Draft

St. Andrew Bay

Watershed Characterization

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Version History

Date	Version	Location(s) in Document	Summary of Revision(s)
6/28/2016	1	All	Initial draft Watershed Characterization (Sections 1, 2, 3, 4, and 6) submitted to NWFWMD.
7/14/2016	2	Throughout	Numerous edits and comments from District staff
11/18/2016	3	Throughout	Numerous revisions to address District comments.
11/23/2016	4	Throughout	Numerous edits and comments from District staff
12/5/2016	5	Throughout	Numerous revisions to address District comments.

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Abbreviations and Acronyms List

Act	Endangered Species Act
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
BOD	biochemical oxygen demand
cfs	cubic feet per second
CISMAs	Cooperative Invasive Species Management Areas
CWA	Clean Water Act
DO	dissolved oxygen
EDC	Economic Development Council
EPA	U.S. Environmental Protection Agency
ERP	Florida - Environmental Resource Permitting
F.A.C.	Florida Administrative Code
FDACS	Florida Department of Agriculture and Consumer Services
FDEC	Florida Demographic Estimating Conference
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FGS	Florida Geological Survey
FHWA	Federal Highway Administration
FNAI	Florida Natural Areas Inventory
F.S.	Florida Statutes
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
GIWW	Gulf Intracoastal Waterway
HAB	harmful algal bloom

IWR	Impaired Surface Waters Rule
MS4s	municipal separate storm sewer systems
NFWF	National Fish and Wildlife Foundation
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	nonpoint source
NRC	National Research Council
NRCS	Natural Resources Conservation Service
NRDA	Natural Resource Damage Assessment
NWFWMD	Northwest Florida Water Management District
OFWs	Outstanding Florida Waters
OSTDS	on-site sewage treatment and disposal systems
PCBs	polychlorinated biphenyls
RESTORE Act	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act
RMA	St. Andrew Bay Resource Management Association
RPC	Regional Planning Council
SAV	submerged aquatic vegetation
SEAS	Shellfish Environmental Assessment Section
SHCAs	Strategic Habitat Conservation Areas
SIMM	Seagrass Integrated Mapping and Monitoring
SLAMM	Sea Level Affecting Marshes Model
SMZs	Special Management Zones
START	Solutions To Avoid Red Tide
STCM	Storage Tank and Petroleum Contamination Monitoring
SWIM	Surface Water Improvement and Management
SWTV	Surface Water Temporal Variability
TEEB	The Economics of Ecosystems and Biodiversity
TMDL	total maximum daily load
TNC	The Nature Conservancy
UF-IFAS	University of Florida’s Institute of Food and Agricultural Sciences
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOC	U.S. Department of Commerce

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 facilities

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1.1 SWIM Program Background, Goals, and Objectives

1.2 Purpose and Scope of 2017 SWIM Plan

1.0 Introduction

This watershed characterization has been prepared in support of an update to the Surface Water Improvement and Management (SWIM) plan for the St. Andrew Bay watershed. The SWIM plan provides 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 Bay Environmental Study Team (BEST) management plan entitled "A Look to the Future: A Management Plan for the St. Andrew Bay Ecosystem."

The St. Andrew Bay watershed includes the interconnected St. Andrew, West, East, and North bays; St. Joseph Bay; and Deer Point Lake Reservoir, as well as the respective surface water basins of each of these waterbodies. The overall watershed area is primarily in Bay and Gulf counties, but also includes significant portions of Washington, Walton, Jackson, and Calhoun counties (Figure 2-1). For planning purposes, the watershed also includes Lake Powell and other coastal dune lakes, as described below, with drainage area within both Walton and Bay counties.

1.1 SWIM Program Background, Goals, and Objectives

Surface Water Improvement Management Plans have been developed pursuant to the SWIM Act, which was 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 programs to provide improved management of surface waters and associated resources;
- Develop plans identifying current conditions and processes affecting the quality of surface waters;
- Identify 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.

The SWIM program addresses overarching goals and priorities through the identification and implementation of projects, which are vetted and prioritized by the District and local stakeholders, with public input. Projects may include stormwater retrofits and floodplain restoration for water quality improvement, wetland and aquatic habitat restoration, resource assessments, and public outreach and awareness initiatives, among others. SWIM 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 that are more generally outlined in the District's strategic plan.

- **In addition to the SWIM Act of 1987, the following Florida statutes and rules 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 62-302, Florida Administrative Code (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**

1.2 Purpose and Scope of 2017 SWIM Plan

Development of the 2017 St. Andrew Bay SWIM Plan update (hereafter called 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. The last St. Andrew Bay SWIM Plan, which was developed in 2000, recognized issues and objectives in seven goal-based categories/programs:

1. Growth management;
2. Nonpoint source (NPS) pollution;
3. Point source pollution;
4. Chemical contamination (as related to habitat quality, wildlife health, and human health);

In the St. Andrew Bay Watershed, major stakeholders include:

- **The NWFWMD**
- **U.S. Department of Agriculture**
- **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**
- **The Nature Conservancy**
- **The NFWF**
- **Bay, Gulf, Washington, Walton, Jackson, and Calhoun counties**
- **Municipalities in Bay and Gulf counties**
- **Various unincorporated communities**
- **St. Andrew Bay Resource Management Association**
- **Friends of St. Andrew Bay**
- **Tyndall Air Force Base**
- **Florida Lake Watch**
- **And many others**

5. Biological diversity;
6. Public outreach; and
7. Deer Point Lake Reservoir Basin management.

This 2017 SWIM Plan assesses progress made toward the implementation of actions identified 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 to meet those challenges and needs. Management actions are generally limited to those within the mission and scope of the NWFWMD SWIM program and the NFWF GEBF, recognizing the ongoing initiatives and needs of local communities and other agencies.

For the purposes of the SWIM program, watersheds are the logical 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 under the purview of all jurisdictions and agencies involved in the watershed. Among these are local, state, and federal regulatory and management agencies; conservation lands acquisition and management organizations; and other interested stakeholders.

The 2017 SWIM Plan identifies projects and opportunities to leverage funding from many sources; integrating the efforts of local governments, state and federal agencies, and private entities to pool resources and achieve mutual objectives and goals; and to present innovative, sustainable solutions to watershed issues.

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2.0 Watershed Description

2.1 Introduction

St. Andrew Bay watershed statistics:

- ✓ **Entirely within Florida**
- ✓ **Two bay systems, with five named bays**
- ✓ **Four EPA Level 4 Ecoregions**
- ✓ **Six Florida counties**
- ✓ **36 Unique natural communities**
- ✓ **1,154 square miles**

The St. Andrew Bay watershed covers approximately 740,000 acres and is the only watershed within the NWFWMD located entirely within the state of Florida. This offers a unique management opportunity for the affected communities and resource management agencies to protect and manage watershed resources, including both natural systems and water supply. The basin spans four U.S. Environmental Protection Agency (EPA) Level 4 ecoregions and encompasses 36 unique habitat types recognized by the Florida Natural Areas Inventory (FNAI). These habitats include freshwater lakes, streams, rivers, springs, bays, estuaries, barrier islands, peninsulas, and dune lakes. The St. Andrew Bay estuary includes West Bay, North Bay, East Bay, and St. Andrew Bay. It encompasses 106 square miles (Fitzhugh 2012a). This bay system, and St. Joseph Bay, are both characterized by minimal freshwater inputs and, thus, relatively high and consistent salinity.

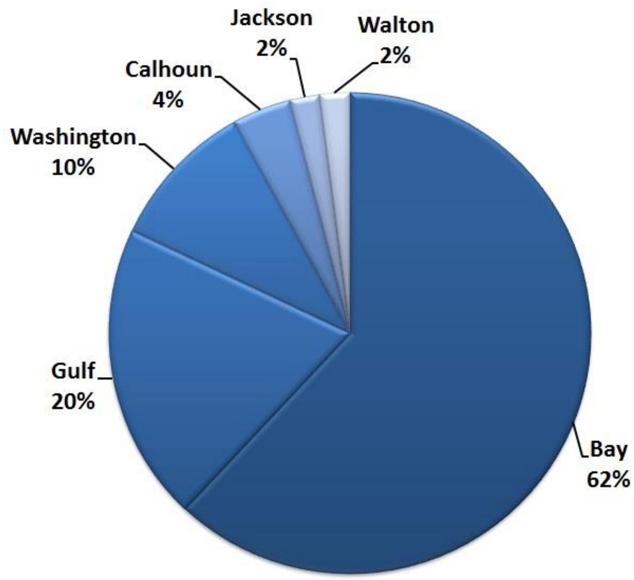
The unique ecosystems comprising the St. Andrew Bay watershed fall under the jurisdiction of multiple local and county governments, state and federal agencies, and two regional planning councils (Apalachee and West Florida [RPCs]). These entities not only manage natural resources, but also shape their expression across the landscape by establishing conservation lands, implementing land use and land management regulations, and establishing best management practices (BMPs) that directly influence water quality and habitat integrity.

This section provides an overview of the physical, hydrological, and ecological characteristics of the St. Andrew Bay watershed, as well as the ecosystem services that those resources provide to the watershed's residents and communities.

2.2 Geographic Characteristics

2.2.1 Geography

The St. Andrew Bay watershed spans portions of Bay, Calhoun, Gulf, Jackson, Walton, and Washington counties. The watershed covers approximately 740,000 acres, of which approximately 62 percent is located in Bay County (see Figures 2-1 and 2-2).



Source: National Oceanic and Atmospheric Administration 2015a

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

Jackson and Washington counties make up the northern-most upland reaches of the drainage basin, while Walton County occurs in the coastal portion of the watershed, west of Bay County and adjacent to the Gulf of Mexico. The southwestern portion of Jackson County includes the headwaters of the 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. Lake Powell and its contributing watershed spans portions of southern Walton and Bay counties.

Calhoun, Jackson, and Walton counties, collectively, occupy approximately eight percent of the total watershed area. Approximately two percent (18,337 acres) of Walton County and two percent (18,113 acres) of Jackson County fall within the St. Andrew Bay watershed, while approximately seven percent (27,158 acres) of Calhoun County is within the watershed. Neither Calhoun, Jackson, nor Walton counties have municipalities within the watershed; however, several unincorporated communities occur within its boundaries.

The cities of Lynn Haven, Parker, Springfield, Callaway, and Panama City are located adjacent to St. Andrew Bay, along with unincorporated coastal communities. The City of Panama City Beach and communities such as Upper and Lower Grand Lagoon, Laguna Beach, Sunnyside,

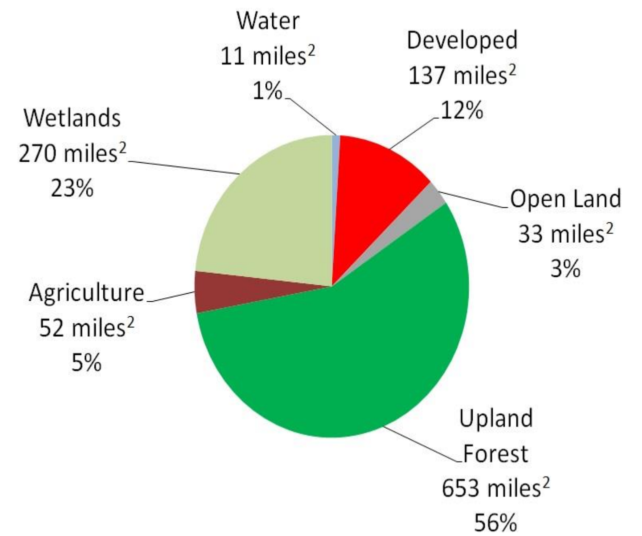
Sources: Federal Highway Administration (FHWA) 2014; NOAA 2015a; U.S. Geological Survey (USGS) 2015, 2016a.

Figure 2-2 St. Andrew Bay Watershed

Rosemary Beach, and Tyndall AFB are located on the barrier peninsula separating St. Andrew Bay from the Gulf of Mexico. Mexico Beach is located on the Gulf of Mexico north of St. Joseph Bay, and the City of Port St. Joe borders on St. Joseph Bay. The coastal community of Cape San Blas is located on the St. Joseph Peninsula in the southern-most portion of the watershed (further discussed in Section 2.5.1). Unincorporated communities in the watershed include Overstreet, Youngstown, and Fountain.

2.2.2 Land Use and Population

The northernmost portions of the watershed consist of a mix of agriculture, silviculture, low-density residential, and conservation land (Figures 2-3 and 2-4). The southeastern-most areas are mostly agricultural, silviculture, and conservation uses, with the exception of the cities of Mexico Beach and Port St. Joe, which include residential, commercial, and industrial land uses. Most residential, commercial, industrial, and institutional land use areas are concentrated in the urban center of Panama City and coastal cities like Panama City Beach, Port St. Joe and others. Tyndall AFB, located on the peninsula southeast of St. Andrew Bay, occupies almost 30,000 acres. Undeveloped portions of the base act as a buffer for the bay.



Source: FDEP 2015a.

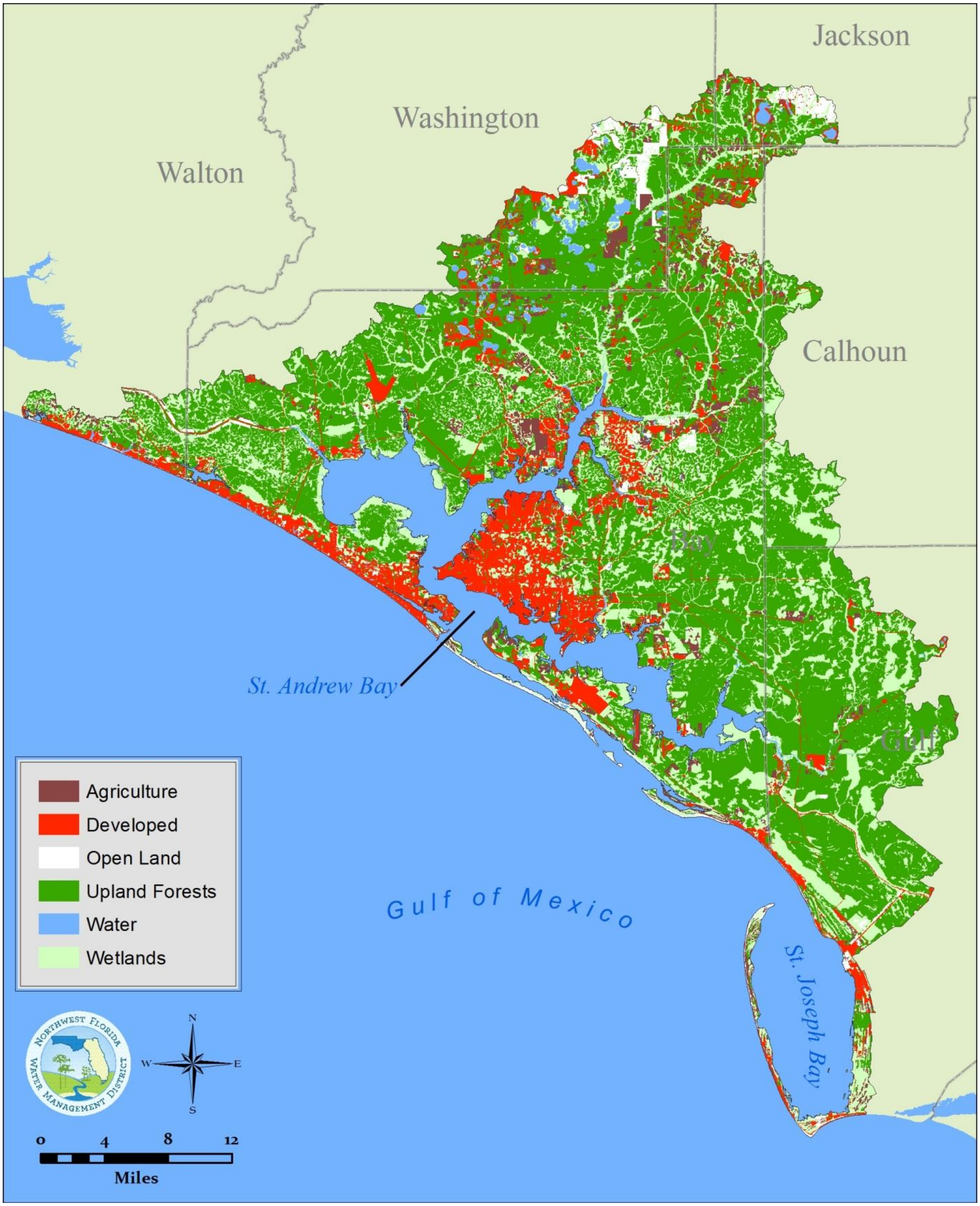
Figure 2-3 General Land Use of the St. Andrew Bay Watershed

Significant holdings of conservation land and protected natural areas can be found around West Bay, North Bay, Deer Point Lake, St. Joseph Bay and Peninsula, St. Andrew Bay, and coastal dune lakes, and within the Econfina Creek Water Management Area (WMA). In total, there are over 107,000 acres of conservation land in the St. Andrew Bay watershed. Conservation lands within the watershed are owned by the NWFWMD, the state of Florida, Bay County, Calhoun County, Gulf County, Jackson County, Walton County, Washington County, Panama City Beach, and private landowners such as the St. Joe Company. These lands provide a buffer system that helps to protect water quality, provide flood protection, and sustain integrated terrestrial and aquatic ecosystems.

The Econfina Creek WMA, comprised of more than 45,000 acres in Bay and Washington counties, is owned and managed by the NWFWMD for water resource protection, restoration, recreation, and preservation. Other conservation areas, including parks, forests, and preserves, are discussed in more detail in Section 3.5.1.

While the relationship between land use and pollutants (particularly nutrients) has been well documented, the extent of that relationship and its potential effect on downstream ecosystems is also dependent upon proximity to surface water bodies, as well as how connected the aquifer is to the surface in a given location (Geisenhoffer 2014).

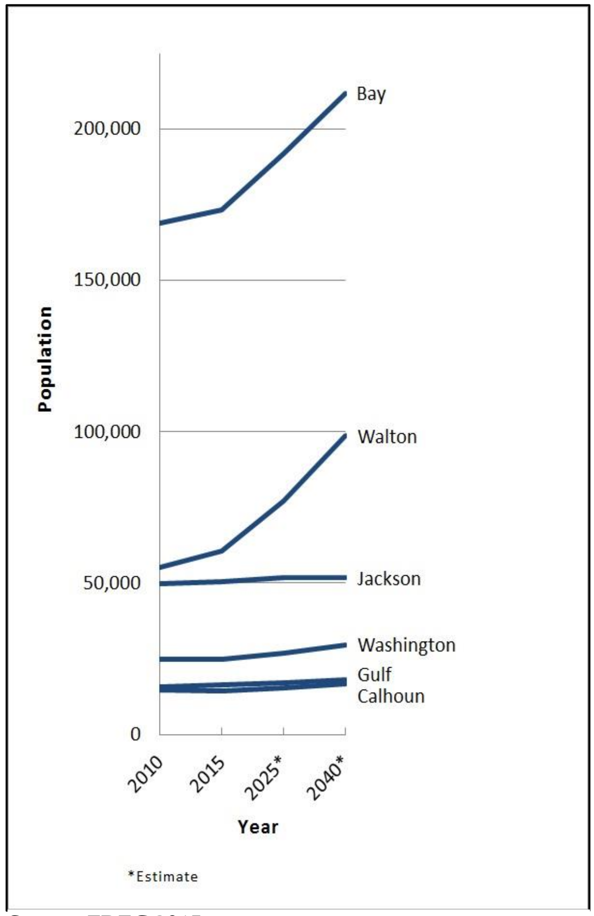
Counties and municipalities within the watershed guide land uses through the development of comprehensive plans, future land use maps, and land development regulations, which are updated regularly. The West Bay Preservation Area was established pursuant to the Bay-Walton Sector Plan to protect ecological systems and provide connectivity to West Bay. The Sector Plan, as described under Chapter 12 of the Bay County Comprehensive Plan, promotes development that fosters a sense of place and provides development standards that protect environmental resources and ensure human and ecological connectivity (Bay County 2009).



Sources: FDEP 2015a; NOAA 2015a; USGS 2016a.

Figure 2-4 2012-2013 Land Use and Land Cover for the St. Andrew Bay Watershed

As is the case across much of northwest Florida, the St. Andrew Bay region has experienced considerable population growth (Figure 2-5 and Table 2-2). This growth has resulted in the transformation of land use in many areas from rural and agricultural to urban/suburban in character. Resulting effects include increased NPS pollution, the generation of additional wastewater and stormwater, and habitat loss and fragmentation. The University of Florida's Bureau of Economic and Business Research projects continue population growth, particularly in Bay and Walton counties (Florida Demographic Estimating Conference [FDEC] 2015). Along with this population increase, will come increases in development, waste production, use of recreational areas, as well as land use changes.



Source: FDEC 2015

Figure 2-5 Population Trends of St. Andrew Bay Watershed Counties

Approximately 93 percent of Bay County (458,764 acres) is located within the St. Andrew Bay watershed, making it the jurisdiction occupying the largest land area in the drainage basin. Bay County has a year-round population of 173,310 people and projected growth rates for 2015 – 2025 showing an increase of 10.7 percent (FDEC 2015). Although St. Andrew Bay drains a larger regional area encompassing nearly 740,000 acres, the St. Andrew Bay estuary is located entirely within Bay County (NWFWMD 2014a, 2014b). Consequently, changes in Bay County's population can potentially have a substantial impact on the bay itself.

Table 2-1 Population in the St. Andrew Bay Watershed (Based on Census Blocks)

County	2010 Population
Bay	167,975
Calhoun	65
Gulf	6,621
Jackson	790
Walton	2,453
Washington	2,392
Total	**180,296**

Sources: U.S. Census Bureau 2010.

Gulf County is the second largest county within the watershed with approximately 40 percent (147,443 acres) of the county occurring within the basin. Gulf County makes up the eastern part of the St. Andrew Bay watershed, including St. Joseph Bay and Wetappo Creek, which discharges into East Bay. Much like Bay County, the majority of Gulf County's residents live in coastal communities.

The third largest county in the watershed is Washington County, which occupies 70,248 acres (or ten percent) of the watershed's total area. None of its municipalities are located within the St. Andrew Bay watershed.

2.3 Physical Characteristics

The St. Andrew Bay watershed can be characterized geographically by its physiographic regions and ecoregions. First introduced by Nevin Fenneman and extensively mapped by the U.S. Geological Survey (USGS), physiographic regions are based on landforms and the geologic formations responsible for their expression across the landscape. Defined by the EPA, ecoregions are geographic areas with similar ecosystems that are used for research, management, monitoring, and assessment. Ecoregions can be similar in extent to physiographic regions due to the interactions between geology, hydrology, and ecology, but unlike physiographic regions, are defined by both their biotic and abiotic characteristics. Ecoregions are identified by analyzing patterns in soils, vegetation, climate, land use, wildlife, and hydrology, as well as geology and landforms (EPA 2013a).

