, and have a per capita income (PCI) less than the State of Florida average of $26,503.
FDEP 319 grants	• State and local governments • Special districts, including water management districts • Nonprofit public universities and colleges • National Estuary Programs	Projects or programs that reduce NPS pollution. Projects or programs must be conducted within the state's NPS priority watersheds, including SWIM watersheds and National Estuary Program waters. All projects should include at least a 40% nonfederal match.
FDEP 319 Education Grants	Local governments in Florida	For projects that provide education and outreach about nonpoint source pollution in the adopted Basin Management Action Plan (BMAP) areas.
FDEP TMDL Water Quality Restoration Grants	Local governments and water management districts	Projects that: • Reduce NPS loadings from urban areas affecting verified impaired waters. • Are at least the 60% design phase. • Have permits issued or pending. • Include storm monitoring to verify load reduction. • Will be completed within three years of appropriation. • Include a minimum of 50% match with at least 25% provided by the local government. • Allocate grant funds to construction of BMPs, monitoring, or related public education.
FDACS Rural and Family Lands Protection Program	Agricultural landowners	State conservation easements that: • Protect valuable agricultural lands. • Ensure sustainable agricultural practices and reasonable protection of the environment. • Protect natural resources in conjunction with economically viable agricultural operations.
FDACS Forest Stewardship Program	Private forest landowners with at least 20 acres of forest land	Cost-share grants for implementation of stewardship to improve and maintain timber, wildlife, water, recreation, aesthetics, and forage resources.
FDACS Endangered and Threatened Plant Conservation Program	Private individuals and non-federal government entities	Actions that restore and maintain populations of listed plants on public land and on private lands managed for conservation purposes.

Funding Source	Eligibility[1]	Project Types
Natural Resources Conservation Service	Private agricultural producers, landowners, and local governments	• Conservation Innovation Grants (CIG) stimulate development and adoption of innovative conservation approaches and technologies. • The Environmental Quality Incentives Program (EQIP) provides financial and technical assistance to agricultural producers that address natural resource concerns and improve water and air quality, conserve ground and surface water, reduce soil erosion and sedimentation, or improve or create wildlife habitat • Emergency Watershed Protection Program includes assistance to remove debris from streams, protect streambanks, establish cover on critically eroding lands, repair conservation practices, and purchase of floodplain easements.
Florida Fish and Wildlife Conservation Commission Wildlife Grants Program	State fish and wildlife agencies	Projects identified within State Wildlife Action Plan, including fish and wildlife surveys, species restoration, habitat management, and monitoring.
Florida Fish and Wildlife Conservation Commission Landowner Assistance Program	Private landowners	Cooperative and voluntary effort between landowners, the FWC, and the USFWS to improve habitat conditions for fish and wildlife.
Local Governments		
Local Government General Revenue	Defined by local statute. Generally local projects as approved by elected body, frequently leveraging state, federal, and other funding sources.	Defined by local statute and elected board.
Utility Funds – Stormwater and Wastewater	Utility projects benefiting rate payers. May leverage other local, state, and federal funding.	Stormwater and wastewater capital improvement and maintenance projects.

5.0 References

Alperin, Lynn, M. 1983. *History of the Gulf Intracoastal Waterway*. Navigational History NWS – 83 – 9. National Waterways Study. U.S. Army Engineer Water Resource Support Center. Institute for Water Resources. http://www.publications.usace.army.mil/ Portals/76/Publications/Miscellaneous/NWS_83-9.pdf.

Barrios, K., and A. Chelette. 2004. *Econfina Creek Spring Inventory: Washington and Bay Counties, FL.* Northwest Florida Water Management District. Water Resources Special Report 04-02.

Bay Environmental Study Team (BEST). 1998. *A Look to the Future.*

Bhadha, J.H., and J.W. Jawitz. 2008. *The Coastal Dune Lakes of Florida: Trends in Water Quality and Changing Land-Use Practices.* Water Resources Impact 10, 5 (September 2008).

Brim, M.S. and L.R. Handley. 2006. *St. Andrew Bay*. In: Handley, L., D. Altsman, and R. DeMay, (Eds.), Seagrass Status and Trends in the Northern Gulf of Mexico: 1940-2002: U.S. Geological Survey Scientific Investigations Report 2006-5287 and U.S. Environmental Protection Agency 855-R-003, pp. 155-169.

City of Panama City Beach. 2016. *Water and Wastewater Utilities.* Accessed May 20, 2016. http://www.pcbgov.com/.

Collins, Mary E. 2010. *Soil Orders of Florida Map.*

Crowe, J.B., W. Huang, F.G. Lewis. 2008. *Assessment of Freshwater Inflows to North Bay from the Deer Point Watershed of the St. Andrew Bay System.* Havana: Northwest Florida Water Management District. Water Resources Assessment 08-01.

Endries M., B. Stys, G. Mohr, G. Kratimenos, S. Langley, K. Root, and R. Kautz. 2009. *Wildlife Habitat Conservation Needs in Florida: Updated Recommendations for Strategic Habitat Conservation Areas.* Florida Fish and Wildlife Conservation Commission (FWC), FWRI Technical Report. Tallahassee, Florida.

Fitzhugh, Linda. 2012a. *An Introduction to St. Andrew Bay, Florida.* St. Andrew Bay Resource Management Association. http://www.sabrma.org/.

______. 2012b. *Epiphyte Growth in West Bay – a Sign of Eutrophication.* St. Andrew Bay Resource Management Association. http://www.sabrma.org/images/Epiphyte_growth_in_West_Bay_fall_2012.pdf

Florida Department of Agriculture and Consumer Services (FDACS). 1993. *Silviculture Best Management Practices.*

______. 2008. *Silviculture Best Management Practices.* Florida Forest Service. http://freshfromflorida.s3.amazonaws.com/Media%2FFiles%2FFlorida-Fores-Service-Files%2Fsilvicultural_bmp_manual.pdf

______. 2014. *Florida Forestry Wildlife Best Management Practices for State Imperiled Species.* FDACS-01869. Revised August 4, 2014. Accessed April 1, 2016.

______. 2016a. *Shellfish Harvest Areas Shapefile.* ShellfishHarvestAreas_NonWinter_fl_poly. Accessed July 29, 2016.

______. 2016b. *BMP Rules, Manuals, and Other Documents.* Accessed March 2016. http://www.freshfromflorida.com/Business-Services/Water/Agricultural-Best-Management-Practices.

______. 2016c. *Our Forests: BMPs. Silviculture BMPs.* Accessed November 10, 2016. http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Our-Forests/Best-Management-Practices-BMP/Wetland-Restoration-on-State-Forests.

Florida Department of Environmental Protection (FDEP). 1997. *Biological Assessment of the Effectiveness of Forestry Best Management Practices: Okaloosa, Gadsden, Taylor, and Clay Counties.* Tallahassee: Florida Department of Environmental Protection, Bureau of Laboratories.

______. 2006. *Water Quality Assessment Report, Choctawhatchee and St. Andrew.*

______. 2008. *Florida Friendly Best Management Practices for Protection of Water Resources by the Green Industries.*

______. 2008. *St. Joseph Bay Aquatic Preserve Management Plan: September, 2008–August, 2018.* Florida Coastal Office. https://www.dep.state.fl.us/coastal/sites/stjoseph/pub/StJosephBay_2008.pdf.

______. 2011b. *Aquatic Preserves (areas) Shapefile.* DEP.AQUATIC_PRESERVES. Published December 15, 2011.

______. 2011c. *Implementation Guidance for the Fecal Coliform Total Daily Maximum Loads Adopted by the Florida Department of Environmental Protection.* Accessed March 2016. http://www.dep.state.fl.us/water/watersheds/docs/fcg_toolkit.pdf.

______. 2012. *Coastal and Aquatic Managed Areas. St. Joseph Bay Staff Buffer Preserve Management Plan.* Accessed March 2016. http://www.dep.state.fl.us/coastal/

______. 2013. *Mercury TMDL for the State of Florida.* Accessed March 2016.

______. 2014b. *Camp Helen State Park Approved Unit Management Plan.* April 21, 2014. Accessed June 28, 2016. http://www.dep.state.fl.us/parks/planning/ parkplans/CampHelenStatePark.pdf.

______. 2014c. *Statewide Comprehensive List of Impaired Waters.* Accessed March 2016. http://www.dep.state.fl.us/water/watersheds/assessment/a-lists.htm.

______. 2014d. *Statewide Comprehensive List of Waters Delisted from the List of Impaired Waters.* Accessed March 2016. http://www.dep.state.fl.us/water/watersheds/ assessment/a-lists.htm.

______. 2014e. *BMES Mandatory Non-Phosphate Map Direct.* http://ca.dep.state.fl.us/ mapdirect/?focus=mannon.

______. 2014f. *Springs Restoration Funding, Fiscal Year 2014-2015 Project Plan for the Legislative Budget Commission.* Accessed March 2016.

______. 2015a. Division of Environmental Assessment and Restoration. *NWFWMD 2012-2013 Land Use Vector Digital Dataset.* Published June 23, 2015. Accessed July 29, 2016. http://publicfiles.dep.state.fl.us/otis/gis/data/NWFWMD_LANDUSE_2012_2013.zip

______. 2015b. *Living Shorelines: Natural Protection of Florida's Coasts.* Accessed April 2016. http://www.dep.state.fl.us/northwest/Ecosys/section/living_shorelines.htm.

______. 2015c. *Wastewater Facility Regulation (WAFR) Facilities.* Wastewater Facilities in Florida - April 2015. Published May 2015. Accessed July 29, 2016.

______. 2015d. *Mandatory Non-Phosphate Sites Vector Digital Dataset.* FDEP Beaches, Mining, and ERP Support Program. Published January 15, 2015. Accessed July 29, 2016. http://ca.dep.state.fl.us/mapdirect?focus=dataportal&topics=*MMP_MANNON_SITES_2015.

______. 2015f. *Designated Clean Marinas Listing.* Updated September 02, 2015. Accessed January 27, 2015. http://www.dep.state.fl.us/cleanmarina/marinas.htm.

______. 2015h. *Water Reuse Program. Reuse Inventory Database and Annual Report.* October 27, 2016. http://www.dep.state.fl.us/water/reuse/inventory.htm

______. 2016a. *Florida TMDL Geodatabase Feature Class.* Accessed July 29, 2016.

______. 2016f. *Draft St. Andrews Aquatic Preserve Management Plan. Published April 2016.* Accessed November 17, 2016

______. 2016g. *Deepwater Horizon Florida website.* Accessed March 2016. http://www.dep.state.fl.us/deepwaterhorizon/default.htm.

______. 2016h.*Temporal Variability (Trend) Network.* Accessed July 2016. http://www.dep.state.fl.us/water/monitoring/trend.htm.

______. 2016i. *Nitrogen Source Inventory and Loading Tool (NSILT).* Last Modified: October 13, 2016Last Modified: October 13, 2016. Accessed November 17, 2016. http://fdep.maps.arcgis.com/home/item.html?id=e71ecaa35bdd4caaba7a0c411691dfa7.

______. 2016j. *Florida Forever Report.* Accessed March 2016. http://www.dep.state.fl.us/lands/FFplan_county.htm.

______. 2016k. *St. Andrews State Park Approved Unit Management Plan.* Approved April 2016. Accessed December 5, 2016. http://www.dep.state.fl.us/parks/planning/parkplans/StAndrewsStatePark.pdf.

______. 2016l. *Statewide Comprehensive Verified List of Impaired Waters.* Accessed March 2017. http://www.dep.state.fl.us/water/watersheds/assessment/a-lists.htm

______. 2017. *St. Andrews Aquatic Preserve Management Plan.* Florida Coastal Office.

http://publicfiles.dep.state.fl.us/CAMA/plans/aquatic/St_Andrews_Aquatic_Preserve_Management_Plan.pdf

Florida Department of Health (FDOH). 2005. *Florida Healthy Beaches Program.* http://www.floridahealth.gov/environmental-health/beach-water-quality/

______. 2015a. *OSTDS Statistics: OSTDS New Installations.* Accessed August 10, 2016. http://www.floridahealth.gov/environmental-health/onsite-sewage/ostds-statistics.html.

______. 2015b. *Environmental Health Database Shapefile.* 2015. EDH_2015July. Created July 6, 2015. Accessed September 12, 2016.

______. 2016. *Environmental Water Management Inventory Shapefile.* 2016. October, 2016.

Florida Department of Transportation (FDOT). 2008. *Florida Waterway System Plan. Draft Final.*

Florida Fish and Wildlife Conservation Commission (FWC). 2011. Fish and Wildlife Research Institute. *Saltwater Marsh Florida Vector Digital Data.* http://myfwc.com/research/.

______. 2015a. *Econfina Creek Wildlife Management Area Regulations Summary and Area Map July 1, 2016- June 30, 2017.* Accessed June 14, 2016. http://myfwc.com/media/3037367/ECONFINA-CREEK.pdf.

______. 2015c. Fish and Wildlife Research Institute. *Seagrass Coverage Geodatabase Feature Class.* SeaGrass_2015. Published November 2015. Accessed July 29, 2016.

______. 2015d. *Annual Report of Activities Conducted Under the Cooperative Aquatic Plant Control Program in Florida Public Waters for Fiscal Year 2014-2015.* Accessed October 31, 2016. http://myfwc.com/media/3585996/aquaticplantmanagement-FY14-15.pdf.

______. 2016a. Fish and Wildlife Research Institute. *Florida Bay Scallop 2015 Annual Report.* Published April 2016. Accessed December 5, 2016. http://www.myfwc.com/media/2144988/2015-annual-report-public.pdf.

______. 2016b. *Bay scallop conservation measures approved for St. Joe Bay. FWC Bulletin June 23, 2016.* 2:41 p.m. EDT. Accessed June 27, 2016. https://content.govdelivery.com/accounts/FLFFWCC/bulletins/15137bc.

______. 2016f. *What are Wildlife Management Areas?* Accessed February 2016. http://myfwc.com/viewing/recreation/wmas/.

______. 2016g. *Panama City Crayfish Management Plan.* Draft February 2016. Accessed August 2017. http://myfwc.com/viewing/recreation/wmas/http://myfwc.com/media/3395300/Panama-City-Crayfish-Draft-Management-Plan-February-2016.pdf.

Florida Natural Areas Inventory (FNAI). 2010. *Guide to the Natural Communities of Florida: 2010 Edition.* Accessed May 11, 2016. http://www.fnai.org/natcom_accounts.cfm.

______. 2016a. *Florida Conservation Lands.* Accessed: May 4, 2016. http://www.fnai.org/webmaps/ConLandsMap/.

______. 2016b. *Natural Communities.* http://www.fnai.org/naturalcommunities.cfm

Friends of St. Andrew Bay. 2016. *Friends of St. Andrew Bay Focus Areas.* Accessed June 2016. http://www.baybest.org/friends-of-st-andrew-bay-focus-areas/.

Geselbracht, L.L., K. Freeman, A.P. Birch, J. Brenner, and D.R. Gordon. 2015. *Modeled Sea Level Rise Impacts on Coastal Ecosystems at Six Major Estuaries on Florida's Gulf Coast: Implications for Adaptation Planning.* Plos One. https://doi.org/10.1371/journal.pone.0132079

Green, R. C., W. L. Evans, J. R. Bryan, D. T. Paul, and M. M. Gaboardi. 2002. *Geologic Map of the Western Portion of the USGS 1:100,000 Scale Marianna Quadrangle, Northwestern Florida.* Florida Geological Survey Open File Map, Series 91-01.

Grubbs, J.W. 1995. *Evaluation of ground-water flow and hydrologic budget for Lake Five-O, a seepage lake in northwest Florida.* U.S. Geological Survey Water-Resources Investigations Report 94-4145, 42 p.

Gulf of Mexico Foundation. 2015. *Gulf Ecological Management Sites.* Accessed April 2016. http://www.gulfmex.org/conservation-restoration/gems/.

Howarth, R.W., Walker, D., Sharpley, A., 2002a. *Nitrogen use in the United States from 1961 to 2000 and potential future trends.* Ambio 31, 88–96.

______. 2002b. *Wastewater and watershed influences on primary productivity and oxygen dynamics in the lower Hudson River estuary.* In: J. Levinton (editor), The Hudson River. Academic, New York.

______. 2002c. *Wastewater and Watershed Influences on Primary Productivity and Oxygen Dynamics in the Lower Hudson River Estuary.* In: J. Levinton (editor), The Hudson River. Academic, New York.

Keppner, E.J. 1996. *An inventory of the biological resources reported from the St. Andrew Bay Estuarine System, Bay County, Florida.* BEST Publication 0001. 72 pp.

Keppner, E. J. and Keppner, L. A. 1997. *A list of the vascular plants of Bay County, Florida.* BEST Public. 0002. 50 pp.

______. 2000. *A Compilation of Information Pertaining to Lake Powell, Bay County, Florida.* Bay County Board of County Commissioners.

______. 2001a. *A List of the Species of Vascular Plants Reported from Bay County, Florida.* Report to BEST, Inc. February 2001. 65 pp.

______. 2001b. *The St. Andrew Bay Ecosystem, Our Environment: A Revision of 'A Look to the Future'.* Bay Environmental Study Team. May 2001.

______. 2005. *Tracked and Protected Species in Bay County and the St. Andrew Bay Ecosystem, Florida.* St. Andrew Bay Environmental Study Team.

______. 2008. *The St. Andrew Bay Ecosystem, our Environment. A Revision of A Look to the Future.* St. Andrew Bay Environmental Study Team, BEST Publication 0004, 90 p.

Kolka, R., S.D. Bridgham, and C.L. Ping. 2016. *Soils of Peatlands: Histosols and Gelisols.* Accessed May 2016. http://www.fs.fed.us/nrs/pubs/jrnl/2015/nrs_2015_kolka_001.pdf.

Lamont, Margaret M., H. Franklin Percival, Leonard G. Pearlstine, Sheila V. Colwell, Wiley M. Kitchens, and Raymond R. Carthy. 2016. *The Cape San Blas Ecological Study*. Florida Cooperative Fish and Wildlife Research Unit.

Long, E.R., G. M. Sloane, R. S. Carr, T. Johnson, J. Biedenbach, K. J. Scott, G. B. Thursby, E. Crecelius, C. Peven, H. L. Windom, R. D. Smith, and B. Loganathon. 1997. *Magnitude and Extent of Sediment Toxicity in Four Bays of the Florida Panhandle: Pensacola, Choctawhatchee, St. Andrew, and Apalachicola.* Silver Spring, Maryland: U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration. NOAA Technical Memorandum NOS ORCA 117.

Mack, R.N., D. Simberloff, W.M. Lonsdale, H. Evans, M. Clout, and F.A. Bazzaz. 2000. *Biotic Invasions: Cases, Epidemiology, Global Consequences, and Control. Ecological Applications.* 10: 689-710.

Morris, J.A., Jr. (Ed.). 2012. *Invasive Lionfish: A Guide to Control and Management.* Gulf and Caribbean Fisheries Institute, Special Publication Series No. 1. Marathon, FL. Accessed August 9, 2017. http://lionfish.gcfi.org/manual/InvasiveLionfishGuide_GCFI_SpecialPublicationSeries_Number1_2012.pdf

National Research Council (NRC). 2000. *Clean Coastal Waters: Understanding and Reducing the Effects of Nutrient Pollution.* National Academy Press, Washington, D.C.

Natural Resources Conservation Service (NRCS). 1992. *Soil Survey of Walton County Florida.* National Cooperative Soil Survey. U.S. Department of Agriculture, 245 p.

______. 2001a. *Soil Survey of Gulf County Florida.* National Cooperative Soil Survey. United States Department of Agriculture, 203 p.

The Nature Conservancy (TNC). 2014. *St. Andrew/St. Joseph Bays Community-Based Watershed Plan.*

Northwest Florida Water Management District (NWFWMD). 2000. *St. Andrew Bay watershed: Surface Water Improvement and Management (SWIM) plan*. September 2000, program development series 00-2. http://www.nwfwater.com/Water-Resources/SWIM/St.-Andrew-Bay.

______. 2008. *Region III Water Supply Plan.* Northwest Florida Water Management District. Program Development Series 08-02.

______. 2014a. *Regional Water Supply Plan Update: Region III.* Bay County, FL. Program Development Series 14-01. http://www.nwfwater.com/Water-Resources/Water-Supply-Planning/Regional-Water-Supply-Planning/Region-III-Bay-County.

______. 2014b. *2013 Water Supply Assessment Update.* Water Resources Assessment 14-01. http://www.nwfwater.com/Water-Resources/Water-Supply-Planning/Water-Supply-Assessments.

