Perdido River and Bay Surface Water Improvement and Management Plan

October 2017

Program Development Series 17-07

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Executive Summary

The Perdido River and Bay watershed covers over 1,100 square miles of northwest Florida and southern Alabama. Within Florida, the watershed covers approximately 350 square miles and extends into the Pensacola metropolitan area. Major features include the Perdido River and tributaries such as Brushy Creek, Boggy Creek, McDavid Creek, and Jacks Branch. Estuarine waters include the main body of Perdido Bay, as well as Tarkiln Bayou, Weekly Bayou, Bayou Garcon, and Bayou Marcus. Big Lagoon, located between Perdido Key and the mainland, is also included within the planning area. Public and private conservation lands that help protect water and related resources include state parks, water management lands, and portions of the Gulf Islands National Seashore.

The Perdido River, Perdido Bay, their contributing tributaries and component wetlands, floodplains, bayous, embayments, and other water and related resources provide numerous functions critical to our quality of life. The watershed's wetlands and floodplains store and regulate stormwater runoff, protecting water quality, providing flood protection, and recharging aquifers and potable water supplies. Its rivers, streams, and coastal waters sustain numerous species of fish, shellfish, and wildlife, and its wetlands and coastal barriers provide resiliency against storms and coastal change.

This is the first edition of the Perdido River and Bay watershed Surface Water Improvement and Management (SWIM) plan. The purpose of the plan is to provide a framework for resource management, protection and restoration using a watershed approach. Protecting and restoring watershed resources is a shared responsibility on the part of numerous stakeholders, including local governments, state and federal agencies, private businesses, and the public. It requires building upon past accomplishments to encompass a range of management approaches.

Significant challenges affect the water quality, natural systems, and public benefits provided by watershed resources and by individual waterbodies within it. Past studies have concluded that long-term point source pollution, as well as nonpoint source pollution, has significantly impacted the ecology of Perdido Bay. Seagrass beds have suffered pronounced declines from historic coverages, and sediment enrichment has been identified within the bay. Additionally, Perdido Key and portions of Big Lagoon and Perdido Bay were repeatedly exposed to crude oil and weathered residue from the Deepwater Horizon oil spill during the summer of 2010.

Population in the Florida portion of the watershed has increased over the last several decades: from 104,947 in 1990 to 118,853 in 2010, a 13 percent increase over 20 years. Population over the next twenty years (2010-2030) is projected to increase by perhaps 10 percent, with continuing changes in land use and increasing demands on wastewater and stormwater management systems.

Addressing these challenges requires a range of strategies. Among these are additional improvements in the treatment and management of stormwater runoff; implementation of best management practices for agriculture, silviculture, and construction activities; and continued advances in wastewater treatment and management. To complement these efforts, long-term protection of critical habitats and associated buffer areas is needed. Public outreach and education, monitoring, and analysis are needed in support of all of these. Projects identified in the plan are listed in the table below:

Recommended Projects: Perdido River and Bay SWIM Plan

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

To further implementation of priority projects, the plan outlines a range of available funding resources. Given the fact that funding sources change over time, it is intended to be adaptable to evolving programs and resources.

Addressing the issues outlined in this plan and implementation of the strategies described requires a long-term, comprehensive approach with continuing collaboration between state and federal agencies, local governments, nonprofit initiatives, regional agencies, private businesses, and members of the public. In August 2017, the U.S. Environmental Protection Agency announced that Escambia County's proposal for the Pensacola and Perdido Bays Estuary Program was selected for funding from the RESTORE program. This program may build upon past efforts to engage stakeholders across the region and further advance both the protection and restoration of the Pensacola Bay system and its public benefits.

Table of Contents

List of Tables

List of Figures

Appendices

Abbreviations and Acronyms List

ADEM	Alabama Department of Environmental Management
ALDNR	Alabama Department of Conservation and Natural Resources
BARC	Bay Area Resource Council
BFA	Bream Fishermen Association
BMAP	Basin Management Action Plan
BMP	best management practice
cfs	cubic feet per second
CWA	Clean Water Act
ECUA	Emerald Coast Utilities Authority
EPA	U.S. Environmental Protection Agency
ERP	Environmental Resource Permitting
°F	Degree Fahrenheit (temperature)
F.A.C.	Florida Administrative Code
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FGS	Florida Geological Survey
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
IWR	Impaired Surface Waters Rule
LOST	local option sales tax
MFLs	minimum flows and minimum water levels
mgd	million gallons per day
MS4s	municipal separate storm sewer systems
NAS	Naval Air Station
NFWF	National Fish and Wildlife Foundation
NPL	National Priority List
NPS	nonpoint source (pollution)
NRC	National Research Council
NRCS	Natural Resources Conservation Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRDA	Natural Resource Damage Assessment
NWFWMD	Northwest Florida Water Management District
OFWs	Outstanding Florida Waters
OSTDS	onsite sewage treatment and disposal systems
PERCH	Partnership for Environmental Research and Community Environmental Health
RESTORE	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States (Act)
SEAS	Shellfish Environmental Assessment Section
SHCA	Strategic Habitat Conservation Area
SIMM	Seagrass Integrated Mapping and Monitoring
STCM	Storage Tank and Petroleum Contamination Monitoring
SMZs	Special Management Zones
SWIM	Surface Water Improvement and Management
SWTV	Surface Water Temporal Variability
TMDL	total maximum daily load
TNC	The Nature Conservancy
UF-IFAS	University of Florida Institute of Food and Agricultural Sciences
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WBID	Waterbody identification number
WFRPC	West Florida Regional Planning Council
WMA	water management area
WWTF	wastewater treatment facility
WWTP	wastewater treatment plant

1.0 Introduction

The Perdido River and Bay watershed begins in southwest Alabama, extends into western Florida and southward to the Gulf of Mexico. The watershed includes the Perdido River, Elevenmile Creek, Perdido Bay, Big Lagoon, Tarkiln Bayou, and Wolf Bay and their tributaries. The watershed is located in Escambia County, Florida, and Baldwin and Escambia counties in Alabama. Although a large portion of the watershed is within Alabama, the scope of this plan for implementation purposes is limited to the Florida portion.

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

In the Perdido River and Bay watershed, major stakeholders include:

- The Northwest Florida Water Management District
- Florida Department of Environmental Protection
- Florida Fish and Wildlife Conservation Commission
- Florida Department of Agriculture and Consumer Services
- Florida Department of Economic Opportunity
- West Florida Regional Planning Council
- Bay Area Resource Council
- Escambia County, Florida
- U.S. Department of Agriculture, Natural Resource Conservation Service
- U.S. Environmental Protection Agency
- U.S. Department of the Interior
- U.S. Fish and Wildlife Service
- The Pensacola metropolitan area
- Emerald Coast Utilities Authority
- The Nature Conservancy
- Friends of Perdido Bay
- Bream Fisherman Association
- Francis M. Weston Audubon Society
- The National Fish and Wildlife Foundation
- National Wildlife Federation
- Unincorporated communities including Cantonment, Walnut Hill, Beulah, Pine Forest, Bellview, Myrtle Grove, Perdido Key, Innerarity Point, and Barrineau Park
- And many others within Florida and Alabama

1.1 Purpose and Scope

The Perdido River and Bay Surface Water Improvement and Management (SWIM) plan is intended to provide a framework for resource management, protection, and restoration using a watershed approach. The SWIM Program is administered through the Northwest Florida Water Management District (NWFWMD) and includes management actions to address water quality, natural systems, and watershed functions and benefits.

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

The District developed a draft Perdido River and Bay SWIM Plan in 2012 that recognized objectives that address three of the NWFWMD's statutory areas of responsibility relating to watershed management:

water quality protection and improvement, focusing on prevention and abatement of nonpoint source (NPS) pollution; natural systems protection, enhancement, and restoration; and protection and restoration of floodplain functions.

The 2017 SWIM Plan was developed as a new plan consistent with updated plans for other watersheds across the northwest Florida. The plan describes and summarizes watershed resources, provides an assessment of current conditions, identifies priority challenges affecting watershed resources, and identifies opportunities watershed protection and restoration. The 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.

1.2 SWIM Program Background, Goals, and Objectives

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

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

In addition to the SWIM Act of 1987, the following Florida statutes and rules support and complement the SWIM program:

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

For the purposes of SWIM, watersheds are the hydrological, ecological, and geographical units for planning and managing restoration efforts along Florida's Gulf Coast. Watershed management requires coordination of complementary programs among jurisdictions, agencies, and stakeholders, including local, state, and federal governments, non-governmental organizations, and private citizens.

The SWIM program addresses watershed priorities by identifying management options and supporting cooperative project implementation. Projects may include stormwater retrofits for water quality improvement, wetland and aquatic habitat restoration, resource assessments, and wastewater management improvements, among others.

Surface Water Improvement and Management plans integrate complementary programs and activities to protect and restore watershed resources and functions. They are also designed to address water quality and natural systems challenges to achieve the District's goal and strategic priorities outlined in the District's strategic plan.

2.0 Watershed Description

2.1 Geographic and Geological Characteristics

The Greater Perdido River and Bay watershed spans portions of Alabama and Florida and ultimately drains into the Gulf of Mexico. The watershed covers approximately 745,000 acres (not including Perdido Bay). Of this, 30 percent is in Escambia County, Florida. The remaining 70 percent of the watershed is within Baldwin and Escambia counties in Alabama (see Figure 2-1). There are no municipalities within the Florida portion of the watershed, although unincorporated Cantonment, Walnut Hill, and the greater Pensacola area encompass substantial communities and populations.

Perdido River and Bay watershed attributes:

- Two states: Alabama and Florida
- 1,165 square miles
- One Florida county and two Alabama counties
- 63 miles of the Perdido River
- 32 distinct natural communities

The watershed headwaters originate north of Interstate 65 in northeastern Baldwin and western Escambia counties of Alabama, approximately 140 miles north of Perdido Bay. The Perdido River itself is formed by the confluence of Fletcher and Perdido creeks in western Escambia County, Alabama. The Styx and Blackwater rivers converge with the Perdido River from the west, close to the mouth of the Perdido river. Tributaries in Florida include Brushy Creek, Boggy Creek, and Elevenmile Creek, among others. Perdido Bay covers about 50 square miles and connects with the Gulf of Mexico through Perdido Pass and Pensacola Bay via Big Lagoon.

The Perdido River and Bay watershed, including Alabama's portion, lies within the Gulf Coastal Plain physiographic region characterized by gently rolling hills, sharp ridges, prairies, and alluvial floodplains underlain by sediments of sand, gravel, porous limestone, chalk, marl, and clay (Omernik 1995). Within this greater physiographic region, the Florida portion of the watershed contains two localized physiographic regions separated by a relic marine escarpment: the Western Highlands to the north and the Gulf Coastal Lowlands to the south (USDA 2004).

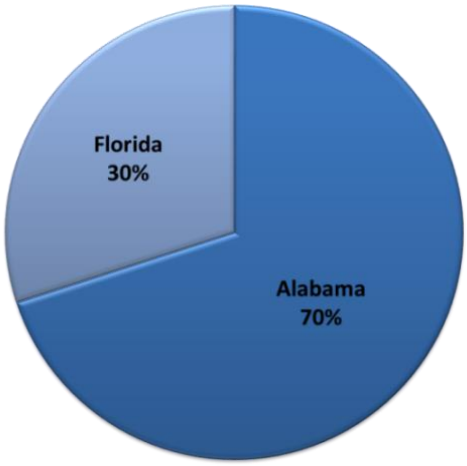


Figure 2-1 Proportion of the Greater Perdido River and Bay Watershed by State

The Western Highlands encompass most of the watershed, extending from a height of 378 feet in elevation in Alabama down to a relict marine escarpment near Perdido Bay at an elevation of 100 to 120 feet (Rupert 1993). The rolling hills of the Western Highlands have sandy soils and generally dry conditions, with groundwater emerging from lower slopes to create hillside seepage bogs (Wolfe *et al.* 1988). A series of gently sloping marine terraces make up the coastal lowlands around Perdido Bay and inland from the Gulf of Mexico (Rupert 1993). A series of sand dune and beach ridge systems run along the coast, including Perdido Key dunes, which can reach 45 feet in elevation (Rupert 1993).

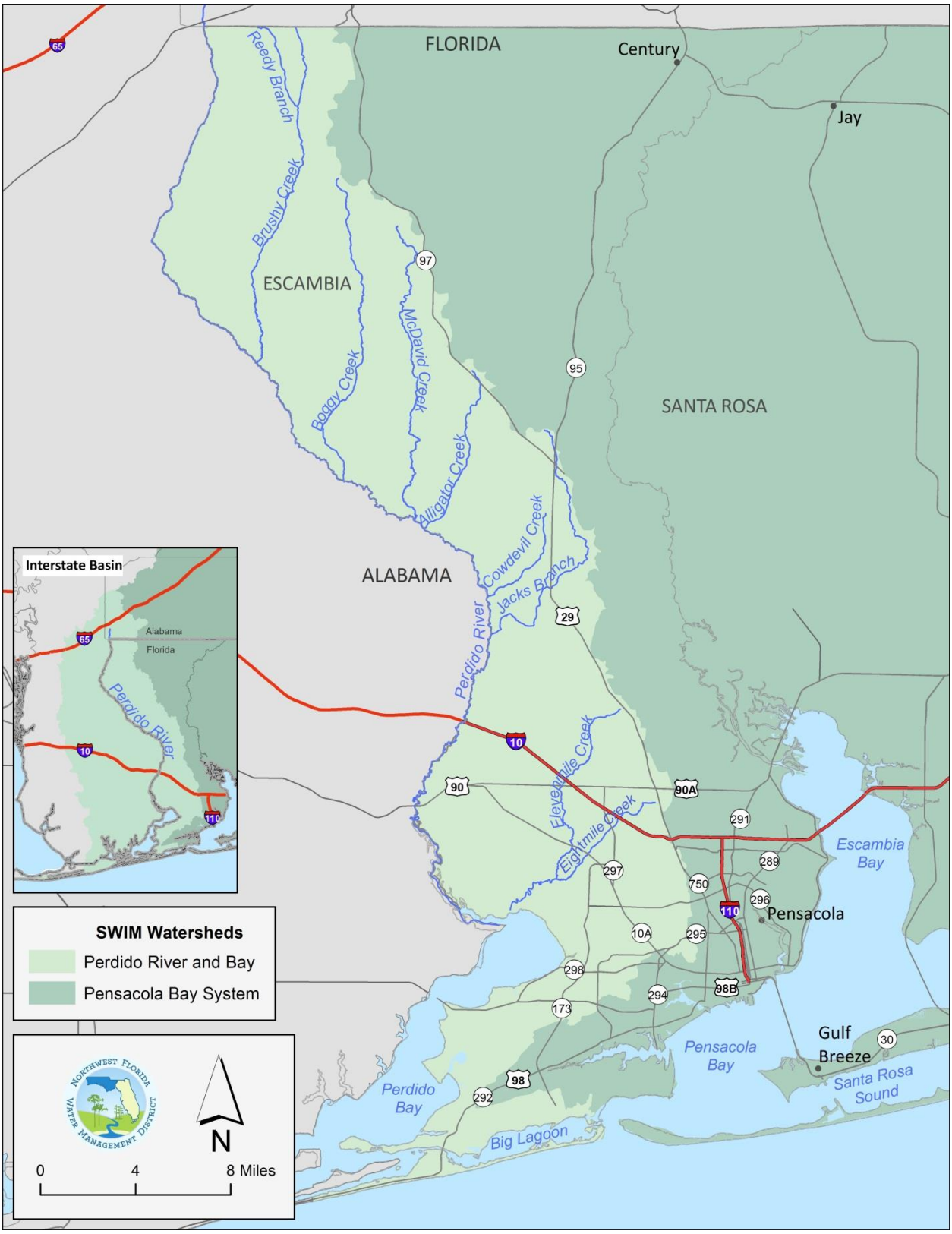


Figure 2-2 Greater Perdido River and Bay Watershed (including Alabama)

The Perdido River and 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 (USDA 2004). Overlying most geologic formations in the watershed are unconsolidated Holocene siliciclastic sediments (nearly pure quartz sands with minor heavy mineral sands) (USDA 2004). These sands were deposited during sea level fluctuations, and are presently found on the watersheds' barrier islands. Relict Pleistocene beach ridges and dunes can be found between Perdido Key and Big Lagoon (USDA 2004).

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

2.2 Hydrologic Characteristics

2.2.1 Major Streams and Tributaries

Receiving a majority of its water from surface runoff, the Perdido River begins in Baldwin County, Alabama, and discharges into Perdido Bay approximately 65 miles from its headwaters. Several rivers in Alabama, including the Styx River and the Blackwater River, converge with the Perdido River from the west and close to its mouth at Perdido Bay. Tributaries within Florida include Reedy Branch, Brushy Creek, Alligator Creek, Jacks Branch, Cowdevil Creek, and McDavid Creek. Additionally, Eightmile Creek and its tributary Elevenmile Creek discharge directly to Perdido Bay northeast of the mouth of the Perdido River (figures 2-1 and 2-3).

The Perdido River has a continuous gauge, operated by the USGS, at Barrineau Park, Florida, about 27 miles above its mouth. Average annual flows measured from 1941-2015 averaged 767 cubic feet per second (cfs).

The Perdido River has a sandy bottom that is closely connected to the sediments within the sand-and-gravel aquifer, from which it receives much of its base flow (FDEP 2006). Streams within the watershed receive up to 55-76 percent total base flow from groundwater seepage (USGS 1965). For example, Elevenmile Creek is estimated to receive approximately 68 percent of its flow from groundwater (FDEP 2008a).

2.2.2 Floodplains and Wetlands

As illustrated by Figure 2-4, floodplain wetlands encompass the length of the Perdido River and its tributaries. Major wetland systems, including palustrine and tidal wetlands, adjoin Perdido Bay at its north shore, including west of Elevenmile Creek and along the bay's northeastern shore. Garcon Swamp is a large wetland system that flows to Bayou Garcon in southeastern Perdido Bay, and the wetlands of the Perdido Pitcher Plant Prairie are east of Tarkiln Bayou. Palustrine and tidal wetlands also encompass much of Tarkiln Bayou in the central Bay, as well as the littoral zone along portions of Big Lagoon.

2.2.3 Coastal Waterbodies

The Gulf Coast Intracoastal Waterway (GIWW) is a 1,100-mile system of inland channels and tributaries traversing the Gulf Coast from Brownsville, Texas, to St. Marks, Florida, passing through the Perdido River and Bay watershed (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 channel between Pensacola Bay and Mobile Bay was completed early in 1934. The route followed Big Lagoon, Old River, Perdido Bay, Bay La Launch, Wolf Bay, Portage Creek, Bon Secour River, and Bon Secour Bay. Besides altering these natural waterways, the project involved two land cuts totaling approximately seven miles in length. During World War II, the

GIWW from Apalachee Bay, Florida, to Corpus Christi, Texas, was widened to accommodate wartime traffic. The completed GIWW was approximately 12 feet deep by 125 feet wide (Alperin 1983). The Gulf 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).

Perdido Bay covers approximately 50 square miles and is connected to the Gulf of Mexico primarily through Perdido Pass in Orange Beach, Alabama, and to a lesser extent, through Pensacola Bay (eastward via the GIWW and Big Lagoon). The pass entrance is protected by a rock jetty on the west and a combined rock weir and jetty on the east. Old River enters the Pass from the east between Florida Point and Ono Island. Big Lagoon is bordered by Perdido Key to the south and Big Lagoon State Park and NAS Pensacola to the north.

North of Innerarity Point is Bayou Garcon, which receives drainage from extensive wetlands. To the north is Weekley Bayou and Tarkiln Bayou, which is the largest bayou on Perdido Bay. Tarkiln Bayou is characterized by a shallow sand and mud bottom estuary rimmed by tidal marsh and pine flatwoods. Water depth in the bayou generally ranges from three to six feet. Water levels at the narrow neck and mouth of the bayou are typically shallow enough to walk across during low tide. The bayou receives freshwater from small, irregular streamlets through the adjacent baygall and flatwoods natural communities and via overland sheet flow (FDEP 2006).

On the eastern portion of Perdido Bay, north of Tarkiln Bayou, lie Heron Bayou and Bayou Marcus. Alligator Bayou is in the upper portion of the bay, north of the Perdido River mouth. Graham Bayou is situated in the Alabama portion of the bay and is connected to Perdido Bay via Wolf Bay (Figure 2-5). Additional waters discharging into the bay include Bridge Creek, Bayou Marcus Creek, Elevenmile Creek, and Tee and Wicker Lakes.