2.3.1 Physiographic Region

Gulf Coastal Plain

The St. Andrew Bay watershed lies within the Gulf Coastal Plain physiographic region, which is characterized by gently rolling hills, sharp ridges, prairies, and alluvial floodplains underlain by sediments of sand, gravel, porous limestone, chalk, marl, and clay (NWFWMD 2000; USDA 1984). Within this greater physiographic region, the St. Andrew Bay watershed contains one localized physiographic region: the Gulf Coastal Lowlands (USDA 1984). Terraces of the Gulf Coastal Lowlands formed during the Pleistocene Epoch (Great Ice Age) when fluctuating sea levels were associated with the growth and melting of ice caps. Dunes, barrier islands, beach ridges, and other topographical features were stranded inland as seas receded. Eight terraces, the highest of which is located in the northernmost portion of the watershed, range in elevation from nearly 300 feet above sea level to 10 feet above sea level near the coast (USDA 1984; USGS 2013). Additional details on the geology and soils of these physiographic regions can be found in Appendix A.

2.3.2 Ecoregions

Southeastern Plains and Southern Coastal Plain

Two EPA Level 3 ecoregions occur in the St. Andrew Bay watershed: the Southeastern Plains and Southern Coastal Plain (Omernik 1995). Level 4 ecoregions are smaller divisions of Level 3 ecoregions with more detailed descriptions. Divisions at this scale allow for the identification of locally defining characteristics and the formulation of specific, locally oriented management strategies (Omernik 1995). The portion of the watershed lying within the Southeastern Plains ecoregion (Level 3) is further classified as two Level 4 sub-regions: the Dougherty Plain and the Southern Pine Plains and Hills. The portion of the watershed located in the Southern Coastal Plain ecoregion (Level 3) includes two Level 4 sub-regions: the Gulf Coast Flatwoods and the Gulf Barrier Islands and Coastal Marshes (Table 2-2 and Figure 2-6) (EPA 2013a, 2013b, 2013c; Griffith *et al.* n.d.).

Table 2-2 Hierarchy of USGS Physiographic Regions and EPA Ecoregions (Level 3 and 4) in the Watershed

USGS Physiographic Region	Sub-Regions
Gulf Coastal Plains	Gulf Coastal Lowlands
EPA Level 3 Ecoregion	**Level 4 Ecoregion**
Southeastern Plains	Dougherty Plain
	Southern Pine Plains and Hills
Southern Coastal Plain	Gulf Coast Flatwoods
	Gulf Barrier Islands and Coastal Marshes

Source: EPA 2013b, 2013c.

Southeastern Plains and Sub-regions

The Southeastern Plains Level 3 ecoregion makes up the northern portion of the St. Andrew Bay watershed. As the largest ecoregion in the east, these irregular plains extend from near the Gulf of Mexico in the south to Maryland in the north. This expansive ecoregion is covered by a mosaic of cropland, pasture, forest, and wetland. Prone to abundant rainfall and a long growing season, relatively poor sandy soils found in much of the ecoregion limit agricultural competitiveness with many other regions. Natural forests of pine, hickory, and oak once covered most of the ecoregion, but much of the natural forest cover has been replaced by heavily managed timberlands.

Sources: EPA 2013b, 2013c; NOAA 2015a; USGS 2016a, 2016b.

Figure 2-6 Level 3 and 4 Ecoregions

Two Level 4 subcategories of the Southeastern Plains ecoregion are found within the St. Andrew Bay watershed:

- **Dougherty Plain.** The Dougherty Plain makes up the upper-most reaches of the watershed in Jackson, Bay, and Washington counties. The Dougherty Plain is a generally flat to gently rolling area of karst topography, largely influenced by limestone near the soil surface. Numerous sinkholes occur within the karst landscape and are the sites of ponds and marshes, with relatively few streams in the flatter part of the plain. In Washington County, the Dougherty Plain encompasses the Econfina Creek WMA and northern reaches of the St. Andrew Bay watershed. The karst geology has a profound impact on the character of the watershed. It provides the origin and functions of the Sand Hill Lakes, as well as major Floridan aquifer springs that provide the majority of the flow of Econfina Creek (Barrios 2011; Richards 1997).
- **Southern Pine Plains and Hills.** The Southern Pine Plains and Hills sub-region can be found in Bay County near Youngstown (U.S. Highway 231 and County Road 388) and the western portion of Calhoun County that falls within the watershed. Once described as almost all southern mixed forest and longleaf pine forests, this ecoregion has since been replaced mostly by slash and loblolly pine plantations. Soils are well- to moderately-drained Ultisols and Alfisols with fine sandy loam or silt loam surface texture. Many rare or endangered species such as the red-cockaded woodpecker are found in this sub-region.

Southern Coastal Plain and Sub-regions

The Southern Coastal Plain Level 3 ecoregion makes up the southern portion of the St Andrew Bay watershed, from just south of State Road 20 to the coastal barrier islands and east towards Gulf County's portion of the watershed and Cape San Blas. This ecoregion is generally lower in elevation, with less relief and wetter soils than the Southeastern Plains. Though predominantly flat plains (including coastal lagoons, marshes, and swampy lowlands), this ecoregion also contains barrier islands. In the St. Andrew Bay watershed, much of the Southern Coastal Plain region is developed land, including several coastal municipalities and military installations, such as Tyndall AFB.

- **Gulf Coast Flatwoods.** The Gulf Coast Flatwoods make up the majority of the Southeastern Coastal Plains including much of the St. Andrew Bay watershed. This ecoregion occurs in Gulf County's portion of the watershed; adjacent to eastern St. Andrew Bay, east of Econfina Creek and Deer Point Lake; as well as along the western portion of Bay County that is not adjacent to the Bay. The Gulf Coast Flatwoods ecoregion is a narrow region of nearly level terraces and alluvial and deltaic deposits composed of Quaternary sands and clays. The wet sandy flats and broad depressions of this ecoregion are typically poorly drained and swampy in nature. Many of the more well-drained areas in the ecoregion have been cleared for use as pasture or cropland.

- **Gulf Barrier Islands and Coastal Marshes.** The Gulf Barrier Islands and Coastal Marshes Region makes up the entire coastline of the St. Andrew Bay watershed adjacent to the Gulf of Mexico and the western coastline of the St. Andrew Bay. This includes the St. Joseph Peninsula and coastal Gulf County, as well as the barrier islands and barrier peninsulas seaward of St. Andrew Bay. The Gulf Barrier Islands and Coastal Marshes region contains salt and brackish marshes, dunes, beaches, and barrier islands. St. Joseph Peninsula State Park and the surrounding area exemplify this ecoregion. Cordgrass (*Spartina spp.*) and saltgrass (*Distichlis spp.*) are common in protected intertidal zones, while xeric coastal strand and pine scrub vegetation occurs on parts of the dunes, spits, and barrier islands.

2.3.3 Climate

The climate of the St. Andrew Bay watershed is largely determined by its subtropical latitude (29.6°-30.6°N) and proximity to the Gulf of Mexico. Temperatures along the coastline tend to be lower relative to areas further inland from the Gulf, a trend most noticeable during late spring and summer. Summers are often hot and humid and winters cool and dry. Wind conditions are typically northerly through the winter and southerly during the summer months, but vary with the passage of major air masses and thermal convection (sea breezes). Hurricanes and tropical storms occasionally influence the summer and fall weather of the watershed, bringing extremes in wind, rainfall, and tides (Natural Resources Conservation Service [NRCS] 1984).

2.3.4 Geology

The St. Andrew Bay watershed follows much of the general stratigraphy of the western Florida Panhandle. Much of the watershed's geologic features are a product of prehistoric marine deposition during periods when sea level was higher than the present. Near-surface formations include dolomitic limestones, sandy clayey limestones, and finally, shell beds, clayey sands, and sands (NRCS 1992). 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, and are presently found on the watershed's barrier islands (Shell Island and Crooked Island) and St. Joseph Peninsula (Brown 2009). In the upper St. Andrew Bay watershed, limestone karst landscapes lead to hydrologic connectivity to the Floridan aquifer through a series of springs and sinkholes, particularly in southwest Jackson and Washington counties and northern Bay County. The hydrologic characteristics of these springs and seeps are discussed further in Section 2.4. More details on the geology of the watershed may be found in Appendix A.

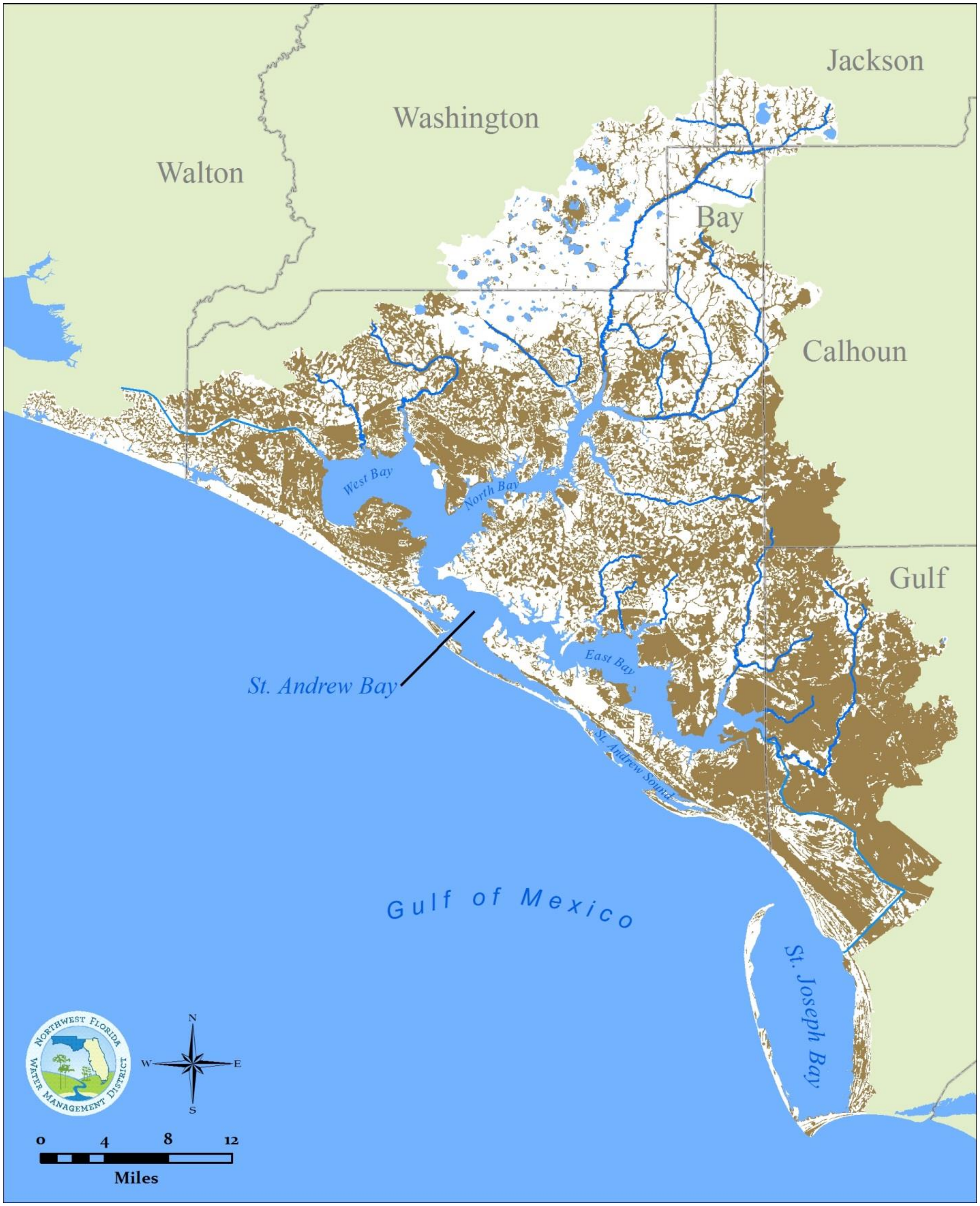
2.3.5 Soils

In addition to serving a critical role in forest and agricultural production and management, soils intercept and absorb surface water runoff, thereby, preventing erosion and water quality impairments when properly managed. Qualities of the soil, such as erodibility and permeability, greatly influence factors such as runoff or groundwater recharge and the potential for groundwater contamination. The pH and clay content of the soil also influence soil cation exchange capacity and potential to retain certain contaminants. Additionally, carbon in soil decreases the concentration of the greenhouse gas carbon dioxide in the atmosphere. At a global scale, soil can store four times more carbon than living biomass (trees, grasses, etc.) (Vasques and Grunwald 2007).

Many soils adjacent to St. Andrew Bay are heavily leached soils with distinct horizon development which form in coastal forests with a pine over story (Collins 2010; USDA 2014). Hydric soils occur in wetlands and floodplains across the watershed, particularly in the Econfina Creek WMA and northern Bay County. In eastern Bay and western Gulf counties, well weathered, clay-rich soils dominate. Younger poorly developed soils can be found along the coast line and barrier peninsulas where depositional processes are still active (Collins 2010).

When soils erode from the landscape, they contribute sediment to surface waters, which changes hydrology of streams and impacts habitat and water quality. The effects of sedimentation and erosion on water quality are further discussed in Section 3.2. However, well managed soils can contribute to improved water quality. Soils store rainwater, runoff, and stormwater in pore spaces, which regulates groundwater recharge, helps mitigate flooding, and increases the duration that water is available for plant uptake. Soils can be amended with organic material to create agricultural benefits, but unlike the vegetation they support, mature soils are not generally considered to be renewable resources on human time scales. The formation of soils that can support ecologically-distinct communities can take anywhere from hundreds to thousands of years, depending on the environment. Detailed information about soils within the watershed is provided in Appendix A.

Hydric soils, which are common throughout the watershed, are defined as soils “formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part” (Figure 2-7) (USDA 2016). Soils that exhibit hydric properties are important indicators of wetlands and floodplains. Hydric soils, in conjunction with hydrophytic vegetation and hydrologic properties, are used to define the jurisdictional boundaries of wetlands in the National Food Security Act Manual (USDA 1994) and the U.S. Army Corps of Engineers (USACE) Wetlands Delineation Manual (USACE Environmental Laboratory 1987). Understanding the distribution of hydric soils is useful for agricultural purposes, land-use planning, conservation planning, and assessment of potential wildlife habitat (USDA 2016). Hydric soils are predominantly found along the floodplains of the watershed's creeks and streams, and in a variety of wetland habitats.



Sources: NOAA 2015a; USDA 2013; USGS 2016a, 2016b.

Figure 2-7 Hydric Soils

2.4 Hydrologic Characteristics

2.4.1 Streams and Tributaries

The St. Andrew Bay watershed is unique in northwest Florida in that no major river flows into the system. As a result, waters of the bay are deep, clear, and of relatively high and consistent salinity (Saloman *et al.* 1982).

Econfina Creek, which is spring-fed, is the major tributary of the St. Andrew Bay estuary (Figure 2-8 and Figure 2-9). It begins in southwestern Jackson County and flows through Washington and Bay counties before discharging into Deer Point Lake Reservoir. Econfina Creek receives a significant contribution of groundwater from the Sand Hill Lakes Area, making up to 85 percent of the stream's average annual flow (Brown 2009). The Econfina Creek (and springs) system discharges an annual average of 355 million gallons per day or 549 cubic feet per second (cfs) (Richards 1997). The Sand Hill Lakes area are internally drained and defined by karst topography. The region serves as the recharge area for Floridan aquifer springs that discharge into Econfina Creek. In addition to Econfina Creek, Cedar Creek, Bear Creek, and Bayou George Creek discharge into Deer Point Lake Reservoir. Other tributaries of St. Andrew Bay include Burnt Mill Creek and Crooked Creek, which discharge into West Bay, and Sandy and Wetappo Creek within the East Bay basin (Brown 2009).

2.4.2 Coastal Waterbodies

Located almost entirely in Bay County, the St. Andrew Bay estuary includes five open bay and lagoon segments (St. Andrew, North, West and East Bays, and Grand Lagoon), which have a combined surface area of approximately 59,568 acres (Brim and Handley 2006). The bay system is connected to the Gulf of Mexico by two coastal passes: West Pass and East Pass. West Pass is a rock-jettied shipping channel constructed in 1938. East Pass, the historical outlet to the Gulf of Mexico located at the eastern end of Shell Island, is no longer navigable, as it has been recently filled in by the natural movement of shoreline sediments (Fitzhugh 2012a) (Figure 2-8).

West Bay covers roughly 17,576 acres and includes estuarine waters northwest of West Bay Point and Shell Point (Brim and Handley 2006). In addition to Burnt Mill and Crooked Creeks, the GIWW enters West Bay from the west, connecting St. Andrew Bay with the Choctawhatchee Bay system.

North Bay encompasses waters between Deer Point Dam and the Hathaway Bridge and covers 6,676 acres. The bay includes 16 bayous and is bounded on the northeast by the Deer Point Lake impoundment (Brim and Handley 2006).

East Bay is located southeast of the DuPont Bridge and its shorelines are largely characterized by the presence of Tyndall AFB. East Bay 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 the Wetappo Creek historical pathway and connects to Lake Wimico, then to the Apalachicola River, for navigational purposes (Brim and Handley 2006).

St. Andrew Sound is located 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 an unmaintained pass connecting the sound to the Gulf of Mexico (Brim and Handley 2006).

Notable bayous and sloughs in the St. Andrew Bay system include Alligator Bayou, Harrison Bayou, Little Johnson Bayou, Massalina Bayou, Watson Bayou, Parker Bayou, Pitts Bayou, Callaway Bayou, Laird Bayou, and Turtle Slough.

St. Joseph Bay was formed the outcropping of the Cape San Blas shoals and the westward migration of sediments from the east including those 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, and includes the barrier peninsulas of St. Andrew Bay. St. Joseph Peninsula encloses and forms St. Joseph Bay, a non-estuarine lagoon that is about 11 miles long and ranges from three to five miles in width. The surface area of the bay is approximately 43,872 acres (NRCS 2001a). St. Joseph Bay is the only body of water in the eastern Gulf of Mexico not substantially influenced by freshwater inflow. It is connected to the GIWW by the Gulf County Canal (NWFWMD 2002; FDEP 2012).

Sources: FGS 2015; NOAA 2015a; USGS 2016a, 2016b.

Figure 2-8 Topography and Major Waterbodies

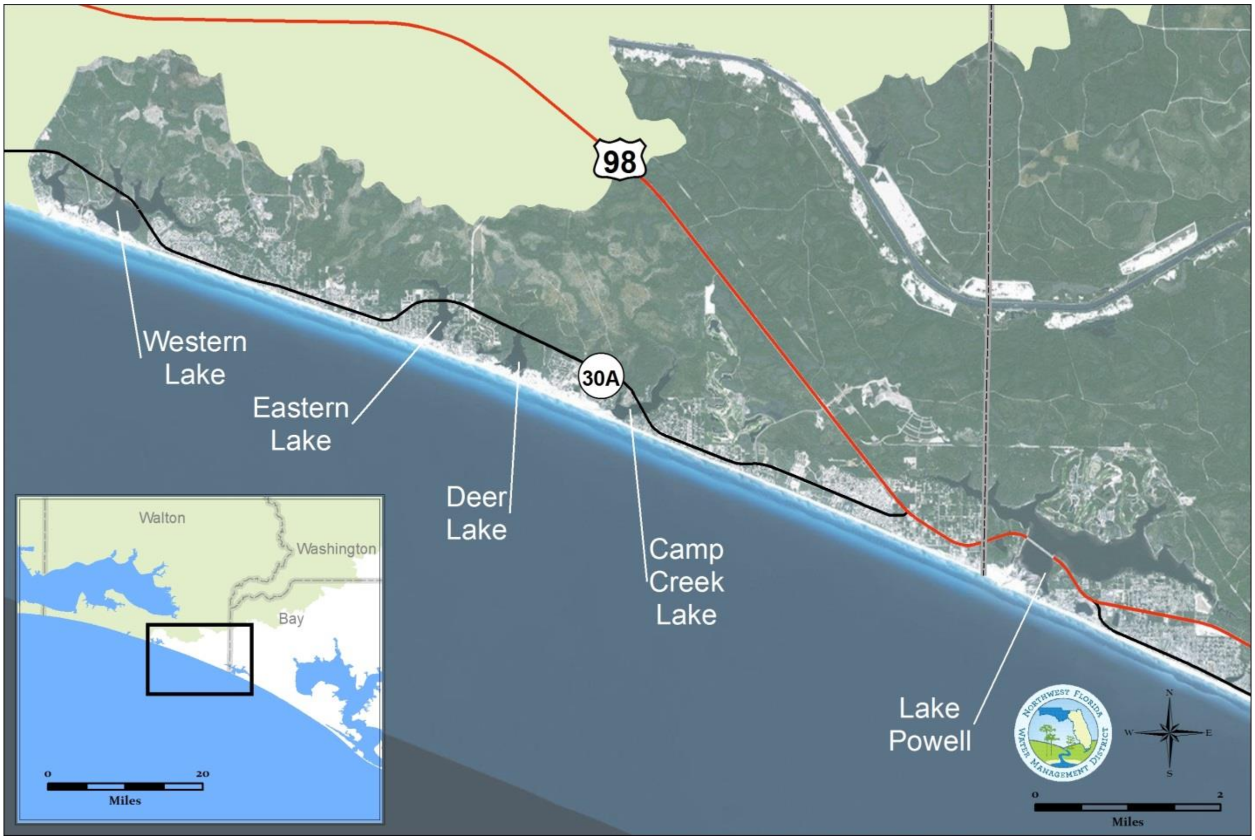
2.4.3 Gulf Intracoastal Waterway (GIWW)

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 Gulf Intracoastal Canal Association 2016). The waterway was constructed to provide a fast and safe 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). The Intracoastal Canal Association provides oversight and guidance for the GIWW in Texas, Louisiana, Mississippi, Alabama, and Florida (FDOT 2008; The Gulf Intracoastal Canal Association 2016). Effects of the GIWW on water quality can be found in Section 3.2.2.

2.4.4 Lakes

The northern portion of the St. Andrew Bay watershed includes much of the Sand Hill Lakes region, 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, some small steep-walled, round-bottomed sinks, as well as larger flat-bottomed pools and other natural and impounded lakes.

Another 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 2-8 and Figure 2-9). Coastal dune lakes are naturally formed fresh water basins, intermittently connected to the Gulf of Mexico. Given the cyclical nature of their hydrology, these lakes are known to have a high biodiversity, with species characteristic of freshwater, estuarine, and marine environments. When water in these lakes rises above full-pool levels, breaching water can form an outlet through the surrounding dunes. Breaches in dunes surrounding these lakes can also be caused by the destabilization of sand dividing the lake from the ocean, or erosion from the beach-side resulting in a breach of the berm (Browder and Dean 1998).