______. 2016a. *Springs Inventory Shapefile.* Published April 28, 2016.

______. 2016b. *St. Andrew Bay.* Accessed April 25, 2016. http://www.nwfwater.com/Water-Resources/SWIM/St.-Andrew-Bay.

______. 2016c. *Land Management.* http://www.nwfwater.com/Lands/Land-Management.

______. 2016d. *Umbrella Plan.* http://www.nwfwmdwetlands.com/Umbrella-Plan.

______. 2016e. *Florida Forever Work Plan.* http://www.nwfwater.com/Lands/Land-Acquisition/Forever-Florida-Land-Aquisition-Work-Plans.

______. 2016f. *Consolidated Annual Report.*http://www.nwfwater.com/Data-Publications/Reports-Plans/Consolidated-Annual-Reports.

Novitzki, R.P., R.D. Smith, and J.D. Fretwell. N.d. *Wetland Functions, Values, and Assessment, in Restoration, Creation, and Recovery of Wetlands.* USGS Water Supply Paper 2425.

Reckendorf, F. 1995. *Sedimentation in Irrigation Water Bodies, Reservoirs, Canals, and Ditches Working Paper No. 5.* Natural Resources Conservation Service.

Richards, Christopher J. 1997. *Delineation of the Floridian Aquifer Zone of Contribution for Econfina Creek and Deer Point Lake: Bay and Washington Counties, Florida.* Havana: Northwest Florida Water Management District. Water Resources Special Report 97-2.

Rink, W. J., Gloria I. Lopez. 2010. *OSL-based Lateral Progradation and Aeolian Sediment Accumulation rates for the Apalachicola Barrier Island Complex, North Gulf of Mexico, Florida.* Geomorphology. Volume 123, Issues 3–4. Pages 330–342.

Saloman, C.H., Naughton, S.P., and Taylor, J.L. 1982. *Benthic Faunal Assemblages of Shallow Water Sand and Seagrass Habitats, St. Andrew Bay, Florida: Panama City, Fla.* U.S. Fish and Wildlife Service, Division of Ecological Services, 565 p.

Scott, T.M, K.M. Campbell, F.R. Rupert, J.D. Arthur, TM. Missimer, J.M. Lloyd, J.W. Yon, and J.G. Duncan. 2001. *Geologic Map of the State of Florida.* Produced by the FGS in cooperation with the FDEP. Accessed September 2016. http://www.dep.state.fl.us/geology/gisdatamaps/state_geo_map.htm

St. Andrew Bay Environmental Science Team. 2001. *St. Andrew Bay Ecosystem, Our Environment: A Revision of "A Look to the Future.*

St. Andrew Bay Resource Management Association (RMA). 2016. *Water Quality Monitoring in the St. Andrew Bay Watershed, Bay County, FL.* Retrieved from http://www.sabrma.org/waterquality.html

Stanhope, Andrine, Larry Robinson, and Cassel Gardner. 2008. *Characteristics of Nutrient Transport from Tate's Hell State Forest into East Bay Florida*. Journal of Coastal Research. Special Issue 52: 263 – 272. ISSN 0749-0208.

Stewart, R.A. 1962. *Recent Sedimentary History of St. Joseph Bay, Florida.* Master's Thesis.

U.S. Census Bureau. 2010. Accessed April 2016. http://www.census.gov/.

U.S. Department of Agriculture (USDA). 1984. *Soil Survey of Bay County.* National Cooperative Soil Survey. United States. Department of Agriculture. 153 p.

______. 2014. *Keys to Soil Taxonomy, Twelfth Edition.* Natural Resource Conservation Service.

U.S. Department of Commerce (USDOC). 2012. *Fisheries Economics of the U.S. 2012, Economics and Sociocultural Status and Trends Series.* Accessed March 2016. http://www.st.nmfs.noaa.gov/Assets/economics/documents/feus/2012/FEUS2012.pdf.

U.S. Department of the Interior. 2007. *Designation of Critical Habitat for Five Endangered and Two Threatened Mussels in Four Northeast Gulf of Mexico Drainages.* Federal Register Vol. 72, No. 220 / Thursday, November 15, 2007.

U.S. Environmental Protection Agency (EPA). 1993. *Urban Runoff Pollution Prevention and Control Planning Handbook.* Cincinnati: U.S. EPA Office of Research and Development, Center for Environmental Research Information.

______. 2015d. *Septic Systems (Onsite/Decentralized Systems).* Accessed March 2016. https://www.epa.gov/septic.

______. 2016a. *Implementing Clean Water Act Section 303(d): Impaired Waters and Total Maximum Daily Loads (TMDLs).* Accessed March 2016. http://www.epa.gov/tmdl.

______. 2016b. *EPA Superfund Program: Tyndall Air Force Base, Panama City, FL.* https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0401205.

______. 2016c. *NPDES Stormwater Program.* https://www.epa.gov/npdes/npdes-stormwater-program.

______. 2016d. *EPA Established Total Maximum Daily Loads (TMDLs).* Shapefile. Retrieved from http://publicfiles.dep.state.fl.us/otis/gis/data/EPA_ESTABLISHED_TMDL.zip

U.S. Fish and Wildlife Service (USFWS). 2000. *Environmental Contaminants Evaluation of St. Joseph Bay, FL.* Accessed June 2016. https://catalog.data.gov/dataset/environmental-contaminants-evaluation-of-st-joseph-bay-florida.

______. 2001. *Buffers: An Efficient Tool for Watershed Protection.* Accessed April 4, 2017. http://fwcg.myfwc.com/docs/Wetland_Buffers_USFWS.pdf

______. 2016. *National Wetlands Inventory (NWI).*

U.S. Geological Survey (USGS). 2002. *Seagrass Status and Trends in the Northern Gulf of Mexico: 1940-2002*" Accessed June 2016. http://pubs.usgs.gov/sir/2006/5287/pdf/St.AndrewBay.pdf.

______. 2013. *Coastal and Marine Geology Program.* North East Florida Atlas. Regional Geology. Figure 7: Physiographic Regions of Florida. Modified from Randazzo and Jones (Ed.S.), 1997. http://coastal.er.usgs.gov/publications/ofr/00-180/intro/fig7.html.

______. 2017. *National Nonindigenous Aquatic Species Database.*

https://nas.er.usgs.gov/queries/SpeciesAnimatedMap.aspx?speciesID=963.

Accessed August 8, 2017.

University of Florida Bureau of Economic and Business Research (BEBR). 2016. *Projections of Florida Population by County, 2020-2045, with Estimates for 2015*. University of Florida Bureau of Economic and Business Research, Volume 49, Bulletin 174.

University of Florida Institute of Food and Agricultural Sciences (UF-IFAS). 2016. *Forest Stewardship Program.* Accessed September 6, 2016. http://sfrc.ufl.edu/extension/florida_forestry_information/additional_pages/forest_stewardship_program.html.

Vasques, Gustavo M., Sabine Grunwald, and Willie G. Harris. 2010. *Spectroscopic Models of Soil Organic Carbon in Florida, USA.* Technical Reports: Organic Compounds in the Environment.

Vernon, R.O. 1942. *Geology of Holmes and Washington Counties, Florida.* Tallahassee: Florida Geological Survey. Geological Bulletin No. 21.

Vitousek, P.M. 1986. *Biological Invasions And Ecosystem Properties: Can Species Make A Difference?* In Mooney, H.A., and J.A. Drake (Ed.S) "Ecology of Biological Invasions of North America and Hawaii: Ecological Studies." Springer-Verlag, Inc., New York, New York.

Wallace, C.W., D.C. Flanagan, and B.A. Engel. 2017. *Quantifying the Effects of Conservation Practice Implementation on Predicted Runoff and Chemical Losses Under Climate Change.* Agricultural Water Management 186, 31. Pp. 51-65.

Weaver, R.E., and P.J. Anderson. 2010. *Notes on Florida's Endangered and Threated Plants.* Bureau of Entomology, Nematology, and Plant Pathology. Botany Section. Contribution No. 38, 5th Edition. http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Our-Forests/Forest-Health/Florida-Statewide-Endangered-and-Threatened-Plant-Conservation-Program.

Wenger, S.J. 1999. *A Review of the Scientific Literature on Riparian Buffer Width, Extent, and Vegetation.* Institute of Ecology, University of Georgia, Athens, Georgia.

Wenger, S.J. and L. Fowler. 2000. *Protecting Stream and River Corridors.* Carl Vinson Institute of Government, University of Georgia, Athens, Georgia.

Yarbro, L.A., and P.R. Carlson. 2016. *Seagrass Integrated Mapping and Monitoring Program Mapping and Monitoring Report No. 2.* Florida Fish and Wildlife Conservation Commission. FWRI Technical Report TR-17, Version 2.0.

http://myfwc.com/research/habitat/seagrasses/projects/active/simm/simm-reports/

Appendix A Implementation and Achievements of the Previous SWIM Plan

Previous SWIM Plan Issues and Priorities

The NWFWMD developed a SWIM Plan for Deer Point Lake Reservoir in 1988 and revised the plan in 1991. Deer Point Lake SWIM activities concluded in 1994 with the publication of the Deer Point Lake Watershed Summary Report, which provided recommendations for future consideration. SWIM projects focused on the documentation of land use and cover data and trends, the development of estimates of NPS loading, recommendations for protecting the reservoir from future NPS pollution, and a GIS-based assessment of environmentally sensitive areas. Following the completion of the SWIM studies and reports in the early 1990s, the focus of the NWFWMD's activities in the Deer Point Lake Reservoir watershed shifted to water quality protection through land acquisition within the Econfina Recharge Area.

A SWIM plan for the entire St. Andrew Bay watershed, including Deer Point Lake Reservoir and St. Joseph Bay, was developed in 2000. Priority issues identified in the plan include the following:

- Providing comprehensive, coordinated management of the watershed;
- Promoting sustainability of the resources of the St. Andrew Bay watershed through public education and outreach;
- Protecting and restoring natural ecological diversity, productivity, and ecological functions of the watershed;
- Reducing and minimizing pollution from urban stormwater runoff and other NPSs;
- Identifying the extent of chemical contamination and initiate restoration actions;
- Identifying environmental quality and trends within the watershed; and
- Protecting water quality and quantity, as well as aquatic habitat, in Deer Point Lake Reservoir.

Progress toward Meeting Plan Goals and Objectives

Most of the projects included in the plan were developed by BEST and listed in "A Look to the Future" (BEST 1998). As shown in Table 4.1, the District proposed funding eight of the 33 projects over five years (fiscal years 2000-2001 through 2004-2005), totaling $467,000.

Table A-1 2000 SWIM Plan Project Schedule and Cost Estimates

ID	Projects	Fiscal Year Estimates (not necessarily funded)				
		2000-01	2001-02	2002-03	2003-04	2004-05
	Planning, Coordination, and Administration					
PC1	Planning, coordination, and Administration	$10,000	$10,000	$10,000	$10,000	$15,000
PC2	Establish National Estuary Program					
PC3	Coordinate with Coast Guard and State Agencies for Spill Response Plans					
PC4	Coordinate Watershed Management Activities with Growth Management Plans		$5,000	$5,000	$5,000	$5,000

ID	Projects	Fiscal Year Estimates (not necessarily funded)				
		2000-01	2001-02	2002-03	2003-04	2004-05
	Stormwater Retrofit and Treatment					
ST1	Examine Stormwater Treatment Effectiveness		$10,000	$10,000	TBD	TBD
ST2	Survey Sediment Quality in Existing Ponds					
ST3	Retrofit Stormwater Infrastructure		$50,000	$50,000	TBD	TBD
	Public Outreach and Education					
PE1	Distribution of the Boaters Guide					
PE2	Update and Manage Watershed Website					
PE3	Inform the Public About Watershed	$7,000	$20,000	$20,000	$5,000	$5,000
PE4	Publicize BEST Activities					
	Biodiversity and Natural Systems					
BD1	Biodiversity Assessment					
BD2	Assessment of Lands					
BD3	Conservation of Primary Tributary Basins	TBD	TBD	TBD	TBD	TBD
BD4	Management of State-Owned Submerged Land – Assessment and Monitoring					
BD5	Management of State-Owned Submerged Land – Policy					
BD6	Assessment and Restoration of East Pass Closure	$15,000				
BD7	Assessment of Freshwater Inflow Needs for St. Andrew Estuary		$100,000	$100,000	TBD	TBD
BD8	Bayou Management Generic Model and Citizen's Bayou Management Groups					
BD9	Finfish Comparison Survey					
BD10	Grand Lagoon Bridge Replacement					
BD11	Seagrass Protection and Management					
BD12	Wetland Protection, Management, and Restoration	$10,000	TBD	TBD	TBD	TBD
	Chemical Contaminants					
CC1	Chemical Contaminant Sediment Monitoring					
CC2	Bayou Restoration					
CC3	Evaluation of Dioxin Compounds					
CC4	Chemical Monitoring of Biological Organisms					
	Cumulative Assessment					
CA1	Point Source Assessment					
CA2	Determine Assimilative Capacity of the St. Andrew Bay Estuary					

ID	Projects	Fiscal Year Estimates (not necessarily funded)				
		2000-01	**2001-02**	**2002-03**	**2003-04**	**2004-05**
CA3	Nonpoint Source Pollution Assessment/Abatement			$25,000	TBD	TBD
	Deer Point Lake Reservoir Basin					
DPR1	Update Biological, Water Quality, and Sediment Data					
DPR2	Nutrient Loading Budget					
DPR3	Water Quality and Quantity Assessment					
	TOTAL					
	Planned for 2000-05	**$42,000**	**$185,000**	**$220,000**	**$10,000**	**$10,000**

Source: NWFWMD 2000.

Since the 2000 SWIM Plan, significant progress has been made on addressing a number of the issues and priorities identified. Reflecting the shared responsibility inherent in watershed management, accomplishments should be recognized on the part of numerous watershed stakeholders, including local governments, state and federal agencies, academic institutions, and others. Among the noteworthy accomplishments are:

- Completion in 2009 by the BEST (later Friends of St. Andrew Bay) of a comprehensive stormwater management plan for the St. Andrew Bay watershed;
- Continued implementation of water and seagrass monitoring, restoration projects, and public awareness and education programs by the St. Andrew Bay RMA (http://www.sabrma.org/);
- Implementation of projects to retrofit stormwater systems and reduce NPS pollution by Bay County; the cities of Port St. Joe, Panama City, Callaway, Springfield, Lynn Haven, Parker, and Mexico Beach; and the Panama City Port Authority;
- Update of the St. Joseph Bay Aquatic Preserve Management Plan by FDEP and development of a draft management plan for the St. Andrews Aquatic Preserve;
- Extensive unpaved road stabilization by Bay County in the Deer Point Lake Reservoir basin;
- Implementation of ERP by the District and FDEP;
- Implementation of 13 local projects with grant funding from the Florida Forever program, including projects to achieve stormwater retrofit for water quality improvement and unpaved road sedimentation abatement;
- Continued improvements in wastewater treatment and in developing the reuse of reclaimed water;
- Implementation of water reuse systems with potable water offset by the cities of Panama City Beach and Lynn Haven; and
- Implementation of habitat restoration projects, including living shoreline and shoreline marsh restoration and wetland restoration.

Cooperative projects that have been implemented or are ongoing in the watershed are listed in Table A-2. The District's Consolidated Annual Reports (http://www.nwfwater.com/Data-Publications/Reports-Plans/Consolidated-Annual-Reports) provide listings and descriptions of specific projects that have been completed or initiated under the auspices of the SWIM, Florida Forever, and other related programs.

Table A-2 Project Implementation

Project	General Description	Lead Entity	Corresponding SWIM Project	Status
Habitat Restoration and BMPs in the Sand Hill Lakes	Erosion control, stabilization, and revegetation completed on 12 sites within the Econfina Water Management Area. Project also included monitoring and outreach.	NWFWMD	Biodiversity and Natural Systems	Completed 2003
Port of Panama City Stormwater Improvements, Phases I-II	Installation of four pollutant separator units to treat stormwater runoff and reduce flooding.	Panama City Port Authority	Stormwater Retrofit and Treatment	Completed 2005-2007
Deer Point Lake Stabilization, Phases I-IV	Reduced sedimentation, erosion and non-point source pollution into Deer Point Lake. Stabilized 32 miles of dirt roads with porous pavement system, stabilized associated ditches.	Bay County	Deer Point Lake Reservoir Basin	Completed 2005-2009
St. Joseph Lake Stormwater Improvement	Stormwater retrofit project that constructed a 7 acre wet detention pond to treat 594 acres draining to St. Joseph Bay.	City of Port St. Joe	Stormwater Retrofit and Treatment	Completed 2007
Henry Davis Park	Construction of a wet-detention stormwater treatment facility to treat runoff, improve water quality and provide flood relief to the park before discharging to Watson Bayou and St. Andrew Bay.	City of Panama City	Stormwater Retrofit and Treatment	Completed 2008
Lake Powell Stormwater Retrofit	Construction of a stormwater treatment system to treat runoff from the three-acre county park before discharging to Lake Powell.	Bay County	Stormwater Retrofit and Treatment	Completed 2008
Fourth Street Stormwater Pond	Stormwater retrofit project that constructed a 1.34 acre-wet detention pond to treat 17.08 acres in the downtown area draining to St. Joseph Bay.	City of Port St. Joe	Stormwater Retrofit and Treatment	Completed 2009
St. Andrew Bay Yacht Club Stormwater Improvement	Installation of a pollutant separator unit to treat stormwater runoff and reduce flooding.	City of Panama City	Stormwater Retrofit and Treatment	Completed 2009
Robindale Subdivision Stormwater Improvement	Stormwater retrofit project that constructed a 0.8 acre-wet detention pond to treat 53 acres draining to Martin Lake.	City of Springfield	Stormwater Retrofit and Treatment	Completed 2010
Sand Hills Pond Stormwater Improvements	Stormwater retrofit project that constructed a wet detention pond to treat 29 acres in the downtown area draining to St. Joe Bay.	City of Port St. Joe	Stormwater Retrofit and Treatment	Completed 2010
Econfina Springs Complex Springs Restoration, Phase I	Restoration at Pitt Spring including: natural shoreline restoration; construction of stormwater treatment; sediment removal; and compatible public access improvements.	NWFWMD	Biodiversity and Natural Systems	Completed 2011

Project	General Description	Lead Entity	Corresponding SWIM Project	Status
Spring Avenue Regional Stormwater Facility	Stormwater retrofit project that constructed a six acre wet detention pond to treat 200 acres draining to Watson Bayou.	Bay County	Stormwater Retrofit and Treatment	Completed 2014
Panama City Maple Avenue Baffle Boxes	Installation of 14 pollutant separators, two baffle boxes, and twelve dual-vortex circular structures to improve water quality entering St. Andrew Bay.	City of Panama City	Stormwater Retrofit and Treatment	Completed 2014
Mexico Beach Baffle Box System	Modification of the existing stormwater management facility around 15th St., Wysong Ave., and Texas Drive. Included conveyance improvements, increased treatment capacity, and reduced pollutant discharge into the Gulf of Mexico.	City of Mexico Beach	Stormwater Retrofit and Treatment	Completed 2015
Ed Lee Road Stabilization	Reduced sedimentation, erosion and non-point source pollution into Deer Point Lake. Stabilized two miles of dirt roads with porous pavement system, stabilized associated ditches.	Bay County	Deer Point Lake Reservoir Basin	Completed 2015
Callaway Water Quality Improvements	Stormwater improvements including retention areas, drainage improvements and baffle box installation for the Lane St. and Pridgen St. areas.	City of Callaway	Stormwater Retrofit and Treatment	Completed 2015
Lisenby Avenue Pond	Engineering design and surveying for stormwater retrofit project. Funded with Deepwater Horizon settlement funds.	FDEP	Stormwater Retrofit and Treatment	Completed 2015
Williford Spring Restoration	Restoration and protection of spring shoreline, sediment removal and public access improvements at Williford Spring, within the Econfina Springs Complex.	NWFWMD	Biodiversity and Natural Systems	Completed 2015
Devil's Hole Restoration, Phase I	Phase I to stabilize eroding shoreline and install a boardwalk and swimming platform.	NWFWMD	Biodiversity and Natural Systems	Completed 2015
Bay County Land Acquisition and Restoration	Fee-simple acquisition and floodplain restoration of approximately 3 acres along Econfina Creek, including 300 linear feet of floodplain habitat restoration.	NWFWMD	Biodiversity and Natural Systems	Acquisition completed 2015; restoration completed 2017
Parker Water Quality Improvements	Stormwater improvements including retention areas, drainage improvements and baffle box installation for the Lake Drive and 11th Street areas.	City of Parker	Stormwater Retrofit and Treatment	Completed 2016
Devil's Hole Restoration, Phase II	Phase II to stabilize eroding shoreline and provide stormwater treatment at recreation site.	NWFWMD	Biodiversity and Natural Systems	In progress; Completion planned for 2017

Project	General Description	Lead Entity	Corresponding SWIM Project	Status
Econfina Blue Spring Camp Improvements	Project will stabilize and restore 150 feet of streambank at Econfina Blue Spring; provide stormwater treatment; and make compatible public access improvements.	NWFWMD	Biodiversity and Natural Systems	In progress
Gainer Springs Land Acquisition	Fee simple and less-than-fee acquisition (conservation easement) of up to 982 acres and spring bank restoration at first magnitude springs complex along Econfina Creek in northern Bay County.	NWFWMD	Biodiversity and Natural Systems	In progress
Econfina Land Acquisition	Fee simple and less-than-fee acquisition (conservation easement) of up to 200 acres in the Econfina Recharge Area.	NWFWMD	Biodiversity and Natural Systems	In progress

Appendix B Related Resource Management Activities

Much of the progress to date is attributable to cooperative efforts made on the part of local governments, state and federal agencies, the District, and private initiatives. Many programs and projects share common goals, and their implementation is most frequently accomplished through coordinated planning, funding, management, and execution. This section describes historical and ongoing activities and programs to address resource issues within the watershed.