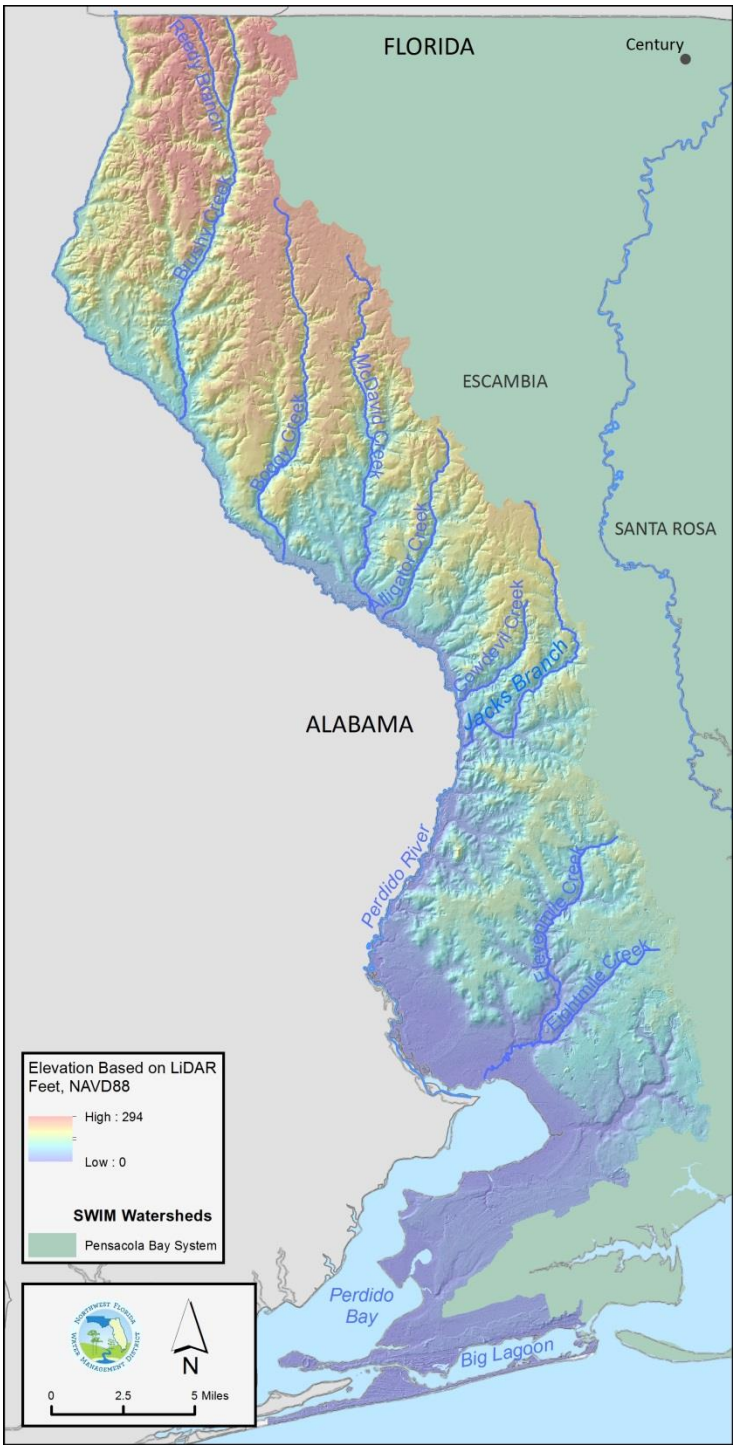


Figure 2-3 General Topography and Hydrology

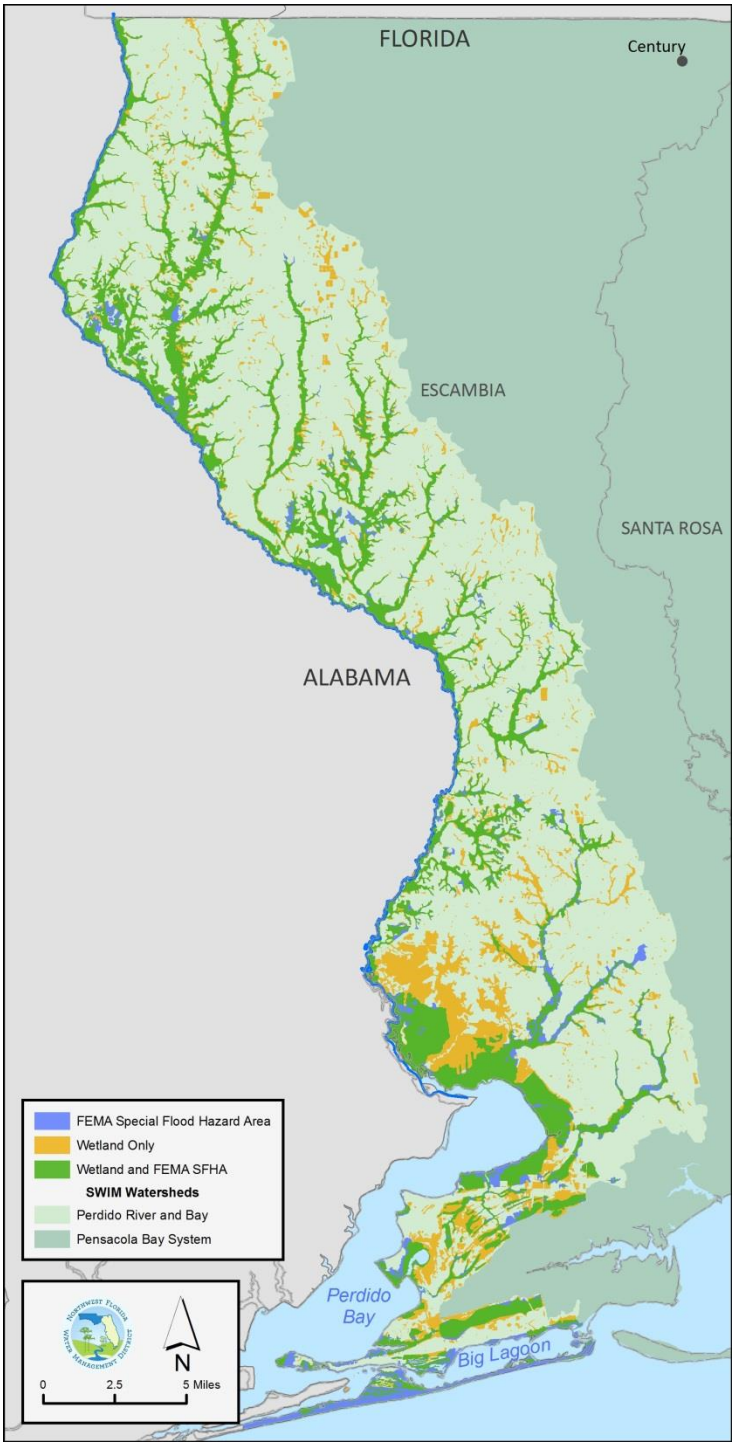


Figure 2-4 Floodplains and Wetlands

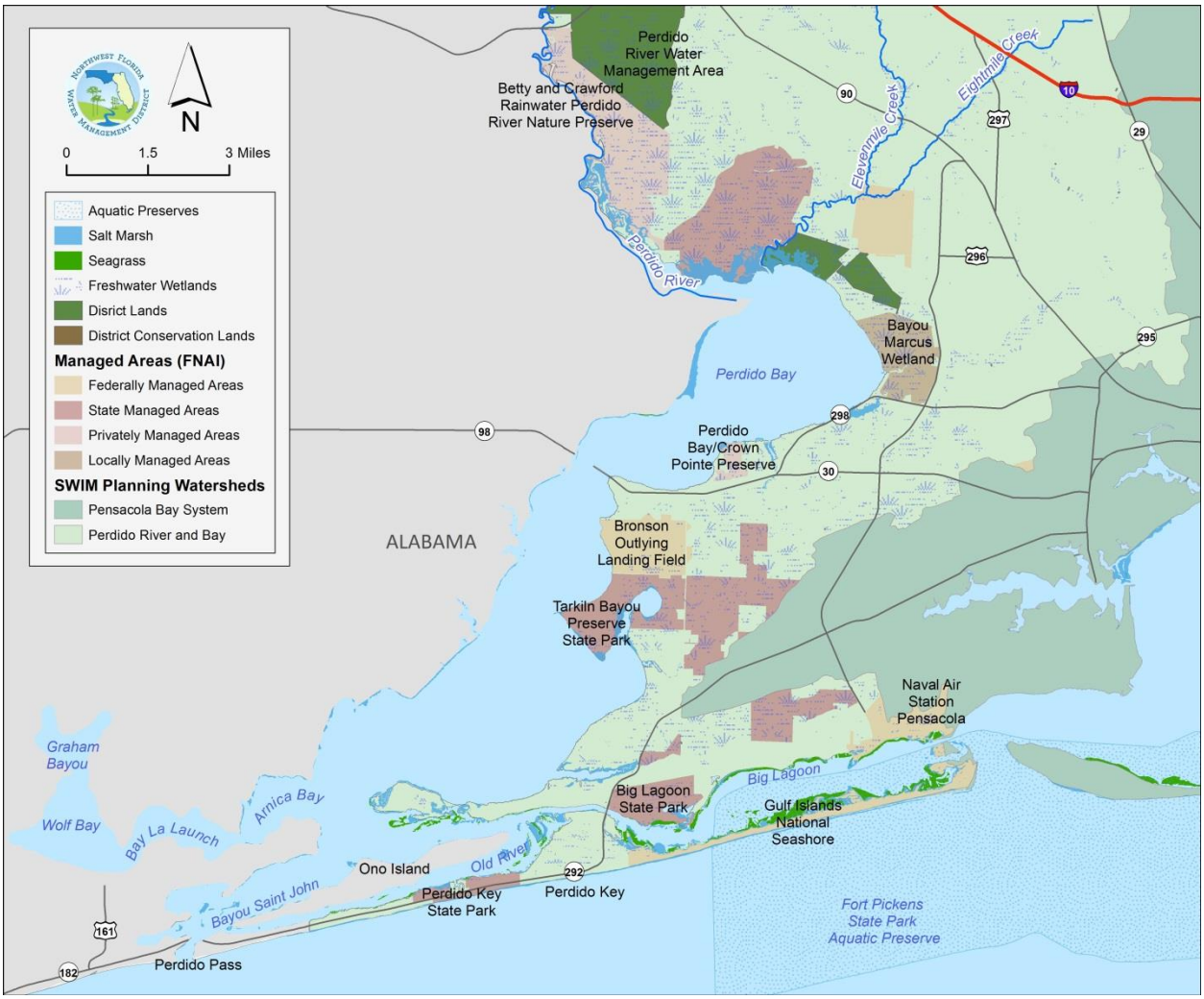
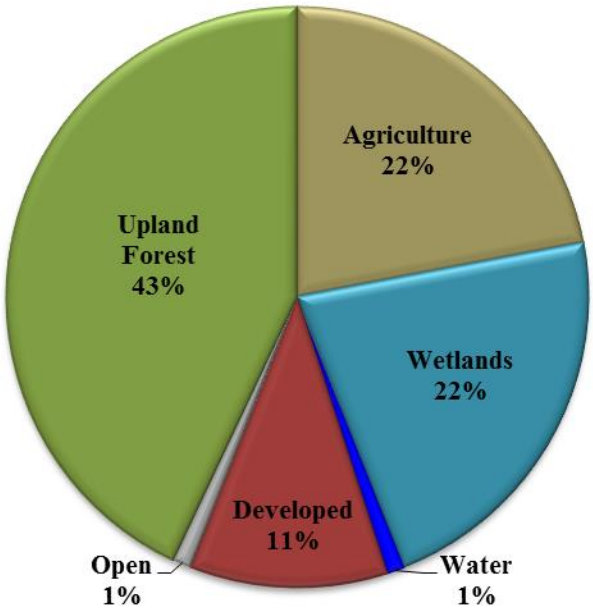


Figure 2-5 Coastal Natural Features in the Watershed

2.3 Land Use and Population

Land use in the overall watershed consists primarily of upland forest, with significant areas of agricultural lands, wetlands, and generally low-density residential areas (Figure 2-6). Within Florida, most residential, commercial, industrial, and institutional areas are concentrated in the greater Pensacola metropolitan area, which extends to the southwest portion of the county. Agricultural lands encompass approximately 15 percent of the watershed in Florida, with upland forest and wetlands accounting for approximately 38 percent and 23 percent respectively (Table 2-1).



Sources: FDEP 2015a; USGS 2011.

Figure 2-6 General Land Use of Greater Perdido Bay Watershed (including Alabama)

Table 2-1 2012-2013 Land Use and Land Cover within the Perdido River and Bay Watershed (Florida Portion)

Land Use Category	Square Miles	Percent of Basin
Agriculture	52.8	15.1
Developed	70.8	20.3
Open Land	7.7	2.2
Upland Forests	133.9	38.4
Water	2.8	0.8
Wetlands	80.1	23.0

Source: FDEP 2015a

The Perdido River and Bay watershed includes substantial areas of conservation lands (Figure 2-8). Nearly 6,300 acres are managed by the NWFWMD. These include the Perdido River Water Management Area (WMA) and the Dutex and Perdido I and II wetland mitigation areas. The Perdido River WMA is also managed by FWC as a Wildlife Management Area. Among state lands are Perdido Key, Tarkiln Bayou Preserve, and Big Lagoon state parks. The National Park Service owns and manages Gulf Islands National Seashore, established in 1971. Escambia County's Jones Swamp wetland preserve provides a 1,300-acre greenway extending from the Bayou Chico basin in the Pensacola Bay watershed to state conservation lands within the Perdido River and Bay watershed. In addition to state and federal lands, The Nature Conservancy owns and manages the 2,331-acre Betty and Crawford Rainwater Perdido River Nature Preserve, adjacent to the Perdido River WMA and the Perdido River just north of Perdido Bay. Conservation lands are described further in Appendix F.

The U.S. Navy has five facilities in Florida's portion of the watershed, encompassing over 3,000 acres. These include:

- Saufley Field, supporting the Naval Education and Training Professional Development Center;
- Blue Angel Recreation Park at Bronson Outlying Landing Field;

- Site 8A Outlying Landing Field;
- NAS Pensacola; and
- Naval Technical Training Center Corry Station.

Population in Escambia County is increasing, largely within in the southern half of the watershed. Table 2-2 displays population estimates for the watershed, based on spatial analysis of 2010 U.S. Census data, together with projections to 2030 calculated based on countywide population growth projections from the University of Florida's Bureau of Economic and Business Research (UF BEBR 2016). Significant future population growth is projected for the Cantonment area, as reflected by local government planning initiatives such as the Escambia County Mid-West Sector Plan (Escambia County 2011; The Florida-Alabama Transportation Planning Organization 2010).

Table 2-2 Watershed Population Estimates: 2010-2030

County	2010	2020	2030
Escambia (Florida)	118,853	125,486	130,496

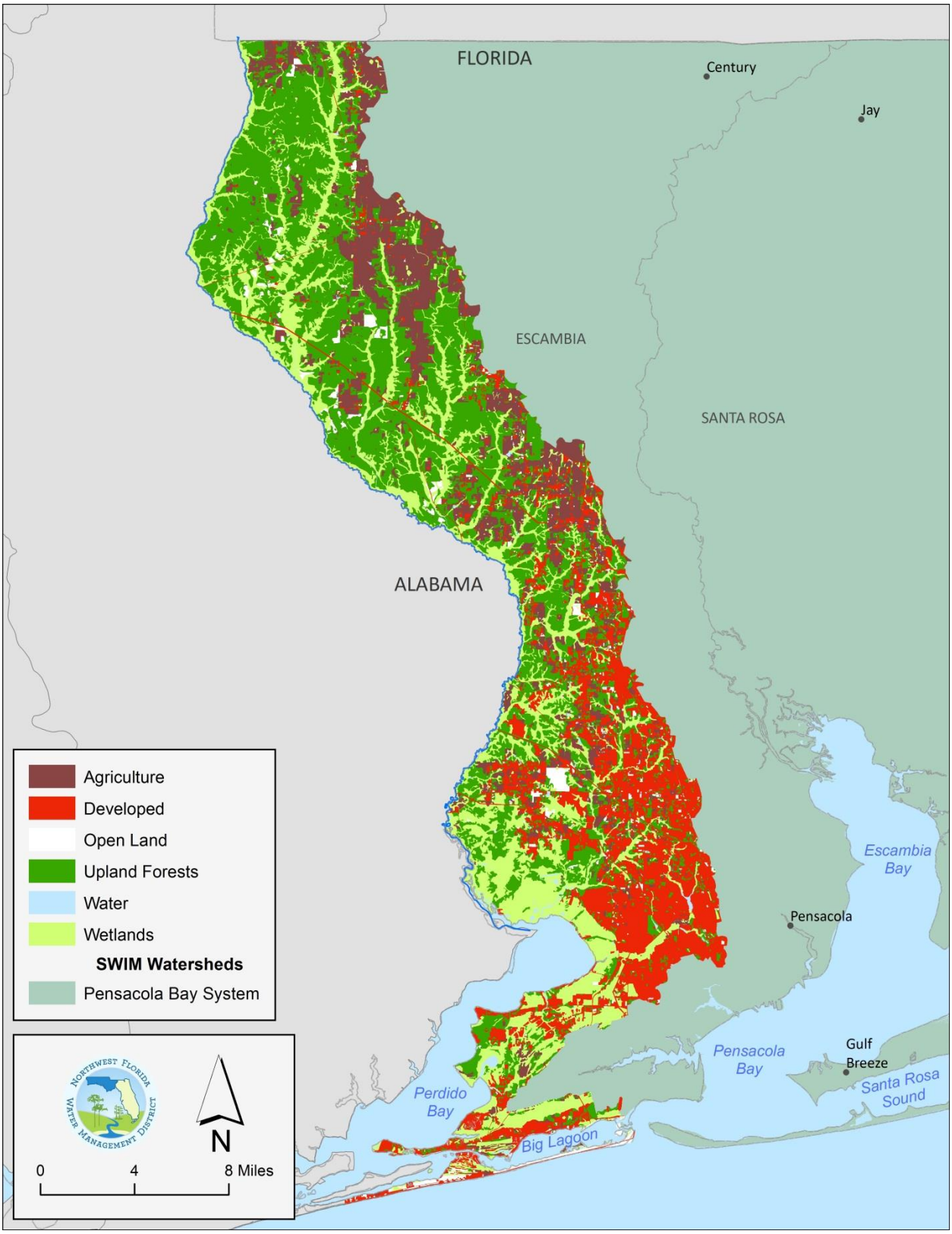


Figure 2-7 2012-2013 Land Use and Land Cover

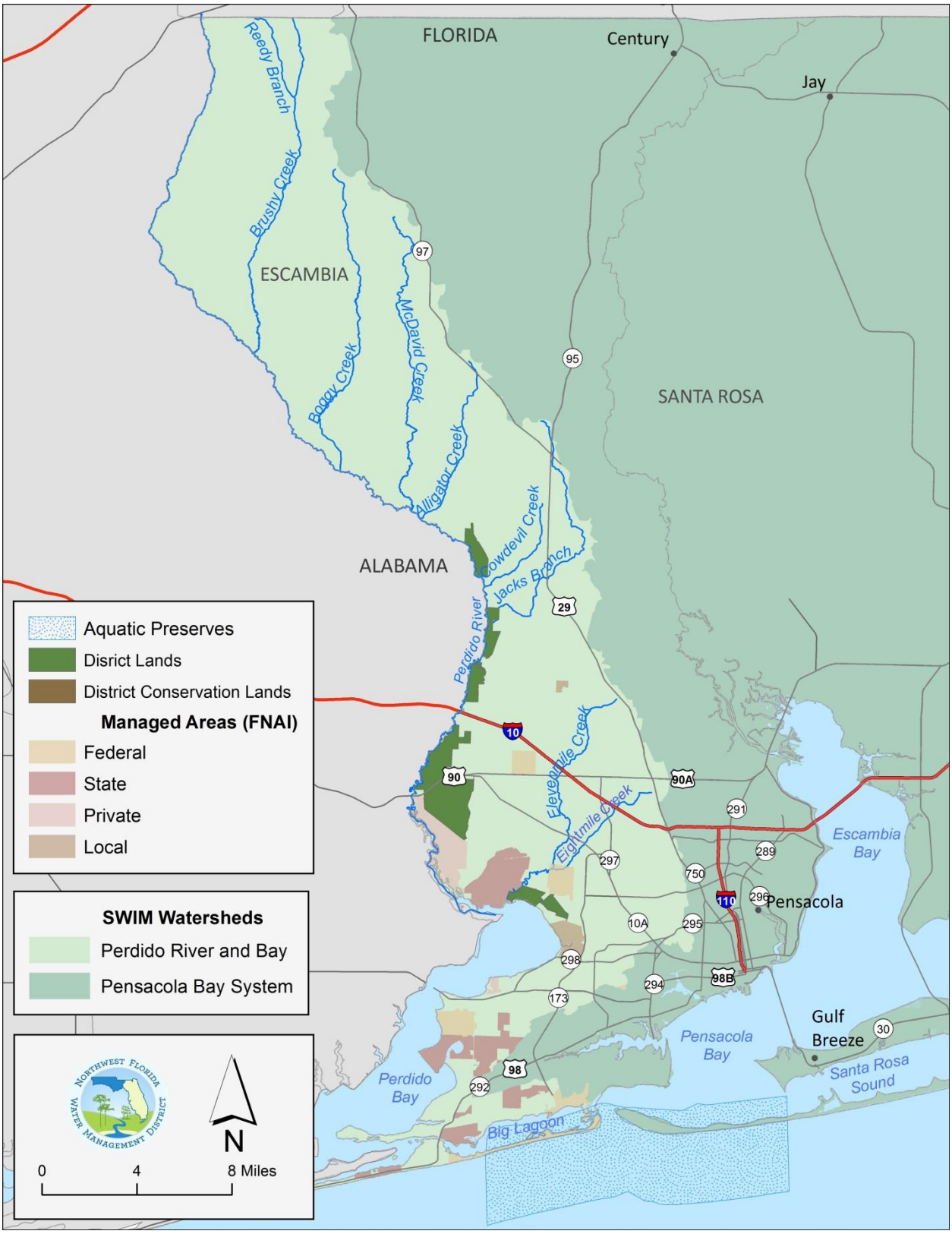


Figure 2-8 Conservation Lands within the Perdido River and Bay Watershed

2.4 Natural Communities

The Perdido River and Bay watershed supports a diversity of natural habitats including upland, coastal, transitional, wetland, aquatic, estuarine, and marine communities. Based on Geographic information system (GIS) analysis of the watershed, there are 32 distinct natural communities within 15 broader community categories recognized by the FNAI (FNAI 2010, 2016a).

This section provides a summary of habitats and natural communities 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 Perdido River and Bay watershed, as well as the species those habitats support, are described in Appendices C and D.

2.4.1 Terrestrial Communities

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

2.4.2 Perdido River

The Perdido River drains approximately 920 square miles in Florida and Alabama. The river has a sandy bottom in its upper reaches and grades to a blackwater stream in the middle and lower portions. Surface waters drain primarily from acidic flatwoods and other wetlands adjacent to the river, giving it a reddish color due to the presence of tannins and organic acids. The Perdido River is designated an Outstanding Florida Water (OFW) and is a popular waterbody for canoeing and other recreational activities.

2.4.3 Riparian, Wetland, and Floodplain Habitats

Riparian habitats include those areas along waterbodies that serve as an interface between terrestrial and aquatic ecosystems. Riparian areas are important fish and wildlife habitats that promote ecological diversity and assist in mitigating or controlling NPS pollution. Riparian vegetation can be effective in removing excess nutrients and sediment from surface runoff and shallow groundwater and in shading streams to optimize light and temperature conditions for aquatic plants and animals. Riparian vegetation, especially trees, is also effective in stabilizing streambanks and slowing flood flows, resulting in reduced downstream flood peaks. Floodplains within the watershed are found along the Perdido River, as well as the River Styx and Blackwater River in Alabama. Major floodplain areas are proximate to the lower Perdido River, as well as within wetland systems bordering northern Perdido Bay and within Garcon Swamp. Floodplains and wetlands are depicted in Figure 2-3.