Sources: ESRI *et al* 2016; FHWA 2014; USGS 2016a

Figure 2-9 Coastal Dune Lakes in the St. Andrew Bay Watershed

Situated between Bay and Walton counties, Lake Powell is the largest coastal dune lake in the region and among the largest in the world. 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) (further discussed in Section 3.5.4).

Deer Point Lake Reservoir, a 5,000-acre impoundment located seven miles north of Panama City, is Bay County's main source of drinking water. Deer Point Lake receives freshwater from Bayou George, Bear Creek, Cedar Creek, and Econfina Creek in the range of 600 million gallons per day (928 cfs) of which approximately 550 million gallons per day (851 cfs) spills over into North Bay (NWFWMD 2008). The Reservoir is designated as a Class I waterbody, and it provides the major source of potable water for Bay County. The reservoir derives 57 to 79 percent of its water from Econfina Creek, with Bear Creek, Cedar Creek, and Bayou George also contributing.

Deer Point Lake Reservoir and Lake Powell are further discussed in Sections 3.3.3 and 2.6.7, respectively. Additional sizable lakes in the watershed include Lake Huntington in Panama City and Lake Martin located between the cities of Parker and Springfield.

2.4.5 Springs

The St. Andrew Bay watershed contains a number of Floridan aquifer springs, most of which discharge into Econfina Creek (Figure 2-10). These springs are characterized as having either typical fissure-type vents, those that incorporate areas of diffuse upward percolation of groundwater into pools and runs, as well as those that discharge laterally at or near the surface level of the creek (i.e., seep springs) (Copeland 2003). The NWFWMD has identified 11 spring groups with more than 39 vents in the St. Andrew Bay watershed. The Gainer Springs group is a first magnitude spring discharging into Econfina Creek in northern Bay County. Its discharge accounts for one-third of Econfina Creek's total base flow rate with another third coming from the remaining ten spring groups (Crowe *et al.* 2008). Five separate second magnitude springs or spring groups also discharge to Econfina Creek in Washington and Bay counties. The ecological significance of springs is further discussed in Section 2.6.8, while springs management is discussed in Section 6.4.8.

Sources: NWFWMD 2016a; NOAA 2015a; USGS 2016a, 2016b

Figure 2-10 Major Springs Located within the St. Andrew Bay Watershed

2.4.6 Groundwater Systems

Groundwater fills the pores and interstitial spaces in subsurface rocks and sediments, with recharge generally occurring from higher topographic elevations to discharge areas along streams, bays, and the Gulf of Mexico. There are two major sources of groundwater for the St. Andrew Bay watershed: the surficial aquifer system and the Floridan aquifer system. The surficial aquifer system is generally a thin, unconfined aquifer composed of discontinuous mixtures of Pleistocene and Recent alluvium and terrace deposits. Water in the surficial aquifer system is recharged through direct infiltration of rainwater and, therefore, fluctuates in elevation due to droughts or seasonal differences in rainfall. As described by the NWFWMD (2014), the Floridan aquifer system consists of a thick sequence of carbonate sediments of varying permeability, the top of which dips from the northeast to the southwest, with the elevation of the top of the system ranging from approximately 100 feet above sea level to more than 1,200 feet below sea level. The residency of this water within the Upper Floridan aquifer is thought to be somewhere between ten to 20 years (Barrios et al. 2011).

Walton, Jackson, and Washington counties derive the majority of their potable water from the Floridan aquifer system, while the surficial aquifer system supplies some rural and domestic areas in Walton County. In Bay County, Deer Point Lake Reservoir is the major source of public and industrial water supply (NWFWMD 2014a). In Gulf County, the City of Port St. Joe receives potable water from the Gulf County Canal, with the Floridan aquifer providing the major water supply source in the remainder of the county (NWFWMD 2014b).

2.5 Ecosystem Services

The St. Andrew Bay watershed supports ecological resources and provides benefits and services for people within the watershed. The ecological resources include the watershed’s associated streams and bays, as well as upland forests and wetlands that provide habitat for various plant and wildlife species, many of which are rare and protected. Human benefits include tourism, recreational opportunities, fisheries, and the economic benefits related to each.

Services provided by healthy ecosystems of the St. Andrew Bay Watershed include:

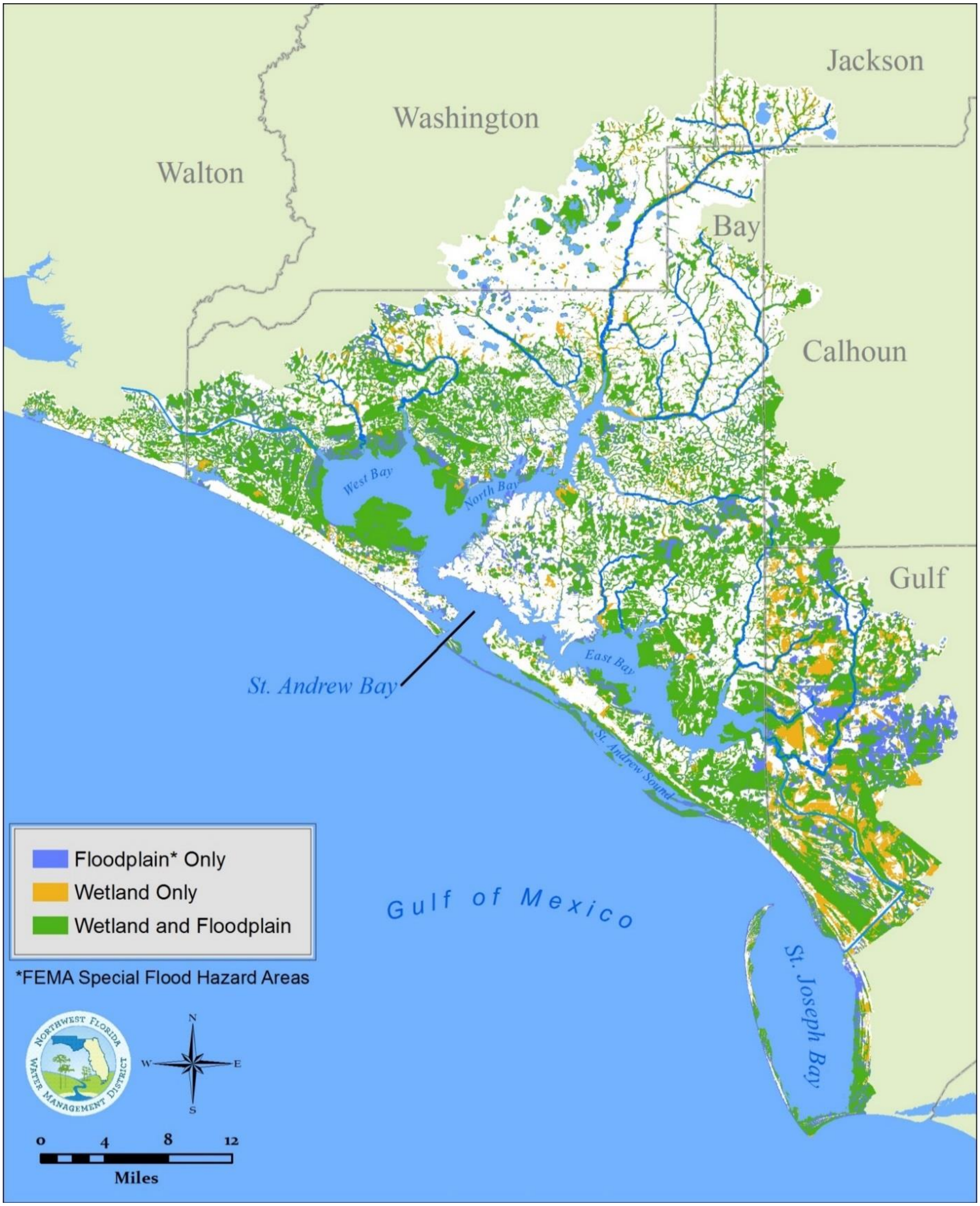
- **Water purification;**
- **Flood control;**
- **Streambank stabilization;**
- **Buffering of coastal storms;**
- **Nutrient cycling;**
- **Fish and wildlife resources; and**
- **Long-term resiliency.**

Watersheds, and the unique ecosystems that comprise them, play an important part in the global hydrological cycle (The Economics of Ecosystems and Biodiversity [TEEB] 2016). Healthy watersheds provide services such as water purification, groundwater and surface flow regulation, erosion and flood control, and streambank stabilization. Healthy watersheds can also be financially valuable when the cost of protecting ecosystems for improved water quality is compared with investment in major restoration efforts; oftentimes investing in the management of natural resources for improved water quality is less expensive and more efficient than infrastructure (USDA 2015a). Watersheds also provide significant value through their role in production of fish and wildlife resources.

2.5.1 Hydrologic Functions

Wetland functions can be grouped into three general categories: hydrologic, water quality protection and improvement, and fish and wildlife habitat (Abbruzzese and Leibowitz 1997). Interrelated functions performed by wetlands and associated natural systems are widely recognized and have been described by numerous authors (National Research Council [NRC] 2001; Novitzki *et al.* n.d.). Hydrologic functions include water storage, flood attenuation, and regulation of discharge to surface and groundwaters.

Floodplains along Econfina Creek and smaller tributaries serve as essential buffers, as they regulate discharge during major storms, and with the help of riparian vegetation, can absorb and slow the flow of stormwater (Conservation Tools 2016). Floodplains reduce runoff energy, which in turn reduces erosion and protects water quality downstream. Healthy riparian ecosystems within the watershed support nutrient-rich soils necessary to support vegetative communities that can aid in the absorption of potential flooding, and attenuate and reduce wave energy during storms (TEEB 2016). Riparian vegetation can also aid in shoreline stabilization by recycling nutrients from over-story vegetation litter, and supplying nutrients to floodplain soils during over-banking events. Increased root systems will also reduce the amount of exposed soil, reducing the potential for erosion and sediment loading.



Sources: Federal Emergency Management Agency (FEMA), FDEP and U.S. Fish and Wildlife Service (USFWS) 2016; NOAA 2015a; USGS 2016a, 2016b.

Figure 2-11 Floodplains and Wetlands

2.5.2 Nutrient Cycling

Wetlands, floodplains, and riparian areas aid in distributing nutrients from their overstory vegetation litter to the wider ecosystem during flooding events. Wetland and riparian vegetation and associated root systems also aid in the attenuation of excess nutrients in stormwater runoff from upland areas, as well as reduce the amount of exposed soil, thus reducing the potential for erosion and downstream sedimentation.

2.5.3 Sediment Stabilization

Coastal features of the St. Andrew Bay watershed, including barrier islands and peninsulas (e.g., Shell Island and St. Joseph Peninsula), aid in the buffering of storm impacts, shoreline erosion, and sedimentation. During coastal storms, these features help to protect the mainland by acting as wind buffers and absorbing potential flooding (Conservation Tools 2016). Among the essential functions of natural coastal features is to ensure long-term resiliency including adapting to coastal change and protecting human communities and natural systems from long-term erosion.

The FDEP (through funding from the U.S. Fish and Wildlife Service [USFWS] Coastal Program) has identified living shoreline restoration sites within the St. Andrew Bay watershed to aid in shoreline stabilization, biodiversity, and water quality (FDEP 2015b). Current living shoreline projects are located in Harbor Village (Bay County) and at Naval Support Activity Panama City Shoreline Restoration (FDEP 2015b). Completed in 2001, the Naval Support Activity Panama City Shoreline Restoration planted 25,000 native salt marsh plants and installed 193 oyster reefs at three sites located five miles northwest of the St. Andrew Bay Aquatic Preserve (FDEP 2015b).

2.5.4 Commercially and Recreationally Important Fisheries

The St. Andrew Bay watershed includes numerous waterbodies with economically important fisheries, shellfish (Figure 2-12), and seafood industries. Recreational fishing generated $691,547 in total sales in west Florida (U.S. Department of Commerce [USDOC] 2012).

Freshwater lakes, streams, and some swamps within the watershed provide a variety of recreational fishing opportunities. Econfina Creek supports largemouth bass (*Micropterus salmoides*), redbreast sunfish (*Lepomis auritus*), and redear sunfish (shellcracker) (*Lepomis microlophus*). Freshwater systems also provide habitat for many species of migratory waterfowl of interest to recreational hunters in the region including rails (*Rallidae*), common moorhen

(*Gallinula chloropus*), snipe (*Scolopacidae*), ducks, geese, coot (*Fulica*), and woodcock (*Scolopax*) (FWC 2015a).

Estuarine and marine waters provide an important source for both commercial and recreational fisheries and some waterfowl hunting as well. Significant portions of the St. Andrew Bay watershed are designated Class II waters of the state (designated for shellfish propagation or harvesting). The watershed contains significant areas that are approved or conditionally approved for shellfish harvesting (see Figure 2-12). Some commercially and recreationally important fish and shellfish of the St. Andrew Bay watershed include shrimp (*Penaeus spp*.), eastern oysters (*Crassostrea virginica*), spotted seatrout (*Cynoscion nebulosus*), Gulf menhaden (*Brevoortia patronus*), red drum or redfish (*Sciaenops ocellatus*), blue crab (*Callinectes sapidus*), Gulf flounder (*Paralichthys albigutta*), striped mullet (*Mugil cephalus*), white mullet (*Mugil curema*), and bay scallop (*Argopecten irradians*).

Waterbodies within the St. Andrew Bay watershed also support local subsistence fisheries. Subsistence fishing refers to fishing carried out primarily for the purpose of obtaining food (or money for food), rather than participation in the commercial or strictly recreational fishing industry. A study sponsored by Impact Assessment, Inc., under contract from the National Marine Fisheries Service in 2003, focused on Florida's west coast, investigating fishing-dependent communities (Huang 2003). Since the late 1970s, these communities experienced a decline due to increases in shoreline development, overfishing, and permit requirements (Huang 2003). The health and public access of the waterbodies within the St. Andrew Bay watershed (and other Florida watersheds) are essential for those utilizing fisheries for subsistence.

St. Andrew Bay is currently closed for scallop harvesting due to the vulnerable and sparse condition of local populations. Scallops are extremely sensitive to changing environmental conditions such salinity, changes in other flora and fauna, changes in sedimentation, pollution and harmful algal blooms (HABs). Because of this sensitivity and the fact that scallops only live one year, local populations are susceptible to periodic collapses. At sites surveyed by the Florida Fish and Wildlife Research Institute (FWRI), scallop populations within St. Andrew Bay have been fluctuating over the past 20 years (FWC 2012, 2016a). Recent surveys have reported no healthy populations (≥ 25 scallops/600 square meter) in ten of the past 17 years, although in three of those years, healthy and transitional populations were reported in roughly half of the survey sites.

Sources: FDACS 2016a; NOAA 2015a; USGS 2016b.

Figure 2-12 Shellfish Harvest Areas

St. Joseph Bay has been open to scalloping for most of the past 20 years. Bay scallop population collapses were observed in 2000, 2004, and 2016. However, most years within the past two decades have shown relatively stable populations, with some vulnerable areas across the survey sites (FWC 2016b). Commercial harvest of scallops is not permitted in the state of Florida (FWC 2016c).

2.5.5 Recreation and Aesthetic Value

The waterbodies and wetlands within the St. Andrew Bay watershed offer other important recreational values, besides fishing, as tourists are attracted to the Florida Panhandle for the mild climate, beaches, golfing, hunting, boating, and other water sports (FWC 2014). Increases in visitors utilizing water resources leads to economic growth in surrounding communities, as visitors will financially contribute not only to recreational activities associated with the water, but also to hotels, restaurants, and retail establishments.

As observed in many areas, ecotourism is an increasingly important component of the economic health of communities within the watershed. Resources such as state and national parks, preserves, conservation lands, and management areas (described in Section 3.5) attract tourists, leading to increased awareness and protection of valuable natural resources. The presence of diverse habitats, as well as rare, imperiled, endemic, and protected species, are additional drivers for people to visit and contribute to the watershed.

According to the Florida State Parks System Direct Economic Impact Assessment, state parks within the St. Andrew Bay watershed, including Grayton Beach, Deer Lake, T.H. Stone Memorial St. Joseph, St. Andrew, Camp Helen, and Constitution Convention state parks, hosted a total of 1.3 million visitors in the 2013/2014 FDEP fiscal year and generated total economic impacts of $102 million while directly supporting over 1,400 jobs. State parks in the watershed attracted approximately 300,000 more visitors in 2013/2014 than during the 2010/2011 fiscal year and more than doubled their revenue (FDEP 2011a, 2014a). St. Andrew State Park was one of Florida's top-ten state parks with the greatest direct economic impact for both the 2010/2011 and 2013/2014 fiscal years. It ranked fourth across the state in fiscal year 2010/2011 and seventh across the state in fiscal year 2013/2014 (FDEP 2014a). This study suggests that there is a continuing high demand for pristine natural areas for recreation visits in the St. Andrew Bay watershed.

The St. Andrew Bay watershed also provides visual aesthetics, thereby, facilitating local art and community-based activities. Nature has always played a role in creative expression, and Florida, in particular, has influenced countless artists (both local and visiting). By working to conserve natural areas, communities can nurture the artistic spirit and promote future generations to continue preserving and utilizing nature for artistic expression (TNC 2016a). Museums, fishing tournaments, and festivals revolving around local art, seafood, and other cultural affairs are important economic drivers, as well as opportunities to bring communities together around heritage and the unique natural environment found in the area. Some of these events include the Panama City Beach Art Walk, Panama City's Annual Celebrate the Arts Festival, the Forgotten Coast Plein Air Painters Invitational, and various fresh and saltwater fishing tournaments (Destination Analysts 2015).

2.6 Ecological Resources

The St. Andrew Bay watershed supports a diversity of natural habitats, including upland, coastal, transitional, wetland, aquatic, estuarine, and marine communities (FNAI 2010). Natural communities are characterized and defined by a combination of physiography, vegetation structure and composition, topography, land form, substrate, soil moisture condition, climate, and fire. They are named for their most characteristic biological or physical feature (FNAI 2010). Based on Geographic Information Systems (GIS) analysis of the St. Andrew Bay watershed, there are 36 unique natural communities within 15 broader community types characterized by the FNAI.

The St. Andrew Bay watershed supports a wealth of biological diversity including a number of rare and/or endemic species, largely due to its rich, diverse mosaic of natural community types. One catalog of the known species from the St. Andrew Bay estuarine system reported 1,649 species of invertebrates, 398 species of vertebrates, and 350 species of plants. More recent publications (Keppner and Keppner 1997, 2001; Wunderlin *et al.* 1996) have expanded the list of known species occurrences, primarily through the addition of freshwater invertebrates and algae along with vascular plants, to a total of 3,643 species (Keppner and Keppner 2008). Among these resources are expansive seagrass beds and other habitats supporting diverse populations of fish and invertebrates, migratory birds utilizing the Atlantic Flyway, and a multitude of commercial and recreationally important fish and shellfish species.

This section provides a summary of habitats and natural communities found in the watershed, particularly those most-influenced by surface water management activities, as well as information about some of the more important biological resources associated with them. 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 B and C (FNAI 2010, 2016a, 2016b, 2016c).

2.6.1 Seagrass Beds

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 as compared to other coastal waterbodies in northwest Florida. These attributes make them an ideal habitat for seagrass communities. St. Joseph Bay alone supports approximately 9,669 acres of seagrass beds and 762 acres of nearshore saltmarshes, as well as substantial mollusk reefs, octocoral beds, and sponge beds (FDEP 2008). St. Andrew Bay includes an estimated 12,193 acres of seagrass beds and many miles of nearshore marshes (FWC 2015b).

Seagrass beds in the St. Andrew Bay watershed are extremely important, as they support an abundance of fish and invertebrates, many of which are commercially and recreationally important (FDEP 2008). Among these are shrimp, eastern oysters, spotted seatrout, Gulf menhaden, red drum or redfish, blue crab, Gulf flounder, striped mullet, white mullet, and bay scallop (NWFWMD 2000).

Seagrass beds are a protected habitat recognized by both the state and federal agencies. The clear, shallow waters of St. Andrew Bay and St. Joseph Bay are dominated by shoal grass (*Halodule wrightii*) and turtle grass (*Thalassia testudinum*), and in deeper waters, manatee grass (*Syringodium filiforme*). Seagrass coverage within the watershed is shown in Figure 2-13.

Sources: FWC 2015c; NOAA 2015a; USGS 2016b.

Figure 2-13 Seagrasses in the St. Andrew Bay Watershed

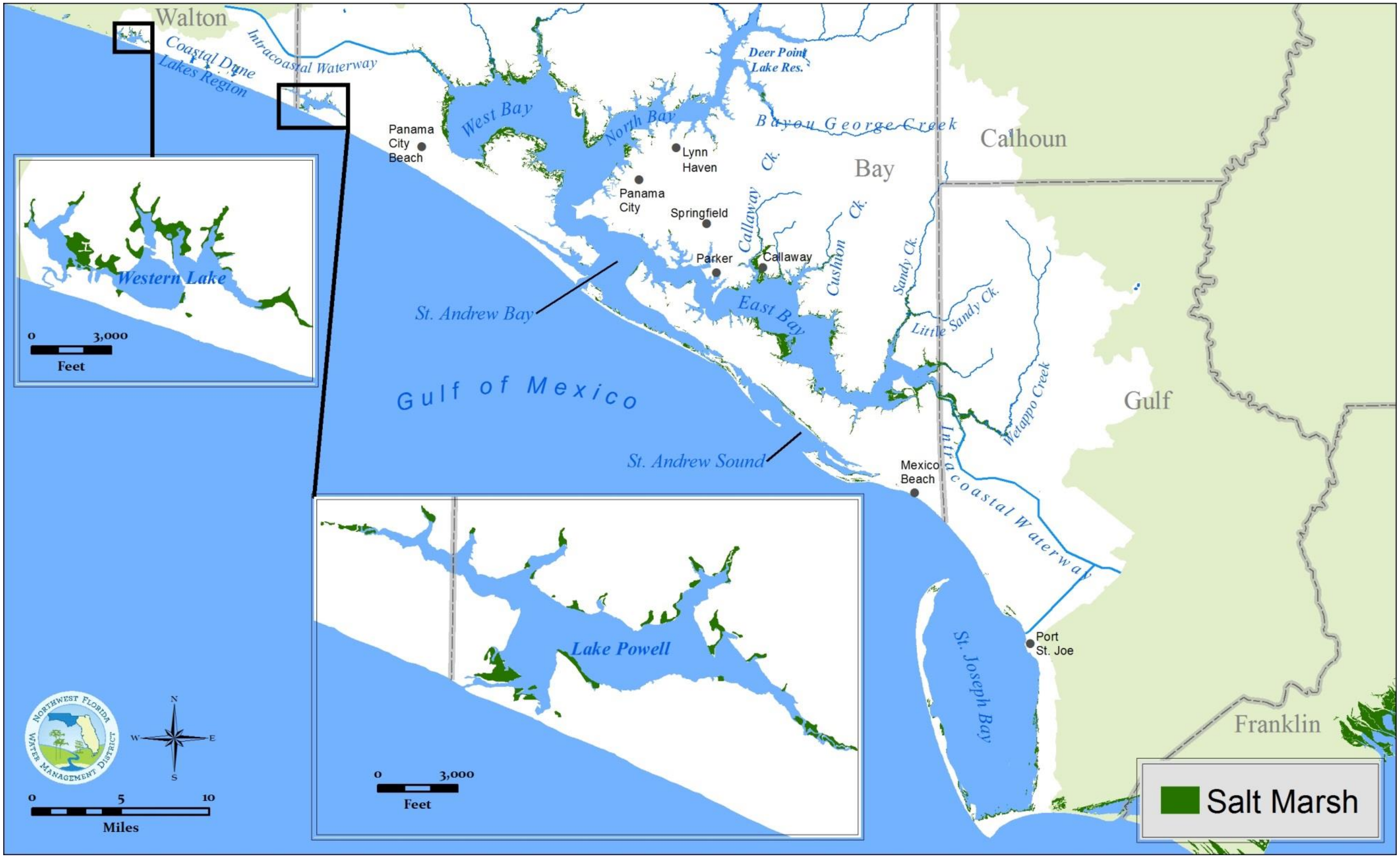
2.6.2 Oyster Reefs

The availability of hard substrate for colonization is a determining factor for the establishment of oyster reefs. Oyster reefs have been widely demonstrated to improve water quality, protect shorelines by abating wave energy, stabilize bottom sediments, and provide habitat for fish, crab, and other invertebrates. There is limited data available regarding the area of this habitat in the St. Andrew Bay estuary, but efforts are underway by the FWC (with funding from the NFWF) to increase the extent of oyster reefs to assist with seagrass restoration in West Bay.