Special Resource Management Designations

Outstanding Florida Waters

The FDEP designates Outstanding Florida Waters (OFWs) under section 403.061(27), F.S., which are then approved by the Environmental Regulation Commission. An OFW is defined by FDEP as a waterbody "…worthy of special protection because of its natural attributes." A number of waterbodies and segments in the watershed have been recognized and receive additional regulatory protection through designation as OFWs, per Section 62-302.700, F.A.C. Designated OFWs include:

- Lake Powell
- Pig Island Unit of St. Vincent National Wildlife Refuge
- Point Washington Conservation and Recreation Lands (portions)
- St. Andrew Bay State Park
- St. Joseph Bay
- St. Joseph Bay Aquatic Preserve

Aquatic Preserves

Florida currently has 41 aquatic preserves, managed by FDEP, encompassing approximately 2.2 million acres of submerged lands that are protected for their biological, aesthetic, and scientific value. As described in Chapter 18-20, F.A.C., aquatic preserves were established for the purpose of being preserved in an essentially natural or existing condition so that their aesthetic, biological, and scientific values may endure for the enjoyment of future generations. There are two aquatic preserves in the St. Andrew Bay watershed: St. Andrews Aquatic Preserve in Bay County and St. Joseph Bay Aquatic Preserve in Gulf County. Details on each preserve and its management may be found at the links below.

- St. Andrews Aquatic Preserve: http://www.dep.state.fl.us/coastal/sites/standrews/.
- St. Joseph Bay Aquatic Preserve: http://www.dep.state.fl.us/coastal/sites/stjoseph/default.htm.

Conservation Lands

The St. Andrew Bay watershed system contains extensive conservation and protected lands (Figure 2-11), which are important for the long-term protection of watershed functions and resources. Conservation lands account for approximately 14 percent, or 107,000 acres, of the land area within the basin.

The NWFWMD owns and manages over 211,000 acres across the District and protects an additional 12,403 acres through conservation easements. More than 43,000 acres of total lands owned and managed by the district are within the St. Andrew Bay watershed, including the Econfina Creek WMA. Ninety percent, or 40,140 acres of the Econfina WMA, occurs within the St. Andrew Bay watershed. The WMA encompasses most the recharge area for springs contributing to Econfina Creek and Deer Point Lake Reservoir, as well as the Sand Hill Lakes. The WMA is managed to protect Bay County's major public water supply, in addition to protecting rare species and habitats and providing public recreational resources (NWFWMD 2016b). Land-management activities include prescribed burning, timber management, groundcover restoration, reforestation, and other activities (FWC 2015a, 2016f; NWFWMD 2016c).

Lands within the Econfina Creek WMA (NWFWMD) and the St. Joseph Bay Buffer Preserve (FDEP) have been acquired specifically to protect surface water and groundwater resources from NPS pollution. Additionally, the FDEP Division of Recreation and Parks lands, FDACS Division of Forestry lands, the Department of the Interior National Wildlife Refuge lands, the William J. Rish Recreational Park on St. Joseph Peninsula, and some U.S. Department of Defense lands are also managed to minimize the potential for NPS pollution.

The federal government owns approximately 31,000 acres within the watershed, the majority of which is managed by the U.S. Department of Defense. The watershed includes over 829 acres of conservation lands located on the Eglin AFB and 28,809 acres of conservation lands located on the Tyndall AFB.

Throughout the watershed are 12 state parks, preserves, and forests encompassing over 13,000 acres, most which are managed by various branches of the FDEP and the FDACS. The FDEP also manages the Panama City Airport Conservation Easement which consists of nearly 10,000 acres of land. State-funded land acquisitions have been important in securing conservation lands within the watershed through various programs such as Preservation 2000 and Florida Forever .

As noted previously, the St. Joseph Bay State Buffer Preserve and St. Joseph Peninsula State Park play an important role in protecting the quality of St. Joseph Bay by providing an important buffer system and by directly protecting coastal and aquatic habitats.

Three private mitigation banks, Sweetwater Mitigation Bank, Breakfast Point Mitigation Bank, and Devils Swamp Mitigation Bank, fall within the St. Andrew Bay watershed, encompassing nearly 6,700 acres of mesic pine flatwoods, wet prairie, basin swamp and other habitats (FNAI 2016a, 2016b).

Gulf Ecological Management Sites

The St. Andrew Bay watershed also includes two Gulf Ecological Management Sites (GEMS): the St. Andrew State Park Aquatic Preserve, which encompasses 23,873 acres of submerged lands, and the St. Joseph Bay Aquatic Preserve, which encompasses 65,770 acres of submerged lands (Figure 3-9). The GEMS Program is an initiative of the Gulf of Mexico Foundation, the EPA Gulf of Mexico Program, and the five Gulf of Mexico states (Gulf of Mexico Foundation 2015). Designated GEMS are considered high priority for protection, restoration, and conservation by state and federal authorities due to unique ecological qualities such as habitats significant to fish, wildlife, or other natural resources (Gulf of Mexico Foundation 2015).

Critical and Strategic Habitat Conservation Areas

Portions of the St. Andrew Bay watershed are designated critical habitat for the endangered St. Andrew beach mouse (*Peromyscus polionotus peninsularis*), threatened piping plover (*Charadrius melodus*), several species of listed freshwater mussels.

Portions of the watershed have also been identified by the FWC as Strategic Habitat Conservation Areas (SHCAs). These areas are important habitats that do not have conservation protection and would increase the security of rare and imperiled species if they were protected. Within the St. Andrew Bay watershed, SHCAs have been identified for several species including the Gulf salt marsh snake (*Nerodia clarkii clarkii*), the Scott's seaside sparrow (*Ammodramus maritimus peninsulae*), the swallow-tailed kite

(*Elanoides forficatus forficatus*), the St. Andrew beach mouse (*Peromyscus polionotus peninsularis*), and the Florida black bear (*Ursus americanus*). Strategic Habitat Conservation Areas occur in the pine fringe and floodplains of eastern Bay County's streams and tributaries; adjacent to the St. Andrew (West) Bay; adjacent to Walker Bayou (East Bay); on St. Joseph Peninsula; and forested areas throughout western Bay County (Endries *et al*. 2009).

The FDACS publishes a list of the protected plants of Florida (Weaver and Anderson 2010). Appendix D provides the list of species that are protected and tracked for the watershed, as well as their habitat requirements.

Deepwater Horizon: RESTORE Act, Natural Resource Damage Assessment (NRDA), and NFWF Projects

The FDEP and FWC are the lead state agencies in Florida for responding to the impacts of the Deepwater Horizon oil spill and the resulting restoration process. Restoration projects submitted through FDEP are considered for funding under the RESTORE Act Comprehensive Plan Component, the NRDA, and the NFWF's GEBF.

RESTORE Act

The RESTORE Act of 2012 allocates to the Gulf Coast Restoration Trust Fund 80 percent of the CWA administrative and civil penalties resulting from the oil spill. The major means of allocation under the RESTORE Act are as follows:

Direct Component Funds ("Bucket 1"): Seven percent of these funds will be directly allocated to counties affected in Florida (5.25 percent to the eight disproportionately affected counties in the Panhandle from Escambia to Wakulla counties; and 1.75 percent to the non-disproportionately impacted Gulf Coastal counties). To receive funds under the Direct Component, each county is required to submit a Multiyear Implementation Plan, subject to review by the U.S. Department of the Treasury, detailing the county's plan to expend funds for a set of publicly vetted projects and goals (FDEP 2016g).

Comprehensive Plan Component ("Bucket 2"): A portion of RESTORE funds will go toward projects with a wider geographic benefit (multiple states). These projects are selected by the Gulf Coast Ecosystem Restoration Council, which includes the five Gulf States and six federal agencies. Projects can be submitted by the Council members and federally recognized Native American tribes.

Spill Impact Component ("Bucket 3"): Each of the five Gulf states will receive these funds to implement a State Expenditure Plan. In Florida, this plan is being developed through the Gulf Consortium, which was created by inter-local agreement among Florida's 23 Gulf Coast counties. Projects will be submitted by each of the 23 counties on Florida's Gulf Coast.

Natural Resource Damage Assessment (NRDA)

The Oil Pollution Act authorizes certain state and federal agencies to evaluate the impacts of the Deepwater Horizon oil spill. This legal process, known as NRDA, determines the type and amount of restoration needed to compensate the public for damages caused by the oil spill. The FDEP, along with the FWC, are co-trustees on the Deepwater Horizon Trustee Council.

National Fish and Wildlife Federation (NFWF)

The NFWF established the GEBF to administer funds arising from plea agreements that resolve the criminal cases against BP and Transocean. The purpose of the GEBF, as set forth in the plea agreements, is to remedy harm and eliminate or reduce the risk of future harm to Gulf Coast natural resources. The plea agreements require the NFWF to consult with state and federal resource agencies in identifying projects. The FWC and FDEP work directly with the NFWF to identify projects for the state of Florida, in consultation with the USFWS and NOAA. From 2013 to 2018, the GEBF will receive a total of $356 million for natural resource projects in Florida. However, the allocation of funds is not limited to five years. The amount of these funds that will be allocated to other projects in the St. Andrew Bay watershed is unknown as of this writing (FDEP 2016g). NFWF funded the development of the 2017 SWIM plan updates through the GEBF.

The Nature Conservancy (TNC): Watershed Management Planning

To achieve comprehensive and long-term success for Gulf restoration, TNC facilitated a community-based watershed management planning process in 2014 and 2015 along Florida's Gulf coast for the following six watersheds: Perdido Bay, Pensacola Bay, Choctawhatchee Bay, St. Andrew and St. Joseph bays, Apalachicola to St. Marks, and the Springs Coast. The process was designed to:

- Develop watershed-based plans that identify the most pressing environmental issues affecting each watershed and solutions that address the issues, regardless of political jurisdiction and funding source;
- Create long-term partnerships among stakeholders in each watershed and across the regions to maximize effectiveness of project implementation and funding efforts; and
- Provide a screening tool to evaluate the project priorities of these watershed plans for potential funding by the communities, FDEP, FWC, NFWF, and the Gulf Coast Restoration Council (TNC 2014).

The TNC Plan developed for the St. Andrew Bay identifies 30 projects to address seven major actions:

- Protect, restore, create and/or manage natural habitat and resources and increase buffer areas;
- Increase cooperation and coordination for management, monitoring, funding, implementation, outreach, and enforcement;
- Reduce impacts to groundwater and ensure adequate fresh water availability;
- Reduce and treat stormwater;
- Reduce nutrient loading;
- Reduce sedimentation; and
- Increase economic diversification.

To complete the planning process and ensure that all of the priority issues are identified and addressed, the plan recommended updating the 2000 St. Andrew Bay SWIM Plan—the subject of this report (TNC 2014).

Water Quality Monitoring

Most the monitoring data in the St. Andrew Bay watershed, including chemical and biological data, has been collected by the FDEP Northwest District staff (FDEP 2006). Data-gathering activities include working with environmental monitoring staff in the NWFWMD and local and county governments to obtain applicable monitoring data from their routine monitoring programs and special water quality projects in the basin. All of the data collected by the FDEP and its partners is uploaded to the statewide water quality database for assessment.

Several water quality monitoring programs are ongoing in the St. Andrew Bay watershed. These include the FDEP Surface Water Temporal Variability (SWTV) and Status Networks; FDACS Shellfish Environmental Assessment Section (SEAS); the FDOH Florida Healthy Beaches monitoring program; and St. Andrew Bay RMA.

The following subsections provide an overview of these programs and some of their relevant findings.

FDEP/NWFWMD

As part of Florida's SWTV Network, the NWFWMD assists the FDEP with the collection of monthly samples from sites on Econfina Creek and Crystal Lake. Parameters monitored include color alkalinity, turbidity, suspended and dissolved solids, nutrients, total organic carbon, chlorides, sulfate, metals (calcium, potassium, sodium, magnesium), pH, conductivity, temperature, DO, total coliform bacteria, fecal coliform bacteria, *enterococci* bacteria, and *escherichia* bacteria. These water quality stations are on gauged streams, which provide for calculated stream discharges (FDEP 2006, 2016h).

The FDEP has also developed the Nitrogen Source Inventory and Loading Tool to identify and quantify the major contributing nitrogen sources to groundwater in areas of interest. This GIS- and spreadsheet-based tool provides spatial estimates of the relative contribution of nitrogen from various sources. It takes into consideration the transport pathways and processes affecting the various forms of nitrogen as they move from the land surface through soil and geologic strata that overlie and comprise the upper Floridan aquifer (FDEP 2016i).

FDEP Northwest District

The FDEP's Northwest District has collected considerable biological data and conducted biological evaluations of numerous stream and other aquatic habitat sites throughout the watershed (FDEP 2006). The biological data collected by the FDEP Northwest District includes Stream Condition Index, Wetland Condition Index, and Bioassessment data, all are reported and accessible in the STOrage and RETrieval (STORET) database. The data is included in the Impaired Surface Waters Rule (IWR) assessments, including the most recent assessment IWR run 50 which can be found on the FDEP website: http://www.dep.state.fl.us/ water/watersheds/assessment/basin411.htm (FDEP 2006).

Florida Department of Agriculture and Consumer Services (FDACS)

To minimize the risk of shellfish-borne illness, the FDACS continually monitors and evaluates shellfish harvesting areas and classifies them accordingly. It also ensures the proper handling of shellfish sold to the public. Under the SEAS program, FDACS monitors bottom and surface temperature, salinity, DO, surface pH, turbidity, fecal coliform bacteria, water depth, and wind direction and speed at 81 stations in the St. Andrew Bay system, including 24 stations in West Bay, 25 stations in North Bay, and 32 stations in East Bay. These stations are monitored at least monthly, and often more frequently, with a dataset for Bay County extending back to 1985. In addition, SEAS monitors 23 stations in St. Joseph Bay, with the dataset beginning in 1985 and continuing to the present (FDOH 2005).

Florida Department of Health (FDOH)

The Florida Healthy Beaches Program was begun by the FDOH as a pilot beach monitoring program in 1998 with expansion to include all the state's coastal counties in August 2000. Bay County and Gulf

County health departments participate in the program with weekly monitoring of recreational beaches for *enterococcus* and fecal coliform bacteria at seven estuary sites and ten Gulf of Mexico sites. County health departments issue health advisories or warnings when bacterial counts are too high (FDEP 2006).

The St. Andrew Bay Resource Management Association (RMA)

The RMA initiated a water quality monitoring program (Baywatch) in 1990. The Baywatch program conducts monthly sampling at 66 permanently designated stations—24 in open water, nine in lakes, 16 in creeks, and 17 within estuarine bayous. Most of these have been sampled since 1990. There are nine study areas including Lake Powell, Powell Creek East, West Bay, North Bay, East Bay, Grand Lagoon, St. Andrew Bay, Lake Marin, and Johnson Bayou. Eighteen seagrass stations are monitored for seagrass health each year and are also sampled for water quality each month. All stations are sampled for temperature, pH, *Secchi* depth, DO, turbidity, and salinity. Open water and seagrass stations are also sampled for chlorophyll-*a*, nitrogen, and phosphorus (St. Andrew Bay RMA 2016).

Baywatch, in partnership with the University of Florida's LakeWatch, also monitors water quality at an additional 40 stations monthly. All stations are sampled for temperature, pH, *Secchi* depth, DO, turbidity, and salinity. Samples collected at each station are also evaluated for turbidity, nutrients, and chlorophyll-*a* (St. Andrew RMA 2016).

Submerged Aquatic Vegetation (SAV) Monitoring

The USGS published a report on the status and trends of seagrasses along the Gulf Coast, including the St. Andrew Bay system (USGS 2002). Since 2009, the FWC's FWRI has monitored changes in the extent, density, and patchiness of seagrass in St. Andrew Bay as part of the statewide SIMM program. The maps are generated through photointerpretation of high-resolution imagery. The FWRI is currently conducting a study to identify the roadblocks to seagrass recovery, which may be different from the causes for their losses. The general status of seagrasses for the watershed is discussed in Section 3.3.1 (FWC 2015c).

Water Quality Restoration and Protection Programs

Water quality in the St. Andrew Bay watershed is protected through several programs working in conjunction to restore water quality and prevent degradation. These programs include FDEP's adopted TMDLs; BMPs for silviculture, agriculture, construction, and other activities related to land use and development; and a variety of permitting programs including NPDES, domestic and industrial wastewater permits, stormwater permits, and ERP. Additionally, water quality is protected through conservation, mitigation, and management programs that protect water resources, aquifer recharge areas, floodplains, and other natural systems within the watershed. These programs include the Florida Forever Work Plan, regional mitigation for state transportation projects, spring protection and restoration, and natural resource management at military facilities. The following section provides an overview of these programs and their contribution to water quality restoration and protection.

Total Maximum Daily Loads (TMDLs)

Total maximum daily loads are developed for waterbodies that are verified as not meeting adopted water quality standards to support their designated use. They provide important water quality restoration goals to guide restoration activities. They also identify the reductions in pollutant loading required to restore water quality. Total maximum daily loads are implemented through the development and adoption of BMAPs that identify the management actions necessary to reduce the pollutant loads. Basin Management Action Plans are developed by local stakeholders (public and private) in close coordination with the water management districts and the FDEP. Although water segments with adopted TMDLs are removed from the state's impaired waters list, they remain a high priority for restoration. The FDEP has developed specific guidance for implementing fecal coliform TMDLs that focuses on identifying and removing bacteria sources (FDEP 2011c).

National Pollutant Discharge Elimination System (NPDES) Permitting

All point sources that discharge to surface waterbodies require a NPDES permit. These permits can be classified into two types: domestic or industrial wastewater discharge permits, and stormwater permits. All communities' NPDES-permitted point sources may be affected by the development and implementation of a TMDL. All NPDES permits include "reopener clauses" that allow the FDEP to incorporate new discharge limits when a TMDL is established. These new limitations may be incorporated into a permit when a TMDL is implemented or at the next permit renewal, depending on the timing of the permit renewal and workload. For NPDES municipal stormwater permits, the FDEP will insert the following statement once a BMAP is completed (FDEP 2006):

> *The permittee shall undertake those activities specified in the (Name of Waterbody) BMAP in accordance with the approved schedule set forth in the BMAP.*

The FDEP implements the NPDES stormwater program in Florida under delegation from the EPA. The program requires the regulation of stormwater runoff from MS4s generally serving populations of more than 10,000 and denser than 1,000 per square mile, construction activity disturbing more than one acre of land, and ten categories of industrial activity. An MS4 can include roads with drainage systems, gutters, and ditches, as well as underground drainage, operated by local jurisdictions, the FDOT, universities, local sewer districts, hospitals, military bases, and prisons.

The cities of Panama City, Parker, Callaway, and Mexico Beach and Bay County, in partnership with the NWFWMD, have recently implemented stormwater retrofit projects within the St. Andrew Bay watershed costing nearly $5 million. These projects included construction of stormwater treatment ponds, installation of a number of stormwater treatment units, and abatement of sedimentation from an unpaved road. These efforts are on top of other initiatives on the part of the County and municipalities to improve the treatment of stormwater and address sedimentation from unpaved roads.