The Perdido River and Bay watershed is extensive wet prairies, which support some of the most diverse plant communities in the Southeast. Tarkiln Bayou Preserve State Park's wet prairies are home to several listed plants, including large-leaved jointweed (*Polygonella macrophylla*), white-topped pitcher plant (*Sarracenia leucophylla*), and red pitcher plant (*Sarracenia rubra*).

Tidal Marshes are abundant in coastal areas of the watershed. Marsh species composition is influenced by a combination of salinity tolerance and differences in soil type, elevations, and competitive interactions. Salt marshes are similar to brackish marshes in that they serve as a transition between terrestrial and marine systems. Generally, salt marshes are intertidal and develop along relatively low energy shorelines.

Unlike brackish marshes, they may be found under significantly more saline conditions. 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 very distinctive and can be separated easily by elevation.

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.

2.4.4 Estuarine Habitats

Perdido Bay is a relatively small, shallow estuarine embayment at the terminus of the Perdido River in the far western Florida Panhandle and southeastern Alabama. As described by Livingston (2007), the bay has a shallow shelf peripheral to deeper mid- and lower bay regions. There is a general trend toward increasing depth toward the lower bay segments. A relatively well-defined channel exists between the main and lower bays. Wolf Bay to the west (within Alabama) and Big Lagoon to the east are included in the estuarine system for planning purposes. The GIWW connects Perdido Bay to Mobile Bay to the west and Pensacola Bay (through Big Lagoon) to the east.

Perdido Bay has an artificial pass to the Gulf of Mexico, Perdido Pass, maintained by the U.S. Army Corps of Engineers. The pass contributes to conditions of salinity stratification and hypoxia in deeper waters within the bay (Livingston 2007).

The Perdido River, as described above, is the primary source of freshwater inflow into the bay (annual average flow of 767 cfs). Two sizeable tributaries, the Styx and Blackwater rivers, enter the main stem of the Perdido River downstream of the USGS gauge at Barrineau Park, resulting in additional freshwater contributions. Of the two, the Styx River is larger and has a gauging station at Elsanor, Alabama. Average annual flows measured from 1988 to 2016, averaged 437 cfs, significantly augmenting freshwater inflow into Perdido Bay.

Subtidal communities in Perdido Bay predominantly include unconsolidated sediment and limited seagrass beds. Seagrass beds (Figure 2-5) provide protective and foraging habitat for many marine species and are critical to the spawning cycle of numerous fish and invertebrate species, some of which are of commercial and recreational significance. Among these are shrimp, spotted seatrout, Gulf menhaden (*Brevoortia patronus*), red drum or redfish, blue crab, Gulf flounder (*Paralichthys albigutta*), striped mullet, and white mullet (Kirschenfeld *et al.* 2002). Big Lagoon has been identified as important estuarine habitat for the Gulf sturgeon (*Acipenser oxyrinchus desotoi*).

In 2009, seagrasses covered approximately 135 acres in Perdido Bay, primarily within its lower reaches (Yarbro and Carlson 2016). This represents a significant decline from historical coverage, as described futher in Section 3.2. As described by Yarbro and Carlson (2016), the primary species of seagrass within the bay is shoalgrass (*Halodule wrightii*). Other species that have been observed are widgeongrass (*Ruppia maritima*), and turtlegrass (*Thalassia testudinum*). Tapegrass (*Vallisneria americana*) has been found in the upper tidal reaches of the bay.

Within Big Lagoon, approximately 515 acres of seagrasses, mostly continuous, were identified in 2010 (Yarbro and Carlson 2016). Turtlegrass is the most common species within the lagoon. Manateegrass (*Syringodium filiforme*) is observed infrequently.

In lower portions of the bay adjacent to the Gulf of Mexico, habitat is present for three species of threatened and endangered sea turtles. Listed sea turtles are the leatherback, green, and loggerhead.

2.4.5 Coastal Barrier Systems

The coastal barrier system includes Perdido Key and supports distinct habitats and natural systems, including beaches, foredune and relic dunes, tidal marsh, brackish ponds and lagoons, coastal grasslands, and upland forest and scrub communities (National Park Service 2016). Barrier islands and peninsulas protect adjacent estuarine and coastal areas from storm impacts and create calm estuarine conditions in landward waters. The majority of Perdido Key is managed by the National Park Service as part of the Gulf Islands National Seashore (National Park Service 2016). Beach and dune communities provide nesting grounds for sea turtles and habitat for the endangered Perdido Key beach mouse (*Peromyscus polionotus trissyllepsis*) (USFWS 2016).

3.0 Watershed Assessment and Water Resource Issues

3.1 Water Quality

The Perdido River and Bay Watershed experiences water quality challenges across both Alabama and Florida. Surface water quality varies by stream reach. Tributaries in both states are affected by NPS pollution and alterations associated with land use practices, including urban land uses including construction sites, silviculture, agriculture, landscape erosion, mining activities, and unpaved roads.

3.1.1 Impaired Waters

Of the 72 waterbody segments in the Perdido River and Bay watershed, FDEP has identified 27 impaired segments with 32 total impairments, including 22 segments for mercury in fish tissue, six segments for bacteria (five for fecal coliforms and one for beach advisories), one segment for turbidity, and three segments for dissolved oxygen (DO) (FDEP 2014b). Since some of the segments are impaired for more than one pollutant, the number of impairments exceeds the number of impaired segments; this includes WBID 489 (Elevenmile Creek) which has two separate dissolved oxygen impairments. Figure 3-1 illustrates the distribution of identified impaired waters. The list of impaired waters, including the pollutant causing the impairment, can be found in Appendix E. A draft list of impaired waters, released September 19, 2017 includes the upper segment of Perdido Bay not attaining standards for Enterococci and nutrients (chlorophyll a), while the southern marine section of Perdido River is listed for iron.

Three TMDLs have been adopted by the FDEP for fecal coliform in the Perdido River and Bay watershed (FDEP 2016a):

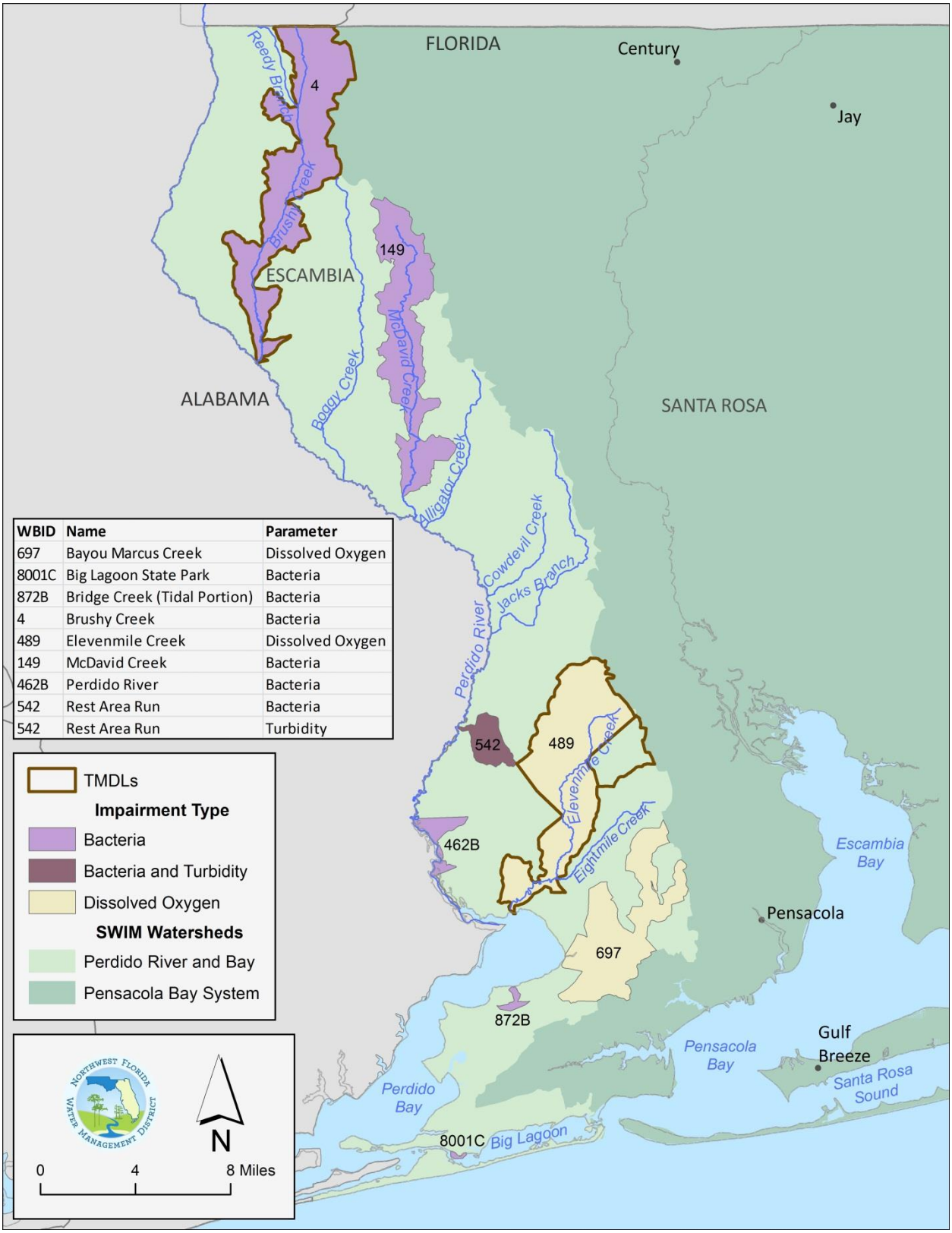
- Brushy Creek (waterbody identification number [WBID] 4) (FDEP 2012);
- Elevenmile Creek (WBID 489) (FDEP 2008b); and
- Tenmile Creek (WBID 489A) (FDEP 2008b).

The FDEP adopted a statewide TMDL for reducing human health risks associated with consuming fish taken from waters impaired for mercury. Mercury impairments are based on potential human health risks, not exceedances of water quality criteria. The primary source of mercury depositions in the environment is atmospheric deposition. It is estimated that about 70 percent of deposited mercury comes from anthropogenic sources (FDEP 2013). Approximately 0.5 percent of the mercury load in Florida waters has been identified as being discharged directly to surface waters by permitted industrial and domestic wastewater facilities (FDEP 2013). Only a small part of mercury in the environment is in the form of methylated mercury, which is biologically available to the food chain. The statewide TMDL for mercury includes a reduction target for fish consumption by humans and by wildlife and an 86 percent reduction in mercury from mercury sources in Florida (FDEP 2013).

In addition to State-listed impaired waters, TMDLs established by the U.S. EPA are listed in Appendix F.

3.1.2 Pollution Sources

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, metals, pesticides, and other contaminants. Typical sources of NPS pollution include stormwater runoff from urban and agricultural lands and erosion and sedimentation from construction sites, unpaved roads, and destabilized stream banks. Atmospheric deposition of nitrogen, sulfur, mercury, and other substances via fossil fuel combustion also contribute to NPS pollution.



WBID	Name	Parameter
697	Bayou Marcus Creek	Dissolved Oxygen
8001C	Big Lagoon State Park	Bacteria
872B	Bridge Creek (Tidal Portion)	Bacteria
4	Brushy Creek	Bacteria
489	Elevenmile Creek	Dissolved Oxygen
149	McDavid Creek	Bacteria
462B	Perdido River	Bacteria
542	Rest Area Run	Bacteria
542	Rest Area Run	Turbidity

Figure 3-1 Impaired Waters and TMDLs

Stormwater runoff, closely associated with land use, is the primary source of NPS pollution. Urban land use, especially medium- to high-density residential, commercial, and industrial uses have the highest NPS pollution per acre (EPA 2016d). In urban areas, lawns, roadways, buildings, commercial, and institutional properties all contribute to NPS pollution (EPA 2016d). Potential pollutants associated with stormwater include solids, oxygen-demanding substances, nutrients such as nitrogen and phosphorus, pathogens, petroleum hydrocarbons, metals, and synthetic organics (EPA 2016d).

Urban and suburban land use in the Perdido River and Bay watershed is concentrated around the Pensacola metropolitan area, with additional development occurring around Cantonment. Along with developments adjacent to Perdido Bay and its bayous and lagoons, tributaries and rivers that discharge to the bay are also vulnerable to NPS pollution associated with stormwater. Extensive redevelopment is occurring in the coastal portions of the watershed and target areas for redevelopment include Perdido Key and Pensacola Beach (The Florida-Alabama Transportation Planning Organization 2010). While urbanized areas contribute significantly to NPS pollution, the urban-rural fringe, which hosts new development and construction sites, introduces new NPS and expands the extent of impervious surfaces in the watershed.

In the Perdido River and Bay watershed, Escambia County and NAS Pensacola hold Municipal Separate Storm Sewer System ([MS4] NPDES Stormwater) permits for stormwater conveyance (not combined with sewer) that discharges to waters of the state (FDEP 2017). The City of Pensacola and FDOT are co-permittees with Escambia County (as well as the Town of Century in the Pensacola Bay System watershed).

In 1991, Escambia County established a Stormwater Master Plan and program to reduce flooding frequency and to improve the water quality of runoff entering surface waterbodies. Under this program, the county has developed stormwater studies for a number of the basins in the Perdido River and Bay watershed (Curb 2011). Among these are the following:

- Elevenmile Creek
- Eightmile Creek
- Beverly Parkway
- Bayou Marcus
- Millview
- Bronson Field
- Paradise Beach
- Sandy Creek Weekly Bayou
- Tarkiln Bayou
- Perdido River South
- Jack’s Branch

These studies aim to reduce NPS pollution, reduce flooding, and enhance transportation by incorporating detailed modeling and prioritizing capital improvement projects (Curb 2011; Hatch Mott MacDonald 2003). Among the project needs identified were dirt road paving, restoring streams, constructing stormwater ponds, and installing stormwater retrofits in established neighborhoods. Efforts to restore the drainage in the Elevenmile Creek region, including wetland creation, are recently funded.

There are currently 339 facilities permitted through the National Pollutant Discharge Elimination System (NPDES) in the Perdido River and Bay watershed including construction permits and other discharges. Together, these facilities hold a total of 364 permits, with some facilities holding multiple permits for multiple types of discharges. For example, a wastewater treatment facility may be registered in two different NPDES databases and hold a permit for both bio-solids and stormwater. Most permitted facilities are concentrated in the western urban fringe of Pensacola, which extends into the Perdido River and Bay watershed. Of the watershed's 364 permits, 281 are for activities within the Pensacola metropolitan area. Other major centers of NPDES activities are located in Cantonment, 20 miles north of Pensacola, along the Perdido River, and near the town of Molino in east-central Escambia County.

On-site sewage treatment and disposal systems (OSTDS) are widespread sources of nutrients and other pollutants. Significant concentrations of OSTDS can result in degraded water quality in groundwater and proximate surface waters. Well-designed and maintained septic systems are 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 (National Research Council 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 (NRC 2000; EPA 2015d).

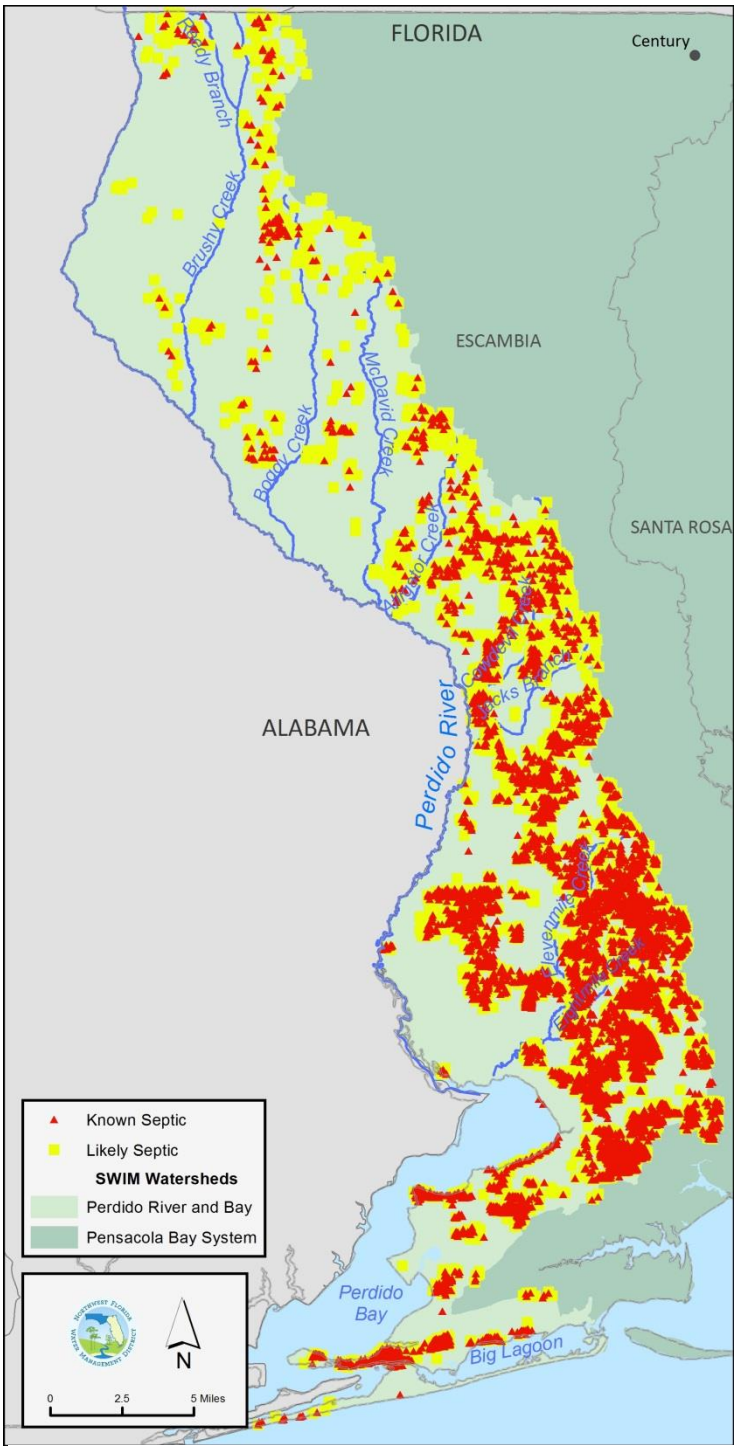


Figure 3-2 Septic Tank Locations in the Perdido River and Bay Watershed

In the Perdido River and Bay watershed, most rural and unincorporated communities and a number of suburban communities and subdivisions near Pensacola rely on OSTDS for wastewater treatment (Figure 3-2). Affected areas extend from the northern reaches of the watershed, where OSTDS are relatively sparse, south through the Ensley, and western Pensacola area where OSTDS are heavily concentrated.

ECUA continues to extend sewer service to previously unserved areas, particularly those on the coast (Escambia County 2010).

The Florida Water Management Inventory data reported approximately 12,000 known or likely septic systems in the watershed (FDOH 2016). Known septic is based on permit data combined with inspection records. Likely septic is based on results of the review of nine criteria, but without inspection verification.

Erosion and sedimentation are natural phenomena that can be accelerated by human activities, with resulting undesirable water quality consequences. Factors such as highly-erodible soils, steep unstable slopes, and high rainfall intensities, are important factors in erosion and sedimentation (Reckendorf 1995). 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 source of sedimentation into receiving waters. The NRCS has calculated rates of erosion for various land use types including cropland (8.3 tons/acre/year), pasture/hayland (0.5 tons/acre/year), and forest land (0.8 tons/acre/year).

Freshwater streams across the watershed have been impacted by the erosion of dirt roads and subsequent deposition of sediment into waterways. In 1991, Escambia County had 282 miles of unpaved dirt roads and used more than 100,000 cubic yards of fill material per year to grade these roads. When roads are graded, much of the applied fill material washes off the roadways and enters streams or stormwater drainage systems (TNC 2014). Escambia County is working to address this with a program to pave dirt roads from hilltop to hilltop. Outside the Florida portion of the watershed, Baldwin County, Alabama, has also been addressing this and expects most dirt roads to be paved by 2020 (FDEP 2006).

In the northern reaches of the watershed, Pliocene Citronelle Formation soils, topped by variable depth Pleistocene and Holocene undifferentiated sediments, are easily erodible and contribute to sedimentation in streams (FDEP 2006; Rupert 1993). Erosion caused by water is a major management concern in Escambia County, especially in areas of cropland that have slopes of more than two percent. The loss of the surface layer because of erosion reduces the productivity of soil.

Sedimentation has the potential to smother submerged aquatic vegetation and other benthic habitats, to impact shellfish beds, accumulate sediment in riffle pools, and increase turbidity in the water column. Additionally, 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).

Pollution from marinas can depend on the availability of pump-out facilities and the level and consistency of marina BMP implementation (FDEP 2015d, 2016e). The Florida Clean Marina Program and Florida Clean Boatyard Program are voluntary designation programs for implementing environmental practices to protect Florida's waterways. Marinas are located within the southern portion of the watershed, both on the mainland and the watershed's numerous peninsulas and barrier islands. There are currently two Clean Marina-designated marinas in the watershed: NAS Pensacola Sherman Cove on Big Lagoon, and Holiday Harbor Marina on Old River (FDEP 2015e). Water quality will likely continue to improve if the marinas implement BMPs and become certified under the Florida Clean Marina Program.

There are two permitted domestic wastewater facilities and six industrial wastewater facilities within the watershed (Figure 3-3). Most of these are south of Jacks Branch.

The largest source of industrial wastewater in the Perdido River and Bay watershed is International Paper's pulp and paper mill in Cantonment. The facility has had a history of water quality violations (FDEP 2006). Discharge of up to 28 million gallons per day (mgd) of untreated wastewater to Elevenmile Creek caused water quality problems in the creek and downstream in Perdido Bay. In 2013, International Paper upgraded its treatment facility and installed a ten-mile pipe system to a new 1,381-acre treatment wetland. An average daily flow of 23.5 mgd was removed from Elevenmile Creek and transferred to the receiving wetlands (Nutter and Associates, Incorporated 2015). International Paper owns over 3,000 acres of wetlands north of Perdido Bay which have also been extensively planted to provide wildlife habitat (International Paper 2014). As this facility has been generally regarded as the most substantial single pollutant source affecting Perdido Bay, success of the upgraded treatment system may be among the most important near-term factors affecting water quality in the bay.