2.6.3 Emergent Marsh

Marshland, including salt (brackish) marsh and freshwater emergent marsh, is abundant in the St. Andrew Bay watershed (Figure 2-14). 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 large, 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.

Salt marshes are among the most productive plant communities on Earth (Fernald 1998). Among the most abundant species found in salt marshes are mussels (*Mytilidae*), oysters, fiddler crabs (*Uca sp*.), marsh periwinkles (*Littoraria irrorata*), crown conchs (*Melogena corona*), mullet, and blue crabs. Emergent freshwater and brackish marshes are dominated by sawgrass (*Cladium jamaicense*), maidencane (*Panicum hemitomon*), giant cutgrass (*Zizaniopsis miliacea*), and cattails (*Typha spp*.); but may contain large interspersed patches of black needlerush. In contrast with more coastal salt marshes, these sites lack the extensive salt flats of saltgrass (*Distichlis spicata*), glasswort (*Salicornia spp.*), and salt barrens.



Sources: FWC 2011; NOAA 2015a; USGS 2016b.

Figure 2-14 Salt Marshes

2.6.4 Palustrine, Riparian, and Floodplain Habitats

Riparian habitats include those areas along waterbodies that serve as an interface between terrestrial and aquatic ecosystems. Riparian areas are important fish and wildlife habitat 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.

Many floodplains and riparian areas include wetland habitats. Basin marsh, baygall, dome swamp, hydric hammock, floodplain swamp, and wet prairie are the primary types of wetland habitats found in the St. Andrew Bay watershed (FNAI 2016a, 2016b). The northernmost reaches of the watershed fall within the Sand Hill Lakes; an important recharge area for the Floridan aquifer. Several lakes in the region contain globally unique plant species, such as smooth-barked St. John's wort (*Hypericum lissophloeus*) (further discussed in Section 2.6.6). The Econfina Creek WMA contains multiple wetland habitat types, as well as sandhill upland lakes (FWC 2016d).

2.6.5 Steepheads

Steepheads are relatively small springs which form when groundwater begins to collect underground and flow along a relatively impermeable layer. Where this layer intersects a sloping ground surface it can cause erosion of the slope base. This process can ultimately form the beginnings of a groundwater fed stream in the underside of a hill (FNAI 2010). Such streams usually have shallow channels containing little to no aquatic vegetation. They often form the headwaters of alluvial and blackwater streams and are known for their biologically diversity.

2.6.6 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 unique 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). Listed species and natural communities are described in more detail in Appendices B and C, respectively.

St. Joseph Peninsula is integrated closely with St. Joseph Bay. A network of public and conservation lands play a major role in protecting the quality and integrity of the terrestrial and aquatic systems, as well as providing for public access and enjoyment. Among these are St. Joseph Peninsula State Park, the St. Joseph Bay State Buffer Preserve, Rish Park, local parklands managed by Gulf County and Port St. Joe, and approximately 500 acres of U.S. Air Force land on Cape San Blas.

2.6.7 Coastal Dune and Sandhill Lakes

Coastal Dune Lakes

The St. Andrew Bay watershed contains several named coastal dune lakes (further described in Section 2.3 and shown in Figure 2-10), which are unique geographical features found elsewhere only in Madagascar, Australia, New Zealand, and the state of Oregon (Walton County 2016). These lakes are fed by streams, groundwater seepage, rain, and storm surge and have intermittent outfall connections with the Gulf of Mexico. Coastal dune lakes are managed locally by the Coastal Dune Lakes Advisory Board (Walton County), the FDEP Division of State Lands, and local governments. Water quality and elevation is regularly monitored, and the data is used to manage and regulate the lakes.

For thousands of years, these lakes have adapted to natural processes such as hurricanes, droughts, and land subsidence. Due to their limited distribution and potential vulnerability, they have been identified by the FNAI and others as being globally rare and imperiled (FNAI 2010).

Aside from their rarity and beauty, coastal dune lakes provide an important stopover point for migrating neo-tropical birds, habitat for aquatic and marine animals, freshwater for aquatic plants, and fish and recreation for residents and visitors. Coastal dune lakes provide habitat for a number of listed species, including migratory birds such as piping plovers (*Charadrius nivosus*) and red knots (*Calidris canutus*), which use the lakeshore edges and outfalls for foraging during their winter migration. Snowy plovers (*Charadrius nivosus*) and least terns (*Sternula antillarum*) use dune habitats adjacent to the lakes for nesting and quality foraging habitat for their chicks (FDEP 2014b).

Lake Powell is the largest coastal dune lake in the St. Andrew Bay watershed. Like other dune lakes in the region, Lake Powell exhibits an intermittent connection to the Gulf of Mexico. 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 an ephemeral channel can form naturally 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 per a permit issued by Bay County and the Florida Division of Recreation and Parks. On average, there are about six inlet openings per year excavated at the Phillips Inlet area (FDEP 2014b).

Sand Hill Lakes

As described by Keppner and Keppner (2008), the Sand Hill Lakes, which can be found in the northern-most 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).

2.6.8 Springs

Florida's springs are significant natural resources, as they can support entire ecosystems and protected species, provide high quality water and recreational use, and discharge to rivers, estuaries, or nearshore waters dependent on clean, clear, fresh water. Florida has more springs than any other state due to underlying geologic formations containing porous marine limestone that holds and transports water, making the Floridan aquifer system one of the most productive freshwater aquifer systems in the world (Florida's Springs 2016).

Major springs along Econfina Creek include:

- **Gainer Springs Group;**
- **Williford Spring;**
- **Pitt Spring;**
- **Econfina Blue Springs Group;**
- **Devil's Hole Spring; and**
- **Sylvan Springs Group.**

The St. Andrew Bay watershed, particularly within the Econfina recharge area, is among the most important and significant concentrations of Floridan aquifer springs in the state. See Section 2.4.5 for a detailed discussion.

Eleven springs or spring groups comprised of more than 36 vents have been identified in the watershed (Figure 2-10). The Gainer Springs Group, on Econfina Creek, is one of only seven first magnitude springs in the NWFWMD. A dye trace performed in the Econfina Creek recharge area demonstrates the vulnerability of the springs, creek, and eventually Deer Point Lake Reservoir to activities within the recharge area (NWFWMD 2014a).

2.6.9 Terrestrial Communities

Upland communities, which include bluffs, mesic flatwoods, sandhill, scrub, scrubby flatwoods, upland hardwood forests, wet flatwoods, and xeric hammocks, provide important habitat, as well as economic and other resources. Federally listed species supported by upland communities within the watershed include the gopher tortoise (*Gopherus polyphemus*), the reticulated flatwoods salamander (*Ambystoma bishopi*), the eastern indigo snake (*Drymarchon corais couperi*), and the red-cockaded woodpecker (*Picoides borealis*), all of which have been documented on the watershed's conservation lands.

Historically, the St. Andrew Bay watershed has been used primarily for agriculture and silviculture. Widespread silviculture activities have caused significant alterations to the landscape and associated hydrology through the construction of dirt roads, overharvest of the native longleaf pine (*Pinus palustris*), and conversion of natural forest lands to slash and sand pine plantations.

2.6.10 Migratory Bird Flyways

The Florida Panhandle falls within two major migratory bird biological flyways; the Atlantic Flyway and the Mississippi Flyway. "Biological" flyways delineate the major migration corridors, while "administrative" flyways are based on the state jurisdictional boundaries that best mimic biological flyways for management purposes. The state of Florida falls within the Atlantic administrative flyway, and the St. Andrew River and Bay watershed is predominantly within the Atlantic biological flyway. The Atlantic flyway is a migratory route that generally follows the Atlantic Coast of North America and the Appalachian Mountains (Bird Nature 2001). Millions of individuals representing over 500 bird species use this route because there is little extreme mountainous terrain and it has good sources of water, food, and cover over its entire length. Forty percent of all species that use the Atlantic flyway are federally-recognized species of conservation concern (Audubon 2011). Many of these species, including least terns (*Sternula antillarum),* piping plovers, American oystercatchers (*Haematopus palliates*), and others, occur throughout the St. Andrew Bay watershed and across a wide variety of habitats. Many of these are area transients, using this area as a resting/feeding ground for summer or winter migrations. Others are accidental visitors, far from their native ranges. Of the bird species utilizing the watershed, approximately one-fifth are dependent on the marine/estuarine environment (Florida Department of Natural Resources 1991).

3

3.0 Current Watershed Conditions and Water Resource Issues

3.1 Introduction

Increasing population, industrialization, and development in northwest Florida are correlated with land use changes and an increased need for added infrastructure. With proper planning and management practices, the impacts of human activities and development that can diminish the overall health of the ecosystem and its many benefits for the people and communities can be reduced.

The following summary of water quality, point and NPS pollution, eutrophication, HABs, conserved and managed lands, and floodplains should inform future planning, development, preservation, and restoration efforts within the watershed. Further discussion on management programs for water quality protection and improvement, including monitoring, BMP development and land use planning can be found in Section 6.0.

3.2 Water Quality

The following discussion identifies impaired waterbodies (per FDEP) throughout the St. Andrew Bay watershed, the potential sources of pollution responsible for those impairments, and ecological indicators of water quality.

3.2.1 Impaired Waters

All states are required identify impaired waters (waters too polluted or degraded to meet state water quality standards, including applicable water quality criteria and designated uses, such as drinking water, recreation, and shellfish harvesting) and submit lists of such waters to the EPA under Section 303(d) of the Clean Water Act (CWA) (EPA 2016a). In Florida, the FDEP is responsible for fulfilling this function.

Of the 189 waterbody segments in the St. Andrew Bay watershed, the FDEP has identified 75 impaired segments with 89 total impairments, including 57 for mercury in fish tissue, 26 for bacteria (fecal coliforms, beach advisories, or shellfish harvesting classification), four for dissolved oxygen (DO), and two for nutrients (FDEP 2014c). A segment can be impaired for more than one pollutant; thus, the number of impairments may exceed the total number of impaired segments. The impaired waters and the pollutant causing the impairment are shown in Figures 3-1 and 3-2. The list of impaired waters, including the water segment name, waterbody identification number (WBID), counties crossed, waterbody class, and the pollutant causing the impairment can be found in Appendix D. The list includes data current through June 2010 (FDEP 2014c). The state adopted an updated list of impaired waters for the watershed in October 2016, with data current through June 2015. The next updated list of impaired waters for the St. Andrew Bay watershed is scheduled for adoption in March 2021 (O' Donnell 2016).

Authorities in Florida issue human fish consumption advisories for mercury in fish tissue. The advisories in Florida are issued by the Florida Department of Health (FDOH) in cooperation with the FWC and FDEP. Health advisories prohibiting the harvesting of shellfish due to potential bacterial contamination are issued by the FDACS. Shellfish advisories and seasonal closures can be found on the FWC website (www.myfwc.com), and the FDACS website (http://www.freshfromflorida.com/Divisions-Offices/Aquaculture/Shellfish-Harvesting-Area-Classification). The FDEP identified three waterbody segments as verified impaired for bacteria in the St. Andrew Bay watershed, based on shellfish classifications issued by FDACS (FDEP, 2014a):

- East Bay (East) (WBID 1061F);
- North Bay (North Segment 1) (WBID 1061G); and
- Sandy Creek (WBID 1111).

County health departments in Florida monitor beaches and other public swimming areas for bacterial contamination and issue health advisories closing beaches when bacterial counts are too high. Based on the high number of beach closures, the FDEP identified ten beach segments as verified impaired for bacteria in the St. Andrew Bay watershed (FDEP 2014c):

- Carl Gray Park (WBID 1061BB);
- Beach Drive (WBID 1061CB);
- Delwood (WBID 1061EB);
- Dupont Bridge (WBID 1061FB);
- St. Joe Monument Beach (WBID 1267C);
- Laguna Beach (WBID 8012B);
- Bid-A-Wee Beach (WBID 8013A);
- Beckrich Road (WBID 8013B);
- Rick Seltzer Park (WBID 8013C); and
- 8th Street (WBID 8015A.

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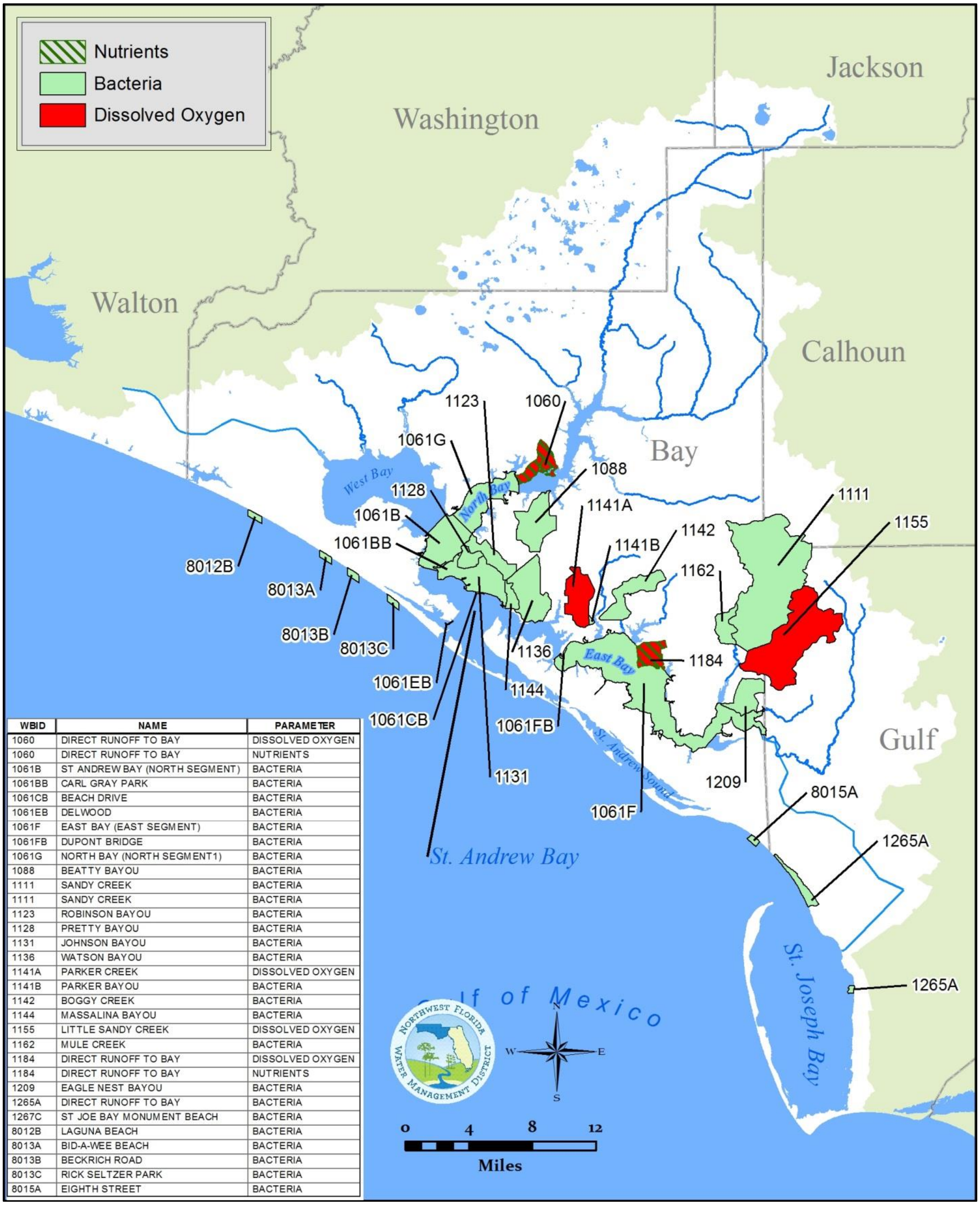
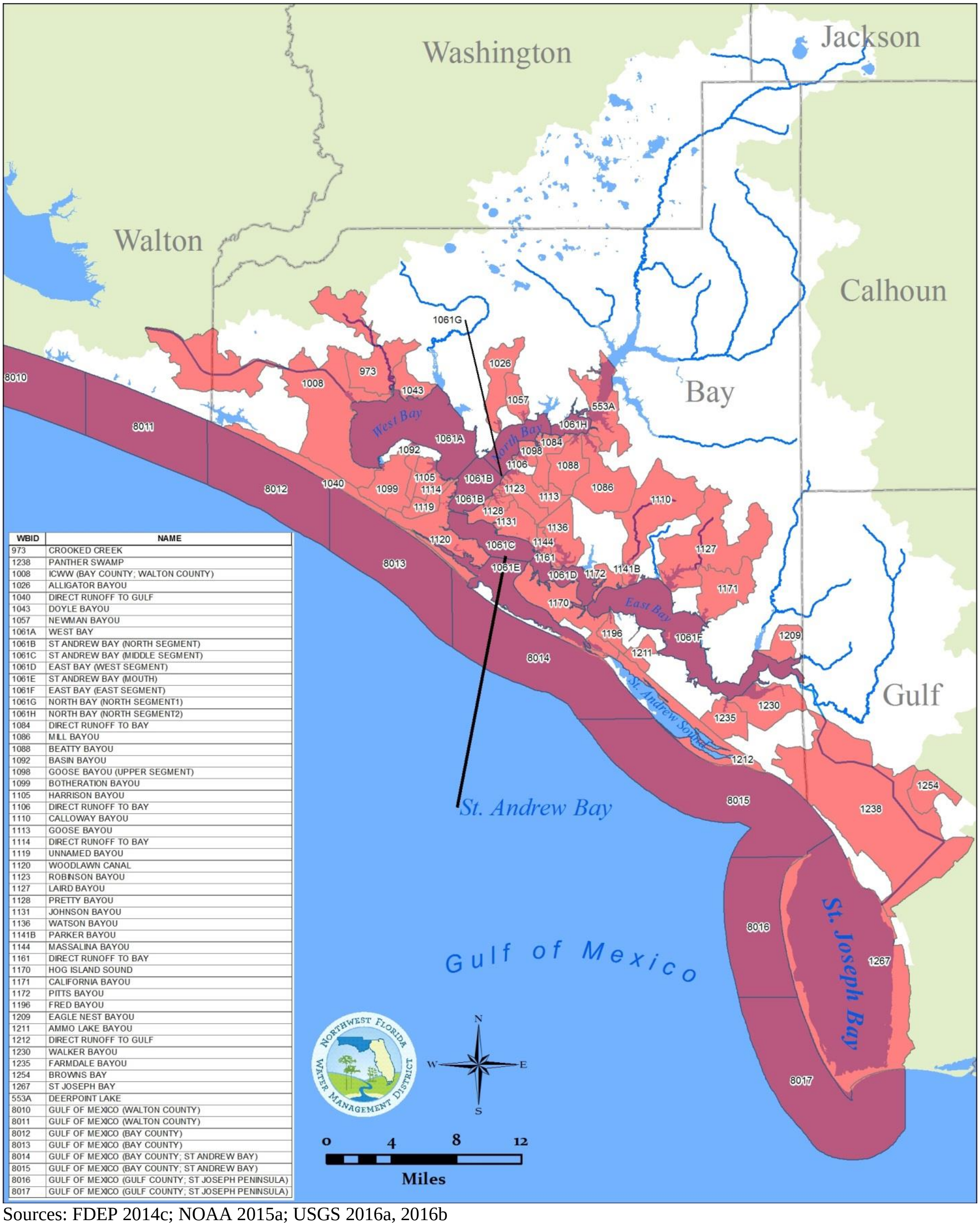


WBID	NAME	PARAMETER
1060	DIRECT RUNOFF TO BAY	DISSOLVED OXYGEN
1060	DIRECT RUNOFF TO BAY	NUTRIENTS
1061B	ST ANDREW BAY (NORTH SEGMENT)	BACTERIA
1061BB	CARL GRAY PARK	BACTERIA
1061CB	BEACH DRIVE	BACTERIA
1061EB	DELWOOD	BACTERIA
1061F	EAST BAY (EAST SEGMENT)	BACTERIA
1061FB	DUPONT BRIDGE	BACTERIA
1061G	NORTH BAY (NORTH SEGMENT1)	BACTERIA
1088	BEATTY BAYOU	BACTERIA
1111	SANDY CREEK	BACTERIA
1111	SANDY CREEK	BACTERIA
1123	ROBINSON BAYOU	BACTERIA
1128	PRETTY BAYOU	BACTERIA
1131	JOHNSON BAYOU	BACTERIA
1136	WATSON BAYOU	BACTERIA
1141A	PARKER CREEK	DISSOLVED OXYGEN
1141B	PARKER BAYOU	BACTERIA
1142	BOGGY CREEK	BACTERIA
1144	MASSALINA BAYOU	BACTERIA
1155	LITTLE SANDY CREEK	DISSOLVED OXYGEN
1162	MULE CREEK	BACTERIA
1184	DIRECT RUNOFF TO BAY	DISSOLVED OXYGEN
1184	DIRECT RUNOFF TO BAY	NUTRIENTS
1209	EAGLE NEST BAYOU	BACTERIA
1265A	DIRECT RUNOFF TO BAY	BACTERIA
1267C	ST JOE BAY MONUMENT BEACH	BACTERIA
8012B	LAGUNA BEACH	BACTERIA
8013A	BID-A-WEE BEACH	BACTERIA
8013B	BECKRICH ROAD	BACTERIA
8013C	RICK SELTZER PARK	BACTERIA
8015A	EIGHTH STREET	BACTERIA

Sources: FDEP 2014c; NOAA 2015a; USGS 2016a, 2016b.