Domestic and Industrial Wastewater Permits

In addition to NPDES-permitted facilities, all discharge to surface waters, Florida also regulates domestic and industrial wastewater discharges to groundwater via land application. Since groundwater and surface water are so intimately linked in much of the state, reductions in loadings from these facilities may be needed to meet TMDL limitations for pollutants in surface waters. If such reductions are identified in the BMAP, they would be implemented through modifications of existing state permits (FDEP 2006).

Best Management Practices (BMPs)

Best management practices may include structural controls (such as retention areas or detention ponds) or non-structural controls (such as street sweeping or public education). Many BMPs have been developed for urban stormwater to reduce pollutant loadings and peak flows. These BMPs accommodate site-specific conditions, including soil type, slope, depth to groundwater, and the use designation of receiving waters (such as drinking water, recreation, or shellfish harvesting).

The passage of the 1999 Florida Watershed Restoration Act (Chapter 99-223, Laws of Florida) increased the emphasis on implementing BMPs to reduce NPS pollutant discharges from agricultural operations. It authorized the FDEP and FDACS to develop interim measures and agricultural BMPs. While BMPs are adopted by rule, they are voluntary if not otherwise implemented by regulatory programs. If they are adopted by rule and the FDEP verifies their effectiveness, then implementation provides a presumption of compliance with water quality standards, similar to that granted a developer who obtains ERP (FDACS 2016b).

Over the last several years, FDACS has worked with farmers, soil and water conservation entities, the University of Florida's Institute of Food and Agricultural Sciences (UF-IFAS), and other interests to improve product marketability and operational efficiency of agricultural BMPs, while at the same time promoting water quality and water conservation objectives. In addition, programs have been established and are being developed to create a network of state, local, federal, and private sources of funds for developing and implementing BMPs.

Agricultural lands within Bay County are primarily used for silviculture, with some interspersed pasture land. In Washington, and Walton counties, agricultural lands support a more diverse array of uses including row crop, cattle (beef and dairy), poultry and other livestock, some nurseries and sod operations, and silviculture. Best management practices have been developed and adopted by rule for silviculture, row crops, container plants, cow/calf, and dairies (FDACS 2014, 2016b, 2016c). A statewide draft BMP for poultry has been developed and adoption is expected by late 2016 (FDACS 1993, 2016b).

Florida Environmental Resource Permitting (ERP)

Florida established the ERP program to prevent stormwater pollution to Florida's rivers, lakes and streams, and to help provide flood protection. The ERP program regulates the management and storage of surface waters and provides protection for the vital functions of wetlands and other surface waters. In northwest Florida, the ERP program is jointly implemented by the NWFWMD and the FDEP.

Regional Mitigation for State Transportation Projects

Under Section 373.4137, F.S., the NWFWMD offers mitigation services, as an option, to the FDOT for road projects with unavoidable wetland impacts when the use of private mitigation banks is not feasible. As required by this statute, a regional mitigation plan (a.k.a., Umbrella Plan) has been developed, and is updated annually to address the FDOT mitigation needs submitted to the NWFWMD. Components of the Umbrella Plan include the federally permitted "In-Lieu Fee Program" instrument and other mitigation projects (NWFWMD 2016d). The District does not compete with private mitigation banks, such as Breakfast Point Mitigation Bank, Devils Swamp Mitigation Bank, and Sweetwater Mitigation Bank, which are located in the St. Andrew Bay watershed (NWFWMD 2016d). The District's mitigation is developed and implemented in consultation with the FDOT, FDEP, the USACE, the EPA, the USFWS, the U.S. National Marine Fisheries Service, and the FWC and is maintained and available for review at http://www.nwfwmdwetlands.com/.

Since 1997, the NWFWMD has implemented mitigation at 29 sites, including six sites in the St. Andrew Bay watershed: Lynn Haven Breakwater, St. Joseph Bay Buffer Preserve, Island Road, Treasure Road, Southgate, and Ward Creek West (NWFWMD 2016d).

Florida Forever Work Plan

Florida Forever is Florida's conservation and recreation lands acquisition program. Under Section 373.199, F.S., and the NWFWMD Florida Forever 2016 Five Year Work Plan, a variety of projects may be implemented, including capital projects, land acquisition, and other environmental projects. Since its inception, the District's land acquisition program has sought to bring as much floodplain as possible of the major rivers and creeks under public ownership and protection.

The District currently owns 43,771 acres in the Econfina Creek watershed. The majority of the acreage currently owned by the District and targeted for future purchase is one of the most important recharge areas for the Floridan aquifer in northwest Florida. Recharge rates in the area have been estimated at 25 to 40 inches per year, and this recharge drives the spring flows along the Econfina Creek, the largest tributary of the Deer Point Lake Reservoir, which serves as the public water supply for Bay County, including Panama City, Panama City Beach, and neighboring communities (NWFWMD 2016e).

The District's priorities for future purchases also include approximately 47,281 acres in West Bay, the westernmost embayment of the St. Andrew Bay estuary; and approximately 15,000 acres in Sandy Creek, a major tributary of East Bay, the easternmost embayment of the St. Andrew Bay estuary. Both acquisitions would provide a riparian buffer that would protect water quality, natural hydrology, and a mosaic of interconnected upland, wetland, stream, and estuarine habitats (NWFWMD 2016e).

In 2015, voters in the state passed the Florida Land and Water Conservation Amendment (Amendment 1). The amendment funds the Land Acquisition Trust Fund to acquire, restore, improve, and manage conservation lands including wetlands and forests; fish and wildlife habitat; lands protecting water resources and drinking water sources, including the Everglades, and the water quality of rivers, lakes, and streams; beaches and shores; outdoor recreational lands; working farms and ranches; and historic or geologic sites, by dedicating 33 percent of net revenues from the existing excise tax on documents for 20 years. In 2016, the Florida legislature appropriated $15 million to Florida Forever for conservation easements and increasing water supplies (FDEP 2016j).

Spring Protection and Restoration

In 1999, the Secretary of the FDEP formed a multiagency Florida Springs Task Force to recommend strategies for protecting and restoring Florida's springs. The Task Force was composed of a group of 16 that included scientists, planners, and other citizens. Its recommendations included action steps for research and monitoring, education, and assistance with BMPs for landowners. In November 2002, the Florida Department of Community Services and the FDEP published *Protecting Florida's Springs: Land Use Planning Strategies and Best Management Practices*. This manual was based on the recommendations developed by the Florida Springs Task Force.

In 2001, the legislature first approved funding for the Florida Springs Initiative, an effort to understand more about the water quality and quantity of over 30 first-magnitude springs throughout north and central Florida. The FDEP requested the assistance of the Northwest Florida, Suwannee River, and Southwest Florida Water Management Districts to help collect and interpret water quality and discharge data from first-magnitude springs within district boundaries. This effort includes activities such as sample collection and analysis, the delineation of spring recharge areas, the development of a groundwater monitoring network, and implementation of projects to help landowners reduce nutrient loading in spring recharge areas (NWFWMD 2016f).

Protection and restoration of northwest Florida's springs and associated systems are a continuing priority. Current and recent activities include restoration and protection projects for Williford Spring, Devil's Hole Spring, and Econfina Blue Spring within the Econfina Creek WMA (NWFWMD 2016f). In 2016, the Florida legislature passed the Legacy Florida Act and appropriated $50 million for springs restoration and protection, which is anticipated to result in significant benefits for this and other watersheds around the state (FDEP 2014f).

Minimum Flows and Minimum Water Levels (MFLs)

Section 373.042, F.S., requires each water management district to develop minimum flows and minimum water levels (MFLs) for specific surface and groundwaters within their jurisdiction. A minimum flow is defined by section 373.042, F.S., as "the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area," and a minimum water levels is "the level of groundwater in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources or ecology of the area." Minimum flows and minimum water levels are calculated using best available data and consider natural seasonal fluctuations; non-consumptive uses; and environmental values associated with coastal, estuarine, riverine, spring, aquatic, and wetlands ecology as specified in Section 62-40.473, F.A.C. (NWFWMD 2016f).

The process of establishing MFLs involves a series of steps including identification of priority waterbodies, data collection, technical assessments, peer review, rule-making and rule adoption. Adopted MFLs are considered when reviewing consumptive use permit applications. A recovery or prevention strategy must be developed for any waterbody where consumptive uses are currently or anticipated to result in flows or levels below an adopted MFL.

The technical evaluation for each MFL is expected to require approximately five years of data collection and analysis. Data collection has begun and will occur concurrently for several waterbodies. The District is not currently working on the development of any MFLs within the St. Andrew Bay watershed, although technical assessment of the Floridan aquifer for coastal Bay County is scheduled to begin in 2021 with completion estimated in 2026 (NWFWMD 2016f).

Natural Resource Management at Military Facilities

The U.S. Air Force owns 29,638 acres of land within the St. Andrew Bay watershed (FNAI 2016a). Eglin AFB maintains a satellite property located on St. Joseph Peninsula, while Tyndall AFB, the largest military installation in the watershed, is located between St. Andrew Bay and the Gulf of Mexico in Bay County. Tyndall AFB is dedicated primarily to Air Force operations and pine plantations (FNAI 2016a).

Tyndall AFB encompasses 28,800 acres and is bounded by East Bay to the northeast, St. Andrew Bay to the northwest, and St. Andrew Bay and the Gulf of Mexico to the south and southeast. Much of the base is undeveloped and protected. The main peninsula includes relatively intact patches of several natural communities, but is largely pine plantation. Shell Island, Crooked Island East, Raffield Island, and the smaller peninsulas are largely undisturbed. These undisturbed areas support 12 natural community types recognized by the FNAI and more than 40 species of rare plants and animals (FNAI 2016a).

The 325th Civil Engineer Squadron, Natural Resources Office performs the operation, maintenance, and construction of the base's real property to sustain its land and facilities. This includes tasks such as fire protection services, environmental programs, natural resource programs, and property management among others.

Since 2009, TNC and Eglin AFB, with funding from the Legacy Program, have worked with military bases in Florida to establish six Cooperative Invasive Species Management Areas (CISMAs). These CISMAs are designed to help to decrease the re-infestation from invasive species at six Florida bases, including Tyndall AFB. As a result of this initiative, a report called *Utilizing Cooperative Invasive Species Management Areas (CISMAs) to Effectively Reduce Re-infestation of Invaders on Six (6) Military Bases and Adjacent Lands in Florida* was developed. The report details the development of the CISMAs, their accomplishments, project monitoring, and strategic plans.

The Eglin AFB holds a Satellite Property at the southern end of St. Joseph Peninsula. The property contains coastal interdunal swale and coastal scrub natural communities and provides habitat for the rare Gulf coast lupine (*Lupinus westianus*). This property is also an important sea turtle nesting site.

University of Florida Institute of Food and Agricultural Sciences Extension (UF-IFAS)

The UF-IFAS is a federal-state-county partnership that focuses on research, teaching, and extension to "develop knowledge in agriculture, human and natural resources, and the life sciences, and enhance and sustain the quality of human life by making that information accessible."

Many UF/IFAS programs and partnerships help protect water resources across the watershed and the state of Florida. Such programs and partnerships include the Fisheries and Aquatic Sciences and Marine Sciences Program, the Aquatic and Invasive Plants Center, the Florida Cooperative Fish and Wildlife Research Unit, the Florida Partnership for Water, Agriculture and Community Sustainability, the Natural Resources Leadership Institute, the Wetland Biogeochemistry Laboratory, the Sea Grant, and the Shellfish Aquaculture Extension among others.

To promote environmentally sound forestry practices, the UF-IFAS offers the voluntary Forest Stewardship Program, which seeks to help private landowners develop a plan to increase the economic value of their forestland while maintaining its environmental integrity (UF-IFAS 2016). The Extension also works with farmers and property owners across the state to minimize the need for commercial pesticides and fertilizers, through environmentally friendly BMPs.

Other Programs and Actions

Citizen and volunteer-based initiatives include the following:

- **Friends of St. Andrew Bay (formerly St. Andrew Bay Environmental Study Team)** – The St. Andrew Bay Environmental Study Team (BEST) was formed in 1987 as a nonprofit community organization to exchange, review, and coordinate information on protection strategies and development threats to the bay area ecosystem. In 1988, BEST, in cooperation with the FDEP, completed the ecosystem management plan, *A Look to the Future: A Management Plan for the St. Andrew Bay Ecosystem*. This document was updated in 2001 with the publication of *St. Andrew Bay Ecosystem, Our Environment: A Revision of "A Look to the Future."* BEST, Inc., a nonprofit 501(c)(3) corporation, was formed in 1996 to receive and administer donations and grant money to fulfill the action plans of the ecosystem management plan (Friends of St. Andrew Bay 2016). In 2008, BEST, Inc., coordinated and completed a countywide effort to develop a cooperative stormwater master plan.
- **St. Andrew Bay Resource Management Association –** The St. Andrew Bay RMA has been conducting water quality monitoring since 1990. Other activities include monitoring of seagrasses and sea turtle nesting, public education, and coordination and implementation of restoration projects. Activities conducted by the St. Andrew Bay RMA are described in more detail above.

Appendix C Geographic and Physical Characteristics

Floridan Aquifer Vulnerability Assessment

In 2017, the Florida Geological Survey released the Floridan Aquifer System Contamination Potential (FAVA II) dataset (Figure C-1). This dataset was calculated through the application of the weights of evidence method. This method examines different data layers including point and area data to determine relative vulnerability. These maps were developed to provide FDEP with a ground-water resource management and protection tool to carry out agency responsibilities related to natural resource management and protection regarding the Floridan Aquifer System. The maps are not appropriate for site specific analysis.

As depicted in the figure, those areas where the Floridan Aquifer is most vulnerable to contamination include the northern watershed planning area. This is the region most associated with spring recharge. No areas classified as least vulnerable are located within the St. Andrew Watershed. The regions of the highest population and adjacent to most estuarine waters are classified as more vulnerable. The lowest area of vulnerability within the planning area is classified as vulnerable. Limited areas, mostly near the fringe of the watershed, are within this classification.

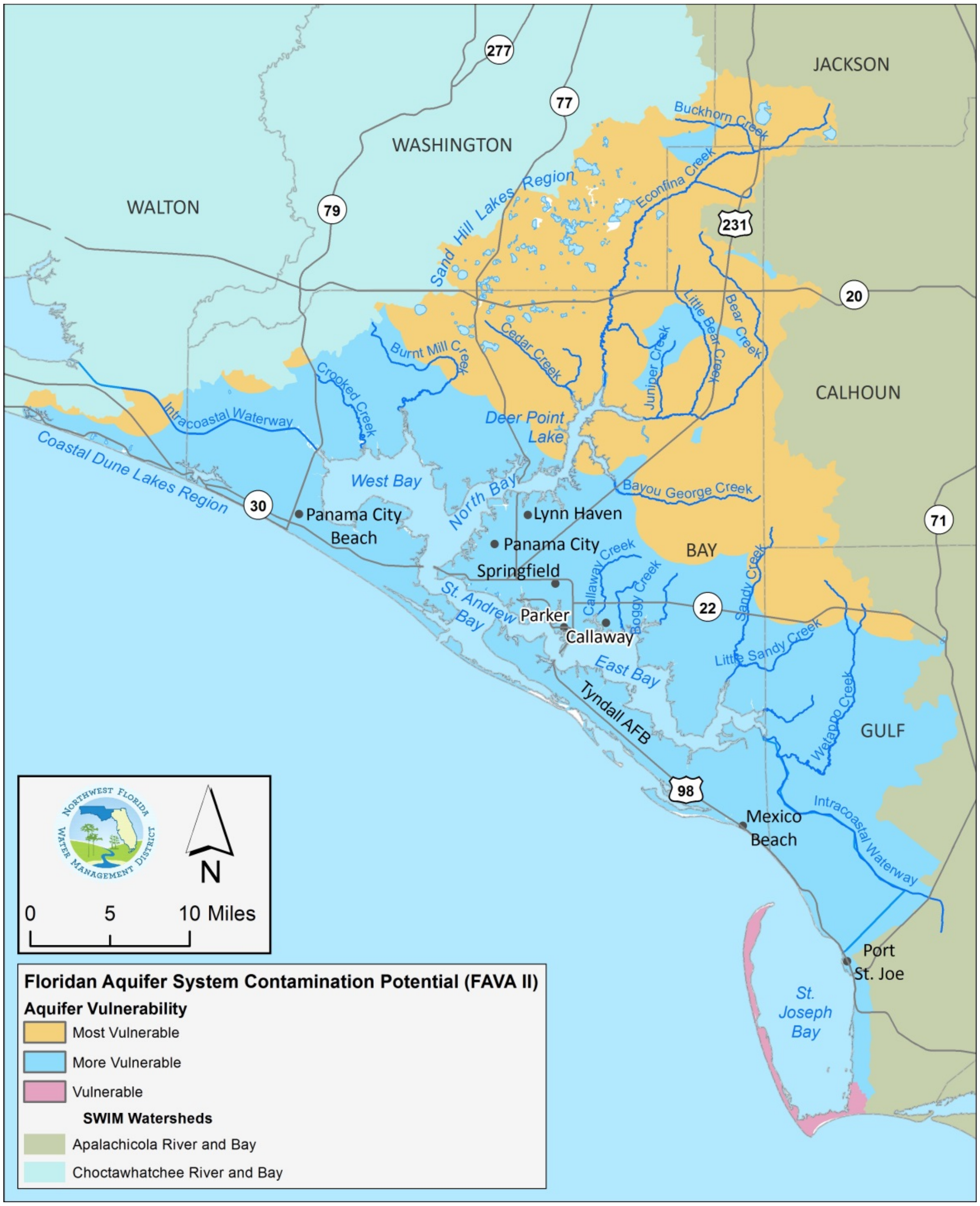


Figure C-1 Floridan Aquifer System Contamination Potential

Geologic Units

The St. Andrew Bay watershed follows much of the general stratigraphy of the western Florida Panhandle. Near-surface formations, which interact with directly with surface waters include dolomitic limestones, sandy-clayey limestones, and finally, shell beds, clayey sands, and sands (Scott *et al.* 2001). The watershed's quaternary sands along the coast create white beaches, for which this part of Florida is well known.

The northern extent of the watershed contains much of the Miocene Alum Bluff group (especially in the Econfina WMA in northern Bay County and southern Washington County) and Citronelle formations. Sediment of the Alum Bluff is generally composed of quartz sands, clays, and shell beds typical of a shallow-water marine environment, and is generally covered by the younger Citronelle formation. Deposits of the Citronelle Formation range from clay through gravel, but sands are the most common size fraction. The deposits are commonly cross-bedded, lenticular, graveliferous sands with an occasional thin bed of clay and varying amounts of silt and clay that can weakly harden or cement the sediment. Overlying most geologic formations in the watershed are unconsolidated Holocene siliciclastic sediments (nearly pure quartz sands with minor heavy mineral sands) (NRCS 1992). These sands were deposited during sea level fluctuations prior to the permanent land emergence of the Florida plateau during the Miocene epoch (23.3 to 5.3 million years ago) and are presently found on the watersheds' barrier islands: St. Joseph Peninsula, Shell Island, and Crooked Island.

Many of the geologic processes described above are a product of prehistoric marine deposition during periods when sea level was higher than present. Fluvial processes, in conjunction, are also greatly responsible for the modern land surface of the St. Andrew Bay watershed. The larger stream valleys within most of the watershed commonly contain deposits of Pleistocene and Holocene alluvium, especially along Bear Creek and Cedar Creek. Most of these sediments are derived from erosion of the Citronelle Formation and upstream sources of undifferentiated sands, clays, and gravels (Green *et al.* 2002).

In the upper St. Andrew Bay watershed, limestone karst landscapes lead to hydrologic connectivity with the Floridan aquifer through a series of springs and sinkholes, particularly in southwest Jackson and Washington counties and northern Bay County. Although sandy soils in the St. Andrew Bay watershed have been a limiting factor in crop production, soils throughout the watershed are an important natural resource for silviculture. Soils also protect water quality by absorbing runoff, store soil organic carbon, and help mitigate flooding. The following soils are found in the Florida portion of the St. Andrew Bay watershed:

Ultisols – Ultisols are intensely-weathered soils of warm and humid climates, and are usually formed on older geologic formations in parent material that is already extensively weathered (i.e., upland areas of the watershed). They are generally low in natural fertility and high in soil acidity, but contain subsurface clay accumulations that give them a high nutrient retention capacity. In the St. Andrew Bay watershed, the majority of ultisols are found to the east of the Econfina Creek in Bay, Calhoun, and Gulf counties where the landscape has been relatively stable over recent geologic time (Collins 2010). Ultisols are the primary agricultural and silvicultural soils of the watershed, as their high clay content contributes to nutrient and water retention, when properly managed.