In 2015, the Bayou Marcus Water Reclamation Facility, owned by Emerald Coast Utilities Authority, discharged 5.89 mgd of treated wastewater to a treatment wetland along the upper eastern shore of Perdido Bay. This WWTF has the permitted capacity of 8.2 mgd with discharge to nearly 1,000 acres of treatment wetlands (ECUA 2016a; FDEP 2015c).

Figure 3-3 Permitted Wastewater Facilities within the Perdido River and Bay Watershed

Wastewater reclamation that supports beneficial reuse has the potential to further decrease pollution in surface waters, while also limiting or reducing potable water demand. For facilities that already have reuse 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.

Table 3-1 Wastewater Facilities in the Perdido River and Bay Watershed

Facility Name	County	Permitted Flow (mgd)	2015 Flow (mgd)	Discharge Type*
ECUA Bayou Marcus WRF	Escambia	8.20	5.89	Wetlands; reuse at facility
Molino Park Elementary School WWTP	Escambia	0.01	0.002	RIB

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

In Florida's portion of the watershed, there are two hazardous waste facilities registered as EPA Biennial Reporter facilities, both are located in the Pensacola metropolitan area. EPA Biennial Reporter facilities handle hazardous waste and are required to report to the EPA Administrator at least once every two years (EPA 2016c).

Additionally, 233 closed, four abandoned, and 182 active petroleum contamination tracking sites within the watershed are registered with the Storage Tank and Petroleum Contamination Monitoring (STCM) database. There are seven contaminated dry-cleaning sites eligible for the state-funded Dry-cleaning Solvent Cleanup Program within the basin. The majority of STCM and dry-cleaning sites are located in developed areas in the southern portion of the watershed, particularly around the Pensacola metropolitan area and in Cantonment. In the northern reaches of the watershed, STCM and dry-cleaning sites are located predominantly in the town Walnut Hill.

There are three recently deleted EPA National Priority List (NPL) Superfund sites within the Perdido River and Bay watershed: Pioneer Sand Company, Beulah Landfill, and Dubose Oil Products Company. Sites that have been deleted from the NPL list have either been remediated or no longer pose a risk to human health. Additionally, there are five non-NPL sites in the watershed including the former Burleson Van Rental, International Paper Mill, Rapid Management Co., C & D Landfill, Sinclair & Valentine Co., Inc., and Woods Dry Cleaning & Laundry. A non-NPL site is a Superfund site that has not been placed on the NPL list through the EPA's formal process for assessing hazardous waste sites; however, the EPA can take short-term cleanup actions on non-NPL sites under the emergency removal program.

Mining activities within the watershed are somewhat limited, with a number of small sand and clay mines sparsely distributed across southern Escambia County near Pensacola (FDEP 2014d). The USGS recognizes the sand and gravel mine, known as Pit #6, operated by the Clark Site Contractors, Inc., as the only major mining operation within the Perdido River and Bay watershed. Additionally, eight small-scale mines and borrow pits within the watershed have been identified by the FDEP; several are located near streams, creeks, tributaries, and other waterbodies (FDEP 2014d, 2015b). In Alabama, there are three permitted sand and clay mines in Baldwin County and one that is inactive (Alabama Department of Environmental Management [ADEM] 2011; Alabama Department of Industrial Relations 2010).

3.2 Natural Systems

Livingston (2007) evaluated water quality, sediment quality, and biological data collected in Perdido Bay, the lower Perdido River, and Elevenmile Creek from 1988-2004 and concluded that orthophosphate and ammonia loading from the Elevenmile Creek paper mill generated a series of plankton blooms in Perdido Bay. These blooms were associated adverse biological effects, including reduced invertebrate and fish populations and disruptions in the bay food web. Some recovery was observed with reduced nutrient loading from the mill; however, these effects appear to have been partially offset by cumulative pollutant loading including from both point and nonpoint sources (Livingston 2007).

Kirschenfeld (2006) conducted a survey of bottom sediments at 37 stations in nearshore areas of Perdido Bay and identified both heavy metal and nutrient pollutant loading to the bay from the contributing watershed. Based on the constituents identified and spatial distribution, nonpoint source pollution was identified as a likely major contributor, although both municipal and industrial wastewater were also identified as potential sources.

Seagrass communities in the watershed have suffered severe historical declines. Seagrass maps from 1940 showed that seagrasses then covered 1,186 acres and that most of the acreage was located in the lower portions of Perdido Bay (Kirschenfeld *et al.* 2006). As of 2010, however, only 135 acres were identified (Yarbro and Carlson 2016). From 2002 to 2010, a minor increase (21 acres) was observed.

Within Big Lagoon, conditions have been more stable, although some losses were observed from 2003-2010 (Yarbro and Carlson 2016). Propeller scarring is also evident within seagrass beds in the southern shore of the lagoon and near Sherman Cove.

Perdido Key and portions of Big Lagoon and Perdido Bay were repeatedly exposed to crude oil and weathered residue from the Deepwater Horizon oil spill during the summer of 2010 (FWC 2015b).

Terrestrial uplands, which influence the hydrology of freshwater systems including wetlands, have undergone significant alteration across the watershed. For example, on lands now protected as Tarkiln Bayou Preserve State Park, six major drainage ditches have altered hydrology across the park. Several of these ditches were installed to increase drainage both on- and off-site for silviculture, adjacent residential developments, and nearby agricultural lands. Substantial areas of historical wet prairie are transitioning to wet flatwoods due to lack of frequent fire and alteration of hydrology (FDEP 2006).

Another example of wetland alteration has been the historic use of recreational off-road vehicles, which create major rutting along traditional jeep trails. Rutting occurred in Tarkiln Bayou Preserve State Park prior to public acquisition, resulting in 50- to100-foot ruts that hold up to four feet of water (FDEP 2006). Planting and harvesting activities associated with silviculture have also altered wetland hydrology in many areas. Associated impacts are caused primarily by the disturbance of wetlands in preparation for planting of pine plantations, construction of logging roads, and rutting caused by heavy equipment during harvesting (FDACS 2016a).

Although it is not a major component of the scope of this plan, it should be noted that 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 2015c; Mack *et al.* 2000; Vitousek 1986).

3.3 Floodplains and Floodplain Management

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

Flood protection needs are closely related with stormwater management, as well as land use planning and land development regulation. Riparian wetlands, marshes, and floodplain forests help to slow stormwater runoff, protecting water quality and regulating the release of water into streams and aquifers. Optimally, stormwater management systems provide both flood protection and water quality treatment.

Federal Emergency Management Agency digital flood maps indicate that approximately 21 percent of the watershed are designated as Special Flood Hazard Area (Figure 2-4). Lands prone to flooding with the greatest potential for economic damage are developed areas in the lower watershed around Perdido Bay and the Gulf of Mexico, including Perdido Key and neighborhoods along Bayou Marcus Creek, Eightmile Creek, and Elevenmile Creek. The major tributaries to the Perdido River and many feeder streams are also subject to periodic flooding. Flood protection needs are closely related with stormwater management, as well as land use planning and land development regulation. Optimally, stormwater management systems provide both flood protection and water quality treatment.

4.0 Watershed Protection and Restoration

4.1 Management Practices

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

4.1.1 Nonpoint Source Pollution Abatement

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

Stormwater Retrofit

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

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

Within the Perdido River and Bay watershed, the greatest need and potential for stormwater retrofit efforts is within municipal and fringe areas with relatively dense development and significant areas of impervious surface. Examples include the Pensacola area, Cantonment, Gonzalez, and the vicinity of Perdido Bay, Big Lagoon, and Innerarity Point. Additionally, there appear to be needs and opportunities for stormwater retrofit actions associated with floodplain and wetland restoration in the Weekly Bayou, Garcon Swamp, Bridge Creek, and Ten Mile Creek basins. Local governments normally take the lead in implementing stormwater retrofit projects, as they most commonly own, operate, and maintain stormwater management systems. Grant funding and planning assistance may be provided by state and federal agencies.

Agricultural Best Management Practices

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

stream bank stability and fish and wildlife habitat. In addition to protecting water and habitat quality and conserving water, BMPs may reduce costs to producers by increasing operational efficiency and effectiveness.

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

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

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

Within the Perdido River and Bay watershed, the most extensive and concentrated areas of agricultural land use occur in the northern portion of Escambia County, notably surrounding McDavid, Boggy, and Brushy creeks which drain to Perdido River (Figure 2-3). Within these areas in particular, application of agricultural BMPs have significant potential to further protect and improve water quality and aquatic habitat conditions.

Silviculture Best Management Practices

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

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

1) The **Primary Zone** varies between 35 and 200 feet and applies to perennial streams, lakes, and sinkholes, OFWs, Outstanding Natural Resource Waters (ONRW), Class I Waters, and, in some

cases, wetlands. A primary zone generally prohibits clear-cut harvesting within 35 feet of perennial waters and within 50 feet of waters designated OFW, ONRW, or Class I. Other operational prescriptions also apply to forestry practices to protect water and natural resources.

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

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

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

Given that the Perdido River and Bay watershed is predominantly forested (Table 2-1; Figure 2-7), silviculture BMPs are some of the most important tools for protecting water quality and wetland and aquatic habitat quality within the watershed. The significant relief that exists within the upper watershed (Figure 2-3) suggests application of SMZs may be effective measures of protecting downstream aquatic habitats from further impacts.

Low Impact Development

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

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

For development of transportation infrastructure, practices recommended to protect water quality and floodplain and wetland functions include the following:

- Minimize structural alteration of low-lying, flood prone lands. Such properties can be used for other purposes, such as passive parks and other public use areas.
- Incorporate bridge spans in transportation facilities that accommodate bank-full stream flows while maintaining intact floodplain, wetland, and wildlife passage functions.
- Conserve sensitive wetland and riparian habitats through both less-than-fee and fee-simple methods.

Riparian Buffers

A riparian buffer zone is an overlay that protects an adjoining waterbody from effects of adjacent development, such as runoff, NPS pollution, erosion, and sedimentation. A buffer zone in this context

refers to an area along the shoreline that is maintained in or restored to generally natural vegetation and habitat. In this condition, an intact buffer zone helps to simultaneously achieve three important goals: water quality protection, shoreline stability, and fish and wildlife habitat. Associated with these are other benefits, including aesthetic improvements and public access and recreation. These benefits are achievable for riparian areas along all types of waterbodies: stream/riverine, estuarine, lacustrine, and wetland.

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

Table 4-1 Generalized Buffer Zone Dimensions

	Buffer Width:					
Benefit Provided:	**30 ft**	**50 ft**	**100 ft**	**300 ft**	**1,000 ft**	**1,500 ft**
Sediment Removal - Minimum	●	●	●	●	●	●
Maintain Stream Temperature	◆	◆	◆	◆	◆	◆
Nitrogen Removal - Minimum		●	●	●	●	●
Contaminant Removal		●	●	●	●	●
Large Woody Debris for Stream Habitat		◆	◆	◆	◆	◆
Effective Sediment Removal			●	●	●	●
Short-Term Phosphorus Control			●	●	●	●
Effective Nitrogen Removal			●	●	●	●
Maintain Diverse Stream Invertebrates			◆	◆	◆	◆
Bird Corridors				▲	▲	▲
Reptile and Amphibian Habitat					▲	▲
Habitat for Interior Forest Species					▲	▲
Flatwoods Salamander Habitat – Protected Species						▲
Key *Water quality protection* *Aquatic habitat enhancement* ◆			*Terrestrial riparian habitat* *Vulnerable species protection* ▲			

Source: USFWS 2001

Basinwide Sedimentation Abatement

Unpaved roads frequently intersect and interact with streams, creating erosion and runoff conditions that transport roadway materials directly into streams, smothering habitats and impacting water quality and the physical structure of the waterbodies. Borrow pits have also caused progressive erosion conditions that smother streams, severely damaging or destroying habitats and diminishing water quality. Existing

impacts and future risks are most pronounced in the upper portion of the watershed, given the slopes and prevalent soils.

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

In addition to addressing unpaved roads and gully erosion sites, comprehensive application of construction BMPs, to include sediment and erosion controls, provides very significant benefits for protecting water and habitat quality, as well as the physical structure of streams and other waterbodies. Extremely heavy and sustained precipitation events are common in northwest Florida; thus, for large-scale construction and transportation projects, implementing sediment controls and staging land clearing and stormwater treatment systems in a manner that exceeds standard practice for smaller projects would avoid major sedimentation and pollution events that are otherwise possible.

4.1.2 Ecological Restoration

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

Wetland, Hydrologic and Floodplain Restoration

Wetland restoration includes actions to restore wetland functions, including plant communities, habitat conditions, and hydrology. It frequently involves substrate composition and profile restoration and vegetation community reestablishment, including shrub reduction, exotic species removal, application of prescribed fire, and replanting. Hydrologic restoration actions include improving.

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

Hydrologic restoration is important for altered flow-ways and waterbodies in urban areas, such as the Pensacola urban area, as well as for riverine systems and for larger wetland systems, such as those associated with Tarkiln Bayou, Bayou Marcus, Garcon Swamp, the Weekly Bayou basin, and Innerarity Point. Wetland restoration, including habitat enhancements and vegetation restoration, is broadly applicable at both large and smaller scales throughout the watershed.

Shoreline Restoration

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

residents and the larger community, including fish and wildlife, improved water quality, shoreline protection, and aesthetic improvements.

Shoreline restoration in this context is particularly applicable as a strategy along altered and/or eroding estuarine shorelines of Perdido Bay and Big Lagoon. Among the areas with shoreline restoration needs and opportunities are Perdido Key (bayside), Big Lagoon, Innerarity point, Bridge Creek, Palmetto Creek, and associated areas.

Stream Restoration

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

The topographic relief within the upper watershed (Figure 2-8), as well as surrounding land uses, suggests that stream restoration may be a particularly appropriate strategy within this area. Additionally, there are substantial stream and floodplain restoration needs within the Elevenmile, Ten Mile, and Bridge Creek basins, as well as within the headwater areas of nearly all of the smaller tributaries of Perdido Bay.

4.1.3 Wastewater Management and Treatment Improvements

Septic to Sewer Connections

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

Extending sewer service to areas that currently rely on conventional onsite treatment and disposal systems for wastewater treatment and disposal is effective in reducing nutrient loading to ground and surface water source. As outlined above, there are over 12,000 known or likely conventional septic systems in the Perdido River and Bay watershed. As illustrated by Figure 3-5, these are particularly concentrated around Bayou Marcus, Eightmile, Tenmile, and Elevenmile Creeks, as well as Jacks Branch which all drain to Perdido Bay or the Perdido River. Connecting residences and businesses in these areas to centralized wastewater treatment systems has the potential to substantially improve wastewater treatment and reduce loading of nutrients and other pollutants to these waterbodies and to downstream receiving waters.

Advanced Onsite Systems

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

Water Reclamation and Reuse

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

Centralized Wastewater Treatment Upgrade and Retrofit

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

4.1.4 Land Conservation

As demonstrated through the Florida Forever program and other state, federal, local, and private initiatives, preserving sensitive lands can be an effective part of protecting water quality and habitat, as well as preserving floodplain and wetland functions. Where land is acquired fee simple by public agencies, other benefits, such as public access and recreation, are also achieved. Conservation can be achieved through less than fee, as well as fee simple acquisition. In addition to land acquisition programs, local planning initiatives, such overlay zones and transfer of development rights programs, can further protect sensitive resources while maintaining private ownership and compatible development.

While the Perdido River and Bay watershed benefits from existing public land areas that protect water quality and wetland and aquatic habitats and provide for public access and use, there are opportunities to further protect water resources through the conservation of sensitive areas, including riverine, stream-front, and estuarine shorelines.

Additionally resource conservation can be accomplished at a sub-basin or project-level scale to augment other strategies, including stormwater retrofit and hydrologic restoration, and to provide for compatible public access and recreation.

4.1.5 Public Awareness and Education

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

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

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

4.1.6 Options for Further Study and Analysis

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

- Develop improved and more detailed assessments of environmental conditions and trends, to include water quality, biology, and habitat.
- Develop an updated assessment of biological conditions within Perdido Bay, to include an evaluation of trends.
- Develop a watershed-wide NPS pollution potential assessment, at the 12-digit HUC level, to include analysis of land uses, applied loading rates, and potential BMP application.
- Evaluate altered shorelines across the estuarine system; identify opportunities for habitat restoration.
- Conduct an analysis of stream buffer conditions and restoration options.
- Conduct a long-term assessment of streamflow trends to better inform and identify options for water quality and aquatic habitat protection and restoration.
- Identify estuarine sites with the potential for seagrass or other benthic habitat restoration through improved water quality treatment and water management within specific contributing basins.
- Complete a current, basin-wide analysis and prioritization of sedimentation sources and sites, to include unpaved road stream crossings, borrow pits, gulley erosion sites, and other erosion and sedimentation sources.
- Develop a spatial analysis of OSTDS, to include pollutant loading estimates and estimates of potential pollutant load reduction and average receiving waterbody pollutant concentrations following connection to central sewer and/or conversion to advanced onsite systems. Delineate target areas for central sewer connections and for advanced onsite systems.
- Develop a hydrodynamic model to improve the understanding of estuarine circulation, with application for estuarine and littoral restoration planning.
- Evaluate planning models (e.g., Goldstein et al. n.d.) to inform comprehensive and coordinated project and implementation planning.
- Develop updated, regionally specific storm surge, floodplain, and sea level rise models to support project planning, floodplain protection, and adaptation planning, and to further the understanding of drivers of coastal habitat change.
- Evaluate the feasibility and potential benefits of proposed innovative and large-scale projects. Also identify and evaluate the potential for unintended adverse effects. Examples of such projects may include, but are not limited to:
  - Pumped and tidal flow-through circulation systems
  - Regional-scale shoreline habitat development proposals
  - Stream channel reconfiguration
  - Dredged material removal and disposal
  - Benthic dredging
- Develop analysis of estuarine habitat, conditions, and trends, including for shellfish and submerged aquatic vegetation habitat, with assessment of suitability for restoration.

- Develop improved metrics for monitoring and evaluating projects, programs, and environmental conditions and trends.
- Evaluate integrated water resource management approaches with application to specific water resource challenges in northwest Florida, potentially further developing plans for the reuse of reclaimed water and stormwater harvesting.
- Evaluate the extent and effects of seasonal hypoxia and the long-term effects of salinity change on estuarine habitats.
- Develop analysis of oyster/shellfish habitat, conditions, and trends.
- Establish a framework for detecting the effects of climate change and ocean acidification on coastal marine resources in the region.
- Conduct monitoring and evaluate potential effects of herbicides, pharmaceuticals, endocrine disruptors, and other contaminants of emerging concern.
- Review of past projects completed, identifying specific project outcomes and lessons learned.
- Identify locally sensitive indicators of biological condition for dominant diversity-building habitats.
- Develop online consolidation of past and present environmental information, including natural resource coverages, research activities, restoration progress, monitoring results, TMDL updates, and regulatory actions.

4.2 Implementation

Table 4-2 outlines the planning progression for SWIM program priorities, objectives, and selected management options and approaches for the Perdido River and Bay watershed. These, in turn, inform and guide SWIM projects listed in Section 4.3. Following the discussion of watershed issues provided above, priorities and objectives are organized by major priority areas: water quality, floodplain functions, and natural systems. Education and outreach is included as well, since it is applicable to all priority areas.

Table 4-2 Priorities, Objectives, and Management Options

Watershed Priorities	Objectives	Management Options
Water Quality		
Degraded Water Quality		• Stormwater retrofit projects • Comprehensive and integrated stormwater management plans • Agricultural, forestry, and construction best management practices. • Fee simple and less-than-fee protection of floodplains, riparian habitats, and other sensitive lands • Floodplain and wetland restoration • Enhanced monitoring of hydrologic and water quality data • Conversion of septic systems to central sewer • Evaluation and deployment of advanced passive onsite wastewater treatment systems • Upgrades to wastewater infrastructure • Water reclamation and reuse • Riparian buffer zones • Urban BMPs, including limiting new effective impervious surface area and implementing other LID practices in developing and redeveloping areas • Evaluate, prioritize, and address unpaved roads and associated erosion at stream crossings. • Evaluate and address other erosion sites, such as borrow pits and gullies
Water quality impairments for listed stream and estuarine waters Vulnerability of estuarine habitats	Protect and, as needed, restore water quality in impacted or designated priority areas: - Listed impaired waters - Urban bayous and streams - Big Lagoon - Perdido River - OFWs Reduce water quality impacts of legacy pollutants.	
Wastewater Management		
Needs and opportunities for improved wastewater collection and treatment	Restore water quality in impaired riverine, stream, and estuarine waters.	
Point source discharges	Reduce loading of nutrients and other pollutants from OSTDS.	
Inadequate treatment from conventional OSTDS	Reduce pollutant loading from aging infrastructure.	
Aging infrastructure (leaky pipes, inflow and infiltration, etc.)		
Nonpoint Source Pollution		
Stormwater runoff	Improve treatment of urban stormwater.	
Sedimentation and turbidity from unpaved roads and other erosion sources	Reduce basinwide NPS pollution from agricultural areas and erosion sites. Reduce sedimentation from unpaved roads, borrow pits, and landscape erosion, and construction sites.	

Watershed Priorities	Objectives	Management Options
Natural Systems		
Wetland Systems		• Restoration of wetland hydrology and vegetation communities • Living shorelines/shoreline habitat restoration, integrated across multiple habitats where possible • Fee simple and less-than-fee protection of floodplains, riparian habitats, and other sensitive lands • Agricultural, forestry, and construction best management practices • Water quality improvement actions described above • Natural channel stream restoration • Development of enhanced modeling tools (such as suitability models for estuarine habitat restoration and enhancement) • Estuarine habitat restoration (e.g., oyster reefs, seagrasses, and tidal marsh) where water quality is sufficient • Coastal adaptation and land use planning • Prioritization and abatement of sedimentation from unpaved road stream crossings and other sources • Sediment removal from degraded aquatic habitats
Wetland loss and degradation	Protect and as necessary restore major wetlands area and functions. Protect and restore riparian and littoral habitats along rivers, streams, and estuaries. Where needed, restore wetland and stream hydrology.	
Estuarine and Coastal Habitat		
Vulnerability of estuarine habitats Legacy pollutants within estuarine substrate Shoreline destabilization and erosion Need for improved understanding of current and potential effects of sea level rise Saltwater intrusion that could alter brackish and freshwater habitats	Protect and restore riparian and littoral habitats along streams and estuarine shorelines. Restore and enhance estuarine benthic habitats. Restore seagrass beds, including through water quality improvement. Ensure restoration projects are compatible with coastal change.	
Riverine and Stream Habitats		
Physically altered and impacted tributary streams Sediment deposition Streambank erosion	Evaluate and correct hydrological alterations as necessary. Reduce sedimentation from unpaved roads, borrow pits, and landscape erosion. Protect and restore riparian habitats. Restore tributary stream channels and floodplain connection, including bayou drainages, other tidal creeks, and tributaries in agricultural areas	

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

4.3 Priority Projects

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

Table 4-3 Recommended Projects: Perdido River and Bay SWIM Plan

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

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

Stormwater Planning and Retrofit

Description:

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

Scope of Work:

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

Outcomes/Products:

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

Watershed Priorities:

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

Supporting Priorities:

- ✓ Stormwater runoff and NPS pollution
- ✓ Aging infrastructure
- ✓ Sediment deposition
- ✓ Streambank erosion
- ✓ Water quality impairments for listed stream and estuarine waters
- ✓ Vulnerability of estuarine habitats

Objectives:

- ✓ Reduce basinwide NPS pollution.
- ✓ Improve treatment of urban stormwater.
- ✓ Reduce pollutant loading from aging infrastructure.
- ✓ Reduce nutrient and bacteria concentrations in receiving waterbodies
- ✓ Prioritize and correct sedimentation and erosion sources.
- ✓ Reestablish and reconnect functional floodplain area.
- ✓ Restore stream, wetland, and estuarine benthic habitats.