Figure 3-1 Impaired Waterbody Segments in the Watershed, Excepting Mercury



WBID	NAME
973	CROOKED CREEK
1238	PANTHER SWAMP
1008	ICWW (BAY COUNTY; WALTON COUNTY)
1026	ALLIGATOR BAYOU
1040	DIRECT RUNOFF TO GULF
1043	DOYLE BAYOU
1057	NEWMAN BAYOU
1061A	WEST BAY
1061B	ST ANDREW BAY (NORTH SEGMENT)
1061C	ST ANDREW BAY (MIDDLE SEGMENT)
1061D	EAST BAY (WEST SEGMENT)
1061E	ST ANDREW BAY (MOUTH)
1061F	EAST BAY (EAST SEGMENT)
1061G	NORTH BAY (NORTH SEGMENT1)
1061H	NORTH BAY (NORTH SEGMENT2)
1084	DIRECT RUNOFF TO BAY
1086	MILL BAYOU
1088	BEATTY BAYOU
1092	BASIN BAYOU
1098	GOOSE BAYOU (UPPER SEGMENT)
1099	BOTHERATION BAYOU
1105	HARRISON BAYOU
1106	DIRECT RUNOFF TO BAY
1110	CALLOWAY BAYOU
1113	GOOSE BAYOU
1114	DIRECT RUNOFF TO BAY
1119	UNNAMED BAYOU
1120	WOODLAWN CANAL
1123	ROBINSON BAYOU
1127	LAIRD BAYOU
1128	PRETTY BAYOU
1131	JOHNSON BAYOU
1136	WATSON BAYOU
1141B	PARKER BAYOU
1144	MASSALINA BAYOU
1161	DIRECT RUNOFF TO BAY
1170	HOG ISLAND SOUND
1171	CALIFORNIA BAYOU
1172	PITTS BAYOU
1196	FRED BAYOU
1209	EAGLE NEST BAYOU
1211	AMMO LAKE BAYOU
1212	DIRECT RUNOFF TO GULF
1230	WALKER BAYOU
1235	FARMDALE BAYOU
1254	BROWNS BAY
1267	ST JOSEPH BAY
553A	DEERPOINT LAKE
8010	GULF OF MEXICO (WALTON COUNTY)
8011	GULF OF MEXICO (WALTON COUNTY)
8012	GULF OF MEXICO (BAY COUNTY)
8013	GULF OF MEXICO (BAY COUNTY)
8014	GULF OF MEXICO (BAY COUNTY; ST ANDREW BAY)
8015	GULF OF MEXICO (BAY COUNTY; ST ANDREW BAY)
8016	GULF OF MEXICO (GULF COUNTY; ST JOSEPH PENINSULA)
8017	GULF OF MEXICO (GULF COUNTY; ST JOSEPH PENINSULA)

Sources: FDEP 2014c; NOAA 2015a; USGS 2016a, 2016b

Figure 3-2 TMDLs in the Watershed

3.2.2 Total Maximum Daily Loads (TMDLs)

A TMDL represents the maximum amount of a given pollutant a waterbody can assimilate and still meet water quality standards, including its applicable water quality criteria and designated uses (such as drinking water, recreation, and shellfish harvesting). 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.

The FDEP has adopted a statewide TMDL for reducing the human health risks associated with consuming fish taken from waters impaired for mercury. Mercury impairments are based upon potential human health risks (fish consumption advisories), not exceedances of water quality criteria. There are no known relationships between environmental and ecological conditions and mercury levels in fish. 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 very small part of mercury in the environment is in the form of methylated mercury, which is biologically available and able to enter the food chain. For these reasons, the statewide TMDL that the FDEP has adopted 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).

No TMDLs have been adopted by FDEP for other parameters causing water quality impairments in the St. Andrew Bay watershed (2016c). There are no pending or adopted Basin Management Action Plans (BMAPs) to implement the adopted TMDL for mercury in the St. Andrew Bay watershed (FDEP 2016b, 2016c). Because there are no TMDLs for parameters other than mercury in the St. Andrew Bay watershed, there are no associated pending or adopted BMAPs. Over the next ten years, the FDEP is scheduled to develop ten bacteria TMDLs and no nutrient TMDLs (FDEP 2014d).

Once a TMDL is adopted by the state, the waterbody segment is removed from the state's impaired waters list. That being said, these waters remain a priority for restoration and restoration funding from the state. In the case of the 56 segments with mercury TMDLs, consumption of fish from these waters should be limited to protect human health as directed by the FDOH. This is important, as these segments will be removed from the impaired waters list when it is updated late in 2016.

Although no waterbody segments with adopted TMDLs have yet to be removed from the state's impaired waters list, previously listed segments have been removed from the list due to flaws in the original analysis or when new data showed the waters to be no longer impaired for the pollutant for which they were originally listed (Table 3-1).

Table 3-1 Waterbody Segments Removed from the Impaired Waters List Because They are No Longer Impaired

Water Segment Name	WBID[1]	Parameter that is No Longer Impaired
Direct Runoff to Bay	1053	Dissolved Oxygen
West Bay	1061A	Nutrients (Historic Chlorophyll-*a*)
Callaway Bayou	1110	Dissolved Oxygen
Watson Bayou	1136	Dissolved Oxygen
Massalina Bayou	1144	Dissolved Oxygen
Pitts Bay	1172	Dissolved Oxygen
Pitts Bay	1172	Nutrients (Historic Chlorophyll-*a*)
St. Joe Bay	1267	Biological Oxygen Demand
St. Joe Bay	1267	Chloride
St. Joe Bay	1267	Fecal Coliform
St. Joe Bay	1267	Nutrients (Historic Chlorophyll-*a*)
Panama City Beach City Pier	8012C	Bacteria (Beach Advisories)

Source: FDEP 2014d.

Due to fluctuations in water quality, the state of Florida issues human consumption advisories for fish and shellfish, when needed. Water quality criteria for fecal coliform bacteria in Florida are 2,000 colony-forming units per 100 milliliters of water. The FDOH issues necessary human consumption advisories through cooperation with the FWC and FDEP. Current fish consumption advisories within the St. Andrew Bay watershed can be found on the FDOH website (www.floridahealth.gov). Shellfish advisories and seasonal closures can be found on the FWC website (www.myfwc.com), and the FDACS website (http://www.freshfromflorida.com/Divisions-Offices/Aquaculture/Shellfish-Harvesting-Area-Classification).

TMDLs for restoring water quality in segments that pose a threat to human health are the highest priority for restoration. There are currently no TMDLs scheduled for development in the St. Andrew Bay Watershed.(FDEP 2014c).

To restore waterbodies with impaired water quality, protect public health, preserve valuable habitat, natural resources, and ecosystem services, and ensure long-term sustainability and resilience, it is critical to understand the local sources of point and NPS pollution, causes of degradation, and the status and health of natural systems and floodplains within the watershed. A comprehensive understanding of watershed conditions and resource issues will inform and facilitate management actions, including planning and permitting.

3.2.3 Point Source Pollution

The EPA defines point source pollution as any discernible, confined, and discrete conveyance from which pollutants are or may be discharged, including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft (EPA 2015a). Examples of point sources include industrial facilities, landfills, wastewater treatment facilities (WWTFs), mines and borrow pits, and marinas, among others. The National Pollutant Discharge Elimination System (NPDES), administered by the EPA, is the permitting program authorized to regulate point source pollution. Within Florida, this permitting has been delegated to the FDEP.

Permits for point source facilities are reviewed and renewed at designated intervals. Specific permits are issued based on the results of water quality based effluent limit studies. The NPDES Permit Writers' Manual encourages permit writers to consider the impact of every proposed surface water discharge on the quality of the receiving water.

There are currently 790 facilities permitted through the NPDES in the St. Andrew Bay watershed including construction permits and other discharges. Together, these facilities hold a total of 875 permits, with some facilities holding multiple permits for multiple types of discharges. For example, a WWTF may be registered in two different NPDES databases and hold a permit for both bio-solids and stormwater.

Most permitted facilities in the watershed are concentrated within and in the vicinity of incorporated areas bordering St. Andrew Bay, along the barrier peninsula from Rosemary Beach to Panama City Beach, and near Tyndall AFB. National Pollutant Discharge Elimination System facilities are sparse in the upper reaches of the watershed. Several point source facilities discharge domestic and industrial wastewater directly into surface waters in the St. Andrew Bay watershed. Additionally, some water reclamation facilities discharge to sprayfields, percolation ponds, and other non-surface waters (NWFWMD 2002). Although water reclamation facility discharge undergoes evaporation and bioremediation, a portion of the discharge enters the local groundwater. Given connections between groundwater and surface waters, these discharges must be well planned and regulated to protect water quality.

Wastewater Treatment Facilities

Wastewater treatment facilities (WWTF), particularly those near streams, rivers, and the coast, as well as those constructed on highly permeable soil and karst geology, are potential sources of point source pollution. Wastewater disposal can introduce nutrients, bacteria, and other pollutants to surface waters and groundwater. There are 12 permitted domestic wastewater facilities and 17 industrial wastewater facilities within the watershed (Figure 3-3). Wastewater treatment facilities are located primarily in populated areas, with the highest concentration of facilities in the vicinity of Panama City, Panama City Beach, Tyndall AFB, and Port St. Joe.

The Lynn Haven WWTF, Military Point Regional Advanced Wastewater Treatment (AWT) Facility, Millville AWT Facility, and St Andrews WWTF currently dispose of treated wastewater to the St. Andrew Bay estuary. Together, these facilities are permitted for an average daily discharge of 19.5 million gallons per day (NWFWMD 2014b). In Washington County, north of the Econfina Creek WMA, the Sunny Hills WWTF uses oxidation ponds to treat effluent.

There is one WWTF (Seacrest WWTF) in Walton County located at Santa Rosa Beach, and one wastewater treatment sprayfield in Gulf County located in Port St. Joe. Bay County currently operates three wastewater facilities: Military Point Regional AWT Facility, North Bay WWTF, and RiverCamps WWTF. However, the county is planning to decommission RiverCamps WWTF and redirect flow to North Bay WWTF (NWFWMD 2014b). In June 2015, the North Bay Wastewater Collection System Improvements Project was approved by the Bay County Board of County Commissioners for funding through the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act (RESTORE Act) Direct Component (Bay County 2014). Through this project, reclaimed water will be provided to Gulf Power Company for use in plant processes, eliminating the use of surface waters and eliminating surface water discharges. At the time of this writing, facilities associated with the project are also under consideration for state and district funding.

In the 1990s, the Panama City Beach WWTF discharged effluent directly into West Bay. Water quality data for 1990-2006 show that chlorophyll-*a* and turbidity were higher in West Bay than in most other areas of the estuary. In April 2011, the 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 the discharge permitted at up to 14 million gallons per day (City of Panama City Beach 2016; NWFWMD 2014b).

Wastewater reclamation that supports beneficial reuse has the potential to further decrease pollution in surface waters, while also limiting or reducing potable water demand. Although some facilities are already redirecting wastewater discharges, there are substantial opportunities for expansion of the reuse of reclaimed water. For example, of Bay County's 12 golf courses, only one currently receives reclaimed water for irrigation. For facilities that already have re-use programs, finding additional recipient sites could reduce surface water discharges. Potential recipient sites include irrigated public areas, such as recreational fields and landscaped areas of public facilities, roadway medians, greenway trails, and irrigated agricultural fields, as well as golf courses. Currently, the Military Point Regional AWT Facility does not have any re-use storage, which limits reclaimed water availability and reliability (NWFWMD 2014b).

Sources: FDEP 2015c; NOAA 2015a; USGS 2016b.

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

Landfills and Solid Waste Disposal Facilities

Landfills and solid waste disposal facilities are a potential source of contamination to surface waters and groundwaters through the percolation of rainwater into waste materials and the leaching of soluble toxins. In the St. Andrew Bay watershed, there are 105 landfills and solid waste disposal facilities recognized by the FDEP, including landfills, yard waste disposal facilities, waste to energy facilities, and construction and debris disposal landfills (Table 3-2). Many of these facilities are closed or inactive, but may still pose a threat to water quality through the leaching of capped waste, if not managed properly.

Table 3-2 Solid Waste Facilities

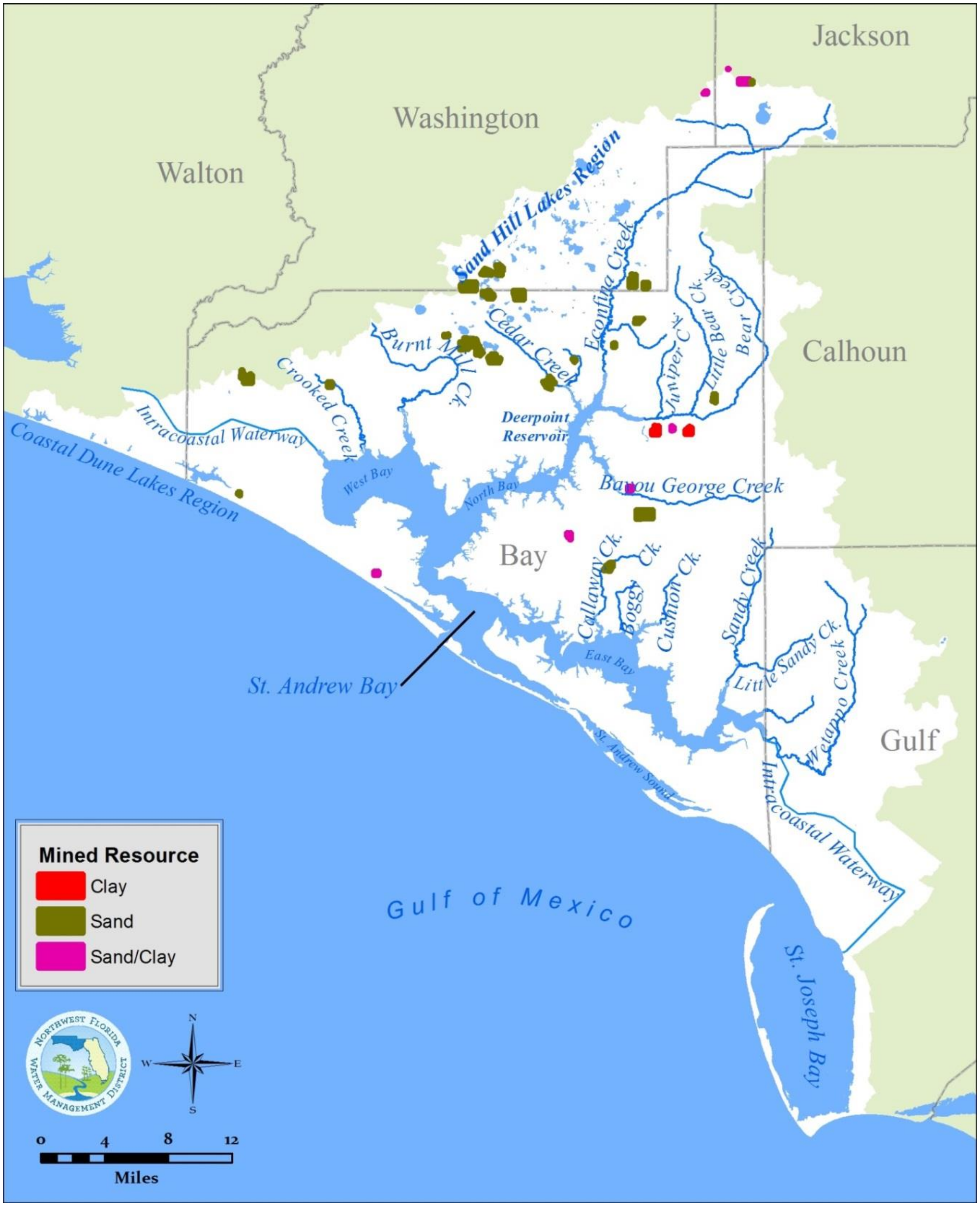
Type of Landfill/Solid Waste Facility	Number of Facilities
Active Sites	15
Not Permitted/Registered	9
Inactive (Registered and Non-Registered)	33
No-Further Action Facilities	7
Closed Facilities	32
Complaint is Under Investigation	2
Registered (No Further Information)	7

Source: FDEP 2016d.

Most landfills and solid waste disposal facilities in the watershed are near the major developed areas along the St. Andrew Bay (Table 3-2) (FDEP 2016d). Over half of the facilities in the watershed are located in Panama City or Panama City Beach. Additionally, seven facilities are in Port St. Joe. A comprehensive list of the solid waste facilities, their location, and status is maintained by the Solid Waste Section of the FDEP (FDEP 2016e).

Mines and Borrow Pits

Mining and extraction activities near waterbodies can cause turbidity, sedimentation, and smothering, if not managed appropriately. 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 the FDEP (Figure 3-4), many of which are 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).



Sources: FDEP 2015d; NOAA 2015a; USGS 2016a, 2016b

Figure 3-4 Mines Located in the St. Andrew Bay Watershed

Industrial Facilities and Superfund Sites

Degradation of water and/or sediment by toxic chemicals can impact surface water quality and the health of associated upland and aquatic habitats and generate contaminated food chains in which top predators are most significantly harmed. Chemical contaminants can also be harmful to humans, particularly through consumption of seafood containing elevated quantities of mercury, polychlorinated biphenyls (PCBs), dioxin, and other harmful chemicals. Public health agencies monitor concentration levels of undesirable chemicals that occur in public natural resource land and recreational waters (EPA 2015b, 2015c).

In the St. Andrew Bay watershed, there are four hazardous waste producing facilities registered as EPA Biennial Reporter facilities. Additionally, 296 closed and 172 active sites within the watershed are registered with the Storage Tank and Petroleum Contamination Monitoring (STCM) database. There are 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 at Tyndall AFB. In the past, operations at the base resulted in contaminated soil, sediment, groundwater, and surface water. The EPA, Air Force, and the FDEP signed an Interagency Agreement on September 20, 2013, to guide the cleanup of the base. A Site Management Plan was originally 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 an ongoing need and effort (EPA 2016b).

Other contaminated sites in the watershed include two facilities (Town and Country Lake Estates in Springfield and Kamax, LLC, in Panama City), which are registered under the state-funded cleanup program. The state-funded cleanup 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. Remediation efforts are triggered when an FDEP district office requests adoption of a site for state-funded cleanup. Arc One Welding in Panama City is a state-funded site that recently became delisted. 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.

Marinas

Due to the location of marinas at the water's edge, there is a strong potential for marina waters to become contaminated with pollutants generated from the various activities that occur at marinas—such as boat cleaning, fueling operations, and marine head (sanitary sewage) discharge—or from the entry of stormwater runoff from parking lots and hull maintenance and repair areas into marina basins. Although some of these would be considered NPS pollution, many of them are point sources (e.g., hull painting, engine maintenance, etc.). Such facilities have the potential to release pollutants, including vessel wastewater, oil and grease, heavy metals, and other pollutants. Actual pollution from marinas can depend on the availability of pump-out facilities and the level and consistency of marina BMP implementation (FDEP 2015e, 2016f).

CLEAN MARINA | CLEAN BOATYARD

"The Florida Clean Marina Program and Florida Clean Boatyard Program are voluntary designation programs for implementing environmental practices to protect Florida's waterways such as implementing BMPs, using dustless sanders, recycling oil and solvents, and re-circulating pressure wash systems to recycle wastewater."

Source: FDEP, About Florida Clean Marina Programs.

Major marinas are located at St. Joseph Peninsula State Park, Port St. Joe, the Naval Support Activity Center, Panama City Beach at Grand Lagoon, St. Andrew 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). Water quality will likely continue to improve as the remaining major marinas implement BMPs and become certified under the Florida Clean Marina Program. There is also significant room for improvement in smaller marinas located in incorporated and unincorporated communities, which contribute to water quality issues, but often go unaddressed because of their size and remote locations.

3.2.4 Nonpoint Source (NPS) Pollution

Nonpoint source 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, toxic metals, pesticides, and other contaminants. Pollutants entering the groundwater may also emerge in surface waters via seepage and spring discharges. Typical categories of NPS pollution include surface runoff of stormwater, leaching from agricultural areas and on-site sewage treatment and disposal systems (OSTDS) (e.g., septic tanks), as well as erosion and sedimentation from un-vegetated lands, including construction sites and unpaved roads. Atmospheric deposition of nitrogen, sulfur, mercury, and other toxic substances via fossil fuel combustion may also contribute to NPS pollution.

In addition to causing current water quality challenges, NPS pollution is likely to be one of the most significant threats to future environmental quality in the St. Andrew Bay watershed. Increases in population and land use changes from rural to urban or suburban, especially in areas located near waterbodies, has the potential to increase stormwater runoff into St. Andrew Bay. Septic systems along the bay system, stormwater runoff, and increased residential development may all contribute to nutrient loading to the bay.

Basins dominated by upland forest, wetland-cover, and low densities of impervious surface tend to be associated with good water and habitat quality (Allan *et al*. 1997; Wang *et al*. 1997). Vegetation provides habitat, regulates runoff, maintains surface and surficial groundwater flow, prevents erosion, and moderates effects of floods and droughts. Wetland functions include floodwater storage, sediment and shoreline stabilization, and fish and wildlife habitat. Riparian and in-stream vegetation contribute to nutrient cycling and primary production, which may remove nutrient pollutants transported by stormwater, such as nitrogen and phosphorus, from surface waterbodies. Urban areas typically have less vegetation and wetland areas that moderate flows and provide recharge, storage and treatment for runoff. Additionally, vegetated areas within urban zones tend to be heavily managed landscaped tracts where the use of fertilizers, pesticides, and herbicides pose additional concerns for NPS pollution and water quality (EPA 1993).