Entisols – Entisols are young soils that show little development, have no diagnostic horizons, and are largely unaltered from their parent material, which can be unconsolidated sediment or rock (USDA 2014). Entisols of the St. Andrew Bay watershed can be found on barrier islands and barrier peninsulas (Crooked Island, Shell Island, St. Joseph Peninsula), where surficial processes are active and parent materials have not undergone substantial weathering (Collins 2010).

Spodosols – Spodosols are sandy, acidic soils, often found in cool, moist climates such as coastal conifer forests (USDA 2014). They are easily identified by their strikingly-colored horizons, which form as a result of leaching and accumulation processes. Spodosols occur in eastern Bay County and adjacent to St. Andrew Bay, East and West Bays and inland towards Vicksburg (Collins 2010). In these areas, the landscape is more stable and conducive to soil development. The presence of spodosols indicates an area that was historically dominated by a pine (longleaf) over-story.

Inceptisols – Inceptisols are described as soils in the beginning stages of soil profile development, as the differences between soil horizons are just beginning to appear in the form of color variation due to accumulations of small amounts of clay, salts, and organic material. Inceptisols occur predominantly along the coast of Gulf County (Collins 2010).

Histosols – Histosols are described as soils without permafrost and predominantly composed of organic material in various stages of decomposition. These soils are usually saturated, resulting in anaerobic conditions, faster rates of decomposition, and increased organic matter accumulation. Histosols generally consist of at least half organic materials and are common in wetlands (USDA 2014). Histosols in the St. Andrew Bay watershed occur near the Econfina Creek WMA and eastern Bay County (Collins 2010; USDA 2014). Histosols cover approximately 15,943 square kilometers in the state of Florida and store more organic carbon than any other soil type (Kolka *et al.* 2016; Vasques *et al.* 2010). Drainage of wetland areas and the associated decomposition of organic matter stored in histosols is a well-documented source of atmospheric carbon dioxide (CO_2) and methane.

Appendix D Threatened and Endangered Species

The St. Andrew Bay watershed supports a wide array of biological resources and habitats for many species of flora and fauna. This appendix provides a list of species that are protected and tracked for the watershed, as well as their habitat requirements (FNAI 2010; USFWS 2016).

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Plants					
Andropogon arctatus	Pinewood Bluestem	S3	T	N	Lacustrine: wet pine flatwoods, seepage wetlands, bogs, wet pine savannas
Arabis canadensis	Sicklepod	N	E	N	Terrestrial: upland mixed forest, limestone outcrops
Asclepias viridula	Green Milkweed	S2	T	N	Palustrine: wet prairie, seepage slope edges Riverine: seepage stream banks Terrestrial: mesic flatwoods, drainage ditches
Asplenium verecundum	Delicate Spleenwort	S1	E	N	Terrestrial: rockland hammocks, limestone outcrops, grottoes, and sinkholes
Aster hemisphericus	Aster	S1	E	N	Terrestrial: upland mixed forest, on sandstone outcrop
Aster spinulosus	Pinewoods Aster	S1	E	N	Palustrine: seepage slope Terrestrial: sandhill, scrub and mesic flatwoods
Baptisia megacarpa	Apalachicola Wild Indigo	S2	E	N	Palustrine: floodplain forest Terrestrial: upland mixed forest, slope forest
Bigelowia nuttallii	Nuttall's Rayless Goldenrod	S1	E	N	Riverine: seepage stream banks Terrestrial: scrub, upland pine forest - sandstone outcrops
Brickellia cordifolia	Flyer's Nemesis	S1	E	N	Terrestrial: upland hardwood forest, near streams
Sideroxylon lycioides	Buckthorn	N	E	N	Palustrine: bottomland forest, dome swamp, floodplain forest Terrestrial: upland hardwood forest
Sideroxylon thornei	Thorn's Buckthorn	N	E	N	Palustrine: hydric hammock, floodplain swamp
Arnoglossum diversifolia	Indian-plantain	N	T	N	Palustrine: forested wetland
Calamintha dentata	Toothed Savory	S3	T	N	Terrestrial: longleaf pine-deciduous oak sandhills, planted pine plantations, sand, open and abandoned fields, and roadsides

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Calamovilfa curtissii	Curtiss's Sandgrass	S3	T	N	Palustrine: mesic and wet flatwoods, wet prairie, depression marsh Terrestrial: mesic flatwoods
Callirhoe papaver	Poppy Mallow	S2	E	N	Terrestrial: upland mixed forest, roadsides; edge or understory
Calycanthus floridus	Sweetshrub	S2	E	N	Terrestrial: upland hardwood forest, slope forest, bluffs Palustrine: bottomland forest, stream banks, floodplains
Calystegia catesbaeiana	Catesby's Bindweed	SH	E	N	Terrestrial: Longleaf pine-wiregrass sandhill
Carex baltzellii	Baltzell's Sedge	S3	T	N	Terrestrial: slope forest, moist sandy loam; moist sandy loam
Cheilanthes microphylla	Southern Lip Fern	S3	E	N	Terrestrial: upland mixed forest, shell mound, rockland hammock; on limestone
Chrysopsis cruseana	Cruise's Goldenaster	S2	E	N	Terrestrial: coastal dunes, coastal strand, coastal grassland; openings and blowouts
Chrysopsis godfreyi	Godfry's Goldenaster	S2	E	N	Terrestrial: grassland/herbaceous, sand/dune, shrubland/chaparral
Cleistes divaricata	Spreading Pogonia	N	T	N	Palustrine: wet flatwoods
Coelorachis tuberculosa	Florida Jointail	S3	T	N	Lacustrine: shallow water Palustrine: herbaceous wetland, temporary pool
Coreopsis integrifolia	Fringeleaf Tickseed	S1	E	N	Lacustrine: forested wetland, riparian
Cornus alternifolia	Pagoda Dogwood	S2	E	N	Palustrine: creek swamps Terrestrial: slope forest, upland hardwood forest, bluffs
Crataegus phaenopyrum	Washington Hawthorn	S1	E	N	Palustrine: basin swamp, basin marsh, edges of wet areas
Cryptotaenia canadensis	Honewort	S1	E	N	Palustrine: floodplain forest, bottomland forest Riverine: alluvial stream bank
Cuphea aspera	Tropical Waxweed	S1	E	N	Palustrine: wet prairie, seepage slope Terrestrial: mesic flatwoods
Dirca palustris	Leatherwood	S2	E	N	Terrestrial: shrub
Drosera filiformis	Threadleaf Sundew	S1	E	N	Lacustrine: exposed lake bottoms
Drosera intermedia	Water Sundew	S3	T	N	Lacustrine: sinkhole lake edges Palustrine: seepage slope, wet flatwoods, depression marsh Riverine: seepage stream banks, drainage ditches
Eriocaulon nigrobracteatum	Darkheaded Hatpins	S1	E	N	Palustrine: wet boggy seepage slopes, mucky soils

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Euphorbia commutata	Wood Spurge	S2	E	N	N/A
Euphorbia telephioides	Telephus Spurge	S1	E	T	Terrestrial: mesic flatwoods; disturbed wiregrass areas, coastal scrub
Forestiera godfreyi	Godfrey's Swamp Privet	S2	E	N	Terrestrial: forest-hardwood, on wooded slopes of lake & river bluffs
Gentiana pennelliana	Wiregrass Gentian	S3	E	N	Palustrine: seepage slope, wet prairie, roadside ditches Terrestrial: mesic flatwoods, planted slash pine
Harperocallis flava	Harper’s Beauty	S1	E	E	Palustrine: seepage slope, wet prairie, roadside ditches
Hexastylis arifolia	Heartleaf Wild Ginger	S3	T	N	Riverine: seepage stream bank Terrestrial: slope forest
Hymenocallis henryae	Henry's Spiderlilly	S2	E	N	Palustrine: dome swamp edges, wet prairie, wet flatwoods, baygall edges, swamp edges Terrestrial: wet prairies and flatwoods
Hypericum lissophloeus	Smoothbark St. John's-wort	S2	E	N	Lacustrine: sandhill upland lake margins Terrestrial: sandhill margins
Ilex amelanchier	Serviceberry Holly	S2	T	N	N/A
Isotria verticillata	Whorled Pogonia	S1	E	N	Terrestrial: sloped forest
Juncus gymnocarpus	Coville's Rush	S2	E	N	N/A
Justicia crassifolia	Thickleaved Waterwillow	S2	E	N	Palustrine: dome swamp, seepage slope Terrestrial: mesic flatwoods
Kalmia latifolia	Mountain Laurel	S3	T	N	Riverine: seepage stream bank Terrestrial: slope forest, seepage stream banks
Lachnocaulon digynum	Panhandle Bog Buttons	S3	T	N	Riverine: pool Palustrine: bog/fen, forested wetland
Liatris provincialis	Godfrey's Gayfeather	S2	E	N	Terrestrial: sandhill, scrub, coastal grassland; disturbed areas
Lilium catesbaei	Catesby Lily	N	T	N	Palustrine: wet prairie, wet flatwoods, seepage slope Terrestrial: mesic flatwoods, seepage slope; usually with grasses
Lilium michauxii	Carolina Lily	S2	E	N	N/A
Linum westii	West's Flax	S2	E	N	Palustrine: dome swamp, depression marsh, wet flatwoods, wet prairie, pond margins

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Lupinus westianus	Gulf Coast Lupine	S2	T	N	Terrestrial: beach dune, scrub, disturbed areas, roadsides, blowouts in dunes
Macbridea alba	White Birds-in-a-nest	S2	E	T	Palustrine: seepage slope Terrestrial: grassy mesic pine flatwoods, savannahs, roadsides, and similar habitat
Macranthera flammea	Hummingbird Flower	S2	E	N	Palustrine: seepage slope, dome swamp edges, floodplain swamps Riverine: seepage stream banks Terrestrial: seepage slopes
Magnolia ashei	Ashe's Magnolia	S2	E	N	Terrestrial: slope and upland hardwood forest, ravines
Magnolia pyramidata	Pyramid Magnolia	S3	E	N	Terrestrial: slope forest
Malaxis uniflora	Green Addersmouth	S3	E	N	Palustrine: floodplain forest Terrestrial: slope forest, upland mixed forest
Malus angustifolia	Southern Crabapple	N	T	N	N/A
Marshallia obovata	Barbara's Buttons	S1	E	N	Terrestrial: sandhill, upland mixed forest
Marshallia ramosa	Barbara's Buttons	S1	E	N	Terrestrial: upland pine forest, with wiregrass
Matelea alabamensis	Alabama Spinypod	S2	E	N	Terrestrial: bluff, slope forest, upland hardwood forest; on slopes
Matelea baldwiniana	Baldwin's Spinypod	S1	E	N	Terrestrial: bluff, upland mixed forest, bottomland forest, roadsides; calcareous soil
Matelea flavidula	Yellowflowered Spinypod	S1	E	N	Terrestrial: moist, nutrient-rich forests , wooded slopes
Myriophyllum laxum	Piedmont Water-milfoil	S3	N	N	Riverine: creek, pool, spring/spring brook Palustrine: riparian, temporary pool
Nyssa ursina	Bog Tupelo	S2	N	N	Open bogs, wet flatwoods, and swamps, often with titi
Oxypolis greenmanii	Giant Water-dropwort	S3	E	N	Palustrine: dome swamp, wet flatwoods, ditches: in water
Pachysandra procumbens	Allegheny Spurge	S1	E	N	Terrestrial: upland mixed forest, bluff; calcareous soil
Panicum nudicaule	Naked-stemmed Panicgrass	S3	LT	N	N/A
Paronychia chartacea	Papery Whitlow-wort	S1	E	T	Terrestrial: karst sandhill lake margins
Pellaea atropurpurea	Hairy Cliff-brake Fern	S1	E	N	Terrestrial: upland glade
Phoebanthus tenuifolius	Narrowleaf Phoebanthus	S3	LT	N	Terrestrial: sandy pinelands

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Physocarpus opulifolius	Ninebark	S1	E	N	Riverine: seepage stream banks
Pinckneya bracteata	Fever Tree	N	T	N	Palustrine: creek swamps, titi swamps, bogs
Pinguicula ionantha	Godfrey's (violet) Butterwort	S2	E	T	Palustrine: wet flatwoods, wet prarie, bog; in shallow water Riverine: seepage slope; in shallow water. Also, roadside ditches and similar habitat
Pinguicula lutea	Yellow Butterwort	N	T	N	Palustrine: flatwoods, bogs
Pinguicula planifolia	Swamp Butterwort	N	T	N	Palustrine: wet flatwoods, seepage slopes, bog, dome swamp, ditches; in water
Pinguicula primuliflora	Primrose-flowered Butterwort	S3	E	N	Palustrine: bogs, pond margins, margins of spring runs
Platanthera blephariglottis	Whitefringed Orchid	N	T	N	N/A
Platanthera ciliaris	Yellowfringed Orchid	N	T	N	Palustrine: bogs, wet flatwoods Terrestrial: bluff
Platanthera clavellata	Green Rein Orchid	SH	E	N	Lacustrine: seepages, springs (usually wooded); shrub borders of acid bogs; swamp woods; creek floodplains; occasionally open fens; and in the northern or mountainous part of its range, seepage slopes or sunlit stream beds, disturbed sites, such as abandoned quarries, roadbanks, ditches, and sandy-acid mine tailings
Platanthera integra	Orange Rein Orchid	S3	E	N	Palustrine: wet prairie, seepage slope Terrestrial: mesic flatwoods
Plantanthera nivea	Snowy Orchid	N	T	N	Palustrine: bogs
Podophyllum peltatum	Mayapple	S1	E	N	Terrestrial: mesic hardwood forests, dry-mesic oak-hickory forests
Polygonella macrophylla	Largeleaf jointweed	S2	T	N	Terrestrial: scrub, sand pine/oak scrub ridges
Polymnia laevigata	Tennessee Leaf-cup	S1	E	N	Terrestrial: rich wooded slopes in light to dense shade of mixed mesophytic woods
Quercus arkansana	Arkansas Oak	S3	T	N	Terrestrial: Sandy or sandy clay uplands or upper ravine slopes near heads of streams in deciduous woods
Rhexia parviflora	Apalachicola Meadowbeauty	S2	E	N	Palustrine: dome swamp margin, seepage slope, depression marsh; on slopes; with hypericum

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Rhexia salicifolia	Panhandle Meadowbeauty	S2	T	N	Lacustrine: full sun in wet sandy or sandy-peaty areas of sinkhole pond shores, interdunal swales, margins of depression, marshes, flatwoods, ponds and sandhill upland lakes
Rhododendron austrinum	Florida Flame Azalea	S3	E	N	Lacustrine: shaded ravines & in wet bottomlands on rises of sandy alluvium or older terraces.
Rhodedendron chapmanii	Chapman's Rhododendron	S1	E	E	Palustrine: seepage slope (titi bog) Terrestrial: mesic flatwoods; ecotone between flatwoods or more xeric longleaf communities and titi bogs
Rhynchospora crinipe	Hairyped-uncled Beakrush	S1	N	N	Riverine: stream and riversides on narrow streamside shelves, sand-clay bars, and occasionally rooted in streambeds
Rudbeckia nitida	St. John's Susan	S2	E	N	Palustrine: wet flatwoods and prairies, roadside ditches
Ruellia noctiflora	Nightflowe-ring Ruellia	S2	E	N	Lacustrine: moist to wet coastal pinelands, bogs, low meadows, open pine savannahs
Salix eriocephala	Hearleaved Willow	S1	E	N	Palustrine: floodplain swamp, alluvial woodlands
Salvia urticifolia	Nettle-leaved Sage	S1	E	N	Terrestrial: upland glade
Sarracenia leucophylla	Whitetop Pitcher Plant	S3	E	N	Palustrine: wet prairie, seepage slope, baygall edges, ditches
Sarracenia psitticina	Parrot Pitcher Plant	N	T	N	Palustrine: wet flatwoods, wet prairie, seepage slope
Sarracenia purpurea	Decumbent Pitcher Plant	N	T	N	Palustrine: bogs
Sarracenia rubra	Sweet Pitcher Plant	S3	N	LT	Palustrine: bog, wet prairie, seepage slope, wet flatwoods Riverine: seepage stream banks
Scutellaria floridana	Florida Skullcap	S1	E	T	Palustrine: seepage slope, wet flatwoods, grassy openings Terrestrial: mesic flatwoods
Silene virginica	Fire Pink	S1	E	N	N/A
Spigelia gentianoides	Gentian Pinkroot	S1	E	E	Terrestrial: mixed hardwood forest; rich humus
Spiranthes laciniata	Lace-lip Ladies'-tresses	N	T	N	Palustrine: wet flatwoods
Stachydeoma graveolens	Mock Pennyroyal	S2	E	N	Palustrine: forested wetland Terrestrial: forest edge, forest/woodland, savanna, woodland - conifer
Stewartia malacodendron	Silky Camelia	S3	E	N	Palustrine: baygall Terrestrial: slope forest, upland mixed forest; acid soils

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Trillium lancifolium	Narrowleaf Trillium	S2	E	N	Palustrine: bottomland forest Terrestrial: upland mixed forest, slope forest
Verbesina chapmanii	Chapman's Crownbeard	S3	T	N	Palustrine: seepage slope Terrestrial: mesic flatwoods with wiregrass
Xanthorhiza simplicissima	Yellowroot	S1	E	N	Riverine: seepage stream; sandy banks
Xyris isoetifolia	Quillwort Yelloweyed Grass	S1	E	N	Lacustrine: sandhill upland lake margins Palustrine: wet flatwoods, wet prairie
Xyris longisepala	Kral's Yelloweyed Grass	S2	E	N	Lacustrine: sandhill upland lake margins
Xyris stricta var. obscura	Pineland Yelloweyed Grass	S1	N	N	N/A
Xyris scabrifolia	Harper's Yelloweyed Grass	S3	T	N	Palustrine: seepage slope, wet prairie, bogs
Invertebrates					
Caecidotea sp. 8	Econfina Springs Cave Isopod	S1	N	N	N/A
Dasyscias franzi	Shaggy Ghostsnail	S1	N	N	N/A
Medionidus penincillatus	Gulf Moccasinshell	S2	FE	E(CH)	Riverine: medium-sized creeks to large rivers with sand and gravel substrates in slow to moderated currents
Panopea bitruncata	Atlantic Geoduck	S3?	N	N	N/A
Pleurobema pyriforme	Oval Pigtoe	S2	FE	E(CH)	Riverine: medium-sized creeks to small rivers; various substrates; slow to moderate currents
Procambarus econfinae	Panama City Crayfish	S1	SSC	N	Palustrine: wet flatwoods; temporary or fluctuating ponds or semi permanently inundated ditches, also ruderal, roadside ditches and utility easements
Fish					
Acipenser oxyrhyncus desotoi	Gulf Sturgeon	S2	FT	T(CH)	Estuarine: various Marine: various habitats Riverine: alluvial and blackwater streams

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Ameirus serracanthus	Spotted Bullhead	S3	N	N	Riverine: deep holes of small to medium rivers with slow to swift currents and rock substrates or sand bottoms; it also occurs over mud bottoms, typically near stumps, in impoundments
Atractosteus spatula	Alligator Gar	S3	N	N	Riverine: sluggish pools of large rivers and their bayous, oxbow lakes, swamps, and backwaters, rarely brackish or marine waters along the coast
Amphibians					
Ambystoma bishopi	Reticulated Flatwoods Salamander	SNR	FE	E	Terrestrial: slash and longleaf pine flatwoods that have a wiregrass floor and scattered wetlands
Lithobates capito	Gopher Frog	S3	SSC	N	Terrestrial; sandhill, scrub, scrubby flatwoods, xeric hammock (reproduces in ephemeral wetlands within these communities)
Reptiles					
Alligator mississippiensis	American Alligator	S4	FT (S/A)	T	Estuarine: herbaceous wetland Riverine: big river, creek, low gradient, medium river, pool, spring/spring brook Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian, scrub-shrub wetland
Caretta caretta	Loggerhead Sea Turtle	S3	FT	T(CH)	Terrestrial: sandy beaches; nesting
Chelonia mydas	Atlantic Green Turtle	S2	FE	E	Terrestrial: sandy beaches; nesting
Crotalus adamanteus	Eastern Diamondback Rattlesnake	S3	N	N	Palustrine: riparian Terrestrial: grassland/herbaceous, old field, savanna, shrubland/ chaparral, woodland - conifer, woodland - hardwood, woodland - mixed
Dermochelys coriacea	Leatherback Sea Turtle	S2	FT	E	Terrestrial: sandy beaches; nesting
Drymarchon couperi	Eastern Indigo Snake	S3	FT	T	Estuarine: tidal swamp Palustrine: hydric hammock, wet flatwoods Terrestrial: mesic flatwoods, upland pine forest, sandhills, scrub, scrubby flatwoods, rockland hammock, ruderal
Eretmochelys imbricata	Hawksbill Sea Turtle	S1	E	E	Terrestrial: sandy beaches; nesting
Gopherus polyphemus	Gopher Tortoise	S3	ST	C	Terrestrial: sandhills, scrub, scrubby flatwoods, xeric hammocks, coastal strand, ruderal