Lead Entities:

- ✓ Local governments
- ✓ Estuary Program

Geographic Focus Areas:

All developed areas of the watershed. Specific project options include, but are not limited to:

- ✓ Escambia County's stormwater master plan
- ✓ Ten Mile, Eightmile, and Elevenmile creek basins, among others
- ✓ Bayou Marcus and Weekly bayou basins
- ✓ Basins for urbanized and developing bayous
- ✓ Big Lagoon

Planning Level Cost Estimate:

>$14,000,000

Septic Tank Abatement

Watershed Priority:
✓ Water Quality
✓ Natural Systems
Supporting Priorities:
✓ Inadequate treatment from conventional OSTDS
✓ Aging infrastructure
✓ Vulnerability of estuarine habitats
Objectives:
✓ Reduce nutrient and bacteria concentrations in receiving waterbodies.
✓ Reduce pollutant loading from aging infrastructure.
Lead Entities:
✓ Utilities, local governments
Geographic Focus Areas:
✓ Widespread throughout much of the watershed
✓ Elevenmile Creek basin and southern Perdido Bay, among other areas
Planning Level Cost Estimates:
>$15,000,000

Description:

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

Scope of Work:

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

Outcomes/Products:

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

Advanced Onsite Treatment Systems

Watershed Priority:
✓ Water Quality
✓ Natural Systems
Supporting Priorities:
✓ Inadequate treatment from conventional OSTDS
✓ Aging infrastructure
✓ Vulnerability of estuarine habitats
Objectives:
✓ Reduce nutrient and bacteria concentrations in receiving waterbodies.
✓ Reduce pollutant loading from aging infrastructure.
Lead Entities:
✓ Utilities, local governments
Geographic Focus Areas:
✓ Rural areas where central sewer is not available or cost-effective
✓ Much of the northern reach of the watershed
Planning Level Cost Estimate:
$15,000,000 (initial implementation)

Description:

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

Scope of Work:

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

Outcomes/Products:

1. Improved surface and groundwater quality

Agriculture and Silviculture BMPs

Description:

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

Scope of Work:

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

Outcomes/Products:

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

Watershed Priorities:

- ✓ All identified program priorities

Supporting Priorities:

- ✓ Stormwater runoff and NPS pollution
- ✓ Sedimentation and turbidity from unpaved roads and other erosion sources
- ✓ Riparian buffer loss
- ✓ Streambank erosion
- ✓ Need for improved BMP technical support

Objectives:

- ✓ Reduce basinwide nonpoint source pollution.
- ✓ Reduce nutrient and bacteria concentrations in receiving waterbodies.
- ✓ Prioritize and correct sedimentation and erosion sources.
- ✓ Restore the function of vegetated riparian buffers on public and private lands.
- ✓ Reduce erosion and sedimentation from agricultural and silvicultural operations.
- ✓ Support agricultural and silviculture BMPs.

Lead Entities:

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

Geographic Focus Areas:

- ✓ For agriculture, areas of focus include the northern watershed, including the McDavid, Boggy, and Brushy creek basins.
- ✓ For silviculture, the focus is basin-wide, as the watershed is predominantly forested.

Planning Level Cost Estimate:

- ✓ $500,000 annually

Basinwide Sedimentation Abatement

Watershed Priorities:
✓ Water Quality
✓ Natural Systems
Supporting Priorities:
✓ Stormwater runoff and nonpoint source pollution
✓ Sedimentation and turbidity from unpaved roads and other erosion sources
✓ Streambank erosion
✓ Shoreline destabilization and erosion
Objectives:
✓ Reduce basinwide NPS pollution.
✓ Prioritize and correct sedimentation and erosion sources.
✓ Prioritize and correct hydrological alterations, including channelized streams.
✓ Reduce erosion and sedimentation from agricultural and silvicultural operations.
Lead Entities:
✓ Local governments
✓ State and federal agencies
✓ Estuary Program
Geographic Focus Areas:
✓ Northern watershed, including the Brushy Creek, Boggy Creek, and McDavid Creek basins
Planning Level Cost Estimate:
$1,500,000 annual cost

Description:

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

Scope of Work:

1. Review existing inventories of sedimentation sites and identify gaps.
2. If current assessment is unavailable, inventory and evaluate sedimentation sites. This includes initial desktop data collection and analysis, together with field data collection and site evaluation.
3. Prioritize sites based on inventory and site evaluation, as well as consideration of water quality, other resource data, severity of impacts, and cumulative sub-basin effects.
4. Develop individual site plans, which detail proposed improvements and cost estimates.
5. Execute on-the-ground construction projects.
6. Implement complementary initiatives that may include education and outreach, development of new/improved BMPs, inspection programs, cost-share programs, training, demonstration projects, and maintenance.
7. Incorporate individual site improvements within a geodatabase.
8. Monitor local water quality and habitat quality, including upstream/downstream and/or before and after implementation.
9. Analyze data to identify water quality trends.

Outcomes/Products:

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

Riparian Buffer Zones

Description:

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

Scope of Work:

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

Watershed Priorities:

- ✓ All identified program priorities

Supporting Priorities:

- ✓ Stormwater runoff and NPS pollution
- ✓ Sedimentation and turbidity from unpaved roads and other erosion sources
- ✓ Diminished or disconnected floodplain area
- ✓ Riparian buffer loss
- ✓ Shoreline destabilization and erosion

Objectives:

- ✓ Reduce basinwide NPS pollution.
- ✓ Reduce nutrient and bacteria concentrations in receiving waterbodies.
- ✓ Prioritize and correct sedimentation and erosion sources.
- ✓ Restore the function of vegetated riparian buffers on public and private lands.
- ✓ Restore stream, wetland, and estuarine benthic habitats.
- ✓ Reduce erosion and sedimentation from agricultural and silvicultural operations.
- ✓ Ensure restoration projects are compatible with coastal change.

Lead Entities:

- ✓ Private Landowners;
- ✓ Local Governments
- ✓ USFWS
- ✓ FWC (Partners for Fish and Wildlife
- ✓ Southeast Aquatic Resources Partnership

Geographic Focus Areas:

- ✓ Perdido River tributaries and headwaters
- ✓ Estuarine shorelines
- ✓ Big Lagoon
- ✓ Holding/staging areas or spawning areas for Gulf sturgeon
- ✓ Locations with documented occurrence of listed species

Planning Level Cost Estimate:

TBD*

*Variable; includes passive implementation by property owners.

Outcomes/Products:

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

Aquatic, Hydrologic, and Wetland Restoration

Description:

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

Scope of Work:

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

Watershed Priorities:

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

Supporting Priorities:

- ✓ Headwater degradation and channelization
- ✓ Diminished or disconnected floodplain area
- ✓ Wetland loss and degradation
- ✓ Physically altered and impacted tributaries
- ✓ Saltwater intrusion that could alter brackish and freshwater habitats
- ✓ Shoreline destabilization and erosion

Objectives:

- ✓ Prioritize and correct hydrological alterations, including channelized streams.
- ✓ Reestablish and reconnect functional floodplain area.
- ✓ Restore wetland area and functions.
- ✓ Restore the function of vegetated riparian buffers on public and private lands.
- ✓ Prioritize and correct hydrological alterations, including channelized streams.

Lead Entities:

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

Geographic Focus Areas:

- ✓ Tarkiln and Weekly bayou basins
- ✓ Dutex mitigation property
- ✓ Garcon Swamp
- ✓ Elevenmile and Ten Mile creek basins
- ✓ Bronson Field
- ✓ Holding/staging areas or spawning areas for Gulf sturgeon

Planning Level Cost Estimate:

TBD*

*Costs variable depending on specific sites.

8. Analyze data to identify water quality trends.
9. Communicate results to watershed stakeholders and participating agencies.

Outcomes/Products:

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

Estuarine Habitat Restoration

Description:

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

Scope of Work:

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

Watershed Priorities:

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

Supporting Priorities:

- ✓ Stormwater runoff and NPS pollution
- ✓ Diminished or disconnected floodplain area
- ✓ Wetland loss and degradation
- ✓ Saltwater intrusion that could alter brackish and freshwater habitats
- ✓ Shoreline destabilization and erosion
- ✓ Lack of understanding of current and potential effects of sea level rise S
- ✓ Riparian buffer loss

Objectives:

- ✓ Reduce basinwide NPS pollution.
- ✓ Reduce nutrient and bacteria concentrations in receiving waterbodies.
- ✓ Reduce pollutant loading from aging infrastructure.
- ✓ Prioritize and correct sedimentation and erosion sources.
- ✓ Reestablish and reconnect functional floodplain area.
- ✓ Restore the function of vegetated riparian buffers on public and private lands.
- ✓ Restore wetland area and functions.
- ✓ Reduce sedimentation from unpaved roads and landscape erosion.
- ✓ Ensure restoration projects are compatible with coastal change.

Lead Entities:

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

Geographic Focus Areas:

- ✓ Perdido Bay, its bayous, and tributaries
- ✓ Big Lagoon

Planning Level Cost Estimate:

TBD*

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

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

Outcomes/Products:

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

Strategic Land Conservation

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

Scope of Work:

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

Outcomes/Products:

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

Watershed Priorities:

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

Supporting Priorities:

- ✓ Stormwater runoff and NPS pollution
- ✓ Headwater degradation and channelization
- ✓ Diminished or disconnected floodplain area
- ✓ Riparian buffer loss
- ✓ Wetland loss and degradation
- ✓ Shoreline destabilization and erosion

Objectives:

- ✓ Reduce basinwide NPS pollution.
- ✓ Reduce nutrient and bacteria concentrations in receiving waterbodies.
- ✓ Restore the function of vegetated riparian buffers on public and private lands.
- ✓ Protect and reestablish functional floodplain area.

Lead Entities:

- ✓ Florida Department of Environmental Protection
- ✓ Private landowners and working forests
- ✓ Local governments

Geographic Focus Areas:

- ✓ Perdido River floodplain
- ✓ Garcon Swamp/Perdido Pitcher Plant Prairie
- ✓ Stream and estuarine riparian habitats
- ✓ Documented or potential habitat for listed species

Planning Level Cost Estimate:

$29,000,000*

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

Watershed Stewardship Initiative

Description:

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

Scope of Work:

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

Watershed Priorities:

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

Supporting Priorities:

Needs for:

- ✓ Public understanding of practices to protect water resources
- ✓ Opportunities for public participation
- ✓ Improved technical knowledge of BMP methods

Objectives:

- ✓ Support agricultural, silvicultural, and urban BMPs.
- ✓ Conduct education and outreach about watershed resources and personal practices to protect water and habitat quality.
- ✓ Create long-term partnerships among stakeholders, including government, academic institutions, non-governmental organizations, businesses, residents, and others, to maximize effectiveness of project implementation.

Lead Entities:

- ✓ Estuary Program
- ✓ Local Governments
- ✓ FDEP
- ✓ Bay Area Resource Council
- ✓ Private landowners and working forests
- ✓ FDACS
- ✓ FWC
- ✓ IFAS

Geographic Focus Areas:

- ✓ Watershed-wide

Planning Level Cost Estimate:

$20,000 annually*

*Potentially integrated with larger program for the Pensacola Bay system

Outcomes/Products:

1. Improved long-term protection of water quality, habitat, and floodplain functions
2. Improved public understanding of watershed resources, functions, and public benefits
3. Improved public understanding of, and participation in, resource programs and projects

Sub-basin Restoration Plans

Watershed Priorities:
✓ Water Quality
✓ Floodplain Functions
✓ Natural Systems
✓ Education and Outreach
Supporting Priorities:
✓ All Supporting Priorities
Objectives:
✓ All Objectives
Lead Entities:
✓ Local governments
✓ Estuary Program
✓ Bay Area Resource Council
✓ FDEP
✓ FWC
✓ NWFWMD
Geographic Focus Areas:
Targeted sub-basins within the watershed, including, but not limited to:
✓ Ten Mile, Eightmile, and Elevenmile Creek
✓ Bayou Marcus and Weekly Bayou
✓ Big Lagoon basin
Planning Level Cost Estimate:
TBD*
*Costs depend on specific projects included

Description:

This strategy consists of development of comprehensive restoration plans for discrete sub-basins or waterbodies. This work should incorporate aspects of other separate strategies described herein.

Scope of Work:

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

Outcomes/Products:

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

Wastewater Treatment and Management Improvements

Watershed Priorities:
✓ Water Quality
Supporting Priorities:
✓ Needs and opportunities for improved wastewater collection and treatment ✓ Aging infrastructure ✓ Point source discharges
Objectives:
✓ Reduce nutrient and bacteria concentrations in receiving waterbodies. ✓ Reduce pollutant loading from aging infrastructure.
Lead Entities:
✓ Local governments ✓ Utilities
Geographic Focus Areas:
✓ Watershed-wide ✓ Systems proximate to direct coastal drainages ✓ Wastewater utilities with opportunities for water reclamation and reuse and integrated water resource management
Planning Level Cost Estimate:
$10,000,000

Description:

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

Scope of Work:

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

Outcomes/Products:

1. Improved water and aquatic habitat quality

Interstate Coordination

Description:

This strategy consists of activities related to interstate coordination to improve and protect surface water quality in the basin.

Scope of Work:

1. Develop a comprehensive plan for coordination between interstate agencies within the watershed. Evaluate case studies of successful interstate programs.
2. Develop a comprehensive contact list for the jurisdictions within the watershed. Develop an email distribution list, SharePoint group, and/or website to foster easy file and information sharing. Agencies should include USDA, Alabama Department of Economic and Community Affairs Office of Water Resources, other federal and state agencies, local governments (counties and cities), and non-profit watershed groups.
3. Identify areas of study and possible gaps in information.
4. Coordinate with Escambia and Baldwin counties in Alabama on the development of the sub-basin plans, agricultural/silvicultural BMPs, and sediment abatement issues.
5. Continually inform and engage all stakeholders during progress or discussions of watershed issues. Hold regular open joint meetings between stakeholders from both states.
6. Coordinate closely on all implementation projects for stormwater management, hydrologic alteration/restoration, sedimentation, agricultural BMPs, etc. Utilize a publicly shared file and discussion tool (such as a website) to house the status and outcome(s) of all implementation projects within the watershed (within both states).

Watershed Priority:
✓ Water Quality ✓ Natural Systems ✓ Education and Outreach
Supporting Priorities:
✓ Public education and outreach ✓ Expansion of cooperative community initiatives
Objectives:
✓ Reduce basinwide NPS pollution. ✓ Reduce nutrient and bacteria concentrations in receiving waterbodies. ✓ Support agricultural, silvicultural, and urban BMPs. ✓ Conduct education and outreach about watershed resources and personal practices to protect water and habitat quality. ✓ Create long-term partnerships among stakeholders, including government, academic institutions, non-governmental organizations, businesses, residents, and others, to maximize effectiveness of project implementation.
Lead Entities:
✓ NWFWMD ✓ FDEP ✓ Estuary Program
Geographic Focus Areas:
Watershed-wide with particular focus on northern extents of the watershed where Florida and Alabama interface
Planning Level Cost Estimate:
$25,000 annually

Outcomes/Products:

1. Progress toward basin approach to watershed protection
2. Expanded public participation and knowledge of watershed resources and management needs

Analytical Program Support

Description:

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

Watershed Priorities:
✓ All identified program priorities
Supporting Priorities:
✓ All identified program priorities
Objectives:
✓ All watershed objectives
Management Approaches:
✓ All identified management approaches
Lead Entities:
✓ FWC ✓ FDEP ✓ US EPA ✓ USFWS ✓ NWFWMD ✓ Educational and research institutions ✓ Estuary Program
Geographic Focus Areas:
Watershed-wide, including across jurisdictional boundaries
Planning Level Cost Estimate:
TBD* *Costs highly variable

Scope of Work:

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

1. For specific resource functions and at the sub-basin level, develop and refine metrics for evaluating conditions and guiding implementation
2. In support of Urban Stormwater Retrofits, develop a stormwater pollutant loading analysis to include NPS pollutant loading estimates at the sub-basin level and pollutant load reduction estimates based on proposed or potential BMPs and facilities. Develop planning level estimates of potential water quality effects (pollutant concentrations) for receiving waterbodies.
3. Also in support of Urban Stormwater Retrofits, evaluate existing stormwater management systems to identify potential or needed improvements.
4. Develop an updated assessment of biological conditions within Perdido Bay, to include an evaluation of trends.
5. Evaluate innovative methods and designs to improve stormwater treatment, wastewater treatment and management, and ecological restoration.
6. In support of Septic Tank Abatement and implementation of Advanced Onsite Systems, develop a spatial analysis of OSTDS to include pollutant loading estimates and estimates of potential pollutant load reduction following connection to central sewer and/or conversion to advanced onsite systems. In cooperation with local governments and utilities, delineate proposed target areas for central sewer connections and for advanced onsite systems.
7. In support of Agricultural and Silvicultural BMPs, develop an agricultural NPS pollution abatement plan. For this purpose, develop nonpoint source pollutant loading estimates at the sub-basin level for watershed areas that are substantially agricultural in land use, and develop pollutant load reduction estimates and targets based on application of proposed or potential BMPs. Develop planning level estimates of water quality effects (pollutant concentrations) for receiving waterbodies.
8. Identify research needs that would quantify the water quality benefits of BMP implementation, provide outreach and training, and strategies for implementing BMPs.
9. Inventory, evaluate, and prioritize unpaved road stream crossings and other sedimentation sites in support of Basinwide Sedimentation Abatement.

10. Evaluate the site-specific feasibility and potential benefits and impacts of proposed innovative and/or large-scale projects, which may include but are not necessarily limited to:
    a. Regional-scale shoreline habitat development proposals
    b. Passive and/or pumped estuarine flushing systems
    c. Proposals for major hydrologic alterations, such as causeway alterations, locks and dams, and barrier island pass alteration and maintenance
    d. Stream channel reconfiguration
    e. Benthic dredging
    f. Dredged material removal and disposal
11. Develop and refine hydrodynamic and water quality modeling tools. Develop specific management applications in cooperation with resource agencies and other public and nonprofit initiatives.
12. Evaluate effects of land use and management, to include forest management practices, on water quality. Identify and/or refine management options to protect and improve water quality.
13. Identify and describe the conditions, status, and trends of oyster and shellfish habitat within the bay.
14. Identify and describe long-term trends with respect to wetland and aquatic habitats, aquatic plants, and water chemistry. Identify management implications and recommendations.
15. Evaluate current sediment conditions and the potential for effects associated with legacy pollutants.
16. Develop improved quantitative and qualitative metrics for evaluating conditions and guiding program and project implementation.
17. Conduct a review of past projects completed, identifying specific project outcomes and lessons learned.
18. Develop a baseline study of current environmental conditions by conducting a one-time, multi-seasonal, multi-metric, and system-wide environmental analysis.
19. Establish a research and monitoring framework for detecting the effects of climate change and ocean acidification on coastal marine resources in the region.

Outcomes/Products:

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

Comprehensive Monitoring Program

Watershed Priorities:
✓ All identified program priorities
Supporting Priorities:
✓ All identified program priorities
Objectives:
✓ All watershed objectives
Lead Entities:
✓ State resource agencies ✓ NWFWMD ✓ Federal resource agencies ✓ Local governments ✓ Bream Fishermen Association and other Community-based watershed monitoring initiatives ✓ Estuary Program or other cooperative, public-private initiatives ✓ Institutions of higher education; other environmental and watershed organizations
Geographic Focus Areas:
✓ Watershed-wide, including across jurisdictional boundaries
Planning Level Cost Estimate:
$50,000 annually

Description:

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

Scope of Work:

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

Outcomes/Products:

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

4.4 Project Criteria and Guidelines

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

Generally suggested guidelines for project development and evaluation are as follows.

Generally suggested criteria include the following:

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

Natural variability, for example, would apply to habitat restoration projects to ensure adaptability to cyclic climatic conditions (e.g., seasonal, hydrologic), discrete events (e.g., coastal storms), and long-term changes in the environment (e.g., climate change and sea level rise).

4.5 Funding Sources

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

Table 4-4 Funding Sources and Eligibility

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

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

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

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

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

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Appendix A Related Resource Management Activities

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

Special Resource management Designations

Outstanding Florida Waters

Of particular interest in the Perdido River and Bay watershed are waterbodies designated as Outstanding Florida Waters (OFWs). The FDEP designates OFWs (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 2015f). Outstanding Florida Waters within the Perdido River and Bay watershed include the Perdido River and waterbodies within the boundaries of Big Lagoon State Park, Gulf Islands National Seashore, and Perdido Key State Park (F.A.C. Rule 62-302.700 [9]).

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 Perdido River and Bay watershed (FDEP 2014a). Fort Pickens Aquatic Preserve, off the coast of Escambia County, includes 34,000 acres of submerged lands. The preserve is adjacent to Gulf Islands National Seashore, and includes sandy bottom and seagrass bed habitat. The preserve is home to threatened and endangered species including the loggerhead sea turtle (*Caretta caretta*), the southeastern snowy plover (*Charadrius nivosus*), the least tern (*Sternula antillarum*), and the black skimmer (*Rynchops niger*). Fort Pickens Aquatic Preserve includes portions of Big Lagoon (as well as parts of Santa Rosa Sound and Pensacola Bay), extending northward to the Gulf Intracoastal Waterway. The preserve also includes submerged lands in the Gulf of Mexico up to three miles south of the coastline (Florida Department of Natural Resources 1992).