Urbanization and Stormwater

Stormwater runoff is the main contributor to NPS pollution, and it is closely associated with land use. Urban land uses, especially residential, commercial, and industrial uses, have the highest NPS pollution per acre due to increased impervious surface area that increases runoff and generates stormwater. In urban areas, lawns, roadways, buildings, commercial, and institutional properties all contribute to NPS pollution. Potential pollutants associated with stormwater include solids, oxygen-demanding substances, nutrients, pathogens, petroleum hydrocarbons, metals, and synthetic organics (EPA 2016c). Urbanization causes the most severe environmental impacts associated with NPS pollution, including degraded water and sediment quality and physical degradation of benthic and littoral communities (Booth and Jackson 1997; Ferguson and Suckling 1990). The Panama City-Bay County area has three major industrial parks totaling 560 acres including the Port Panama City Industrial Complex, Hugh Nelson Industrial Park, and Bay Industrial Park. In addition, the Port Authority and the Bay Line Railroad are in the process of developing a new 1,500-acre industrial park (Panama City 2016).

Significant investments have been made in improving stormwater management and treatment systems throughout the watershed. There continues to be substantial opportunities, however, for stormwater retrofit within both incorporated and unincorporated areas.

Intensive land use in the St. Andrew Bay watershed is concentrated around the Panama City metropolitan area, with additional development occurring around Tyndall AFB and unincorporated communities along the bay. In the St. Joseph Bay basin, 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. While these developments contribute to NPS pollution, the expansive urban-rural fringe, which hosts new development and construction sites, introduces new NPS and expands the extent of impervious surfaces in the watershed. With additional growth will come increased development and increased waste water production.

In the St. Andrew Bay watershed, nine entities hold Municipal Separate Storm Sewer System (MS4) NPDES Stormwater 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.

Recent developments, such as the construction of the Northwest Florida Beaches International Airport have resulted in land use changes across large tracts of formerly managed timberlands. The airport, which opened in 2010, replaced the Panama City Bay County International Airport and is located approximately 18 miles northwest of Panama City. It is important to note that the airport, with associated additional approved development was approved in concert with the West Bay Sector Plan, now incorporated as part of the Bay-Walton Sector Plan. As part of this plan, Bay County designated over 30,000 acres as West Bay Preservation area to serve as a buffer, protecting water and habitat quality within West Bay and the larger estuary.

Silviculture and Agriculture

Silvicultural and agricultural practices can lead to sedimentation, stream and habitat alteration, and the export of nutrients and chemicals into surface and groundwaters, particularly if proper soil and water conservation BMPs are not implemented.

As of 2013, lumber/wood products were the number one export in Washington, Gulf, Calhoun, and Jackson counties (FDOT 2013a, 2013b, 2013c, 2013d) and the number two export in Bay County (FDOT 2013e). In northwest Florida, forest products and associated services provide approximately $1.21 billion annually to the region's economy (FDACS 2014). These forests also support recreational opportunities for residts and millions of visitors to the state, bolstering the tourism and ecotourism industries. Managed forests also provide important environmental services such as biodiversity, hydrologic function, and mitigation of global climate change by sequestering 5.8 million tons of atmospheric carbon per year statewide (FDACS 2014; Hodges *et al.* 2005).

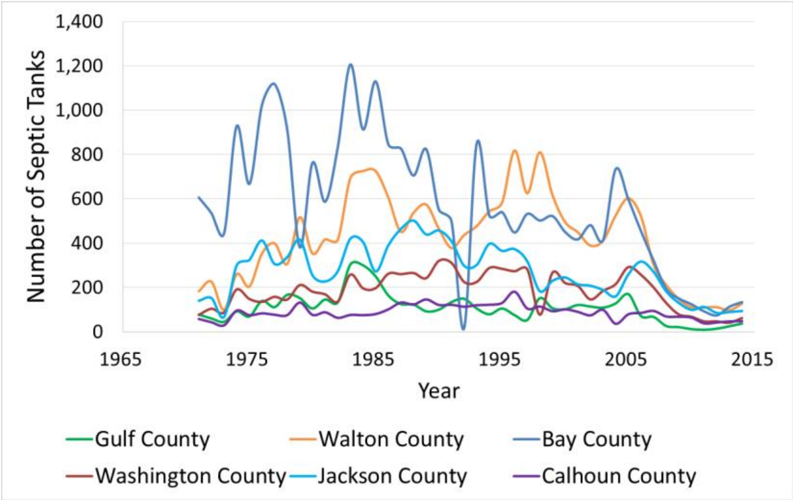
Silviculture practices such as ditching, landscape alteration, road construction, fertilizer application, and harvesting can result in effects such as channelization, erosion, sedimentation, nutrient enrichment, discharge of untreated runoff, as well as effects on water temperature, DO, and pH (Stanhope *et al.* 2008). Where appropriate, BMPs such as those developed and coordinated by FDACS, are employed; however, silviculture has been found to be consistent with the maintenance of excellent water quality (FDEP 1997; NWFWMD 1998). Silvicultural BMPs establish Special Management Zones (SMZs), which consist of specific areas associated with waterbodies within which certain activities are limited. Implementation of SMZs and other BMPs protect water quality by reducing discharges of sediments, nutrients, logging debris, and chemicals, as well as by reducing water temperature fluctuations and riparian habitat disturbance.

Although a relatively limited portion of the St. Andrew Bay watershed is devoted to active agricultural production, 61 percent of Bay County's land is classified as agricultural (Greenbelt) (Bay County Property Appraiser 2002). FDACS has developed specific agricultural BMPs for Florida, to control NPS pollution, nutrients, chemical applications, livestock waste, erosion and sedimentation, and streambank and hydrologic impacts.

On-Site Sewage Treatment and Disposal Systems (OSTDS)

On-site sewage treatment and disposal systems are potential widespread sources of nutrients and other pollutants. Significant concentrations of OSTDS can result in degraded water quality in groundwater and proximate surface waters. A well-designed and maintained septic system is effective for containing pathogens, surfactants, metals, and phosphorus. However, greater mobility of nitrogen in soils 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 including microbial pathogens. These pollutants can enter surface waters as seepage into drainage ditches, streams, lakes, and estuaries (EPA 2015d; NRC 2000).

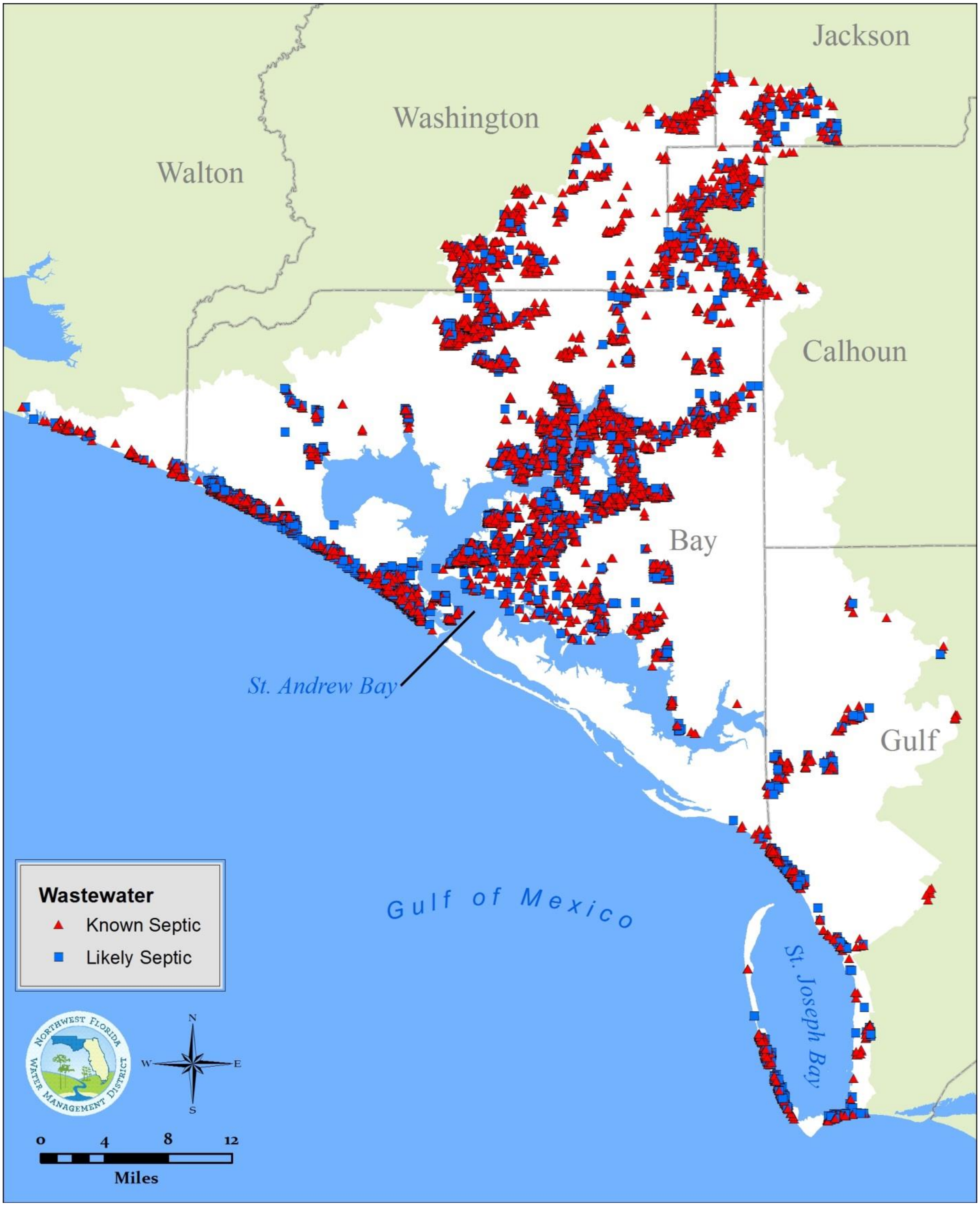
Across the watershed, new septic installations have declined significantly since the early 2000s (Figure 3-5). In general, coastal counties within the watershed have historically had more new septic system installations annually than the sparsely populated counties in the watershed's northern reaches (FDOH 2015a). According to 2012 FDOH permitting data, there were an estimated 44,445 septic tanks in the St. Andrew Bay watershed; however, that year, 1,273 permits had been issued to abandon septic tanks, presumably due to connection to a centralized sewer collection system. Figure 3-6 shows the likely distribution of septic tanks as of 2015.



Source: FDOH 2015c.

Figure 3-5 New Septic System Installations by Year

In the St. Andrew Bay watershed, most rural and unincorporated communities rely on OSTDS for wastewater treatment. Affected areas include St. Joseph Peninsula, adjacent to St. Joseph Bay and the Gulf of Mexico, as well as Grand Lagoon, much of Panama City, and communities on the barrier islands seaward of St. Andrew Bay. The Gulf County Board of County Commissioners recently approved a multi-phase Sewer Extension Project for Cape San Blas (adjacent to St Joseph Bay and the Gulf of Mexico) to be included in the County's Multi-Year Implementation Plan (Gulf County 2016).



Sources: FDOH 2015b, NOAA 2015a.

Figure 3-6 Septic Tank Locations in the Watershed

Erosion and Sedimentation

Erosion and sedimentation are natural phenomena that can be significantly accelerated by human activities, with resulting undesirable water quality consequences. Factors such as soil erodibility, slopes and rainfall intensity are important factors in erosion and sedimentation (Reckendorf 1995). However, natural erosion is typically a slow process. Human-induced erosion, however, can cause rapid increases in sediment inputs to surface waters result in major increases in sediment flux. 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 increased runoff associated with impervious surfaces, can also be a significant and increasing source of sedimentation into receiving waters.

The NRCS has calculated rates of erosion for various land use types in the region including cropland (8.3 tons/acre/year), pasture/hayland (0.5 tons/acre/year), and forest land (0.8 tons/acre/year). However, the NRCS recognizes gullies and cropland as the largest erosion sources, followed by dirt roads, forest land, other uses, pasture, and streambanks (USDA and U.S. Forest Service 1993).

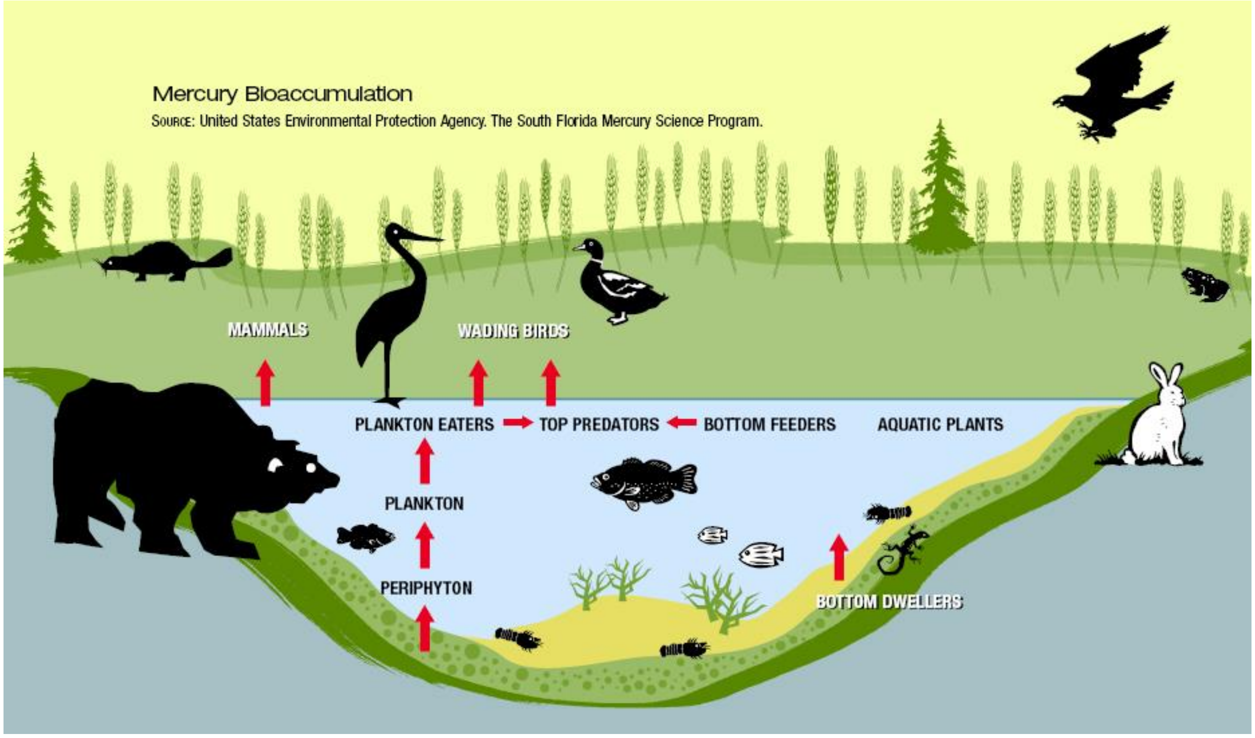
Adverse impacts associated with sedimentation include smothering of submerged aquatic vegetation (SAV) and other benthic habitats, degraded shellfish beds and tidal flats, fill in riffle pools, and increased levels of turbidity and nutrients in the water column. Additionally, increased sediment accumulation in surface waters changes the hydrology and holding capacity of waterbodies by reducing channel depth and accommodation space and altering channel morphology, which exacerbates flooding issues. Sediment accumulation in channels and waterways also impedes navigation and increases the need for costly dredging activities (Reckendorf 1995).

The GIWW is a potential source of sedimentation, given that it must be dredged intermittently to maintain the channel depth. Banks along much of the GIWW are used for dredge spoil disposal. Un-vegetated dredge spoil is a potential recurring source of sedimentation within the GIWW.

Atmospheric Deposition

While many impacts to water quality result from direct input to surface waters, either as point or NPS, some pollutants such as nitrogen and mercury can enter surface waters through atmospheric deposition.

Florida is particularly susceptible to mercury contamination of fish, due in part to the state’s latitude, geographical setting, and meteorology, which allows a high rate of mercury deposition from the atmosphere onto its lands and surface waters. Additionally, biochemical conditions in Florida waterbodies and sediment are conducive to the conversion of mercury from atmospheric deposition, to the more toxic and bio-accumulative methyl-mercury form (EPA 1997).



Source: Adapted from EPA South Florida Science Program by Ecology and Environment, Inc.

Figure 3-7 Bioaccumulation of Methyl-Mercury

Methyl-mercury is a toxic mercury compound that biomagnifies (Figure 3-7) as it moves up the aquatic food chain (EPA 1997). While agricultural, urban, and residential stormwater NPS are all potential sources of contaminants, atmospheric deposition due to fossil fuel combustion is the most significant source of mercury. Fifty-six of the 88 monitored waterbodies within the St. Andrew Bay watershed, one lake (Deer Point Lake), 48 estuaries, and seven coastal locations on the Gulf of Mexico are listed as impaired due to elevated mercury levels found in sampled fish tissue (see appendix D). While agricultural, urban, and residential stormwater NPS are all potential sources of contaminants, atmospheric deposition due to fossil fuel combustion is the most significant source of mercury.

Although nitrogen is necessary for the function of all ecosystems, in excess, it is also a nutrient pollutant that can cause damage to aquatic systems by inducing eutrophication as described in Section 3.2.5. Nitrogen inputs from industry, sewage and wastewater treatment discharges, and agriculture are most likely the primary point source discharges of nutrients to waterways in the

St. Andrew Bay watershed. However, atmospheric deposition of nitrogen from fossil fuel combustion may also be a source within the watershed. Most oxidized-nitrogen emissions are deposited close to the emission source and can especially impact surface water in urban areas within the watershed (Howarth *et al.* 2002a, 2002b; NRC 2000).

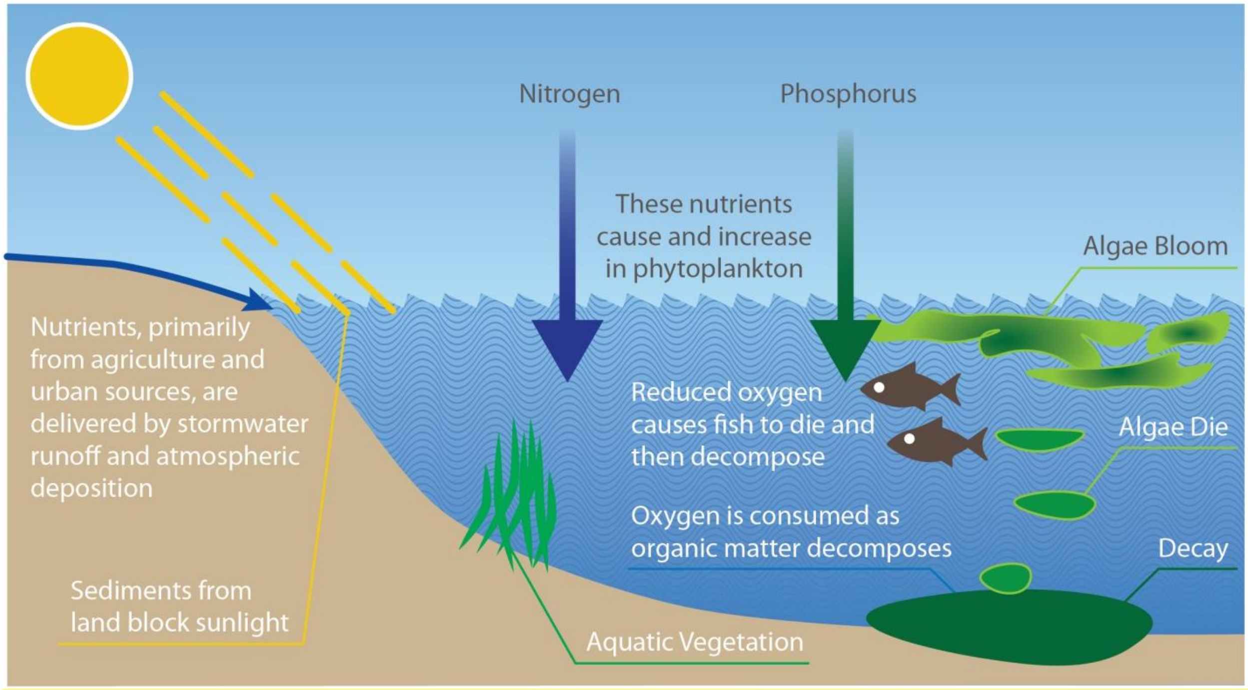
3.2.5 Ecological Indicators of Water Quality

Eutrophication

Eutrophication is defined as an increase in the rate of supply of organic matter to an ecosystem, characterized by excessive plant and algal growth due to the increased availability of one or more limiting growth factors needed for photosynthesis (Nixon 1995; Schindler 2006). Both point and NPS pollution have accelerated the rate and extent of eutrophication through increased loadings of limiting nutrients, such as nitrogen and phosphorus, into aquatic ecosystems (Chislock *et al.* 2013). Nutrient loading over-stimulates the production of planktonic algae (floating), epiphytic algae (those attached to surfaces), and macrophytes (large plants) and leads to dense nuisance and toxic blooms.

Eutrophication is associated with major changes in aquatic community structure as a result of changes in ratios of key plant nutrients (e.g., nitrogen and phosphorus). These changes result in food webs that are less efficient in supporting key fisheries and favor algal blooms, including those toxic to fish, marine mammals, birds, and people. Algal blooms can lead to low DO levels, loss of beneficial SAV, fish kills, and habitat degradation. These symptoms of eutrophication impact public health and the use of coastal ecosystems for recreation, tourism, and commercially important fisheries (Bricker *et al.* 1999). The estimated cost of damage caused by eutrophication in the U.S. alone is approximately $2.2 billion annually (Dodds *et al.* 2009). Figure 3-8 illustrates how the eutrophication process can occur.

Signs of eutrophication have been observed in West Bay of St. Andrew Bay. Impacts on water quality in West Bay include the dredging of the GIWW in the 1950s, the discharge of treated wastewater into West Bay Bowl from 1970 to 2011, and urbanization along the banks. Increased runoff associated with upland development and the point source discharge of treated wastewater have the potential to increase the nutrient content of the water, ultimately resulting in algal blooms, reduced water clarity, and negative impacts to the seagrass communities (Fitzhugh 2012b). The GIWW allows sediments and nutrients to enter West Bay during periods of low tides or high precipitation. Although water samples collected in West Bay from 1990 to 2006 did not show exceedingly high nutrient levels, mean total nitrogen concentrations, mean chlorophyll-*a* concentrations, and turbidities were higher than in other portions of the bay.



Source: Graphic by Ecology and Environment, Inc.

Figure 3-8 Eutrophication Process

Symptoms of eutrophication identified in the bay have historically included elevated chlorophyll-*a* and low DO. Portions of St. Andrew Bay may be at risk of eutrophication due to human influence and natural susceptibility (e.g., relatively low flushing rates, warm water, and long algal growing seasons) (Bricker *et al.* 1999; NWFWMD 2002). A NOAA estuarine eutrophication survey found "medium" levels of chlorophyll-*a*, turbidity, nitrogen, and phosphorus concentrations, observed nuisance and toxic blooms, and anoxia and hypoxia, and low coverage of SAV. Elevated nitrogen was found to occur in West Bay from April to September, while elevated phosphorus was found to occur from February/March to September. Additionally, the nitrogen isotopic signature (15N content) of epiphytes and seagrasses are higher in West Bay Bowl, indicating anthropogenic sources (Costanza *et al.* 2001; Fitzhugh 2012b; Grice *et al.* 1996; Heaton 1986; Udy and Dennison 1997).