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Chelonia mydas	Green Sea Turtle	S2	E	E	Estuarine: bays, inlets Terrestrial: sandy beaches; nesting
Graptemys barbouri	Barbour's Map Turtle	S2	ST	N	Palustrine: floodplain stream, floodplain swamp Riverine: alluvial stream
Lepidochelys kempii	Kemp's Ridley Sea Turtle	S1	FE	E	Terrestrial: sandy beaches; nesting
Macroclemys temminckii	Alligator Snapping Turtle	S3	SSC	N	Estuarine: tidal marsh Lacustrine: river floodplain lake, swamp lake Riverine: alluvial stream, blackwater stream
Nerodiaclarkii clarkii	Gulf Salt Marsh Snake	S3?	N	N	Estuarine: herbaceous wetland, scrub-shrub wetland
Pituophis melanoleucas mugitus	Florida Pine Snake	S3	ST	N	Lacustrine: ruderal, sandhill upland lake Terrestrial: sandhill, scrubby flatwoods, xeric hammock, ruderal
Birds					
Ammodramus maritimus peninsulae	Scott's Seaside Sparrow	S2	ST	N	N/A
Aramus guarauna	Limpkin	S3	SSC	N	Estuarine: scrub-shrub wetland Palustrine: forested wetland, herbaceous wetland, riparian
Calidris canutus rufa	Red knot	S2	N	T	Estuarine: bays, tidal flats, salt marshes Terrestrial: sandy beaches Marine: aerial, near shore
Charadrius alexandrius	Snowy Plover	S2	LT	N	Estuarine: exposed unconsolidated substrate Marine: exposed unconsolidated substrate Terrestrial: dunes, sandy beaches, and inlet areas
Charadrius melodus	Piping Plover	S2	FT	T(CH)	Estuarine: exposed unconsolidated substrate Marine: exposed unconsolidated substrate Terrestrial: dunes, sandy beaches, and inlet areas. Mostly wintering and migrants
Cistothorus Palustris marianae	Marian's Marsh Wren	S3	SSC	N	N/A
Egretta caerulea	Little Blue Heron	S4	ST	N	Estuarine: herbaceous wetland, lagoon, scrub-shrub wetland, tidal flat/shore Riverine: low gradient Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian, scrub-shrub wetland

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Egretta rufescens	Reddish Egret	S2	ST	N	Estuarine: tidal swamp, depression marsh, bog, marl prairie, wet prairie Lacustrine: flatwoods/prairie lake, marsh lake Marine: tidal swamp
Egretta thula	Snowy Egret	S3	N	N	Estuarine: bay/sound, herbaceous wetland, lagoon, river mouth/tidal river, scrub-shrub wetland, tidal flat/shore Riverine: low gradient Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian
Egretta tricolor	Tricolored Heron	S4	ST	N	Estuarine: bay/sound, herbaceous wetland, lagoon, river mouth/tidal river, scrub-shrub wetland, tidal flat/shore Riverine: low gradient Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian
Eudocimus albus	White Ibis	S4	ST	N	Estuarine: bay/sound, herbaceous wetland, lagoon, river mouth/tidal river, scrub-shrub wetland, tidal flat/shore Riverine: low gradient Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian
Falco peregrinus	Peregrine Falcon	S2	N	N	Marine: aerial Estuarine: aerial, bay/sound, herbaceous wetland, lagoon, river mouth/tidal river, tidal flat/shore Riverine: aerial Lacustrine: aerial Palustrine: aerial, herbaceous wetland, riparian Terrestrial: cliff, desert, shrubland/chaparral, tundra, urban/edificarian, woodland - conifer, woodland - hardwood, woodland – mixed
Falco sparvarius paulus	Southeastern American Kestrel	S3	T	N	Estuarine: various habitats Palustrine: various habitats Terrestrial: open pine forests, clearings, ruderal, various
Haematopus palliatus	American Oystercatcher	S2	T	N	Estuarine: tidal flat/shore Terrestrial: bare rock/talus/scree, sand/dune

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Haliaeetus leucocephala	Bald Eagle	S3	N	BGEPA	Estuarine: marsh edges, tidal swamp, open water Lacustrine: swamp lakes, edges Palustrine: swamp, floodplain Riverine: shoreline, open water Terrestrial: pine and hardwood forests
Mycteria americana	Wood Stork	S2	FT	T	Estuarine: marshes Lacustrine: floodplain lakes, marshes (feeding), various Palustrine: marshes, swamps, various
Pandion haliatus	Osprey	S3S4	SSC	N	Marine: near shore Estuarine: bay/sound, herbaceous wetland, lagoon, river mouth/tidal river Riverine: big river, medium river Lacustrine: deep and shallow water Palustrine: forested wetland, riparian Terrestrial: cliff
Picoides borealis	Red-cockaded Woodpecker	S2	FE	E	Terrestrial: mature pine forests
Rhynchops niger	Black Skimmer	S3	ST	N	Marine: near shore Estuarine: bay/sound, herbaceous wetland, lagoon, river mouth/tidal river, tidal flat/shore Riverine: big river, low gradient Lacustrine: deep water, Shallow water Palustrine: riparian Terrestrial: sand/dune
Sterna antillarum	Least Tern	S3	ST	N	Estuarine: various Lacustrine various Riverine: various Terrestrial: beach dune, ruderal. Nests common on rooftops
Sterna maxima	Royal Tern	S3	N	N	Marine: near shore Estuarine: bay/sound, lagoon, river mouth/tidal river, tidal flat/shore Terrestrial: sand/dune
Sterna sandvicensis	Sandwich Tern	S2	N	N	Marine: near shore Estuarine: bay/sound, lagoon, river mouth/tidal river, tidal flat/shore Terrestrial: sand/dune
Mammals					
Mustela frenata olivacea	Southeastern Weasel	S3	N	N	Palustrine: forested wetland, riparian Terrestrial: forest - hardwood, old field, woodland - conifer, woodland - hardwood, woodland - mixed
Myotis grisescens	Gray Bat	S1	FE	E	Palustrine: caves, various Terrestrial: caves, various
Myotis sodalis	Indiana bat	SA	FE	E	Palustrine: various Terrestrial: various
Peromyscus polionotus allophrys	Choctawhatchee Beach Mouse	S1	FE	E(CH)	Terrestrial: beach dune, coastal scrub

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Peromyscus polionotus peninsularis	St. Andrew Beach Mouse	S1	FE	E(CH)	Terrestrial: beach dune, coastal scrub
Sciuris niger shermani	Sherman's Fox Squirrel	S3	SSC	N	Terrestrial: woodland - conifer, woodland - mixed
Trichechus manatus latirostris	West Indian Manatee	S2	FE	E	Estuarine: submerged vegetation, open water Marine: open water, submerged vegetation
Ursus americanus floridanus	Florida Black Bear	S2	N	N	Palustrine: forested wetland, riparian Terrestrial: forest - hardwood, forest - mixed

Sources: FNAI 2010; USFWS 2016.

Key:
FNAI STATE ELEMENT RANK
S1 = Critically imperiled in Florida because of extreme rarity (5 or fewer occurrences or less than 1000 individuals) or because of extreme vulnerability to extinction due to some natural or man-made factor.
S2 = Imperiled in Florida because of rarity (6 to 20 occurrences or less than 3000 individuals) or because of vulnerability to extinction due to some natural or man-made factor.
S3 = Either very rare and local in Florida (21-100 occurrences or less than 10,000 individuals) or found locally in a restricted range or vulnerable to extinction from other factors.
S4 = Apparently secure in Florida (may be rare in parts of range).
S5 = Demonstrably secure in Florida.
SH = Of historical occurrence in Florida, possibly extirpated, but may be rediscovered (e.g., ivory-billed woodpecker).
SX = Believed to be extirpated throughout Florida.
SU = Unrankable; due to a lack of information no rank or range can be assigned.
SNA = State ranking is not applicable because the element is not a suitable target for conservation (e.g. a hybrid species).
SNR = Element not yet ranked (temporary).

FEDERAL LEGAL STATUS
BGEPA = Protected by Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act
C = Candidate species for which federal listing agencies have sufficient information on biological vulnerability and threats to support proposing to list the species as Endangered or Threatened.
E(CH) = Endangered critical habitat
E = Endangered: species in danger of extinction throughout all or a significant portion of its range.
E, T = Species currently listed endangered in a portion of its range but only listed as threatened in other areas
E, PDL = Species currently listed endangered but has been proposed for delisting.
E, PT = Species currently listed endangered but has been proposed for listing as threatened.
E, XN = Species currently listed endangered but tracked population is a non-essential experimental population.
N = None
T = Threatened: species likely to become Endangered within the foreseeable future throughout all or a significant portion of its range.
T(CH) = Threatened critical habitat
PE = Species proposed for listing as endangered
PS = Partial status: some but not all of the species' infraspecific taxa have federal status
PT = Species proposed for listing as threatened
SAT = Treated as threatened due to similarity of appearance to a species which is federally listed such that enforcement personnel have difficulty in attempting to differentiate between the listed and unlisted species.
SC = Not currently listed, but considered a "species of concern" to USFWS.

STATE LEGAL STATUS
C = Candidate for listing at the Federal level by the U. S. Fish and Wildlife Service
FE = Listed as Endangered Species at the Federal level by the U. S. Fish and Wildlife Service
FT = Listed as Threatened Species at the Federal level by the U. S. Fish and Wildlife Service
FXN = Federal listed as an experimental population in Florida
FT(S/A) = Federal Threatened due to similarity of appearance

ST = State population listed as Threatened by the FWC. Defined as a species, subspecies, or isolated population which is acutely vulnerable to environmental alteration, declining in number at a rapid rate, or whose range or habitat is decreasing in area at a rapid rate and as a consequence is destined or very likely to become an endangered species within the foreseeable future.
SSC = Listed as Species of Special Concern by the FWC. Defined as a population which warrants special protection, recognition, or consideration because it has an inherent significant vulnerability to habitat modification, environmental alteration, human disturbance, or substantial human exploitation which, in the foreseeable future, may result in its becoming a threatened species. (SSC* for *Pandion haliaetus* (Osprey) indicates that this status applies in Monroe county only.)
N = Not currently listed, nor currently being considered for listing.
Plants: Definitions derived from Sections 581.011 and 581.185(2), Florida Statutes, and the Preservation of Native Flora of Florida Act, 5B-40.001. FNAI does not track all state-regulated plant species; for a complete list of state-regulated plant species, call Florida Division of Plant Industry, 352-372-3505 or see: http://www.doacs.state.fl.us/pi/.
E = Endangered: species of plants native to Florida that are in imminent danger of extinction within the state, the survival of which is unlikely if the causes of a decline in the number of plants continue; includes all species determined to be endangered or threatened pursuant to the U.S. Endangered Species Act.
T = Threatened: species native to the state that are in rapid decline in the number of plants within the state, but which have not so decreased in number as to cause them to be Endangered.
N = Not currently listed, nor currently being considered for listing.

Appendix E Habitats and Natural Communities

The FNAI defines a natural community as a distinct and recurring assemblage of populations of plants, animals, fungi, and microorganisms naturally associated with each other and their physical environment. Based on GIS analysis there are 36 unique natural communities recognized by the FNAI within the St. Andrew Bay watershed (FNAI 2010). Habitats and Natural Communities were identified using the 2010 Florida Land Use, Cover and Forms Classification System (FLUCFS) data from the NWFWMD, as well as the 2004-2013 Statewide Land Use Land Cover datasets created by the five Water Management Districts in Florida. Data were modified and refined based on aerial photograph signatures and field observations. Below are community descriptions (excerpts from FNAI 2010) with some site-specific information about many of the communities in the watershed.

Community Type	Description
Upland Communities	
Bluff	Bluff is a habitat characterized as a steep slope with rock, sand, and/or clay substrate that supports sparse grasses, herbs, and shrubs. This community type can be found near Gainer Springs and Econfina Creek in the Econfina Water Management Area, as well as at Camp Helen State Park.
Mesic Flatwoods	Mesic flatwoods can be found on the flat sandy terraces left behind by Plio-Pleistocene high sea level stands. Mesic flatwoods consist of an open canopy of tall pines (commonly longleaf pine or slash pine) and a dense, low ground layer of shrubs, grasses (commonly wiregrass), and forbs. The most widespread natural community in Florida, mesic flatwoods are home to many rare plants and animals such as the frosted flatwoods salamander (*Ambystoma cingulatum*), the reticulated flatwoods salamander (*Ambystoma bishop*) the Red-cockaded woodpecker (*Leuconotopicus borealis*) and many others. Mesic flatwoods require frequent fire (two to four years) and all of its constituent plant species recover rapidly from fire, including many rare and endemic plants. In the Panhandle north of the Cody Scarp, mesic flatwoods occupy relatively small, low-lying areas (FNAI 2010). Within the St. Andrew Bay watershed, healthy mesic flatwoods occur on both the mainland and Shell Island tracts of the St. Andrew State Park; however, these communities are vulnerable to invasion from woody species and invasive exotics due to historic fire excision (FDEP 2016k).
Sandhill	Sandhill communities are characterized by broadly-spaced pine trees with a deciduous oak understory sparse midstory of deciduous oaks and a moderate to dense groundcover of grasses, herbs, and low shrubs. Species typical of sandhill communities include longleaf pine (*Pinus palustris*), turkey oak (*Quercus laevis*), and wiregrass (*Aristida stricta var. beyrichiana*). Sandhill is observed on crests and slopes of rolling hills and ridges with steep or gentle topography. Sandhill communities are important for aquifer recharge, as sandy soils allow water to infiltrate rapidly, resulting in sandy, dry soil, with little runoff evaporation. Fire is a dominant environmental factor in sandhill ecology and is essential for the conservation of native sandhill flora and fauna. Within the St. Andrew Bay watershed, exemplary sandhill communities can be found at Deer Lake State Park, Point Washington State Forest, St. Joseph Bay Buffer Preserve, and on the state lands of Porter Pond Tract (FNAI 2010).

Community Type	Description
Scrub	Scrub is a community composed of evergreen shrubs, with or without a canopy of pines, and is found on well-drained, infertile, narrow sandy ridges distributed parallel to the coastline. Signature scrub species include three species of shrubby oaks, Florida rosemary (*Ceratiola ericoides*), and sand pine (*Pinus clausa*), which may occur with or without a canopy of pines. Scrub is characterized by burn intervals of five to 40 years, depending on the dominant vegetation. Within the St. Andrew Bay watershed, exemplary scrub community can be found at the St. Joseph Peninsula State Park (Gulf County) (FNAI 2010). The St. Andrew State Park (Bay County) also supports scrub community in variable conditions. Scrub communities on Shell Island in Bay County, which are largely secluded from human impact, are in excellent condition, while mainland communities suffer from the impact of foot trails and nearby development (FDEP 2016k). Scrub communities can also be found at Deer Lake State Park, the St. Joseph Bay Buffer Preserve, and Eglin AFB Cape San Blas Satellite Property.
Scrubby Flatwoods	Scrubby flatwoods have an open canopy of widely-spaced pine trees (commonly longleaf or slash pines) and a low, shrubby understory which differ structurally from scrub communities in the respect that scrub flatwoods lack continuous shrubby oak cover. Understory vegetation consists largely of scrub oaks and saw palmetto, often interspersed with barren areas of exposed sand. Scrubby flatwoods occur on slight rises within mesic flatwoods and in transitional areas between scrub and mesic flatwoods. Scrubby flatwoods are inhabited by several rare plant and animal species including the Florida mouse (*Podomys floridanus*), Florida scrub-jay (*Aphelocoma coerulescens*) (Peninsular Florida only), gopher tortoise (*Gopherus polyphemus*), the Florida gopher frog (*Rana capito*), goldenaster (*Chrysopsis floridana*), and large-plumed beaksedge (*Rhynchospora megaplumosa*) (FNAI 2010). Within the St. Andrew Bay watershed, scrubby flatwood communities can be found at Point Washington State Forest.
Terrestrial Caves	Terrestrial caves are cavities below the surface that lack standing water. These caves develop in areas of karst topography; water moves through underlying limestone, dissolving it and creating fissures and caverns. Most caves have stable internal environments with temperature and humidity levels remaining fairly constant. In areas where light is present, some plants may exist, although these are mostly limited to mosses, liverworts, ferns, and algae. Subterranean natural communities such as terrestrial caves are extremely fragile because the fauna they support are adapted to stable environments and do not tolerate environmental changes (FNAI 2010).
Upland Hardwood Forests	Upland hardwood forests are described as having a well-developed, closed-canopy dominated by deciduous hardwood trees such as southern magnolia (*Magnolia grandiflora*), pignut hickory (*Carya glabra*), sweetgum (*Liquidambar styraciflua*), Florida maple (*Acer saccharum ssp. floridanum*), live oak (*Quercus virginiana*), American beech (*Fagus grandifolia*), white oak (*Q. alba*), and spruce pine (*Pinus glabra*), and others. This community occurs on mesic soils in areas sheltered from fire, on slopes above river floodplains, in smaller areas on the sides of sinkholes, and occasionally on rises within floodplains. It typically supports a diversity of shade-tolerant shrubs, and a sparse groundcover. Upland hardwoods occur throughout the Florida Panhandle and can be found in upland portions of the watershed (FNAI 2010).
Wet Flatwoods	Wet flatwoods are pine forests with a sparse or absent midstory. The typically dense groundcover of hydrophytic grasses, herbs, and low shrubs occurring in wet flatwoods can vary depending on the fire history of the system. Wet flatwoods occur in the ecotones between mesic flatwoods and shrub bogs, wet prairies, dome swamps, or strand swamps and are common throughout most of Florida. Wet flatwoods also occur in broad, low flatlands, frequently within a mosaic of other communities. Wet Flatwoods often occupy large areas of relatively inaccessible land, providing suitable habitat for the Florida black bear (*Ursus americanus floridanus*) as well as a host of rare and endemic plant species (FNAI 2010). This community type is found throughout the St. Joseph Bay State Buffer Preserve and at Ward Creek West in Bay County.

Community Type	Description
Xeric Hammock	Xeric hammock is an evergreen forest typically dominated by sand live oak (*Quercus geminata*), found on deep, fine sand substrate, where fire exclusion allows for the establishment of an oak canopy. In these areas, xeric hammock can form extensive stands or as small patches within or near sandhill or scrub. These forests are also found on high islands within flatwoods or less commonly on a high, well-drained ridge within a floodplain where fire-exclusion allows for the establishment of an oak canopy. Xeric hammocks are inhabited by several rare animals including the gopher frog (*Rana capito*), gopher tortoise (*Gopherus polyphemus*), eastern diamondback rattlesnake (*Crotalus adamanteus*), and the Florida pine snake (*Pituophismelanoleucus mugitus*). Xeric hammock is most common in the central peninsula of Florida and is less common north of the Cody Scarp where clay-rich soils create mesic conditions (FNAI 2010).
Coastal Communities	
Beach	The beach is the immediate shoreline area of the Gulf of Mexico and consists of white quartz sand. It has few plants, except along the extreme inner edge at the base of the dunes. Organic marine debris, including seaweed and driftwood, typically form a wrack line on the shore. The upper beach area at the base of the foredune is an unstable habitat and is continually re-colonized by annuals, trailing species, and salt-tolerant grasses (FNAI 2010). Beach habitat is found along the entire Gulf front, especially at tidal passes, and some bay front shorelines in the watershed. The St. Joseph Peninsula State Park hosts exemplary beach communities.
Beach Dune	The beach dune community includes seaward dunes that have been shaped by wind and water movement. This community is composed primarily of herbaceous plants such as pioneer grasses and forbs, many are coastal specialists. The vegetated upper beach and foredune are often sparsely covered by plants adapted to withstand the stresses of wind, water, and salt spray, or to rapidly recolonize after destruction. Many rare shorebirds use the Florida Panhandle's beach dunes for nesting. This community is also a major nesting area for loggerhead, green, Kemp's Ridley, and leatherback sea turtles. The beach dunes on Shell Island at St. Andrew State Park were impacted by hurricanes Opal (1995), Earl (1998), Georges (1998), Tropical Storm Isadore (2002) (2016k). Beach dune communities can also be found at the St. Joseph Peninsula State Park and the St. Vincent National Wildlife Refuge.
Coastal Grasslands	Coastal grassland, found primarily on broad barrier islands and capes, is a predominantly herbaceous community found in the drier portion of the transition zone between the beach dune and coastal strand or maritime hammock communities. Several rare animals use coastal grasslands for foraging and nesting, including neo-tropical migratory birds and the St. Andrew beach mouse (*Peromyscus polionotus peninsularis*) - one of four rare subspecies of beach mouse along the Florida Panhandle Coast. Coastal grassland can form from two major processes: the seaward build-up of a barrier island, which protects inland ridges from sand burial and salt spray, or the development of a new foredune ridge, which protects the previously overwashed area behind it (FNAI 2010). This community type can be found throughout St. Joseph Peninsula State Park.
Coastal Strand	Coastal strand is an evergreen shrub community growing on stabilized coastal dunes, often with a smooth canopy due to pruning by wind and salt spray. It usually develops as a band between dunes dominated by sea oats along the immediate coast, and maritime hammock, scrub, or mangrove swamp (in peninsular Florida) communities further inland. This community is very rare on the Florida Panhandle coast where the transition zone is occupied by scrub or coastal grassland communities (FNAI 2010). This community type can be found in St. Joseph Bay, specifically on Black's Island as well as in St. Joseph Peninsula State Park.