Conservation Lands

As described previously, the Perdido River and Bay watershed contains more than 20,000 acres of conservation land within the Florida portion of the basin. This includes three state parks managed by the Florida State Parks system. There are also two state park in the larger watershed managed by the Alabama State Parks, as well as a segment of Gulf Islands National Seashore. Compared to other watersheds in the Florida Panhandle, the Perdido River and Bay watershed has relatively limited conservation land area (approximately nine percent of total land area) to protect water and related resources.

Nearly 6,300 acres managed by the NWFWMD are within the Perdido River and Bay watershed. These include the Perdido River WMA and the Dutex and Perdido I and II mitigation areas. The Perdido River WMA is also managed by FWC as a Wildlife Management Area. The National Park Service owns and manages the Gulf Islands National Seashore (approximately 912 acres), within the watershed, established in 1971. Escambia County's Jones Swamp wetland preserve provides a 1,300-acre greenway extending from the Bayou Chico basin in the Pensacola Bay watershed to state conservation lands within the

Perdido River and Bay watershed. In addition to state and federal lands, The Nature Conservancy owns and manages the 2,331-acre Betty and Crawford Rainwater Perdido River Nature Preserve, located adjacent to the Perdido River WMA and the Perdido River just north of its mouth into Perdido Bay.

Within Alabama's portion of the watershed, there are approximately 22,500 acres of conservation lands, including Baldwin State Forest, Gulf State Park, Splinter Hill Bog, Lillian Swamp, and Perdido River Wildlife Management Area (USGS 2010). In 2006, the Mobile Bay National Estuary Program identified four projects for acquisition (NWFWMD 2012):

- AIG Baker/Reeder Lake Tract (2,124 acres of longleaf pine flatwoods and wetlands);
- IP Perdido River Tracts (30,000 acres of longleaf pine);
- Lillian Swamp (pine savanna wetlands); and
- Perdido River Delta, LLP Connector (longleaf pine and upland hardwood forest near the top of the watershed incorporating Dyas Creek).

Gulf Ecological Management Sites

The Perdido River and Bay watershed includes five Gulf Ecological Management Sites (GEMS): the Lower Perdido Bay, Orange Beach Maritime Forest, Fort Pickens State Park Aquatic Preserve, Lillian Swamp, and Perdido River Corridor. 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. Designated GEMS are considered high priority for protection, restoration, and conservation by state and federal authorities due to unique ecological qualities such as habitats significant to fish, wildlife, or other natural resources (Gulf of Mexico Foundation 2015).

Critical Habitat and Strategic Habitat Conservation Areas

The Perdido River and Bay watershed includes designated critical habitat for a variety of protected species, including the threatened Gulf sturgeon (*Acipenser oxyrinchus desotoi*), the threatened piping plover (*Charadrius melodus*), and the endangered Perdido Key Beach Mouse (*Peromyscus polionotus trissyllepsis*). Specifically, Big Lagoon is within the estuarine area designated as critical habitat for the Gulf sturgeon. Escambia County has adopted the Perdido Key Habitat Conservation Plan.

Certain natural areas within the watershed have been identified by the FWC as Strategic Habitat Conservation Areas (SHCAs). These are important habitats that do not have conservation protection and would increase the security of rare and imperiled species if they were protected. SHCAs occur adjacent to the Perdido River, including the Perdido River WMA and have been identified for several species including the Cooper's hawk (*Accipiter cooperii*) and the swallowtail kite (*Elanoides forficatus* (Endries et al. 2009).

The FDACS publishes a list of the protected plants of Florida, including those species listed as federally threatened and endangered by the USFWS (Weaver and Anderson 2010). The table in Appendix C provides a list of species that are protected and tracked for the watershed, as well as their habitat requirements.

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

The FDEP and the 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 the FDEP are considered for funding under the Resources and Ecosystems Sustainability, Tourist

Opportunities, and Revived Economies of the Gulf Coast Act (RESTORE Act) Comprehensive Plan Component, the NRDA, and the NFWF's GEBF.

RESTORE Act

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

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

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

In August 2017, the U.S. Environmental Protection Agency announced that Escambia County's proposal on behalf of the Bay Area Resource Council for the Pensacola and Perdido Bays Estuary Program was selected for funding through the RESTORE Council. Near term component of program development will include establishing an independent estuary program office, hiring a program director and staff, developing a Management Conference to include a Policy Board and Technical, Community, Education, and Economic advisory committees; identifying stressors; conducting initial outreach; and develop and adopting a Comprehensive Conservation and Management Plan (CCMP).

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

Natural Resource Damage Assessment (NRDA)

The Oil Pollution Act of 1990 authorizes certain state and federal agencies to evaluate the impacts of the Deepwater Horizon oil spill. This legal process, known as NRDA, determines the type and amount of restoration needed to compensate the public for damages caused by the oil spill. The FDEP, along with the FWC, are co-trustees on the Deepwater Horizon Trustee Council.

National Fish and Wildlife Foundation (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 the FDEP work directly with the NFWF to identify projects for the state of Florida, in consultation with the USFWS and the 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. NFWF funded the updates of the 2017 SWIM plans through the GEBF. There are no other projects currently funded by the NFWF in the Perdido River and Bay watershed (FDEP 2016d).

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, the FDEP, the FWC, the NFWF, and the Gulf Coast Restoration Council (TNC 2014).

The plan developed for the Perdido Bay watershed identifies 25 projects to address seven major actions (TNC 2014):

- 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 2012 Perdido River and Bay Draft SWIM Plan—the subject of this report (TNC 2014).

Monitoring

The majority of the monitoring data in the Perdido River and Bay watershed, including chemical and biological data, has been collected by or for the FDEP Northwest District (FDEP 2008c). 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 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 the Bream Fisherman Association (BFA).

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

FDEP/NWFWMD

As part of Florida's SWTV Monitoring Network, the NWFWMD assists the FDEP with the collection of monthly samples from 78 fixed sites, including three sites within the Perdido River basin. A site in northern Escambia County is on Brushy Creek at Nakomis Road. A second site is located on the Perdido River at Barrineau Park. The third site is located on Elevenmile Creek in the southern portion of the basin. Parameters monitored include color alkalinity, turbidity, suspended and dissolved solids, nutrients, total organic carbon, chlorides, sulfate, metals (calcium, potassium, sodium, magnesium), pH, conductivity, temperature, dissolved oxygen, total coliform bacteria, fecal coliform bacteria, enterococci bacteria, and Escherichia bacteria. These water quality stations are on USGS-gauged streams, which provide for calculated stream discharges (FDEP 2016e).

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 2008c). The biological data collected by the FDEP Northwest District includes Stream Condition Index, Wetland Condition Index, and Bioassessment data, all are reported and accessible in the STOrage and RETrieval (STORET) database. The data is included in the Impaired Surface Waters Rule (IWR) assessments, including the most recent assessment IWR run 50 which can be found on the FDEP website: http://www.dep.state.fl.us/water/watersheds/assessment/basin411.htm.

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, dissolved oxygen, surface pH, turbidity, fecal coliform bacteria, water depth, and wind direction and speed at shellfish beds. The FDACS is not currently monitoring shellfish harvesting areas in Perdido Bay.

Florida Department of Health (FDOH)

The Florida Healthy Beaches Program was begun by the FDOH as a pilot beach monitoring program in 1998 and was expanded to include all the state's coastal counties in August 2000 (FDOH 2005). Local county health departments participate in the program with weekly monitoring of beaches for *enterococcus* and fecal coliform bacteria. The departments issue health advisories or warnings when bacterial counts are too high (FDEP 2008c).

The Bream Fishermen Association (BFA)

The BFA is an organization of local fishermen that has assisted the city, county, state, and region as an environmental steward in protecting northwest Florida and south Alabama waters by performing regular water quality assessments since the 1970s. The BFA, established in the mid-1960s, was officially chartered as a non-profit organization in 1970. During the 1970s and 1980s, the BFA expanded their water sampling program to include 93 quarterly stations. Today, the BFA collects samples at 48 quarterly stations in Escambia, Santa Rosa, and Okaloosa counties (BFA 2016).

Submerged Aquatic Vegetation Monitoring

Since 2009, the FWC's FWRI has monitored changes in the extent, density, and patchiness of seagrass in Perdido Bay as part of the SIMM program. The maps are generated through photointerpretation of high-resolution imagery. The status of seagrasses in the watershed is discussed in Section 3.3.1.

Water Quality Restoration and Protection

Water quality in the Perdido River and Bay watershed is protected through several programs working together to restore water quality and prevent degradation. These programs include FDEP's Watershed Assessment program; BMPs for silviculture, agriculture, construction, and other activities related to land use and development; regulatory programs including NPDES, domestic and industrial wastewater permits, stormwater permits, and the ERP; and local efforts to retrofit stormwater infrastructure to add or improve water quality treatment. Additionally, water quality is protected through a number of conservation, mitigation, and management programs that protect water resources, aquifer recharge areas, floodplains, and other natural systems within the watershed. These programs include Florida Forever, regional mitigation for state transportation projects, and local government efforts to protect resources and provide for flood protection. The following section provides an overview of these programs and their contribution to water quality restoration and protection.

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.

Total maximum daily loads are implemented through the development and adoption of BMAPs that identify the management actions necessary to reduce the pollutant loads. The BMAPs 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. In the Perdido River and Bay watershed FDEP has adopted three TMDLs for fecal coliform, a statewide TMDL for mercury (in fish tissue), and one Reasonable Assurance Plan for Elevenmile Creek (discussed in Section 3.2). There are no pending or adopted BMAPs in the Perdido River and Bay watershed (FDEP 2016b). Verified impaired waters may be subject to TMDL development in the future.

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. An NPDES permit includes limits on the composition and quantity of a discharge, monitoring and reporting requirements, and other provisions to ensure that the discharge does cause pose a threat to human health or quarter quality. 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 2016b):

> *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.

As part of the MS4 program, Escambia County's Stormwater Program has delineated the county into 41 drainage basins. The basins have been numerically ranked based on the severity of water quality and drainage issues to establish an order of priority for remediation. A countywide Stormwater Master Plan has been completed (Hatch Mott MacDonald 2003). Countywide drainage plans have either been completed or are underway for 23 individual drainage basins. Within the Perdido River and Bay Basin, about 13 stormwater master plans are proposed or underway. Each plan describes current stormwater structural controls and identifies and recommends water quality and drainage improvement projects. Funding for stormwater retrofits is provided by a local option sales tax, which was approved by Escambia County voters in 1992. The intent of the tax is to help pay for capital improvement projects that address flooding, improve access to residential and commercial properties (improve transportation), and improve stormwater quality. The local option sales tax was most recently reapproved by voters in 2008 and will be in effect until December 31, 2017. Revenue generated by the tax has provided funding to pave dirt roads and improve drainage and transportation. As of February 2003, $37.3 million had been spent for projects to primarily improve drainage, $28.4 million to primarily improve transportation, and $16.2 million to pave dirt roads (Hatch Mott McDonald 2003).

Domestic and Industrial Wastewater Permits

Florida regulates domestic and industrial wastewater discharges to surface waters and 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 2016b).

Best Management Practices (BMPs)

BMPs 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 the FDACS to develop interim measures and agricultural BMPs. While BMPs are adopted by rule, they are voluntary if not covered 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 an ERP (FDACS 2016b).

Over the last several years, the FDACS has worked with farmers, soil and water conservation entities, the University of Florida's Institute of Food and Agricultural Sciences, 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.

BMPs have been developed and adopted into rules for silviculture, row crops, container plants, cow-calf, and dairies. The BMP manuals can be accessed on the FDACS website (FDACS 2016b). A draft BMP manual for poultry has been developed and adoption is expected by late 2016 (FDACS 2016b).

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 ERPs program regulates the management and storage of surface waters and provides protection for the vital functions of wetlands and other surface waters. Environmental resource permits are designed to obtain 80 percent average annual load reduction of total suspended solids. In northwest Florida, the ERP program is jointly implemented by the NWFWMD and the FDEP.

Regional Mitigation for State Transportation Projects

Under section 373.4137, F.S., the NWFWMD offers optional mitigation services for road projects to the FDOT when the use of private mitigation banks is not feasible and impacts to wetlands cannot be avoided. A regional mitigation plan (a.k.a., Umbrella Plan) has been developed, and is updated annually, to address mitigation needs submitted to the NWFWMD by FDOT. Components of the Umbrella Plan include the federally permitted "In-Lieu Fee Program" instrument and other mitigation projects (NWFWMD 2016a). The District's mitigation plan is developed and implemented in consultation with the FDOT, FDEP, USACE, EPA, USFWS, U.S. National Marine Fisheries Service, and FWC and is maintained and available for review at http://www.nwfwmdwetlands.com/.

Since 1997, the NWFWMD has implemented mitigation at numerous sites, including three in the Perdido River and Bay watershed: Dutex (810 acres), located on Perdido Bay; Perdido I (220 acres dedicated to mitigating the U.S. 90 Escambia County Weigh Station impacts); and Perdido II (restoration of 67 acres of hydric pine flatwoods, forested mixed wetlands, and mesic pine flatwoods). Perdido I and II are part of the 5,456 acres of wetlands and forested upland buffers acquired from International Paper Company located in the Perdido River WMA (NWFWMD 2016a).

Florida Forever Work Plan and Other Conservation Programs

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 watershed includes significant areas on the approved Florida Forever lands acquisition list, including Coastal Headwaters Longleaf Forest, Perdido Pitcher Plant Prairie, and Lower Perdido River Buffer (FDEP 2016g).

The District owns and manages 6,261 acres in fee simple and four acres in less than fee between the Perdido River and Bay. The project area is mostly undeveloped and contains a diverse list of species. Acquisition of any floodplain area along the Perdido River, whether in fee or less than fee, will significantly protect the water resources of the area as well as enhance water quality protection efforts for the Perdido Bay system. Priority purchases will be concentrated on parcels adjacent to existing District lands along the river, around the river mouth, and designated tributaries. Currently, the District owns 810 acres along Perdido Bay. Priority purchases will be concentrated on parcels adjacent to the bay which can

enhance water quality protection and mitigate for wetland impacts associated with FDOT highway construction in southern Escambia County. Approximately 1,447 acres have been identified for possible acquisition (NWFWMD 2016b).

The Nature Conservancy's Betty and Crawford Rainwater Perdido River Nature Preserve protects an additional 2,331 acres, including eight miles of riverfront, along the Perdido River in Alabama. The white top pitcher plant and numerous other rare and listed plants are found on the preserve property. The preserve land was purchased from International Paper by TNC. The preserve is named for Betty and Crawford Rainwater, whose trust funds contributed funds toward its purchase (FDEP 2008a).

In Alabama, several tracts of land within the Perdido River and Bay watershed in Baldwin County have been acquired for preservation. The Alabama Department of Conservation and Natural Resources (ALDNR) Forever Wild Land Trust Acquisition Program, in partnership with NOAA's Coastal Impact Assistance Program funds, the Alabama Forestry Commission, and a U.S. Forest Service Forest Legacy grant, purchased the following tracts of land: Perdido River Longleaf Hills Tract in 2006, Lillian Swamp South Addition in 2003, and Lillian Swamp-Caney Bayou Tract in 2003 (ALDNR 2016). These tracts geographically complement TNC's Betty and Crawford Rainwater Perdido River Nature Preserve and the additional proposed state acquisition of the Lower Perdido River Buffer.

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.

Minimum Flows and Levels (MFLs)

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

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

The technical evaluation for each MFL is expected to require approximately five years of data collection and analysis. Data collection has begun and will occur concurrently for several waterbodies. Starting in 2018, one MFL assessment is expected to be completed annually within the NWFWMD. There are no MFL assessments scheduled for any waters in the Perdido River and Bay watershed (NWFWMD 2016c).

Coastal Alabama Clean Water Partnership

The Coastal Alabama Clean Water Partnership is a coalition of Alabama governmental agencies, private organizations and citizens, and businesses created to provide solutions for the protection and preservation of aquatic resources in Alabama (FDEP 2008c). The Coastal Alabama Clean Water Partnership specifically works with the Perdido River and Bay Basin, Mobile Bay Basin, and Escatawpa River Basin within Alabama. The partnership is a project of the Mobile and Baldwin County Alabama Soil and Water Conservation Districts and the ADEM. Auburn University Marine Extension and Research Center provides project facilitation. A Steering Committee composed of environmental interests, government, and business interests directs the activities of the partnership by setting policy and providing oversight.

EPA Gulf Ecology Division

The EPA, Gulf Ecology Division Laboratory in Gulf Breeze, Florida, is a primary research facility of the EPA's Office of Research and Development National Health and Environmental Effects Research Laboratory. The lab assesses the ecological condition, ecological services and values of estuaries, coastal wetlands, seagrass, and coral ecosystems of the Gulf of Mexico and the southeastern United States; determines causes of ecological impairment; predicts future risk to populations, communities and ecosystems from multiple aquatic stressors; supports the development of criteria to protect coastal environments; and transfers scientific technology to federal and state agencies, industry, and the public (EPA 2016f).

Bay Area Resource Council (BARC)

The BARC was created from the Escambia/Santa Rosa Coast Resource Planning and Management Committee formed in February 1985 by then Governor Bob Graham. An interlocal agreement between Escambia and Santa Rosa counties, and the cities of Pensacola and Gulf Breeze was established in May 1987 to solidify the organization into an entity that could accept funding and promote the goals of the committee. The City of Milton has since joined the BARC. The West Florida Regional Planning Council (WFRPC) serves as staff to the BARC (WFRPC 2016). Although the focus of the BARC has historically been focused on the Pensacola Bay system, its area of interest has recently been expanded to include the Perdido Bay watershed.

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 2016b). 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.

Escambia County Stormwater Initiatives

Escambia County's local option sales tax (LOST) has funded projects to reduce NPS pollution from stormwater, including dirt road paving, restoring streams, constructing stormwater ponds, and installing stormwater retrofits in established neighborhoods.

In response to the large flooding event in April 2014, the Escambia County Stormwater Advisory Team was created to identify conditions associated with the April 2014 flooding and to assist Escambia County staff. The rainfall caused damage to both public and private stormwater facilities across the county, but mostly in the southern area. A needs assessment and a county-wide stormwater recommendation report were drafted to rank priority drainage projects and provide recommendations for stormwater within Escambia County (Escambia County 2016).

Other Programs and Actions

As described in the preceding section, local governments and organizations are active participants in the restoration projects being or expected to be funded through the RESTORE Act, the NRDA, and the NFWF. These organizations have been long-standing partners in monitoring water quality and environmental health throughout the watershed. They have also been key partners in developing stormwater master plans and retrofit projects to reduce and treat stormwater, as well as building community support for watershed protection through the creation of citizen advisory councils and volunteer organizations.

Numerous citizen or citizen-government groups with a primary interest in protecting or enhancing water resources are active in the Perdido River and Bay watershed. Most organizations have a specific geographic focus at either the watershed or waterbody level. Identified groups and their activities are:

- **Wolf Bay Watershed Watch** – Wolf Bay Watershed Watch is a community advocacy group whose mission is to promote the protection and preservation of the natural resources of the Wolf Bay watershed (Alabama Water Watch 2002). Wolf Bay is connected to the western end of Perdido Bay in Alabama. This watershed organization is affiliated with the larger Alabama Watershed Watch organization coordinated by Auburn University's Department of Fisheries Allied Aquaculture and International Aquaculture and Aquatic Environments. Wolf Bay Watershed Watch, formed in 1998, collects water quality samples from Wolf Bay and Perdido Bay, and members participate in coastal cleanups. More recently, the group participated in the preparation of a NPS pollution management guide, the *Wolf Bay Plan: A Stakeholder's Guide to Protecting the Watershed* (Wolf Bay Watershed Project 2005). The Wolf Bay Watershed Project is a multiagency initiative formed for the purpose of developing the plan for improving and protecting Wolf Bay. The plan was prepared with funding from an ADEM Clean Water Act, Section 319 grant.
- **Gulf Coastal Plain Ecosystem Partnership** – The Gulf Coastal Plain Ecosystem Partnership is a voluntary partnership between ten private and public land owners in western Florida and includes the following governmental, business, and environmental interests: the U.S. Department of Defense, FDEP, Florida Division of Forestry, International Paper, Conecuh National Forest (in Alabama), Nokuse Plantation, NWFWMD, National Park Service, FWC, and TNC. The purpose of the partnership is to provide a collaborative approach to the preservation and management of natural lands. The parties operate together under a 1996 Memorandum of Understanding for the management of about one million acres of northwest Florida and south Alabama. It was initially formed in response to extensive loss of longleaf pine and aquatic habitats and to increase the land buffers surrounding military reservations (http://www.cooperativeconservationamerica.org/viewproject.asp?pid=544).

Members of the partnership have agreed to a set of land management principles directed at ecosystem preservation by using prescribed burns, recovering listed species, restoring aquatic habitat, providing public outreach, and sharing and exchanging relevant information and technology on new land management and protection techniques. Through collaboration and the pooling of resources, the partners are able to leverage the purchase of additional conservation lands. Within the Perdido River and Bay Basin, the partnership has provided review and assistance for the FDEP's Tarkiln Bayou Burn Plan and assistance with purchases of the Betty and Crawford Rainwater Perdido River Nature Preserve along the Perdido River.

Bream Fishermen Association – As described above, the BFA, which was established in the 1960s, serves as an environmental steward in monitoring waterbodies and protecting northwest Florida and south Alabama waters.

- **Partnership for Environmental Research and Community Environmental Health (PERCH)** – The University of West Florida Partnership for Environmental Research and Community Environmental Health (PERCH) was formed to provide input to the University of West Florida regarding environmental health studies, and investigate questions pertaining to environmental pollution and how it may affect human health. The partnership is funded by federal appropriation grants (University of West Florida PERCH 2016).
- **Friends of Perdido Bay/Perdido Bay Foundation** – The Friends of Perdido Bay was formed in response to wastewater discharges from Champion's (currently International Paper) paper plant located in Cantonment (http://www.friendsofperdidobay.com). The Friends have participated with government and other interest groups with a 2000 plan for monitoring Perdido Bay. The Perdido Bay Foundation is a charitable trust formed in 1997 for the purpose of improving water quality in Perdido Bay. The foundation's activities are organized and coordinated through a Board of Directors.
- **Florida Geological Survey's (FGS's) 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).