Harmful Algal Blooms (HABs) and Aquatic Life Mortality Events

Harmful algal blooms periodically occur in coastal Gulf of Mexico waters. Harmful algal bloommonitoring resources include federal and state advisories and bulletins. Although the National Oceanic and Atmospheric Administration (NOAA) is the predominant national source for HAB monitoring data, the FWC's FWRI also conducts *Karenia brevis* (*K. brevis*) HAB monitoring and currently maintains Florida's HAB Monitoring Database, one of the longest continually recorded datasets of red tide in the U.S., for more than 170 years. State- and county-level monitoring can also be a resource to citizens looking for HAB information and updates.

Harmful algal blooms occur when colonies of certain types of algae grow at increased rates within the water column and produce toxins at concentrations that have harmful effects on marine life and humans (NOAA 2014). Red tide, caused by the microscopic algae *K. brevis*, is one of the more common HABs in the bays and estuaries along the Gulf Coast of Florida (Solutions to Avoid Red Tide [START] 2016). *K. brevis* produces a neurotoxin that kills fish, shellfish, and marine mammals. This toxin can also cause respiratory and skin irritation in humans (START 2016). Red tide is a natural occurrence; however, nutrient loading, pollution, food web alterations, introduced species, water flow changes, and climate change influence the frequency and duration of blooms (NOAA 2015b).

Scientists at NOAA monitor and study HABs to detect and forecast red tide blooms to warn communities in advance of possible environmental and health effects (NOAA 2014). The NOAA is authorized by the Harmful Algal Bloom and Hypoxia Research and Control Act to assist in the control of possible HABs through research centers, labs, and funding (NOAA 2015b). Citizens can visit NOAA's Harmful Algal Bloom Operational Forecast System Operational Conditions Reports for updates on any known HAB colonies from Southwest Florida to the Texas coastline (NOAA 2016a). The NOAA also posts HAB bulletins with conditions reports and analyses of HABs in the Gulf of Mexico.

High chlorophyll-*a* concentrations in St. Andrew Bay occur periodically in the summer and tend to be associated with the nuisance species *Anacystis spp.*, *Anabaena spp.*, and *K. brevis*. Sampling in the bay area of Bay and Gulf counties confirmed the presence of *K. brevis* concentrations in St. Andrew Bay near St. Andrew Park and within St. Joseph's Bay in 2015. That same year, fish kills were reported near the Port St. Joe area of Gulf County and within St. Andrew Bay in Bay County. Detailed sample information and a summary of impacts can be found through the FWC FWRI at: http://myfwc.com/redtidestatus (NOAA 2015b).

3.3 Habitat Quality in Receiving Waters

3.3.1 Subtidal Communities

The St. Andrew Bay watershed includes a variety of subtidal communities, the most prominent of which are seagrass beds, oyster/mollusk reefs, coral reefs, and unconsolidated (marine) substrate. Unconsolidated substrate communities may support a large population of infaunal organisms and transient planktonic and pelagic organisms (e.g., tube worms, sand dollars, mollusks, isopods, amphipods, burrowing shrimp, and an assortment of crabs) (FDEP 2016f).

However, sediments in areas with high industrial/maritime activity often contain chemical pollutants, which may pose a risk to human health and the health of surrounding ecosystems (Long *et al.* 1997). Because St. Andrew Bay is poorly flushed and sediments within the bay tend to be rich in fine clays, silts, and organic carbon, there is a higher potential for bay sediments to become a reservoir for metals and other contaminants (Brim and Handley 2006).

Industrial/maritime activity may impact subtidal communities, including seagrasses. A major impact to seagrasses in West Bay occurred in the early 1970s when Marifarms, a commercial shrimp aquaculture facility, netted off a 2,500-acre section of West Bay. The nets, which were regularly treated with antifouling compound, were used to contain the shrimp and exclude predators. Once the nets were in place, the area was treated with Rotenone to kill any fish or other predators. Finally, frequent trawling occurred through the seagrass beds during harvesting. Today, this area is devoid of seagrasses, though it is not clear exactly which specific factor(s) caused it to disappear (Brim and Handley 2006).

The status of seagrass in the St. Andrew Bay has been studied as part of the Florida Seagrass Integrated Mapping and Monitoring (SIMM) Program (FWC 2015b). St. Andrew Bay:

Historically (from 1953 and 1992), St. Andrew Bay suffered large losses in seagrass coverage, especially in West Bay, which lost almost half of its seagrasses. In the following years (1992 and 2003), seagrasses appeared to be recovering; St. Andrew Bay had an increase of 11,232 acres (14 percent), which included large gains in West Bay (585 acres or 30 percent). Since then, tropical storms in 2004 and 2005, as well as heavy rainfall events in 2009 and 2010, are thought to have negatively impacted seagrass coverage, but this has not yet been confirmed. Propeller scarring continues to be a problem in shallow areas of St. Andrew Bay (FWC 2015b).

Seagrass area in St. Joseph Bay generally appears to be stable, but may have decreased from 1992 and 2006, depending on the mapping data and methodology used. Algae growth on seagrass blades may be increasing, presumably due to increased nutrients in the Bay. Propeller scarring is evident in nearly half of all seagrass beds in the Bay. However, efforts are underway to help inform boaters about the presence of shallow seagrass beds so they can be avoided (discussed further in Section 6) (FWC 2015b).

Human activities that could impact seagrasses include dredging and related sediment suspension and deposition, operation of recreational and commercial watercraft, nonpoint source pollution, and sedimentation from construction and other land-based activities (Livingston 1986).

The appearance of corals in the St. Andrew Bay watershed was first noted in 2010 and includes several species of coral and related species on the rocks and the surrounding sand of the jetties of the St. Andrew Aquatic Preserve on both sides of Shell Island. Documented species include the tube coral (*Cladocora arbsuscala*) and the diffuse ivory bush coral (*Oculina diffusa*) (FDEP 2016f).

3.3.2 Intertidal Communities

Intertidal communities within the St. Andrew Bay watershed include salt marsh and un-vegetated intertidal mud flats, which occur throughout the bay system, including the coastal barrier complex. The area just inside the border of St. Andrews Aquatic Preserve contains approximately 15 acres of protected tidal marsh, but more extensive marshes are immediately adjacent to the preserve. The tidal marsh community on Shell Island declined following an influx of saltwater and overwash caused by hurricanes in 2004 and 2005. Sand migration and increase in beach elevation has caused many of these areas to become beach dune or coastal grassland habitat (FDEP 2016f). Little research has been conducted on the quality of intertidal communities for this watershed, particularly outside of the St. Andrew Aquatic Preserve. However, where urban development has occurred, impacts to intertidal communities are likely, which may result in reduced wildlife habitat.

The Nature Conservancy conducted a joint analysis of St. Andrew and Choctawhatchee bays using the Sea Level Affecting Marshes Model (SLAMM) to evaluate changes in habitat composition under five different scenarios ranging from 0.39 to 2.0 meters of sea level rise by the year 2100. The SLAMM model indicates that under all five sea-level rise scenarios (0.39 to 2.0 meters), rocky intertidal, tidal fresh marsh, and irregularly flooded marsh communities were the most heavily impacted (TNC 2011). Sea Level Affecting Marshes Model (SLAMM) simulations indicate that marshes are very susceptible to sea level rise under more extreme scenarios, with 89 percent of irregularly flooded marsh lost under the 1.5 meter scenario and 96 percent lost under the 2 meter scenario (TNC 2011).

3.3.3 Freshwater Systems

Habitat quality in freshwater systems is largely dependent upon local water quality conditions and level of development in surrounding areas (further discussed in Section 3.2).

Many of the freshwater systems in the watershed, including Econfina Creek and many large springs (discussed in detail in other sections of this report), are in relatively good condition, because they are publicly protected as the headwaters of a major potable surface water supply. The series of karst lakes in the Econfina recharge area in Washington and Bay counties are well protected by District lands in the Econfina WMA.

Deer Point Lake Reservoir, managed by Bay County, is the primary source of drinking water for the County, but it also supports substantial recreational fishing including sunfish (multiple *genera*), bluegill (*Lepomis macrochirus*), and largemouth bass (FWC 2016e). Deer Point Lake Reservoir has been impacted by the proliferation of excessive aquatic vegetation and is managed by annual draw-downs.

Although it is not a primary component of the scope of this plan, it should be noted that the negative impacts of invasive plant species on native communities have been widely recognized (Florida Exotic Pest Plant Council 2005). The proliferation of non-native species poses a significant threat to biodiversity as non-native species modify ecosystem structure and contribute to the decline of native species, particularly in aquatic systems (Florida Exotic Pest Plant Council 2005; 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.

3.4 Floodplains

Floodplains provide important functions for water resources, as well as for the human community. Properly functioning floodplains, for example, protect water quality by allowing storage of floodwaters, reducing runoff velocity, and preventing erosion and sedimentation. They also provide important habitat for many terrestrial and aquatic species.

In addition to impacting water resources, development and encroachment into flood-prone areas has the potential to put residents and property at risk. Floodplain encroachment decreases floodplain function by reducing the flood-carrying capacity, increases flood heights and velocities, and increases flood hazards and degrades natural systems in areas beyond the encroachment itself. Floodplains offer a way to attenuate potential flood effects, while also providing an ecological link between aquatic and upland ecosystems. Economic gain from floodplain development should be balanced against the resulting increase in flood hazard and associated costs (Federal Emergency Management Administration [FEMA] 2014).

While severe rainfall events can lead to flooding and flood-related impacts on surface waters, drought can have severe impacts on water supply, aquifer recharge, water chemistry, DO concentrations, and other parameters that affect water quality and in-stream habitat. 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, grasslands and floodplain forest areas absorb high flows and stormwater runoff, then filter and slowly release it to streams and aquifers, moderating against dry times (TNC 2016b). Floodplain protection is important to support not only recharge and water storage, but also protect the quality of groundwater that may emerge later as surface water.

3.4.1 Flood Prone Areas

Northwest Florida, with its extensive river networks and other water resources, has a long history of flooding events, which makes it clear that such events will re-occur and that it is necessary to plan accordingly. Riverine floods are significant and common in northwest Florida and tend to occur along major river systems and their tributaries. Although the St. Andrew Bay watershed has no major riverine system, streams, wetlands, low-lying areas, coastal areas, and closed basins within the watershed are subject to significant flooding. Federal Emergency Management Agency digital flood maps indicate that 357,852 acres (approximately 48 percent) of the St. Andrew Bay watershed are delineated as Special Flood Hazard Area. Flooding can be particularly problematic in high-growth and densely populated coastal areas. Flooding impacts appear to be aggravated by inadequate public awareness of the potential for flooding events and associated consequences. Residents and visitors must be aware of the implications of building, living, working, and recreating in areas prone to flooding.

Based on a comparison of the Sea, Lake, and Overland Surge from Hurricanes model, storm surge elevations, and known tidal and the dam structure elevations, Deer Point Lake Reservoir may be vulnerable to major hurricane impacts (NWFWMD 2014b). It was estimated that a Category 3 hurricane storm surge could maintain coastal water levels above the tide gates for up to three hours, introducing saltwater into the reservoir. Depending on rainfall, it could take from two to four weeks or more for salinity to be reduced to drinking water standards (NWFWMD 2014b). The Digital Flood Insurance Rate Map published by FEMA in 2009 indicates a coastal 100-year flood elevation including wave heights higher than the dam (NWFWMD 2014b).

3.4.2 Recent Flood Events

The most severe flooding in the watershed is associated with tropical storms, hurricanes, and other large-rainfall events that subject coastal communities to widespread flooding resulting from storm surges from the Gulf of Mexico, East Bay, St. Andrew Bay, North Bay, and West Bay (FEMA 2009). The FEMA Flood Insurance Study for Bay County (2009) provides a comprehensive list of historical hurricanes and other large storm events, and indicates that such storms can result in up to $14 billion dollars in total damages (FEMA 2009).

3.4.3 Floodplain Management

Flood protection needs within the St. Andrew Bay watershed are closely related to stormwater management, as well as land use planning and land development regulation. Thus, for both retrofit and new development, flood protection and water quality treatment efforts must be closely coordinated through protection of floodplains, wetlands, natural hydrology, and recharge. Where necessary and appropriate, both retrofit needs and stormwater management for new development should be addressed through construction of facilities that provide both flood protection and water quality treatment.

To facilitate protection of floodplain and wetland resources, the NWFWMD and FEMA have identified flood hazards through the Flood Hazard Map Modernization program (originally), the FEMA Risk MAP program (currently), and county and watershed based Flood Insurance Studies, the SWIM program, storm surge modeling, and other cooperative efforts. Additionally, ongoing land acquisition efforts serve to protect floodplains, wetlands, and associated public benefits. Restoration efforts implemented through SWIM and wetland mitigation also help restore natural hydrology, with benefits for flood protection, habitat, and water quality.

Finally, implementation of the Environmental Resource Permitting (ERP) program in northwest Florida helps ensure flood protection is addressed in an integrated manner with water quality protection. Florida’s ERP Program regulates activities that alter surface water flows, including activities in uplands that generate stormwater runoff, and dredging and filling in wetlands and surface waters. In addition to the state wetlands permitting process, Section 404 of the CWA establishes a federal wetlands program administered by the USACE.

3.5 Unique Features and Special Resource Management Designations

3.5.1 Conservation Lands

The St. Andrew Bay watershed system contains extensive conservation and protected lands (Figure 3-9), which are important for the long-term protection of watershed functions and resources and are listed with short descriptions in Appendix E. Conservation lands account for approximately 14 percent, or 107,000 acres, of the land area within the basin. Public and private conservation lands provide a buffer system that helps to protect water quality, provide flood protection, and sustain integrated terrestrial and aquatic ecosystems.

The NWFWMD owns and manages over 211,000 acres across the District and protects an additional 12,403 acres through conservation easements. Over 43,000 acres of the total property controlled by the district lies within the St. Andrew Bay watershed, including the Econfina Creek

WMA. Ninety percent, or 40,140 acres of the WMA, occurs within the St. Andrew Bay watershed (FNAI 2016). 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 and restore 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 vast majority of which is managed by the U.S. Department of Defense (Navy and Air Force). 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. Management of these lands are further discussed in Section 6.4.11.

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 (Figure 3-9). 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 (discussed further in Section 6.4.7).

As discussed in Section 3.5.1, 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).

Sources: FDEP 2011c; FNAI 2016a; NOAA 2015a; Texas A&M University 2013; USGS 2016a, 2016b.

Figure 3-9 Public and Conservation Lands

3.5.2 Critical Habitat and Strategic Habitat Conservation Areas (SHCAs)

The St. Andrew Bay watershed provides critical habitat for numerous rare, endemic, and protected species, and/or species of special concern. The USFWS administers the Endangered Species Act (Act) of 1973, which provides for the conservation of species that are endangered or threatened throughout all or a significant portion of their range, and the conservation of the ecosystems on which they depend. In the Act, critical habitat is defined as specific geographic area(s) that contain features essential for the conservation of a threatened or endangered species and that may require special management and protection. Critical habitat may include an area that is not currently occupied by the species, but that will be needed for its recovery.

In Florida, the FWC maintains the state list of animals designated as "Federally-designated Endangered or Threatened, State-designated Threatened, or State-designated Species of Special Concern," in accordance with F.A.C. Rules 68A-27.003, and 68A-27.005, respectively. The FDACS publishes a list of the protected plants of Florida (Weaver and Anderson 2010). The table in Appendix B provides the list of species that are protected and tracked for the watershed, as well as their habitat requirements. The St. Andrew Bay watershed includes designated critical habitat for a variety of protected species, including several threatened endangered species of freshwater muscles, the threatened piping plover (*Charadrius melodus*), and the endangered St. Andrew beach mouse (*Peromyscus polionotus peninsularis*).

Certain natural areas within the watershed have been identified by the FWC as Strategic Habitat Conservation Areas (SHCAs). Strategic Habitat Conservation Areas are important habitats in Florida 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).

3.5.3 Aquatic Preserves

The state of Florida currently has 41 aquatic preserves, encompassing approximately 2.2 million acres of submerged lands that are protected for their biological, aesthetic, and scientific value, including one preserve in the St. Andrew Bay watershed (FDEP 2016f). The St. Andrews

Aquatic Preserve includes 24,116 acres of submerged lands and covers the entire inlet of St. Andrews Bay (Figure 3-9). Habitats within the aquatic preserve include composite, consolidated, and unconsolidated substrates, sponge beds, seagrass beds, octocoral beds, coral reefs, and algal beds (FDEP 2016f). These habitats support more than 40 species listed including endangered, threatened, or species of special concern, that potentially inhabit or utilize resources in St. Andrews Aquatic Preserve (FDEP 2016f).

The St. Joseph Bay Aquatic Preserve includes 73,000 acres of submerged lands and extends from the eastern shoreline of Gulf County to the St. Joseph Peninsula (Figure 3-9). Habitats within the aquatic preserve include composite and unconsolidated substrate, sponge beds, seagrass beds, octocoral beds, mollusk reefs, tidal marsh and algal beds (FDEP 2008) Outstanding Florida Waters (OFWs)

Of particular interest in the St. Andrew Bay watershed are the waterbodies designated as OFWs. The FDEP designates OWFs (under Section 403.061[27], F.S.), which are then approved by the Environmental Regulation Commission. The FDEP defines an OFW as “a water designated worthy of special protection because of its natural attributes.” This special designation is applied to certain waters, and is intended to protect existing good water quality (FDEP 2015g). Outstanding Florida Waters within the St. Andrew Bay watershed include surface waters within the boundaries of St. Andrew Bay State Park, St. Andrew State Recreation Area (around Shell Island), Lake Powell, St. Joseph Bay and the St. Joseph Bay Aquatic Preserve, Pig Island Unit of the St. Vincent National Wildlife Refuge, and portions of the Point Washington Conservation and Recreation Lands (F.A.C. Rule 62-302.700 (9); FNAI 2016).

3.5.4 Gulf Ecological Management Sites (GEMS)

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).

3.5.5 Northwest Florida Greenway Project

The Northwest Florida Greenway project was established in 2001 through the partnership of the Economic Development Council (EDC) of Okaloosa County, Eglin AFB, the FDEP, and TNC

(EDC 2016). The goal of this project is to protect and sustain existing military land and airspace, promote industry growth, preserve environmental quality and biodiversity, maintain economic viability of timber land, and create additional recreational value (EDC 2016). These goals will be obtained by creating a corridor connecting the Apalachicola National Forest and the region including the Eglin AFB WMA, Blackwater River State Forest, and Conecuh National Forest, that are already protected (Cooperative Conservation America 2016). The corridor will harbor common, protected, and endemic species, protect future water resources, provide storm buffers, and allow ecological adaptations to potential changes in sea level and rainfall (Blaustein 2008). Through ongoing efforts, the partner organizations and authorities are working to obtain the land necessary for the project's completion.

4

4.0 Implementation and Achievements of the Previous SWIM Plan

4.1 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.

4.2 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 4-1 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					
PC4	Coordinate Watershed Management Activities with		$5,000	$5,000	$5,000	$5,000
	Stormwater Retrofit and Treatment					
ST1	Examine Stormwater Treatment Effectiveness		$10,000	$10,000	To be determined (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					

ID	Projects	Fiscal Year Estimates (not necessarily funded)				
		2000-01	2001-02	2002-03	2003-04	2004-05
	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 –					
BD5	Management of State-Owned Submerged Land –					
BD6	Assessment and Restoration of East Pass Closure	$15,000				
BD7	Assessment of Freshwater Inflow Needs for St.		$100,000	$100,000	TBD	TBD
BD8	Bayou Management Generic Model and Citizen's Bayou					
BD9	Finfish Comparison Survey					
BD10	Grand Lagoon Bridge Replacement					
BD11	Seagrass Protection and Management					
BD12	Wetland Protection, Management, and	$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					

ID	Projects	Fiscal Year Estimates (not necessarily funded)				
		2000-01	2001-02	2002-03	2003-04	2004-05
CA2	Determine Assimilative Capacity of the St. Andrew					
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.

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 under the auspices of the SWIM and Florida Forever programs.

5.0 Related Resource Management Activities

Over the years, management plans and activities in the St. Andrew Bay watershed have been implemented to reduce wastewater discharges; reduce discharges of polluted stormwater from urban and agricultural areas; and protect, preserve, and restore special areas. This section describes historical and ongoing activities and programs to address natural resource issues and water quality problems, including the impacts of the 2010 Deepwater Horizon oil spill.

Much of the progress in restoring the watershed is attributable to coordinated efforts on the part of local, state, and regional efforts, including the District, county and municipal governments, state agencies, and private initiatives. Many plans and programs share common goals, and their implementation is based on multiple groups cooperating in planning, funding, managing, and executing projects. The NWFWMD coordinates its efforts with these entities to facilitate project implementation, as well as to obtain data, strengthen monitoring activities, and exchange information.

5.1 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, the NRDA, and the NFWF's GEBF.

5.1.1 RESTORE

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 nondisproportionately 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).

Council-selected Projects ("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 the Florida Association of Counties. Projects will be submitted by each of the 23 counties on Florida's Gulf Coast.

5.1.2 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.

The NRDA Trustees have thus far selected four regional projects to implement in the coastal waters of the Florida Panhandle, including the St. Andrew Bay watershed (FDEP 2016g):

- **Oyster Cultch Placement** ($5,370,596, St. Andrew, Pensacola, Apalachicola bays) – will place 12,000 cubic yards of cultch material over 60 acres for the settling of oyster larvae and oyster colonization to foster reef development in St. Andrew Bay.
- **Seagrass Recovery** ($2,691,867, St. Andrew and St. Joseph bays and Alligator Harbor) – will assess and monitor seagrass propeller scaring and place sediment tubes to restore two acres of seagrasses in St. Joseph Bay Aquatic Preserve, and perhaps St. Andrew Aquatic Preserve.
- **Artificial Reef Creation and Restoration** ($11,463,587, Escambia, Santa Rosa, Okaloosa, Walton, and Bay counties) – off the coast of Bay County, will develop both deepwater "nearshore reefs" within nine nautical miles of shore and shallower "snorkeling reefs" within 950 feet of shore and at depths of less than 20 feet.

- **Scallop Enhancement for Increased Recreational Fishing** ($2,890,250, Pensacola Bay, Santa Rosa Sound, St. Andrew Bay) – intended to increase scallop populations to support recreational harvests in St. Andrew Bay.