Community Type	Description
Maritime Hammock	Maritime hammock is a predominantly evergreen hardwood forest that occurs on deep well-drained sandy soils or sandy soils mixed with shell fragments. Maritime hammock forests grow on stabilized coastal dunes at various distances from the shoreline. Maritime hammocks provide migrating songbirds with crucial resting and foraging areas on their fall and spring migrations to and from the tropics. On the Florida Panhandle coast, maritime hammock is found only in isolated pockets where shell is mixed with sandy substrate (FNAI 2010). Within the St. Andrew Bay watershed, a small stand of mature maritime hammock can be found on the north side of Shell Island at the St. Andrew State Park near Spanish Ante cove, as well as at Camp Helen State Park and the Naval Coastal Systems Center in Bay County (FDEP 2016k, FNAI 2016a).
Shell Mounds	Shell mounds are a relic of generations of Native Americans who lived along the Florida coast and discarded clams, oysters, whelks, and other shells in small hills. These mounds of shell support an assemblage of calciphilic plant species. Originally, there were many such shell mounds along coastal lagoons and near the mouths of rivers, however presently many are surrounded by marshes (FNAI 2010). Artifacts found throughout Gulf County provide evidence of habitation by Native Americans beginning around 1500 B.C., however projectile points found near the town of Overstreet may be 10,000 years old (USDA 2001). Native Americans once inhabited the St. Joseph Peninsula and gathered shellfish from the bay's pristine waters. Prehistoric and Native occupations spanned the third major stage of cultural development in North America: the Woodland stage. During this period, populations along the coast increased, coinciding with sea levels stabilizing around 400 B.C., as a result, the coastline is spotted with shell-mound associated ecological communities (FDEP 2008).
Transitional and Wetland Communities	
Basin Marsh	Basin marshes, unlike depression marshes, are marshes that lack a fire-maintained matrix community and rather, occur in relative isolation as larger landscape features. Basin marshes are regularly inundated freshwater from local rainfall, as they occur around fluctuating shorelines, on former "disappearing" lake bottoms, and at the bead of broad, low basins marking former embayments of the last high-sea level stand. Species composition is heterogeneous both within and between marshes and generally includes submerged, floating, and emergent vegetation with intermittent shrubby patches. Common species include maidencane (*Panicum hemitomon*), sawgrass (*Cladium sp.*), bulltongue arrowhead (*Sagittaria lancifolia*), pickerelweed (*Pontederia cordata*), and cordgrass (*Spartina sp.*) (FNAI 2010). In the St. Andrew Bay watershed, basin marsh occurs in the St. Andrew State Park with the largest community (Buttonbush Marsh) occurring west of the main park drive. Buttonbush Marsh was impacted by an impoundment in the 1930's, which created Gator Lake in the center of the basin marsh (FDEP2016k).
Basin Swamp	Basin swamp is a wetland vegetated with hydrophytic trees, commonly including pond cypress (*Taxodium ascendens*) and swamp tupelo (*Nyssa sylvatica var. biflora*) and shrubs that can withstand an extended hydro-period. Basin swamps are characterized by highly variable species composition and are expressed in a variety of shapes and sizes due to their occurrence in a variety of landscape positions including old lake beds or river basins, or ancient coastal swales and lagoons that existed during higher sea levels. Basin swamps can also exist around lakes and are sometimes headwater sources for major rivers. Many basin swamps have been heavily harvested and undergone significant hydrological changes due to the conversion of adjacent uplands to agricultural and silvicultural lands (FNAI 2010).

Community Type	Description
Baygall	Baygall is an evergreen-forested wetland dominated by bay species including loblolly bay (*Gordonia lasianthus*), sweetbay (*Magnolia virginiana*), and/or swamp bay (*Persea palustris*). This community can be found on wet soils at the base of slopes or in depressions; on the edges of floodplains; and in stagnant drainages. Baygalls are not generally influenced by flowing water, but may be drained by small blackwater streams. Most baygalls are small; however, some form large, mature forests, called "bay swamps." The dominance of evergreen bay trees rather than a mixture of deciduous and evergreen species can be used to distinguish baygall from other forested wetlands (FNAI 2010). This community type can be found along Crooked Creek.
Bog	Bog habitat typically includes areas of saturated substrates, often deep peat, and acidic conditions, with the dominant vegetation consisting of sedges and grasses. Bog habitat is often surrounded by a transition zone of trees and shrubs between the bog and upland area (FNAI 2010). In the St. Andrew Bay watershed, this community type can be found along Sandy Creek, at the St. Joseph Bay Buffer Preserve, and the Tumble Creek Audubon Preserve (FNAI 2016a).
Coastal Interdunal Swales	Coastal interdunal swales are marshes, moist grasslands, dense shrublands, or damp flats in linear depressions that occur between successive dune ridges as sandy barrier islands, capes, or beach plains. Dominant species tend to vary based on local hydrology, substrate, and the age of the swale, but common species include sawgrass (*Cladium sp.*), hairawn muhly (*Muhlenbergia capillaris*), broomsedge (*Andropogon virginicus*), seashore paspalum (*Paspalum vaginatum*), sand cordgrass (*Spartina bakeri*), and saltmeadow cordgrass (*Spartina patens*). For example, hurricanes and large storm events can flood swales with salt water, after which they become colonized, often temporarily, by more salt-tolerant species. Salt water intrusion and increased sand movement after storm events can reset successional processes of interdunal swale communities (FNAI 2010). Within the St. Andrew Bay watershed coastal interdunal swale can be found at the St. Vincent National Wildlife Refuge and the Eglin Air Force Base Cape San Blas Satellite Property (FNAI 2016a).
Dome Swamp	Dome swamp is an isolated, forested, and usually small depression wetland consisting of predominantly pond cypress (*Taxodium ascendens*) and/or swamp tupelo (*Nyssa sylvatica var. biflora*). This community occurs within a fire-maintained community such as mesic flatwoods and commonly occupies depressions over a perched water table. Smaller trees grow on the outer edge of the swamp where the water is shallow, while taller trees grow deeper in the swamp interior creating the characteristic dome shape. Shrubs are typically sparse to moderate, but dome swamps with high fire frequencies or fire exclusion, the shrub layer may be absent. Many dome swamps form when poor surface drainage causes the dissolution of limestone bedrock, creating depressions which fill in with peat or marl. Surficial runoff from the surrounding uplands supplies much of the water within dome swamps. Consequently, water levels in these communities fluctuate naturally with seasonal rainfall changes. Dome swamps may also be connected directly to the aquifer, where groundwater influences the hydrological regime. Thus dome swamps can function as reservoirs that recharge the aquifer. Logging, nutrient enrichment, pollution from agricultural runoff, ditching, impoundment, and invasive exotic species invasion have degraded dome swamps. Some dome swamps have been used as treatment areas for secondarily-treated wastewater (FNAI 2010). Dome swamp community can be found at the St. Joseph Bay Buffer Preserve.

Community Type	Description
Hydric Hammock	Hydric hammock is an evergreen hardwood and/or palm forest with a variable understory typically dominated by palms and ferns. This community occurs on moist soils, often with limestone very near the surface. While species composition varies, the community generally has a closed-canopy of oaks and palms, an open understory, and a sparse to a moderate groundcover of grasses and ferns. Hydric hammock occurs on low, flat, wet sites where limestone may be near the surface and soil moisture is kept high mainly by rainfall accumulation on poorly-drained soils. During heavy rains, sheet flow is slowed across the forested-floor of a hammock, resulting in greater absorption into the soil. Hammocks adjacent to salt marshes protect inland areas from damage during hurricanes and major storms (FNAI 2010). This community type is found frequently down grade of wet flatwoods located throughout the St. Joseph Bay State Buffer Preserve.
Floodplain Swamp	Floodplain swamp is a closed-canopy forest community of hydrophytic trees such as bald cypress (*Taxodium distichum*), water tupelo (*Nyssa aquatica*), swamp tupelo (*N. sylvatica var. biflora*), or ogeechee tupelo (*N. ogeche*). Floodplain swamp occurs on frequently- or permanently-flooded hydric soils adjacent to stream and river channels and in depressions and oxbows within the floodplain. The understory and groundcover are sparse in floodplain swamps, which can also occur within a complex mosaic of communities including alluvial forest, bottomland forest, and baygall. As rivers meander, they create oxbows and back swamps that are important breeding grounds for fish when high water connects them to the river. Floodplain swamp communities provide important wildlife habitat, contribute to flood attenuation, and help protect the overall water quality of streams and rivers. These communities may also transform nutrients or act as a nutrient sink depending on local conditions. This makes floodplain swamps useful for the disposal of partially-treated wastewater. Artificial impoundments on rivers can severely limit the seasonal flooding effects that maintain healthy floodplain systems; particularly, the stabilization of alluvial deposits and the flushing of detritus (FNAI 2010). Floodplain swamp communities are distributed along most creeks and streams within the watershed such as Econfina Creek, Juniper Creek, Bear Creek, Bayou George Creek, and Burnt Mill Creek.
Seepage Slope	Seepage slope is an open, grass sedge-dominated community consisting of wiregrass (*Aristida stricta*), toothache grass (*Ctenium aromaticum*), pitcherplants, plumed beaksedge (*Rhynchospora plumose*), flattened pipewort (*Eriocaulon compressum*), and woolly huckleberry (*Gaylussacia mosieri*). Seepage slopes are kept continuously moist by groundwater seepage. This community occurs in topographically variable areas, with 30- to 50-foot elevational gradients, frequently bordered by well-drained sandhill or upland pine communities. The soil is often soft and mucky underfoot, in contrast to the firm texture of the bordering sandhill and upland pine soils. Seepage slopes range from the Alabama border eastward to Calhoun County in the inland portions of the Florida Panhandle. Within the St. Andrew Bay watershed, seepage slope communities can be found at Pine Log State Forest.
Wet Prairie	Wet prairie is an herbaceous community usually occurring on acidic, continuously wet, but not inundated, soils. This community can be found on somewhat flat or gentle slopes between lower lying depression marshes, shrub bogs, or dome swamps or on slightly higher wet or mesic flatwoods. Wet prairies in northern Florida are some of the most diverse communities in the U.S., with an average of over 20 species per square meter in some places and over 100 total species in any given stand. The Panhandle is a hotspot for rare plants of the wet prairie community with 25 out of the 30 rare species found in this community; 12 of these are endemic to the Panhandle (FNAI 2010). This community type is found throughout the St. Joseph Bay State Buffer Preserve and at Washington Point State Forest.

Community Type	Description
Aquatic Communities	
Blackwater Streams	Blackwater streams are perennial or intermittent seasonal watercourses laden with tannins (natural organic chemicals), particulates, and dissolved organic matter and iron. These dissolved materials result from the streams' origins in extensive wetlands with organic soils that collect rainfall and discharge it slowly to the stream. The dark-colored water reduces light penetration and, inhibits photosynthesis, and prevents the growth of submerged aquatic plants. Blackwater streams are frequently underlain by limestones and have sandy bottoms overlain by organics that have settled out of suspension. Blackwater streams are the most widely distributed and numerous riverine systems in the southeast Coastal Plain (FNAI 2010) and found draining into most creeks, streams and bayous in the watershed.
Coastal Dune Lakes	Coastal dune lakes are naturally-formed fresh water basins that exhibit cyclical hydrology through intermittent connectivity to sources of salt water. Consequently, coastal dune lakes are known to have a high biodiversity, with species characteristic of fresh, estuarine, and marine environments. Coastal dune lakes (listed in Section 2.3) provide an important stopover point for migrating neo-tropical birds and are popular recreation spots for the coastlines' residents and frequent visitors. These rare lakes have withstood natural processes such as hurricanes, droughts, and land subsidence, and have been identified as imperiled by the Florida Natural Areas Inventory due to their global rarity. Coastal dune lakes (listed in Section 2.3 for the watershed) are extremely vulnerable to hydrological manipulations such as excessive withdrawals of groundwater that could lower the water table, as well as saltwater intrusion. Groundwater pollution, especially chemical pollution from the surrounding coastal communities, could significantly alter the nutrient balance and produce devastating effects on the fauna and flora (FNAI 2010). Shell Island in St. Andrew State Park has one unnamed coastal dune lake, which is the only permanent source of fresh water on the island and is largely protected from human impacts due to its isolation on a remote part of the island (FDEP 2016k). Another prominent dune lake in the watershed is located at Deer Lake State Park. Lake Powell, one of the largest dune lakes in existence can be found at the coastal boarder of Walton and Bay counties.
Sandhill Upland Lakes	Sandhill upland lakes are shallow-rounded solution depressions in sandy upland communities that lack significant surface inflows or outflows. Instead, water is largely derived from lateral groundwater seepage and/or from artesian sources connected with the underlying limestone aquifer. Sandhill upland lakes are generally permanent water bodies, although water levels may fluctuate substantially. Vegetation is largely restricted to a narrow band along the shore, and may include hydrophytic grasses and herbs or a dense shrub thicket, depending on fire frequency and water fluctuations. Sandhill upland lakes are extremely vulnerable to hydrological manipulations such as excessive groundwater withdrawals that could lower the regional water table. Additionally, groundwater pollution can significantly alter the nutrient balance of sandhill upland lakes, causing significant damage to flora and fauna. Furthermore, chemical pollution in sandhill lakes can result in groundwater contamination because they often function as aquifer recharge areas (FNAI 2010). Upland Sandhill Lake communities are located in Washington and northern Bay counties within the St. Andrew Bay watershed, particularly in the uppermost reaches of the Econfina Creek Water Management Area (WMA). The state lands of Porter Pond Tract in Washington County include sandhill upland lakes community. Examples include Porter Lake, Lucas Lake, Big Blue Lake, and Hicks Lake. Compass Lake in the southwestern corner of Jackson County is a notable Sandhill Upland Lake in the northern-most reaches of the watershed (FNAI 2010).

Community Type	Description
Seepage Streams	Seepage streams may be perennial or intermittent seasonal as they originate from shallow groundwater percolating through sandy upland soils. Seepage streams are small magnitude features, and unlike other stream communities in Florida, they lack a deep aquifer water source and extensive swamp lowlands surrounding their head waters. Seepage streams are generally sheltered by a dense overstory of broad-leaved hardwoods which block out most sunlight. Filamentous green algae occur sporadically within the stream, while vegetation at the water's edge may include mosses, ferns and liverworts. Seepage streams are often associated with seepage slope and slope forest communities near their head waters, and bottomland forest, alluvial forest and floodplain swamp communities near their mouths. The waters of seepage streams is filtered by percolation through deep soils which slows the release of rainwater and buffers temperature extremes, creating low flow rates of clear, cool, unpolluted water. Seepage streams are generally confined to areas where topographic relief is pronounced such as northern Florida (FNAI 2010). Within the St. Andrew Bay watershed seepage streams are found at Deer Springs Park in Bay County and the Tumble Creek Audubon Preserve in Washington County.
Sinkhole Lakes	Sinkhole lakes typically form in deep, funnel-shaped depressions in limestone bedrock and are moderately widespread in the karst regions of the Florida Panhandle. Sinkhole depressions are geologic features which are relatively permanent; however, water levels may fluctuate dramatically due to hydrologic connectivity with the aquifer. Sinkhole lakes are characterized by clear, alkaline water with high concentrations of calcium, bicarbonate, and magnesium. The vegetation in some sinkhole lakes is absent or limited to a narrow fringe of emergent species at the edge of the water, while other sinkhole lakes are completely covered by floating vegetation. Sinkhole Lakes are considered endangered in Florida due to the threat of erosion which destroys the surrounding vegetation and pollutes the aquifer with which these lakes are closely connected (FNAI 2010).
Spring-run Streams	Spring-run streams generally have sandy or limestone bottoms and derive most of their water from artesian openings to the underlying aquifer, making their waters clear, circumneutral, mineral-rich, and cool. These conditions are highly conducive for plant growth, thus, spring-run streams are extremely productive aquatic habitats. Good examples in the watershed are listed and described in Section 2.3. Agricultural, residential, and industrial pollutants that enter the groundwater may infiltrate the deep aquifer that feeds a Spring-run stream. Herbicides applied to control aquatic plant growth are particularly detrimental because they can induce eutrophication in spring run streams. Overuse and misuse of spring-run streams from recreation is also a threat to this unique community (FNAI 2010). Spring run streams are found throughout the Econfina Water Management Area.
Estuarine and Marine Communities	
Salt Marsh	Salt marsh is a largely herbaceous tidal zone community commonly consisting of saltmarsh cordgrass (*Spartina alterniflora*), which dominates the seaward edge, and needle rush (*Juncus roemerianus*), which dominates higher, less frequently flooded areas. Salt marshes form where the coastal zone is protected from large waves, either by the topography of the shoreline, a barrier island, or by location along a bay or estuary. Salt marshes support a number of rare animals and plants, and provide nesting habitat for migratory and endemic bird species. Many of Florida's extensive salt marshes are protected in aquatic preserves, but the loss of marshes and adjacent seagrass beds due to human impacts such as shoreline development, ditching, and pollution and natural stressors, such as sea level rise, have vastly reduced their numbers. Salt marshes are instrumental in attenuating wave energy and protecting shorelines from erosion (FNAI 2010) and are found in the coastal/ estuarine portion of the watershed. Salt marsh communities are common at the St. Andrew Bay State Park.

Community Type	Description
Seagrass Beds	Seagrass beds consist of expansive stands of submerged aquatic vascular plants including turtlegrass (*Thalassia testudinum*), manateegrass (*Syringodium filiforme*), and shoalgrass (*Halodule wrightii*), which occur predominantly in subtidal zones in clear low-energy coastal waters. Seagrass beds occur on unconsolidated substrates and are highly susceptible to changes in water temperature, salinity, wave-energy, tidal activity, and available light. This natural community supports a wide variety of animal life including manatees, marine turtles, and many fish, particularly spotted sea trout (*Cynoscion nebulosus*), spot (*Micropogonias undulates*), sheepshead, (*Archosargus probatocephalus*), and redfish *(Sciaenops ocellatus*). Pollution, particularly sedimentation and wastewater/sewage, have led to the widespread loss of seagrasses in nearly every bay in the Florida Panhandle (FNAI 2010). Seagrass beds occur within the St. Joseph and St. Andrew bays, particularly at the portions of those bays designated as Aquatic Preserves.
Oyster/Mollusk Reef	Oyster/Mollusk reef consists of expansive concentrations of sessile mollusks, which settle and develop on consolidated substrates including rock, limestone, wood, and other mollusk shells. These communities occur in both the intertidal and subtidal zones to a depth of 40 feet. In Florida, the American oyster (*Crassostrea virginica*) dominates mollusk reef communities, but other organisms including species of sponge, anemones, mussels, the burrowing sponge anemones, mussels, clams, barnacles, crabs, amphipods, and starfish live among or within the reef itself. Mollusks are filter-feeders that remove toxins from polluted waters and improve overall water quality (FNAI 2010). However, higher levels of toxins and bacteria can contaminate and close areas for commercial harvest and human consumption. Oyster/mollusk reefs can be found throughout the St. Andrew Bay.
Unconsolidated (Marine) Substrate	Unconsolidated (marine) substrate consists of coralgal, marl, mud, mud/sand, sand or shell deposited in expansive, open areas of subtidal, intertidal, and supratidal zones. Unconsolidated substrates support large populations of tube worms, sand dollars, mollusks, isopods, amphipods, burrowing shrimp, and an assortment of crabs, but lack dense populations of sessile plant and animal species. Unconsolidated substrates are an important feeding ground for bottom-feeding fish, shorebirds, and invertebrates. These areas also grade into a variety of other natural communities, making them the foundation for the development of other marine and estuarine habitats. Unconsolidated substrate communities are found throughout the estuarine and riverine portions of the watershed. They are susceptible to many types of disturbances including vehicle traffic, low-dissolved oxygen (DO) levels, as well as the accumulation of metals, oils, and pesticides in the sediment (FNAI 2010).