Appendix B Geologic and Physical Characteristics

Overview

The greater Perdido River and Bay watershed covers approximately 1,164 square miles of Florida and Alabama. About 30 percent of this area is within Florida (Figure C-1). There is distinct topographical variation, with the highest elevations and most significant slopes within the northern extent of the watershed (Figure C-2). The lower reaches of the watershed are defined more substantially by floodplains within the coastal plain.

Generalized land cover (Figure C-3) reflects major urban development associated within the greater Pensacola region and coastline in Florida, with additional development and agricultural uses within Alabama. Upland forests and wetlands both have extensive coverage throughout the watershed planning area.

The following three figures depict the interstate basin, topography, and generalized land use and land cover.

Figure C-1 Greater Perdido River and Bay Watershed

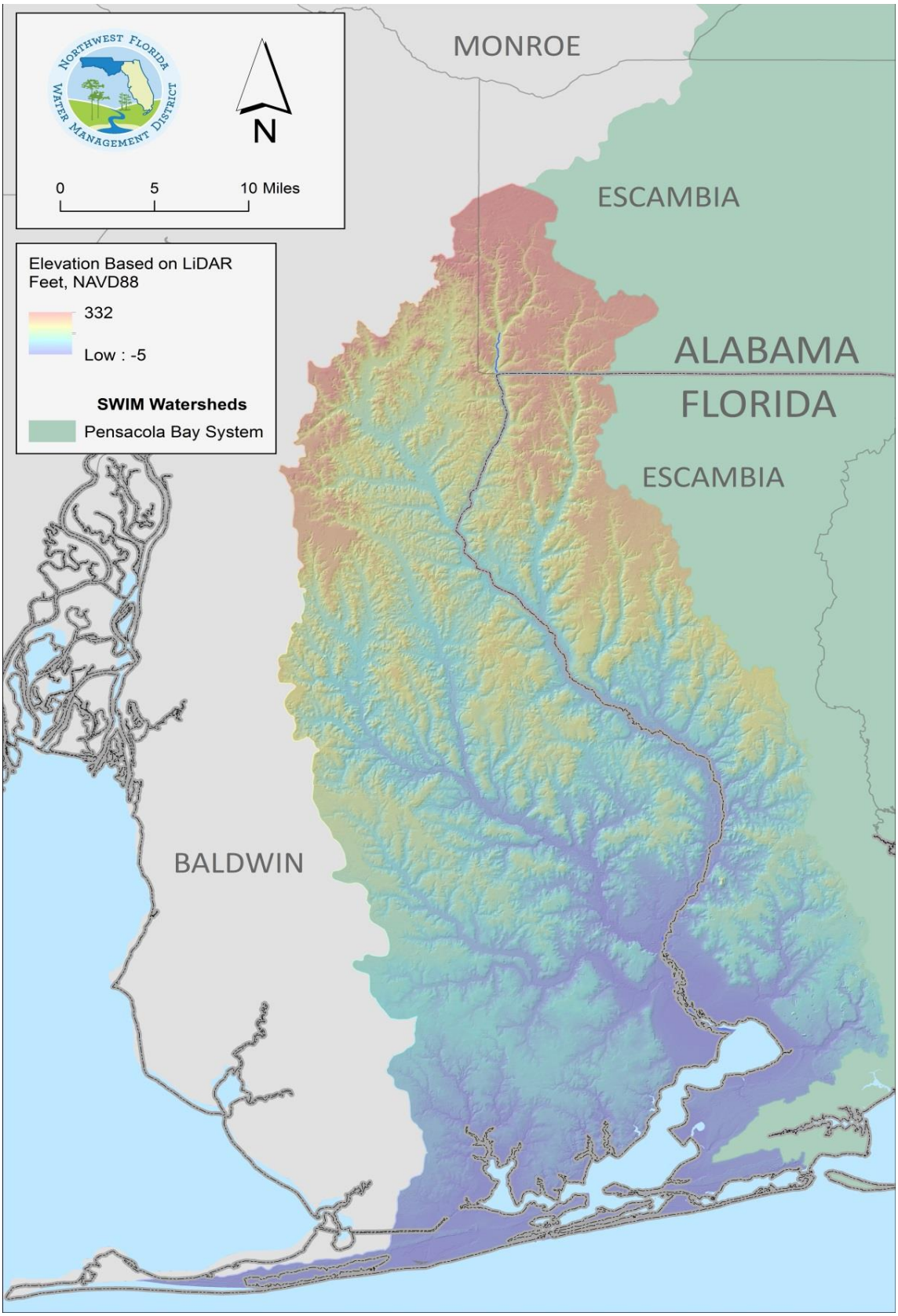

Figure C-2 Greater Perdido River and Bay Watershed Topography

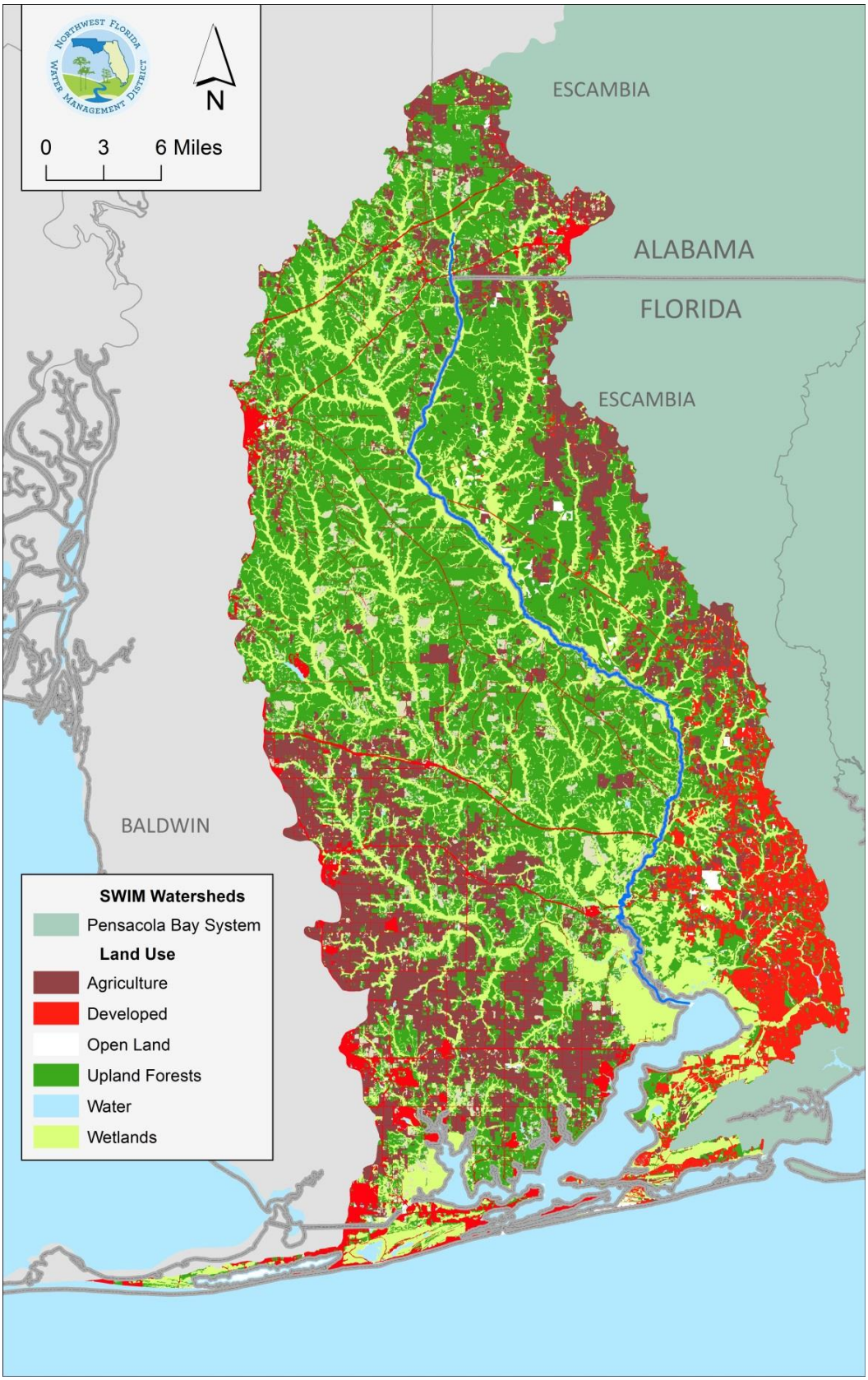

Figure C-3 Greater Perdido River and Bay Watershed Land Use and Land Cover

Aquifer Vulnerability Assessment

In 2017, the Florida Geological Survey released the Floridan Aquifer System Contamination Potential (FAVA II) dataset, which examines the sand-and-gravel aquifer as well as the Floridan aquifer (Figure C-4). This dataset was calculated through the application of the weights of evidence method. This method examines different data layers including point and area data to determine relative vulnerability. These maps were developed to provide FDEP with a ground-water resource management and protection tool to carry out agency responsibilities related to natural resource management and protection regarding the Floridan aquifer system. The maps are not appropriate for site specific analysis.

Potable water sources within the Perdido River and Bay watershed come primarily from the sand-and-gravel aquifer system. As depicted in the figure, the sand-and-gravel aquifer system is most vulnerable to contamination within the coastal portion of the watershed planning area, as well as other areas distributed in the middle and upper watershed.

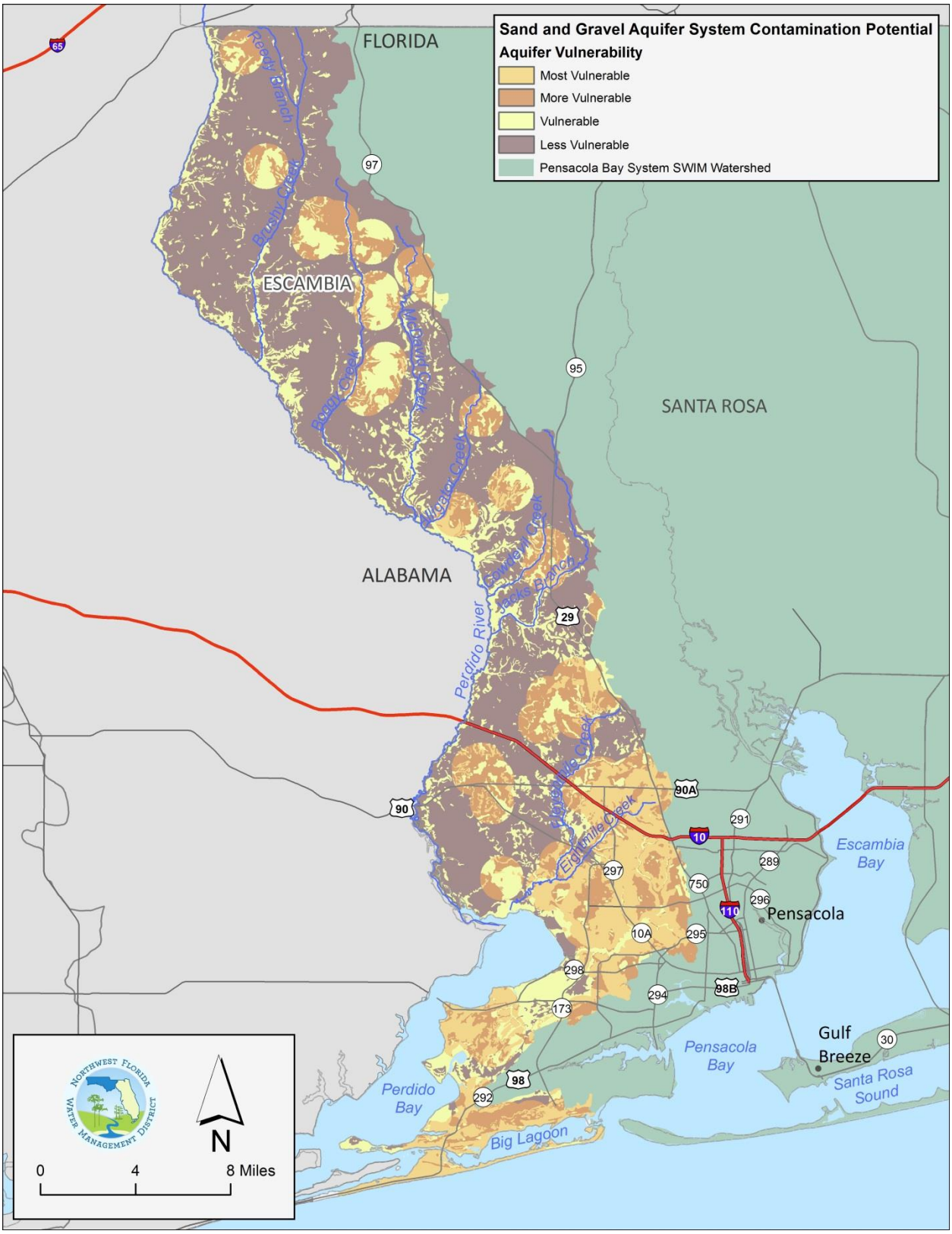

Figure C-4 Sand-and-Gravel Aquifer System Contamination Potential

Geologic Units

The Perdido River and Bay watershed encompasses two localized physiographic regions divided by a relict marine escarpment just north of Perdido Bay: the Western Highlands to the north and the Gulf Coastal Lowlands to the south (Rupert 1993).

The northern extent of the watershed contains the Pliocene Citronelle Formation, which consists of sedimentary deposits ranging in size from clay to gravel; however, 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 indurate the sediment. In some areas, thicker discontinuous layers of sandy clay can create semi-confined groundwater conditions or perched water table conditions. Overlying most geologic formations in the watershed are unconsolidated Holocene siliciclastic sediments (nearly pure quartz sands with minor heavy mineral sands) (USDA 2004). 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). These same sediment deposits form much of the coastal sand dunes, beach ridges (i.e., spit between Perdido Bay and Big Lagoon), and barrier islands.

Fluvial processes, in conjunction, are also greatly responsible for the modern land surface of the Perdido Bay watershed. The larger stream valleys within most of the watershed commonly contain deposits of Pleistocene and Holocene alluvium, especially along the Perdido, Blackwater, and River Styx. 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 Gulf Coastal Lowlands, ancient marine geomorphic features including beach ridges, spits, bars, dunes, and terraces make up the modern topography. 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 Perdido River and Bay watershed.

Soils

Soils within the watershed have been used extensively for crop production, silviculture, and pastureland. Along with being a valuable agricultural resource, 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 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 Pensacola Bay watershed, ultisols form in the majority of non-coastal, interior locations 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 and are found extensively in the northern reaches of the entire watershed.

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 are found in the floodplain of the Escambia River and on Santa Rosa Sound where surficial processes are active (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 can be found throughout the coastal portion of the watershed (Collins 2010). The presence of spodosols usually indicates an area that was historically dominated by a pine 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 floodplains of the watershed's various rivers and tributaries (Collins 2010).

Appendix C Threatened and Endangered Species within the Watershed

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

Plants:

Scientific Name	Common Name	Designation			Natural Communities
		FNAI	State	Federal	
Plants					
Agrimonia incisa	Incised Groove-bur	S2	T	N	Terrestrial Habitat(s): Forest/Woodland, Woodland - Conifer, Woodland - Mixed
Andropogon arctatus	Pine-woods Bluestem	S3	T	N	Lacustrine: wet pine flatwoods, seepage wetlands, bogs, wet pine savannas
Baptisia calycosa var. villosa	Hairy Wild Indigo	S3	T	N	N/A
Calamovilfa curtissii	Curtiss' Sandgrass	S3	T	N	Palustrine: mesic and wet flatwoods, wet prairie, depression marsh Terrestrial: mesic flatwoods
Calopogon multiflorus	Many-flowered Grass-pink	S2S3	T	N	Palustrine Habitat(s): Bog/fen, forested wetland herbaceous wetland Terrestrial Habitat(s): Forest Edge, Forest/Woodland, Grassland/herbaceous, Savanna, Woodland - Conifer
Carex baltzellii	Baltzell's Sedge	S3	T	N	Terrestrial Habitat(s): Forest/Woodland, Woodland - Mixed
Chrysopsis godfreyi	Godfrey's Goldenaster	S2	E	N	Terrestrial: grassland/herbaceous, sand/dune, shrubland/chaparral
Cladonia perforata	Perforate Reindeer Lichen	S1	E	E	Terrestrial Habitat(s): Sand/dune, Shrubland/chaparral
Lachnocaulon digynum	Bog Button	S3	T	N	Riverine Habitat(s): Pool Palustrine Habitat(s): Bog/fen, forested wetland
Lilium iridollae	Panhandle Lily	S2	E	N	Palustrine Habitat(s): Bog/fen, herbaceous wetland, Riparian, scrub-shrub wetland
Linum westii	West's Flax	S1	E	N	Palustrine: dome swamp, depression marsh, wet flatwoods, wet prairie, pond margins
Litsea aestivalis	Pondspice	S2	E	N	Palustrine Habitat(s): Bog/fen
Lobelia boykinii	Boykin's Lobelia	S1	E	N	Palustrine Habitat(s): Forested wetland, herbaceous wetland, scrub-shrub wetland Terrestrial Habitat(s): Forest/Woodland, Savanna, Woodland - Conifer
Lupinus westianus	Gulf Coast Lupine	S3	T	N	Terrestrial: beach dune, scrub, disturbed areas, roadsides, blowouts in dunes
Magnolia ashei	Ashe's Magnolia	S2	E	N	Terrestrial: slope and upland hardwood forest, ravines

Scientific Name	Common Name	Designation			Natural Communities
		FNAI	State	Federal	
Malaxis unifolia	Green Adder's-mouth Orchid	S3	E	N	Palustrine: floodplain forest Terrestrial: slope forest, upland mixed forest
Macranthera flammea	Hummingbird Flower	S2	E	N	Palustrine: seepage slope, dome swamp edges, floodplain swamps Riverine: seepage stream banks Terrestrial: seepage slopes
Matelea alabamensis	Alabama Spiny-pod	S2	E	N	Terrestrial Habitat(s): Cliff, Forest - Hardwood, Forest - Mixed, Forest Edge, Forest/Woodland, Woodland - Hardwood, Woodland - Mixed
Nuphar advena ssp. ulvacea	West Florida Cowlily	S2	N	N	Riverine Habitat(s): Medium river, spring/spring brook
Pinguicula primuliflora	Primrose-flowered Butterwort	S3	E	N	Palustrine: bogs, pond margins, margins of spring runs
Platanthera integra	Yellow Fringeless Orchid	S3	E	N	Palustrine: bogs, wet flatwoods Terrestrial: bluff
Polygonella macrophylla	Large-leaved Jointweed	S3	T	N	Terrestrial: scrub, sand pine/oak scrub ridges
Pteroglossaspis ecristata	Giant Orchid	S2	T	N	Terrestrial Habitat(s): Forest Edge, Forest/Woodland, Old field, Savanna, Shrubland/chaparral, Woodland - Conifer
Quercus arkansana	Arkansas Oak	S3	T	N	Sandy or sandy clay uplands or upper ravine slopes near heads of streams in deciduous woods
Rhexia parviflora	Small-flowered Meadowbeauty	S2	E	N	Palustrine Habitat(s): Bog/fen, forested wetland, scrub-shrub wetland
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
Sarracenia leucophylla	White-top Pitcherplant	S3	E	N	Palustrine: wet prairie, seepage slope, baygall edges, ditches
Sarracenia rubra	Sweet Pitcherplant	S3	T	N	Palustrine: bog, wet prairie, seepage slope, wet flatwoods Riverine: seepage stream banks
Stewartia malacodendron	Silky Camellia	S3	E	N	Palustrine: baygall Terrestrial: slope forest, upland mixed forest; acid soils
Tephrosia mohrii	Pineland Hoary-pea	S3	T	N	Longleaf pine-turkey oak sandhills; driest sites.
Xyris scabrifolia	Harper's Yellow-eyed Grass	S3	T	N	Palustrine: seepage slope, wet prairie, bogs

Scientific Name	Common Name	Designation			Natural Communities
		FNAI	State	Federal	
Xyris stricta var. obscura	Kral's Yellow-eyed Grass	S1	N	N	Lacustrine: sandhill upland lake margins
Ants, Bees, and Wasps					
Hesperapis oraria	Gulf Coast Solitary Bee	S1S2	N	N	N\A
Stoneflies					
Tallaperla cornelia	Southeastern Roachfly	S1	N	N	N/A
Beetles					
Selonodon santarosae	Santa Rosa Cebrionid Beetle	S1	N	N	Terrestrial
Fish					
Acipenser oxyrinchus desotoi	Gulf Sturgeon	S2	FT	T(CH)	Estuarine: various Marine: various habitats Riverine: alluvial and blackwater streams
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
Fundulus jenkinsi	Saltmarsh Topminnow	S2	ST	SC	Estuarine Habitat(s): Herbaceous wetland, Lagoon, Tidal flat/shore Palustrine Habitat(s): Herbaceous wetland
Percina austroperca	Southern Logperch	S2	N	N	Riverine Habitat(s): Creek, Low gradient, medium river, Moderate gradient
Pteronotropis welaka	Bluenose Shiner	S3S4	ST	N	Riverine Habitat(s): Creek, Low gradient, medium river, Pool
Amphibians					
Ambystoma bishopi	Reticulated Flatwoods Salamander	S2	FE	E	Terrestrial: slash and longleaf pine flatwoods that have a wiregrass floor and scattered wetlands
Desmognathus monticola	Seal Salamander	S1	N	N	Riverine Habitat(s): Creek, High gradient, Moderate gradient, spring/spring brook Palustrine Habitat(s): Riparian
Reptiles					
Alligator mississippiensis	American Alligator	S4	FT(S/A)	SAT	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