In addition to the regional projects, the Trustees have selected six recreational use projects in Bay County (FDEP 2016g):

- **Panama City Marina Fishing Pier, Boat Ramp, and Staging Docks** ($2,000,000) – construct 400-foot long pier, replace boat ramp, and construct new staging docks.
- **City of Parker, Earl Gilbert Dock and Boat Ramp Improvements** ($169,929) – improve existing dock and expand existing parking.
- **Panama City St. Andrew Marina Docking Facility Expansions** ($250,029) – add three boat slips, replace boat ramp, and replace wooden dock with a concrete floating dock.
- **City of Mexico Beach Marina** ($1,763,554) – remove and replace 18 existing finger piers, replace existing retaining wall, and replace boardwalk dock with a concrete surface with increased width.
- **City of Parker Oakshore Drive Pier** ($993,649) – construct a 500-foot long fishing pier.
- **City of Lynn Haven** (cost unknown) – acquisition of a 90.7-acre tract and development of a public park on the property to enhance public access to natural resources and increase recreational opportunities.

5.1.3 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.

5.1.4 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 23 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).

5.2 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.

5.2.1 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).

5.2.2 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 of which 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).

5.2.3 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. The dataset in Bay County begins in 1985 and continues to the present. These stations are monitored at least monthly and often more frequently. In addition, SEAS monitors 23 stations in St. Joseph Bay, with the dataset beginning in 1985 and continuing to the present (FDOH 2005).

5.2.4 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).

5.2.5 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).

5.3 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 2006). 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).

5.4 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.

5.4.1 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).

5.4.2 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.

5.4.3 Domestic and Industrial Wastewater Permits

In addition to NPDES-permitted facilities, all of which 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).

5.4.4 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).

5.4.5 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.

5.4.6 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).

5.4.7 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).

5.4.8 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).

5.4.9 Natural Resource Management at Military Facilities

The U.S. Air Force owns 29,638 acres of land within the St. Andrew Bay watershed (FNAI 2016). 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 2016).

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 2016).

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.

5.4.10 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.

5.4.11 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.
- **Florida Geological Survey Aquifer Vulnerability Assessment Model -** The FGS Aquifer Vulnerability Assessment model can facilitate protection of groundwater and surface waters by identifying less vulnerable areas that may support development and more vulnerable areas that should be prioritized for conservation (Arthur *et al.* 2007).

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Appendix A Geology and Soils in the St. Andrew Bay Watershed

The St. Andrew Bay watershed follows much of the general stratigraphy of the western Florida Panhandle, described in detail below.

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) (Brown 2009), 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 as well as 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.

Sources: Collins 2010; Kolka *et. al*. 2016; USDA 2014; Vasques *et. al*. 2010.

Appendix B Threatened and Endangered Species within the Watershed

The St. Andrew Bay watershed supports a wide array of biological resources and habitats; and therefore, 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):

Plants:

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
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

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
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
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.

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
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

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
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
Euphorbia commutata	Wood Spurge	S2	E	N	N/A
Euphorbia telephioides	Telephus Spurge	S1	E	N	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
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

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
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

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Linum westii	West's Flax	S2	E	N	Palustrine: dome swamp, depression marsh, wet flatwoods, wet prairie, pond margins
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

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
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
Physocarpus opulifolius	Ninebark	S1	E	N	Riverine: seepage stream banks

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Pinckneya bracteata	Fever Tree	N	T	N	Palustrine: creek swamps, titi swamps, bogs
Pinguicula ionantha	Panhandle 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

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
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
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.

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
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	Hairypeduncle d 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	Nightflowering 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

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
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
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

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
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

Animals:

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
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	N	LE	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

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Pleurobrema pyriforme	Oval Pigtoe	S?	N	LE	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	SSC	T	Estuarine: various Marine: various habitats Riverine: alluvial and blackwater streams
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

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Ambystoma cingulatum	Flatwoods Salamander	S2S3	N	T	Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian, scrub-shrub wetland, temporary pool Terrestrial: forest - conifer, forest/woodland, savanna, woodland - conifer
Rana capito	Gopher Frog	S3	SSC	N	Terrestrial; sandhill, scrub, scrubby flatwoods, xeric hammock (reproduces in ephemeral wetlands within these communities)
Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Reptiles					
Alligator mississippiensis	American Alligator	S4	SSC	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	Atlantic Loggerhead Turtle	S3	T	T	Terrestrial: sandy beaches; nesting
Chelonia mydas	Atlantic Green Turtle	S2	E	E	Terrestrial: sandy beaches; nesting

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Crotalis 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 Turtle	S2	T	T	Terrestrial: sandy beaches; nesting
Drymarchoncorias couperi	Eastern Indigo Snake	S3	T	T	Estuarine: tidal swamp Palustrine: hydric hammock, wet flatwoods Terrestrial: mesic flatwoods, upland pine forest, sandhills, scrub, scrubby flatwoods, rockland hammock, ruderal
Gopherus polyphemus	Gopher Tortoise	S3	SSC	N	Terrestrial: sandhills, scrub, scrubby flatwoods, xeric hammocks, coastal strand, ruderal
Graptomys barbouri	Barbour's Map Turtle	S2	SSC	N	Palustrine: floodplain stream, floodplain swamp Riverine: alluvial stream
Lepidochely kempii	Kemp's Ridley	S1	E	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
Reptiles (continued)					

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Pituophis melanoleucas	Florida Pine Snake	S3	SSC	N	Lacustrine: ruderal, sandhill upland lake Terrestrial: sandhill, scrubby flatwoods, xeric hammock, ruderal
Birds					
Ammodramus maritimus peninsulae	Scott's Seaside Sparrow	S2	SSC	N	N/A
Aramus guarauna	Limpkin	S3	SSC	N	Estuarine: scrub-shrub wetland Palustrine: forested wetland, herbaceous wetland, riparian
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	T	T	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

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Egretta caerulea	Little Blue Heron	S4	SSC	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
Egretta rufescens	Reddish Egret	S2	SSC	N	Estuarine: tidal swamp, depression marsh, bog, marl prairie, wet prairie Lacustrine: flatwoods/prairie lake, marsh lake Marine: tidal swamp
Birds (continued)					
Egretta thula	Snowy Egret	S3	SSC	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	SSC	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

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Eudocimus albus	White Ibis	S4	SSC	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	E	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	SSC	N	Estuarine: tidal flat/shore Terrestrial: bare rock/talus/scree, sand/dune

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Birds (continued)					
Haliaeetus leucocephala	Bald Eagle	S3	T	T	Estuarine: marsh edges, tidal swamp, open water Lacustrine: swamp lakes, edges Palustrine: swamp, floodplain Riverine: shoreline, open water Terrestrial: pine and hardwood forests
Myctera americana	Wood Stork	S2	E	E	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	T	E	Terrestrial: mature pine forests

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Birds (continued)					
Rhynchops niger	Black Skimmer	S3	SSC	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	T	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

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Myotis grisescens	Gray Bat	S1	E	E	Palustrine: caves, various Terrestrial: caves, various
Myotis sodalis	Indiana bat	SA	E	E	Palustrine: various Terrestrial: various
Peromyscus polionotus allophrys	Choctawhatchee Beach Mouse	S1	E	E	Terrestrial: beach dune, coastal scrub
Peromyscus polionotus peninsularis	St. Andrew Beach Mouse	S1	E	N	Terrestrial: beach dune, coastal scrub
Sciuris niger shermani	Sherman's Fox Squirrel	S3	SSC	N	Terrestrial: woodland - conifer, woodland - mixed
Trichechus manatus	West Indian Manatee	S2	E	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

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 = 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.
T = Threatened: species likely to become Endangered within the foreseeable future throughout all or a significant portion of its range.
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 FFWCC. 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 FFWCC. 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 C 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.

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).
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.
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 of which 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.

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 2016).
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).

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 2016).
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 2016).

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.
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.
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 *et al.* 2015).
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.
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 D 2014 FDEP Verified 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 2014 FDEP designated and impaired waters in the St. Andrew Bay watershed.

Waterbody Segment ID	Water Segment Name	County	Waterbody Class[1]	Parameters Assessed Using the Impaired Waters Rule (IWR)
553A	Deer Point Lake (Reservoir)*	Bay	1	Mercury (in fish tissue)
973	Crooked Creek*	Bay	3M	Mercury (in fish tissue)
1008	Direct Runoff to Bay*	Bay, Walton	3M	Mercury (in fish tissue)
1026	Alligator Bayou*	Bay	3M	Mercury (in fish tissue)
1040	Direct Runoff to Gulf*	Bay	3M	Mercury (in fish tissue)
1043	Direct Runoff to Bay*	Bay	2	Mercury (in fish tissue)
1057	Newman Bayou*	Bay	2	Mercury (in fish tissue)
1060	Direct Runoff to Bay*	Bay	3F	Dissolved Oxygen (Total Nitrogen, Total Phosphorus, and BOD)
1060	Direct Runoff to Bay*	Bay	3F	Nutrients (chlorophyll-a)
1084	Direct Runoff to Bay*	Bay	2	Mercury (in fish tissue)
1086	Mill Bayou*	Bay	2	Mercury (in fish tissue)
1088	Beatty Bayou*	Bay	2	Fecal Coliform

Waterbody Segment ID	Water Segment Name	County	Waterbody Class[1]	Parameters Assessed Using the Impaired Waters Rule (IWR)
1088	Beatty Bayou	Bay	2	Mercury (in fish tissue)
1092	Basin Bayou*	Bay	2	Mercury (in fish tissue)
1098	Goose Bayou (Upper Segment)*	Bay	2	Mercury (in fish tissue)
1099	Botheration Bayou*	Bay	2	Mercury (in fish tissue)
1105	Harrison Bayou*	Bay	2	Mercury (in fish tissue)
1106	Direct Runoff to Bay*	Bay	3M	Mercury (in fish tissue)
1110	Callaway Bayou*	Bay	2	Mercury (in fish tissue)
1111	Sandy Creek*	Bay, Calhoun, Gulf	2	Bacteria (in Shellfish)
1111	Sandy Creek*	Bay, Calhoun, Gulf	2	Fecal Coliform
1113	Goose Bayou*	Bay	2	Mercury (in fish tissue)
1114	Direct Runoff to Bay*	Bay	3M	Mercury (in fish tissue)
1119	Unnamed Bayou*	Bay	2	Mercury (in fish tissue)
1120	Woodlawn Canal*	Bay	3M	Mercury (in fish tissue)
1123	Robinson Bayou*	Bay	2	Fecal Coliform
1123	Robinson Bayou*	Bay	2	Mercury (in fish tissue)
1127	Laird Bayou*	Bay	2	Mercury (in fish tissue)
1128	Pretty Bayou*	Bay	2	Fecal Coliform
1128	Pretty Bayou*	Bay	2	Mercury (in fish tissue)
1131	Johnson Bayou*	Bay	2	Fecal Coliform

Waterbody Segment ID	Water Segment Name	County	Waterbody Class[1]	Parameters Assessed Using the Impaired Waters Rule (IWR)
1131	Johnson Bayou*	Bay	2	Mercury (in fish tissue)
1136	Watson Bayou*	Bay	3M	Fecal Coliform
1136	Watson Bayou*	Bay	3M	Mercury (in fish tissue)
1142	Boggy Creek*	Bay	2	Fecal Coliform
1144	Massalina Bayou*	Bay	3M	Fecal Coliform
1144	Massalina Bayou*	Bay	3M	Mercury (in fish tissue)
1155	Little Sandy Creek*	Bay, Gulf	3F	Dissolved Oxygen (Total Nitrogen)
1161	Direct Runoff to Bay*	Bay	3M	Mercury (in fish tissue)
1162	Mule Creek*	Bay	2	Fecal Coliform
1170	Direct Runoff to Bay*	Bay	3M	Mercury (in fish tissue)
1171	California Bayou*	Bay	2	Mercury (in fish tissue)
1172	Pitts Bay*	Bay	3M	Mercury (in fish tissue)
1184	Direct Runoff to Bay*	Bay	3F	Dissolved Oxygen (Total Nitrogen and BOD)
1184	Direct Runoff to Bay*	Bay	3F	Nutrients (chlorophyll-a)
1196	Fred Bayou*	Bay	2	Mercury (in fish tissue)
1209	Eagle Nest Bayou*	Bay	2	Fecal Coliform
1209	Eagle Nest Bayou*	Bay	2	Mercury (in fish tissue)
1211	Ammo Lake Bayou*	Bay	2	Mercury (in fish tissue)

Waterbody Segment ID	Water Segment Name	County	Waterbody Class[1]	Parameters Assessed Using the Impaired Waters Rule (IWR)
1212	Direct Runoff to Gulf*	Bay	3M	Mercury (in fish tissue)
1230	Walker Bayou*	Bay	2	Mercury (in fish tissue)
1235	Farmdale Bayou*	Bay	2	Mercury (in fish tissue)
1238	Panther Swamp*	Bay, Gulf	3M	Mercury (in fish tissue)
1254	Browns Bay*	Gulf	3M	Mercury (in fish tissue)
1265	Direct Runoff to Bay	Gulf	2	Fecal Coliform
1267	St Joseph Bay*	Gulf	2	Mercury (in fish tissue)
1270	Direct Runoff to Gulf*	Gulf	2	Mercury (in fish tissue)
8011	Gulf of Mexico (Walton County)	Walton	3M	Mercury (in fish tissue)
8012	Gulf of Mexico (Bay County)	Bay	3M	Mercury (in fish tissue)
8013	Gulf of Mexico (Bay County)	Bay	3M	Mercury (in fish tissue)
8014	Gulf of Mexico (Bay County; St Andrew Bay)	Bay	3M	Mercury (in fish tissue)
8015	Gulf of Mexico (Bay County; St Andrew Bay)	Bay, Gulf	3M	Mercury (in fish tissue)
8016	Gulf of Mexico (Gulf Co.; St Joseph Peninsula)	Gulf	3M	Mercury (in fish tissue)
8017	Gulf of Mexico (Gulf Co.; St Joseph Peninsula)	Gulf	3M	Mercury (in fish tissue)
1061A	West Bay*	Bay	2	Mercury (in fish tissue)
1061B	St Andrews Bay (North Segment)*	Bay	2	Fecal Coliform

Waterbody Segment ID	Water Segment Name	County	Waterbody Class[1]	Parameters Assessed Using the Impaired Waters Rule (IWR)
1061B	St Andrews Bay (North Segment)	Bay	2	Mercury (in fish tissue)
1061BB	Carl Gray Park	Bay	3M	Bacteria (Beach Advisories)
1061C	St Andrews Bay (Middle Segment)*	Bay	3M	Mercury (in fish tissue)
1061CB	Beach Drive	Bay	3M	Bacteria (Beach Advisories)
1061D	East Bay (West Segment)*	Bay	3M	Mercury (in fish tissue)
1061E	St Andrews Bay (Mouth)*	Bay	3M	Mercury (in fish tissue)
1061EB	Delwood	Bay	3M	Bacteria (Beach Advisories)
1061F	East Bay (E)	Bay	2	Bacteria (in Shellfish)
1061F	East Bay (East Segment)*	Bay	2	Mercury (in fish tissue)
1061FB	Dupont Bridge	Bay	3M	Bacteria (Beach Advisories)
1061G	North Bay (North Segment 1)*	Bay	2	Bacteria (in Shellfish)
1061G	North Bay (North Segment 1)*	Bay	2	Mercury (in fish tissue)
1061H	North Bay (North Segment 2)*	Bay	2	Mercury (in fish tissue)
1141A	Parker Creek*	Bay	3F	Dissolved Oxygen (Total Nitrogen, Total Phosphorus, and BOD)
1141B	Parker Bayou*	Bay	2	Fecal Coliform
1141B	Parker Bayou*	Bay	3M	Mercury (Based on fish consumption advisory)
1267C	St. Joe Bay Monument Beach	Gulf	3M	Bacteria (Beach Advisories)
553A	Deerpoint Lake	Bay	1	Mercury (in fish tissue)

Waterbody Segment ID	Water Segment Name	County	Waterbody Class[1]	Parameters Assessed Using the Impaired Waters Rule (IWR)
8012B	Laguna Beach	Bay	3M	Bacteria (Beach Advisories)
8013A	Bid-A-Wee Beach	Bay	3M	Bacteria (Beach Advisories)
8013B	Beckrich Road	Bay	3M	Bacteria (Beach Advisories)
8013C	Rick Seltzer Park	Bay	3M	Bacteria (Beach Advisories)
8015A	8th Street	Bay	3M	Bacteria (Beach Advisories)

Sources: FDEP 2014c

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

Appendix E 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, 66,019acres state-managed, 3,006 cares 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 of recent origins. The property contains coastal interdunal swale, coastal scrub, and the rare gulf coast lupine. This property is an important sea turtle nesting site.		829

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
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

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
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	This park contains a diversity of habitats ranging 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 rare example of 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

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
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. The easement consists of consist of uplands and wetlands.		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

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
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. Highway 30 bisects the southeastern tract. 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 that is surrounded by Econfina Creek Water Management Area property.	http://www.nwfwater.com/	1,181

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
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 goal of the project is restoration to hydric pine flatwoods and hydric pine savanna, and preservation and enhancement of remaining 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

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Grayton Dunes Park	Walton County	Walton	Grayton Dunes Park is a beach access park that is undeveloped except for a boardwalk with an observation deck. Western Lake, on the eastern edge of the park, is a coastal dune lake that opens periodically and exchanges water with the Gulf. 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 2004 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 Wastewater Treatment Plant ceased discharge into West Bay and re-routed its treated effluent to the Conservation Park for release into treatment wetlands, with the discharge permitted at up to 14 million gallons per day.	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					

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Audubon Nature Preserve	Bay County Conservancy	Bay	Located in the middle of Panama City, the Audubon Nature Preserve consists primarily 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

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
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
Marjorie's Magical Marsh - Symone's Sanctimonious Swamp	Bay County Conservancy	Bay	Managed by Bay County Conservancy. This preserve received a new name in 2008, bestowed by Julie Hilton after a substantial donation was made to the BCC on her behalf. The Marjorie-Symone Preserve is located on East Lakeland Drive, off Highway 2311, which is to the east of Deer Point Lake. This 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. Native plants have been established as a wildlife garden. The site also serves as stormwater retention area for the surrounding development.	http://www.baycountyconservancy.org	0.36

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
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

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
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 2016

Appendix F Projects Funded by the National Fish and Wildlife Foundation affecting the St. Andrew Bay Watershed

The NFWF established the GEBF to administer funds arising from plea agreements that resolve the criminal cases against British Petroleum and Transocean. The FWC and FDEP work directly with the NFWF to identify projects for the state of Florida, in consultation with the USFWS and the NOAA. Over the next five years, the GEBF will receive a total of $356 million for the following natural resource projects in Florida. The following projects affecting the St. Andrew Bay watershed have been identified for funded through GEBF as of June 2016.

Project	Description
Projects within St. Andrew Bay watershed	
Oyster Reef Habitat Restoration in the Saint Andrew Bay (FWC, $1,973,500)	This project will restore one and a quarter miles of oyster reef habitat in West Bay, improve water quality, enhance fisheries, and increase coastal resiliency. By improving water quality and reducing wave action and turbidity, this project is expected to promote the expansion of over 200 acres of seagrass beds that were lost or degraded as a result of a former shrimp farm operation and wastewater discharge. This project is the second phase of a larger restoration project that will also complement a pilot restoration effort to be constructed in early 2015. Project partners include: FDACS, the University of Florida, the FWS, and St. Andrew Bay Resource Management Association.

Projects with benefits to all Gulf coastal communities, including St. Andrew and St. Joseph Bays	
Benthic Mapping, Characterization, and Assessment (University of South Florida, $4,477,900)	This project will provide data on the extent and species utilization of offshore fishery habitats along the West Florida Continental Shelf – an area utilized by reef fish and sea turtle populations for shelter, feeding and spawning. It will inform sustainable fishing practices for red snapper and other reef fish, and future efforts to reduce bycatch of marine fish and sea turtles through improved management during periods of high utilization in these benthic habitats. Project partners: FWC, Florida Fish and Wildlife Research Institute, and Florida Institute of Oceanography.
Comprehensive Coastal Panhandle Bird Conservation (National Audubon, $3,205,000)	This project will improve Panhandle beach-nesting bird habitat through nesting habitat enhancements and stewardship activities that will result in increased nesting, hatching, and rearing of chicks. These efforts will result in more effective and comprehensive success throughout the Florida Panhandle for important beach-nesting species such as Black Skimmer, American Oystercatcher, Least Tern, Piping Plover and Red Knot. Project partners: FWC, Florida Park Service, National Park Service, Department of Defense, Santa Rosa Island Authority, TNC, and State University of New York.
Florida Shorebird Conservation Initiative **(FWC, $1,489,800)**	This proposal will sustain activities of the Florida Shorebird Alliance (FSA) to enhance shorebird and seabird populations along the Florida Gulf Coast for two years. The FSA is a statewide network of government and non-governmental organizations advancing shorebird and seabird conservation through coordinated and collaborative management, monitoring, education and outreach, and public policy activities. Partners: Florida Audubon Society.

Enhanced Assessment for Gulf of Mexico Fisheries: **Phases I-III (FWC, $11,814,200)**	This five-year project will expand the collection of data on both catch effort and stock assessment in the northern and eastern Gulf of Mexico. It is complementary to similar projects in Alabama and Mississippi. The data will be used to assess the recovery of reef fish stocks in association with restoration efforts implemented in response to the Deepwater Horizon oil spill, improve and expand single-species stock assessments for managed fish species, and foster improved ecosystem-based assessment and management capabilities. Project partners: NOAA and University of Florida.
Increased Capacity for Marine Mammal Response (FWC, NOAA, and other stranding organizations, $4,400,000)	This project will improve capacity and date collection efforts for the FWC's marine mammal field stations as well as eight marine mammal stranding response and research organizations working in the Gulf. The Gulf of Mexico is habitat for 22 species of marine mammals—many were directly impacted by the oil spill, all are listed under the Marine Mammal Protection Act and several are listed as endangered under the ESA. Given the high occurrence of annual marine mammal strandings along Florida's Gulf Coast – more than 2,000 over the past five years – it is a management priority to enhance and sustain a viable stranding network.
Eliminating Light Pollution on Sea Turtle Nesting Beaches: Phases I and II (FWS, FWC, and Sea Turtle Conservancy, $3,614,400)	This project will greatly increase sea turtle hatchling survivorship on Florida Panhandle nesting beaches by correcting problematic lights on private properties with a history of sea turtle disorientations. Florida hosts over 90 percent of all sea turtle nesting in the continental U.S., including the largest population of loggerheads in the Western Hemisphere and regionally significant nesting populations of the Kemp's Ridley sea turtles.

Source: FDEP 2016e.