Source: FNAI 2010.

Appendix F Impaired Waterbody Segments in the St. Andrew Bay Watershed

All states are required to submit lists of impaired waters that are too polluted or degraded to meet water quality standards and their designated use (potable, recreational, shellfish harvesting) to the EPA under section 303(d) of the CWA (EPA 2016a). The following table provides a list of 2016 FDEP designated and impaired waters in the St. Andrew Bay watershed.

Waterbody Segment ID	Water Segment Name	County	Waterbody Class1	Parameters Assessed Using the Impaired Waters Rule (IWR)
1061CB	Beach Drive	Bay	3M	Bacteria (Beach Advisories)
8015D	Beacon Hill Beach	Gulf	3M	Bacteria (Beach Advisories)
1088	Beatty Bayou	Bay	2	Fecal Coliform
8013B	Beckrich Road	Bay	3M	Bacteria (Beach Advisories)
1142	Boggy Creek	Bay	2	Fecal Coliform
1142A	Boggy Creek (Shellfish Portion)	Bay	2	Fecal Coliform
1061BB	Carl Gray Park	Bay	3M	Bacteria (Beach Advisories)
1061EB	Delwood	Bay	3M	Bacteria (Beach Advisories)
1267B	Dixie Belle Beach	Gulf	3M	Bacteria (Beach Advisories)
1061FB	Dupont Bridge	Bay	3M	Bacteria (Beach Advisories)
1209	Eagle Nest Bayou	Bay	2	Fecal Coliform
1061F	East Bay (East Segment)	Bay	2	Bacteria (in Shellfish)
1061F	East Bay (East Segment)	Bay	2	Nutrients (Total Nitrogen)
8015B	East County Line	Bay	3M	Bacteria (Beach Advisories)
1131	Johnson Bayou	Bay	2	Fecal Coliform
8012B	Laguna Beach	Bay	3M	Bacteria (Beach Advisories)
1041	Little Bear Creek (South Fork)	Bay, Calhoun	1	Fecal Coliform
1155	Little Sandy Creek	Bay, Gulf	3F	Dissolved Oxygen
8015C	Lookout Beach	Bay, Gulf	3M	Bacteria (Beach Advisories)
1144	Massalina Bayou	Bay	3M	Fecal Coliform
1086	Mill Bayou	Bay	2	Fecal Coliform
1162	Mule Creek	Bay	2	Fecal Coliform
1061G	North Bay (North Segment1)	Bay	2	Bacteria (in Shellfish)
1061G	North Bay (North Segment1)	Bay	2	Nutrients (Total Nitrogen)
1061H	North Bay (North Segment2)	Bay	2	Fecal Coliform (SEAS Classification)
1061H	North Bay (North Segment2)	Bay	2	Nutrients (Total Nitrogen)
8012C	Panama City Beach, City Pier	Bay	3M	Bacteria (Beach Advisories)
1141B	Parker Bayou	Bay	2	Fecal Coliform

Waterbody Segment ID	Water Segment Name	County	Waterbody Class1	Parameters Assessed Using the Impaired Waters Rule (IWR)
1128	Pretty Bayou	Bay	2	Fecal Coliform
780A	Rattlesnake Lake	Washington	3F	Nutrients (Total Nitrogen)
780A	Rattlesnake Lake	Washington	3F	Nutrients (Total Phosphorus)
1111	Sandy Creek	Bay, Calhoun, Gulf	2	Bacteria (in Shellfish)
1111	Sandy Creek	Bay, Calhoun, Gulf	2	Fecal Coliform
1111A	Sandy Creek (Shellfish Portion)	Bay	2	Fecal Coliform
1061E	St Andrew Bay (Mouth)	Bay	3M	Nutrients (Total Nitrogen)
1061B	St Andrews Bay (North Segment)	Bay	2	Fecal Coliform
8015E	St Joe Beach	Gulf	3M	Bacteria (Beach Advisories)
1267	St Joseph Bay	Gulf	2	Fecal Coliform (SEAS Classification)
1267	St Joseph Bay	Gulf	2	Nutrients (Total Nitrogen)
1267C	St. Joe Bay Monument Beach	Gulf	3M	Bacteria (Beach Advisories)
8015F	Sunset Park	Bay	3M	Bacteria (Beach Advisories)
1136	Watson Bayou	Bay	3M	Fecal Coliform
1061A	West Bay	Bay	2	Fecal Coliform (SEAS Classification)
1061A	West Bay	Bay	2	Nutrients (Total Nitrogen)

Sources: FDEP 2016l
Notes:
* = new Florida listings since 2006
Footnote1 - Florida's waterbody classifications:
1 - Potable water supplies
2 - Shellfish propagation or harvesting
3F - Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife in fresh water
3M - Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife in marine water
4 - Agricultural water supplies
5 - Navigation, utility, and industrial use

The following table provides a list of EPA established TMDLs in the St. Andrew Bay watershed.

Waterbody Segment ID	Water Segment Name	County	Waterbody Class	Pollutant
1088	Beatty Bayou	Bay	2	Biochemical Oxygen Demand
1088	Beatty Bayou	Bay	2	Nitrogen, Total
1088	Beatty Bayou	Bay	2	Phosphorus, Total
1131	Johnson Bayou	Bay	2	Biochemical Oxygen Demand
1131	Johnson Bayou	Bay	2	Nitrogen, Total
1131	Johnson Bayou	Bay	2	Phosphorus, Total
1144	Massalina Bayou	Bay	3M	Biochemical Oxygen Demand
1144	Massalina Bayou	Bay	3M	Nitrogen, Total
1144	Massalina Bayou	Bay	3M	Phosphorus, Total
1141	Parker Bay	Bay	3M	Biochemical Oxygen Demand
1141	Parker Bay	Bay	3M	Nitrogen, Total
1141	Parker Bay	Bay	3M	Phosphorus, Total
1172	Pitts Bay	Bay	3M	Biochemical Oxygen Demand
1172	Pitts Bay	Bay	3M	Nitrogen, Total
1172	Pitts Bay	Bay	3M	Phosphorus, Total
1128	Pretty Bayou	Bay	2	Biochemical Oxygen Demand
1128	Pretty Bayou	Bay	2	Nitrogen, Total
1128	Pretty Bayou	Bay	2	Phosphorus, Total
1123	Robinson Bayou	Bay	2	Biochemical Oxygen Demand
1123	Robinson Bayou	Bay	2	Nitrogen, Total
1123	Robinson Bayou	Bay	2	Phosphorus, Total

Source: US EPA 2016d

Appendix G Conservation Lands within the St. Andrew Bay Watershed

Within the St. Andrew Bay watershed there are approximately 106,781 acres of conservation lands, including 30,894 acres of federally managed lands, 66,019 acres of state-managed, 3,006 acres of locally managed lands, and 6,863 acres of privately managed lands. Five conservation lands within the St. Andrew Bay watershed span multiple counties, and several extend into other watersheds. The details of these conservation lands are presented in the following table.

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Federally Managed					
Dees Tract	US Dept. of Agriculture, Forest Service	Bay	Dees Tract is a part of the Florida National Scenic Trail that adjacent to the Econfina Creek Water Management Area.	http://www.fs.usda.gov/fnst	38
Eglin AFB Cape San Blas Satellite Property	US Dept. of Defense, Air Force	Gulf	The Eglin Air Force Base Satellite Property is found at the southern end of St. Joseph Peninsula, which connects to southwest Gulf County through a sand spit. The property contains coastal interdunal swale, coastal scrub, the rare gulf coast lupine and is an important sea turtle nesting site.		829
Lathrop Bayou Tract	US Dept. of the Interior, Bureau of Land Management	Bay	Lathrop Bayou Tract is an open wet pine-wiregrass natural community that supports several rare plant species. It is located adjacent to Lathrop Bayou which drains into East Bay.	http://www.blm.gov/es/st/en/fo/Jackson_Home_Page.html	209
Naval Coastal Systems Center	US Dept. of Defense, Navy	Bay	The Naval Coastal Systems Center is naval facility that contains estuarine tidal marsh, maritime hammock, flatwoods, and coastal recreation areas. It is located adjacent to Alligator Bayou which drains into St. Andrew Bay proper near Upper Grand Lagoon.		635
St. Joe Tract	US Dept. of Agriculture, Forest Service	Bay	The St. Joe Tract is part of the Florida National Scenic Trail that is located adjacent to the Econfina Creek Water Management Area north of Sweetwater Creek.	http://www.fs.usda.gov/fnst	332

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
St. Vincent National Wildlife Refuge	US Dept. of the Interior, Fish and Wildlife Service	Franklin, Gulf	St. Vincent National Wildlife Refuge is an undeveloped barrier island east of Cape San Blas, with an extensive beach dune and swale system. The island supports coastal grassland and scrub, slash pine flatwoods, freshwater lakes, and tidal marsh. The refuge hosted an experimental introduction of the red wolf.	http://www.fws.gov/southeast	43
Tyndall Air Force Base	US Dept. of Defense, Air Force	Bay	Tyndall Air Force Base is located between St. Andrew Bay and the Gulf of Mexico. This base is primarily dedicated to Air Force operations and pine plantations. Patches of relatively intact natural communities remain on the main peninsula. Extensive undisturbed acreage on Shell Island, Crooked Island East, Raffield Island, and the smaller peninsulas support 12 natural community types and more than 40 species of rare plants and animals.		2,8807
State Managed					
Camp Helen State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Bay, Walton	Can Helen State park is located on a Pleistocene bluff on the west side of Lake Powell. Natural communities include beach dune, coastal grassland, scrub, mesic flatwoods, maritime hammock. Known for large populations of Godfrey's golden aster and gulf lupine, and the presence of least tern, snowy plover, and piping plover.	http://www.floridastateparks.org/	178
Constitution Convention Museum State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Gulf	The Constitution Convention Museum State Park is predominantly forested by large natural slash pine, but the understory and groundcover is mowed. The park fronts St. Joseph Bay but is isolated from other natural lands by streets and houses.	http://www.floridastateparks.org/	13

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Deer Lake State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Walton	Deer Lake State Park contains a diversity of habitats, from pristine beach dunes and freshwater lakes to uplands of sand pine scrub and sandhill. At least 5 plant species that are globally threatened are found on this site. The park also contains a coastal dune lake.	http://www.floridastateparks.org/	2,008
Econfina Creek Water Management Area	Northwest Florida Water Management District	Bay, Jackson, Washington	Econfina Creek and its surrounding forests are found on an unusual collection of geographic features such as bluffs, deep ravines, and springs giving it an unusually high diversity of rare plants and animals.	http://www.nwfwater.com/	40,140
Grayton Beach State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Walton	Grayton Beach State Park includes wide, white sand beaches, barrier dunes with sea oats, pine flatwoods, scrub, and extensive salt marsh. The park is also a nesting site for sea turtles.	http://www.floridastateparks.org/	1,262
Panama City Airport Conservation Easement	FL Dept. of Environmental Protection, Northwest District	Bay	Panama City Airport Conservation Easement is a regulatory conservation easement with no public access. The easement is located north of West Bay (adjacent to the bay) and between Rooked Creek and Burnt Mill Creek which drains into the bay.		9,531
Patronis Conservation Easement	Northwest Florida Water Management District	Bay	Patronis Conservation Easement is a privately owned conservation easement with no public access located adjacent to the Econfina WMA near Cat Creek.	http://www.nwfwater.com/	891
Pine Log State Forest	FL Dept. of Agriculture and Consumer Services, Florida Forest Service	Bay, Washington	Pine Log State Forest is Florida's oldest state forest. The property is predominantly slash pine plantations, with a few areas of natural longleaf pine. Upland pine restoration efforts have been underway for years. Pine Log Creek runs through the forest, and there are small patches of seepage slopes with white-topped pitcher plants.	http://www.floridaforestservice.com/index.html	276

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Point Washington State Forest	FL Dept. of Agriculture and Consumer Services, Florida Forest Service	Walton	Point Washington State Forest is very diverse tract of land with scrub, sandhills, wet flatwoods, scrubby flatwoods, cypress swamps, depression marshes, wet prairies and estuarine areas. The forest's large tract of sandhill is unusual for this area. The park is located on a barrier peninsula in eastern Walton County.	http://www.floridaforestservice.com/index.html	2,583
Porter Pond Tract	Undesignated State Land (not currently assigned to a managing agency)	Washington	Porter Pond Tract contains a portion of a large sandhill upland lake and includes only 30 acres of dry land. Longleaf pine sandhills occur on the Porter Pond Tract which was formerly managed by FDACS, Division of Forestry.		79
St. Andrews State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Bay	St. Andrews State Park contains white sand beach; well-developed beach dunes vegetated with sand pine, oak and rosemary scrub, slash pine flatwoods, salt marsh; and freshwater marshes. The park is located on a barrier peninsula between St. Andrew Bay and the Gulf of Mexico	http://www.floridastateparks.org/	1,140
St. Joseph Bay State Buffer Preserve	FL Dept. of Environmental Protection, Florida Coastal Office	Gulf	St. Joseph Bay State Buffer Preserve lies along the east and southwest coasts of St. Joseph Bay and consists of 3 tracts. West of Highway 30 the land is mostly slash pine flatwoods and black needlerush marsh, while east of the highway the land rises onto old dunes with sandhill and scrub. Lower areas are occupied by cypress swamps and bogs. Many rare plants are found on the preserve including telephus spurge, panhandle spiderlily, thick-leaved water-willow, and bog tupelo.	http://www.dep.state.fl.us/coastal	2,919
Steele/Lachina Conservation Easement	Northwest Florida Water Management District	Washington	Steele/Lachina Conservation Easement is a small privately owned conservation easement adjacent to the Econfina Creek Water Management Area near Fox Trot Trail.	http://www.nwfwater.com/	0.78

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Syfrett Conservation Easement	Northwest Florida Water Management District	Washington	Syfrett Conservation Easement is a privately owned conservation easement located near River Lake, north of Highway 20 along the border between Bay and Washington Counties.	http://www.nwfwater.com/	381
T. H. Stone Memorial St. Joseph Peninsula State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Gulf	The park contains the western end of the St. Joseph barrier spit and includes white sand beaches, well-developed dunes, sand pine scrub, and pine flatwoods. The park also contains areas of coastal hammocks and is an important site for migratory birds.	http://www.floridastateparks.org/	2,633
Urquhart/Perry Conservation Easement	Northwest Florida Water Management District	Washington	The Urquhart/Perry Conservation Easement is a privately owned conservation easement south of Porter Lake, with no public access. It is surrounded by the Econfina Creek WMA.	http://www.nwfwater.com/	1,181
Ward Creek West	Northwest Florida Water Management District	Bay	The Ward Creek West site consists of bedded slash pine plantation with isolated pockets of mixed forested wetlands. The headwaters of Ward Creek, a first-order stream flowing east to West Bay, occur within this tract.	http://www.nwfwater.com/	723
William J. Rish Recreational Park	State Agency for Persons with Disabilities	Gulf	The William J. Rish Recreational Park is completely ADA accessible with approximately two miles of boardwalks and ramps. The park is located in St. Joseph Peninsula.	http://apd.myflorida.com/rish-park/	79
Locally Managed					
Deep Springs Park	Bay County	Bay	Deep Springs Park is located at the headwaters of Deep Springs Canyon and contains the head of a steephead ravine.	http://www.co.bay.fl.us	40
Grayton Dunes Park	Walton County	Walton	Grayton Dunes Park provides beach access and contains Western Lake, a coastal dune lake. The beach may provide nesting habitat for loggerhead sea turtles.		12
Inlet Beach	Walton County	Walton	Inlet Beach is a natural area with three walk-over boardwalks to provide beach access to the public. This beach is located west of Camp Helen State Park.	http://www.beachesofsouthwalton.com/todo_nature.aspx	20

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Panama City Beach Conservation Park	City of Panama City Beach	Bay	This park contains 908 acres of uplands and 2,004 acres of wetlands. It was established to protect and balance the natural resources while providing passive recreational opportunities. In April 2011, the Panama City Beach WWTP ceased discharge into West Bay and re-routed its treated effluent to the Conservation Park for release into treatment wetlands.	http://www.pcbeach.org/ecotourism/panama_city_beach_conservation_park	2,899
Salinas Park	Gulf County	Gulf	Salinas Park is a Gulf County park consisting of beach dunes and coastal scrub. It is located between the St. Joseph Bay State Buffer Preserve and Cape San Blas.	http://www.gulfcounty-fl.gov/countyparks.cfm	35
Privately Managed					
Audubon Nature Preserve	Bay County Conservancy	Bay	Located in the middle of Panama City, this preserve consists mostly of wetlands and includes Doctor's Pond, which is encircled by cypress, sweetbay and longleaf pine.	http://www.baycountyconservancy.org	32
Breakfast Point Mitigation Bank	The St. Joe Company	Bay	Breakfast Point Mitigation Bank is located adjacent to West Bay just north of Panama City Beach. The site has been significantly impacted by silviculture.	http://www.joe.com/	3,852
Devils Swamp Mitigation Bank	The St. Joe Company	Bay, Walton	Devil's Swamp Mitigation Bank is located on the Walton-Bay County boarder north of the Intracoastal Waterway. The site has been converted to sand or slash pine plantation, with bedding in the wetlands.	http://www.joe.com/	1,980
King Family Preserve	Bay County Conservancy	Bay	The King Family Preserve is a mid-city wetland preserve that is heavily wooded with old growth pines, cypress and loblolly bays. It provides habitat for many species of birds that depend on wetlands, such as wood ducks.	http://www.baycountyconservancy.org	26
Margaret Roberts Meek Preserve	Bay County Conservancy	Bay	Margaret Roberts Meek Preserve a Bay County preserve located south of Tram Road on Callaway Creek.	http://www.baycountyconservancy.org	17

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Marjorie's Magical Marsh - Symone's Sanctimonious Swamp	Bay County Conservancy	Bay	The Marjorie-Symone Preserve is located on East Lakeland Drive, off Highway 2311, which is to the east of Deer Point Lake. These ten acres were donated by Highpoint developer Stacey Wilson in 2006. A 1.5- acre addition was purchased in late 2011.	http://www.baycountyconservancy.org	10
Mary Ola Reynolds Miller Palm Preserve	Bay County Conservancy	Bay	Located in downtown Panama City, this small preserve contains 70 native palms plus some hardwoods. The site also serves as stormwater retention area for the surrounding development.	http://www.baycountyconservancy.org	0.36
McNaughton Tract	Bay County Conservancy	Bay	McNaughton Tract is a small conservancy property in a neighborhood off of Country Club Drive east of Highway 2297.	http://www.baycountyconservancy.org	2
Richard Jennings Preserve	Bay County Conservancy	Bay	Richard Jennings Preserve is a small conservancy property located off of Highway 231 in Panama City.	http://www.baycountyconservancy.org	5
Sweetwater Mitigation Bank	Sweetwater Mitigation Bank, LLC	Bay	Sweetwater Mitigation Bank is a private mitigation bank located in eastern Bay County northeast of Panama City and south of Bear Creek.		864
Talkington Family Preserve	Bay County Conservancy	Bay	The Talkington Family Preserve was designated to provide habitat for crayfish and other wetland species. It is located east of Goose Bayou off of Jenks Avenue in Panama City.	http://www.baycountyconservancy.org	8
Tumble Creek Audubon Preserve	Bay County Conservancy	Washington	The Tumble Creek Audubon Preserve is located on the Washington/Jackson County line. Tumble Creek, a seepage stream, runs through the property. Natural communities on site include slope forest, sphagnum bog, shrub bog, bottomland hardwood forest, and longleaf pine-turkey oak-wiregrass sandhill.	http://www.baycountyconservancy.org	66

Source: FNAI 2016a