Scientific Name	Common Name	Designation			Natural Communities
		FNAI	State	Federal	
Caretta caretta	Loggerhead Sea Turtle	S3	FT	T(CH)	Terrestrial: sandy beaches; nesting
Chelonia mydas	Green Sea Turtle	S2S3	FE	E	Terrestrial: sandy beaches; nesting
Crotalus adamanteus	Eastern Diamondback Rattlesnake	S3	N	N	Palustrine: riparian Terrestrial: grassland/herbaceous, old field, savanna, shrubland/ chaparral, woodland - conifer, woodland - hardwood, woodland - mixed
Dermochelys coriacea	Leatherback Sea Turtle	S2	FE	E	Terrestrial: sandy beaches; nesting
Drymarchon corais couperi	Eastern Indigo Snake	S3	FT	T	Estuarine: tidal swamp Palustrine: hydric hammock, wet flatwoods Terrestrial: mesic flatwoods, upland pine forest, sandhills, scrub, scrubby flatwoods, rockland hammock, ruderal
Gopherus polyphemus	Gopher Tortoise	S3	ST	C	Terrestrial: sandhills, scrub, scrubby flatwoods, xeric hammocks, coastal strand, ruderal
Graptemys ernsti	Escambia Map Turtle	S2	N	N	Riverine Habitat(s): big river, Low gradient, medium river, Pool Palustrine Habitat(s): Riparian Terrestrial Habitat(s): Sand/dune
Heterodon simus	Southern Hognose Snake	S2	N	N	Palustrine Habitat(s): Riparian Terrestrial Habitat(s): Grassland/herbaceous, Old field, Savanna, Woodland - Conifer, Woodland - Hardwood, Woodland - Mixed
Lepidochelys kempii	Kemp's Ridley Sea Turtle	S1	E	E	Terrestrial: sandy beaches; nesting
Macrochelys temminckii	Alligator Snapping Turtle	S2	SSC	N	Estuarine: tidal marsh Lacustrine: river floodplain lake, swamp lake Riverine: alluvial stream, blackwater stream
Nerodia clarkii clarkii	Gulf Salt Marsh Snake	S2	N	N	Estuarine: tidal marsh Lacustrine: river floodplain lake, swamp lake Riverine: alluvial stream, blackwater stream
Pituophis melanoleucus mugitus	Florida Pine Snake	S3	ST	N	Lacustrine: ruderal, sandhill upland lake Terrestrial: sandhill, scrubby flatwoods, xeric hammock, ruderal
Birds					
Athene cunicularia floridana	Florida Burrowing Owl	S3	ST	N	Terrestrial Habitat(s): Grassland/herbaceous, Sand/dune
Calidris canutus rufa	Red knot	S2	N	T	Estuarine: bays, tidal flats, salt marshes Terrestrial: sandy beaches Marine: aerial, near shore

Scientific Name	Common Name	Designation			Natural Communities
		FNAI	State	Federal	
Charadrius melodus	Piping Plover	S2	T	T(CH)	Estuarine: exposed unconsolidated substrate Marine: exposed unconsolidated substrate Terrestrial: dunes, sandy beaches, and inlet areas; mostly wintering and migrants
Charadrius nivosus	Snowy Plover	S1	ST	N	Estuarine: exposed unconsolidated substrate Marine: exposed unconsolidated substrate Terrestrial: dunes, sandy beaches, and inlet areas
Haliaeetus leucocephala	Bald Eagle	S3	T	BGEPA	Estuarine: marsh edges, tidal swamp, open water Lacustrine: swamp lakes, edges Palustrine: swamp, floodplain Riverine: shoreline, open water Terrestrial: pine and hardwood forests
Mycteria americana	Wood Stork	S2	E	T	Estuarine: marshes Lacustrine: floodplain lakes, marshes (feeding), various Palustrine: marshes, swamps, various
Peucaea aestivalis	Bachman's Sparrow	S3	N	N	N/A
Leuconotopicus borealis	Red-cockaded Woodpecker	S2	FE	E	Terrestrial: mature pine forests
Rallus longirostris scottii	Florida Clapper Rail	S3?	N	N	Estuarine Habitat(s): Herbaceous wetland, Tidal flat/shore
Rynchops 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
Sternula antillarum	Least Tern	S3	ST	N	Estuarine: various Lacustrine various Riverine: various Terrestrial: beach dune, ruderal. Nests common on rooftops
Thalasseus maximus	Royal Tern	S3	N	N	Marine: near shore Estuarine: bay/sound, lagoon, river mouth/tidal river, tidal flat/shore Terrestrial: sand/dune
Thalasseus sandvicensis	Sandwich Tern	S2	N	N	Marine: near shore Estuarine: bay/sound, lagoon, river mouth/tidal river, tidal flat/shore Terrestrial: sand/dune
Mammals					

Scientific Name	Common Name	Designation			Natural Communities
		FNAI	State	Federal	
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	S2	N	N	Palustrine Habitat(s): Riparian Terrestrial Habitat(s): Forest - Hardwood, Suburban/orchard, Urban/edificarian, Woodland - Hardwood Subterranean Habitat(s): Subterrestrial
Myotis austroriparius	Southeastern Bat	S3	N	N	Riverine Habitat(s): Aerial Palustrine Habitat(s): Aerial, forested wetland, Riparian Terrestrial Habitat(s): Forest - Conifer, Forest - Hardwood, Forest - Mixed, Forest Edge, Forest/Woodland, Suburban/orchard, Urban/edificarian, Woodland - Conifer, Woodland - Hardwood, Woodland - Mixed Subterranean Habitat(s): Subterrestrial
Neofiber alleni	Round-tailed Muskrat	S3	N	N	Estuarine Habitat(s): Herbaceous wetland Lacustrine Habitat(s): Shallow water Palustrine Habitat(s): Bog/fen, herbaceous wetland
Trichechus manatus latirostris	West Indian Manatee	S2	E	E	Estuarine: submerged vegetation, open water Marine: open water, submerged vegetation
Peromyscus polionotus trissyllepsis	Perdido Key Beach Mouse	S1	FE	E(CH)	Terrestrial Habitat(s): Grassland/herbaceous, Sand/dune
Ursus americanus floridanus	Florida Black Bear	S2	N	N	Palustrine: forested wetland, riparian Terrestrial: forest - hardwood, forest - mixed

Sources: FNAI 2010; FWC 2016c; USFWS 2016.

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

FEDERAL LEGAL STATUS
BGEPA = Protected by Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act
C = Candidate species for which federal listing agencies have sufficient information on biological vulnerability and threats to support proposing to list the species as Endangered or Threatened.
E(CH) = Endangered critical habitat
E = Endangered: species in danger of extinction throughout all or a significant portion of its range.
E, T = Species currently listed endangered in a portion of its range but only listed as threatened in other areas

E, PDL = Species currently listed endangered but has been proposed for delisting.
E, PT = Species currently listed endangered but has been proposed for listing as threatened.
E, XN = Species currently listed endangered but tracked population is a non-essential experimental population.
N = None
T = Threatened: species likely to become Endangered within the foreseeable future throughout all or a significant portion of its range.
T(CH) = Threatened critical habitat
PE = Species proposed for listing as endangered
PS = Partial status: some but not all of the species' infraspecific taxa have federal status
PT = Species proposed for listing as threatened
SAT = Treated as threatened due to similarity of appearance to a species which is federally listed such that enforcement personnel have difficulty in attempting to differentiate between the listed and unlisted species.
SC = Not currently listed, but considered a "species of concern" to USFWS.

STATE LEGAL STATUS
C = Candidate for listing at the Federal level by the U. S. Fish and Wildlife Service
FE = Listed as Endangered Species at the Federal level by the U. S. Fish and Wildlife Service
FT = Listed as Threatened Species at the Federal level by the U. S. Fish and Wildlife Service
FXN = Federal listed as an experimental population in Florida
FT(S/A) = Federal Threatened due to similarity of appearance
ST = State population listed as Threatened by the FWC. Defined as a species, subspecies, or isolated population which is acutely vulnerable to environmental alteration, declining in number at a rapid rate, or whose range or habitat is decreasing in area at a rapid rate and as a consequence is destined or very likely to become an endangered species within the foreseeable future.
SSC = Listed as Species of Special Concern by the FWC. Defined as a population which warrants special protection, recognition, or consideration because it has an inherent significant vulnerability to habitat modification, environmental alteration, human disturbance, or substantial human exploitation which, in the foreseeable future, may result in its becoming a threatened species. (SSC* for Pandion haliaetus (Osprey) indicates that this status applies in Monroe county only.)
N = Not currently listed, nor currently being considered for listing.

Plants: Definitions derived from Sections 581.011 and 581.185(2), Florida Statutes, and the Preservation of Native Flora of Florida Act, 5B-40.001. FNAI does not track all state-regulated plant species; for a complete list of state-regulated plant species, call Florida Division of Plant Industry, 352-372-3505 or see: http://www.doacs.state.fl.us/pi/.
E = Endangered: species of plants native to Florida that are in imminent danger of extinction within the state, the survival of which is unlikely if the causes of a decline in the number of plants continue; includes all species determined to be endangered or threatened pursuant to the U.S. Endangered Species Act.
T = Threatened: species native to the state that are in rapid decline in the number of plants within the state, but which have not so decreased in number as to cause them to be Endangered.
N = Not currently listed, nor currently being considered for listing.

Appendix D 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 32 unique natural communities recognized by the FNAI within the Perdido River and 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 (5) 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 along the Perdido River.
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, mesic flatwoods occupy relatively small, low-lying areas (FNAI 2010). This community type can be found across vast expanses of Tarkiln Bayou Preserve State Park (FDEP 2006).
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 minimal runoff evaporation. Fire is a dominant environmental factor in sandhill ecology and is essential for the conservation of native sandhill flora and fauna (FNAI 2010). Within the Perdido Bay and River watershed, exemplary sandhill communities can be found in the Tarkiln Bayou Preserve State Park, in the interior of Tarkiln Peninsula.
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*). Scrub is characterized by burn intervals of five to 40 years, depending on the dominant vegetation. This community type can be found throughout Perdido Key.

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 scrubby 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 Perdido Bay and River watershed, scrubby flatwood communities can be found throughout Perdido Key.
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*), 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 upper 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 througout Tarkiln Bayou Preserve State Park in both large tracts and small pockets along the edges of baygall swamps.
Xeric Hammocks	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 (*Pituophis melanoleucus mugitus*). Xeric hammock is most common in the central peninsula of Florida and is less common to the north where clay-rich soils create mesic conditions (FNAI 2010). Within watershed, xeric hammock community occurs east of Bauer Road in Tarkiln Bayou State Park.
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.

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. Beach dune habitat can be found throughout Perdido Key.
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 Perdido Key beach mouse (*Peromyscus polionotus trissyllepsis*) - 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 along Perdido Key.
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 along Perdido Key.
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 Perdido Bay watershed, this community type can be found in Tarkiln Bayou Preserve State Park on the southwestern tip of Tarkiln Peninsula (DuPont Point) and on Perdido Key.
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). Shell mounds can be found along Perdido Key.
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).

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). An exemplary basin swamp community is located at Tarkiln Bayou State Park in Garcon Swamp.
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). An exemplary baygall community occurs on the northern sides of Tarkiln Bayou within the state park boundary.
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 Perdido Bay watershed, this community type can be found along the Perdido River.
Coastal Interdunal Swales	Coastal interdunal swales are marshes, moist grasslands, dense shrublands, or damp flats in linear depressions that occur between successive dune ridges on 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*). Salt water intrusion and increased sand movement after storm events can reset successional processes of interdunal swale communities (FNAI 2010). For example, hurricanes and large storm events can flood swales with salt water. After this, they may become colonized, often temporarily, by more salt-tolerant species. This community type can be found along Perdido Key.
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 in dome swamps with high fire frequencies 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 in depressions along the floodplains of the Blackwater and Perdido Rivers.

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 on Perdido Key.
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 the Perdido, Styx, and Blackwater rivers and their many tributaries.
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 Perdido Bay watershed, seepage slopes can be found along the Perdido River.
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 can be found east of Bauer Road at Tarkiln Bayou State Park.

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, 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. These 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. Many of the Perdido River's smaller tributaries are blackwater streams, including several streams that feed Tarkiln Bayou (FDEP 2006).
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 Perdido River and Bay watershed seepage streams are along the Perdido, Styx, and Blackwater rivers. Seepage streams can also be found east of Bauer Road in Tarkiln Bayou State Park (FDEP 2006).
Estuarine and Marine Communities	
Salt Marsh	Salt marsh is a largely herbaceous tidal zone community commonly consisting of smooth 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 throughout the Perdido River and Bay watershed.
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 lower portions of the Perdido Bay watershed.

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. The Rockpile Reef located just below the confluence of Eightmile Creek and the Perdido Bay is one example of a reef community in the Perdido watershed.
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-DO levels, as well as the accumulation of metals, oils, and pesticides in the sediment (FNAI 2010). Unconsolidated (marine) substrate can be found throughout the Perdido Bay and Big Lagoon.

Source: FNAI 2010.

Appendix E Impaired Waterbody Segments in the Perdido River and 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 2016b). The following table provides a list of 2014 FDEP designated and impaired waters in the Perdido River and Bay watershed.

Waterbody Segment ID	Water Segment Name	County	Waterbody Class[1]	Parameters Assessed Using the Impaired Waters Rule (IWR)
987	Bayou Garcon	Escambia	3M	Mercury (in fish tissue)
987	Bayou Garcon	Escambia	3M	Mercury (in fish tissue)
697	Bayou Marcus Creek*	Escambia	3F	Dissolved Oxygen (Nutrients - TN)
1004	Big Lagoon	Escambia	3M	Mercury (in fish tissue)
8001C	Big Lagoon State Park	Escambia	3M	Bacteria (Beach Advisories)
872B	Bridge Creek (Tidal Portion)*	Escambia	3M	Fecal Coliform
872B	Bridge Creek (Tidal Portion)*	Escambia	3M	Mercury (in fish tissue)
1014	Direct Runoff to Bay	Escambia	3M	Mercury (in fish tissue)
1018	Direct Runoff to Bay	Escambia	3M	Mercury (in fish tissue)
991	Direct Runoff to Bay	Escambia	3M	Mercury (in fish tissue)
489	Elevenmile Creek*	Escambia	3F	Dissolved Oxygen (BOD)
489	Elevenmile Creek*	Escambia	3F	Dissolved Oxygen (Nutrients)
8001	Gulf of Mexico (Escambia County; Perdido Bay)	Escambia	3M	Mercury (in fish tissue)
974	Perdido Bay	Escambia	3M	Mercury (in fish tissue)
797A	Perdido Bay (Lower Segment)	Escambia	3M	Mercury (in fish tissue)
797	Perdido Bay (Upper Segment)	Escambia	3M	Mercury (in fish tissue)
945	Tarkiln Bayou	Escambia	3M	Mercury (in fish tissue)
784	Tee And Wicker Lakes*	Escambia	3M	Mercury (in fish tissue)
935	Weekly Bayou*	Escambia	3M	Mercury (in fish tissue)
4	Brushy Creek	Escambia	3F	Fecal Coliform
72	Direct Runoff to Stream	Escambia	3F	Mercury (in fish tissue)
72D	Direct Runoff to Stream	Escambia	3F	Mercury (in fish tissue)
72E	Direct Runoff to Stream	Escambia	3F	Mercury (in fish tissue)
72F	Direct Runoff to Stream	Escambia	3F	Mercury (in fish tissue)
149	McDavid Creek*	Escambia	3F	Fecal Coliform
2F	Perdido River	Escambia	3F	Mercury (in fish tissue)
462A	Perdido River	Escambia	3M	Mercury (in fish tissue)

Waterbody Segment ID	Water Segment Name	County	Waterbody Class[1]	Parameters Assessed Using the Impaired Waters Rule (IWR)
462B	Perdido River*	Escambia	3F	Fecal Coliform
462B	Perdido River	Escambia	3M	Mercury (in fish tissue)
462C	Perdido River	Escambia	3M	Mercury (in fish tissue)
542	Rest Area Run*	Escambia	3F	Fecal Coliform
542	Rest Area Run	Escambia	3F	Turbidity

Source: FDEP 2014b.

Notes:
* = new Florida listings since 2003

Footnote 1 - Florida's waterbody classifications:
1 - Potable water supplies
2 - Shellfish propagation or harvesting
3F - Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife in fresh water
3M - Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife in marine water
4 - Agricultural water supplies
5 - Navigation, utility, and industrial use

The following table provides a list of EPA established TMDLs in the Ochlockonee River and Bay watershed.

Waterbody Segment ID	Water Segment Name	County	Waterbody Class[1]	Pollutant
489	Elevenmile Creek	Escambia	3F	Biochemical Oxygen Demand
489	Elevenmile Creek	Escambia	3F	Nitrogen, Total
489	Elevenmile Creek	Escambia	3F	Ammonia, Un-ionized
489	Elevenmile Creek	Escambia	3F	Phosphorus, Total
291	Jacks Branch	Escambia	3F	Phosphorus, Total
291	Jacks Branch	Escambia	3F	Nitrogen, Total
291	Jacks Branch	Escambia	3F	Biochemical Oxygen Demand
462B	Perdido River (South Fresh)	Escambia	3F	Fecal Coliform

Source: EPA 2016g.

Appendix F Conservation Lands within the Perdido River and Bay Watershed

Within the Perdido River and Bay watershed there are approximately 20,943 acres of conservation lands, including 4,058 acres of federally managed lands, 13,236 acres state-managed, 1,134 acres of locally managed lands, and 2,514 acres of privately managed lands. One conservation land within the Perdido River and Bay watershed, Gulf Island's National Seashore, spans multiple counties and lies partially outside of the watershed. The details of these conservation lands are presented in the following table (Florida Department of Natural Resources 1992; FNAI 2016a):

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Federally Managed					
Naval Air Station (NAS) Pensacola	NAS Pensacola	Escambia	NAS Pensacola extends from lower Pensacola Bay through a portion of Big Lagoon. Although most of the site has been developed for mission activities, many natural communities remain including: beach dune, maritime hammock, sand pine scrub, mesic flatwoods, and sandhill.	http://www.cnic.navy.mil/regions/cnrse/installations/nas_pensacola.html	618
Bronson Outlying Field (OLF)	NAS Pensacola	Escambia	Bronson OLF is a naval reservation with an outdoor recreation complex (Blue Angel Recreational Park) and significant natural features including managed forests, a thriving gopher tortoise population, and critical watershed buffers for the Tarkiln Bayou State Preserve, and Pensacola and Perdido Bay watersheds. Included in the NAS Pensacola INRMP.	http://www.cnic.navy.mil/content/dam/cnic/cnrse/pdfs/NAS_PENSACOLA/NAS%20Pensacola%20INRMP%202014%20Final.pdf http://www.navymwrpensacola.com/	1098

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Saufley Field	U.S. Dept. of Defense, Navy	Escambia	Naval reservation with a solar array facility on the former airfield. Elevenmile and Eightmile Creeks flow southwest through the northwest portion of the Saufley Field property through maritime forests surrounded by an upland sandhill ecosystem with a thriving biological community of invertebrates, and gopher tortoise. Saufley Field is an important watershed for Pensacola and Perdido Bay. Included in the Naval Air Station (NAS) Pensacola INRMP.	http://www.navfac.navy.mil/products_and_services/ev/products_and_services/env_restoration/installation_map/navfac_atlantic/southeast/nas_saufley_field.html	866
Navy Technical Training Center at Corry Station	NAS Pensacola	Escambia	Corry Station is an inactive naval air field that contains approximately 100 acres of planted pines; and 0.5 acres of wetlands; and a few isolated patches of second growth forest. The property also has a naval hospital and naval housing.	http://www.netc.navy.mil/centers/ceninfodom/corry/	34
Site 8A OLF	NAS Whiting Field	Escambia	Site 8A OLF is an inactive naval field that is mostly open land but does contain a large wetland on its eastern boundary that is home to several rare plant species. Included in the Naval Air Station Whiting Field.	http://www.cnic.navy.mil/regions/cnrse/installations/nas_whiting_field.html	637
Gulf Islands National Seashore	National Park Service	Escambia, Santa Rosa	Gulf Islands National Seashore extends 150 miles from Mississippi into Florida. In Florida, it extends from the eastern end of Perdido Key, across the mouth of Pensacola Bay, to the east end of Santa Rosa Island. It also includes other barrier islands and historic sites.	http://www.nps.gov	919
State Managed					
Big Lagoon State Park	FDEP Division of Recreation and Parks	Escambia	Big Lagoon State Park contains sand pine scrub on relic dunes with dune rosemary, slash pine flatwoods, titi thickets, sandy beaches, and salt marshes.	http://www.floridastateparks.org/	651

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Fort Pickens Aquatic Preserve	FDEP Northwest District	Escambia	Located off of the coast of Escambia County, Fort Pickens Aquatic Preserve includes sandy bottom and seagrass habitat The preserve is located adjacent to Gulf Islands National Seashore.	http://www.dep.state.fl.us/coastal/sites/ftpickens/	34,000
Perdido Key State Park	FDEP Division of Recreation and Parks	Escambia	On a barrier island 15 miles southwest of Pensacola, Perdido Key State Park contains large, undisturbed areas of coastal scrub and beach dune with a large population of Godfrey's golden aster.	http://www.floridastateparks.org/	294
Tarkiln Bayou Preserve State Park	FDEP Division of Recreation and Parks	Escambia	Located on the western border of Florida, the Tarkiln Bayou Preserve State Park is on a peninsula formed by Tarkiln Bayou and Perdido Bay. Natural communities include maritime hammock, mesic flatwoods, wet prairie, and sandhill.	http://www.floridastateparks.org/	3,416
International Paper Company Conservation Easement	FDEP Division of Recreation and Parks	Escambia	The International Paper Company Conservation Easement is a regulatory conservation easement with no public access. The easement is located at the northern edge of Perdido Bay, east of Saufley Field and south of Helms Road and Highway 90.	https://www.dep.state.fl.us/lands/FFAnnual/Lower_Perdido_River_Buffer.pdf	2,616
Herndon Conservation Easement	NWFWMD	Escambia	Herndon Conservation Easement is a privately owned conservation easement with no public access. The easement is located north of Perdido Bay, southwest of Site 8A OLF, and between Belle Pines Lane and Highway 90.	http://www.nwfwater.com/	4.3
Perdido River Water Management Area (and Wildlife Management Area)	NWFWMD and FWC	Escambia	The Perdido River Water Management Area is broken into multiple parcels running north along the Perdido River and just north of Perdido Bay (south of Saufley Field). The area is primarily pine plantation.	http://www.nwfwater.com/	6,255

Locally Managed					
R.L. Hyatt Environmental Center	School District of Escambia County	Escambia	The R.L. Hyatt Environmental Center consists of young, dry slash pine/longleaf pine forest dissected west to east by a dendritic drainage pattern which flows east off the property into the north arm of Elevenmile Creek. Downhill slopes support several seepage bogs with pitcher plants. The center serves the Escambia County School District.	https://ecsd-fl.schoolloop.com/rhec	124
Bayou Marcus Wetland	Emerald Coast Utilities Authority	Escambia	This property is managed as a receiving wetland under an operating agreement with the State. It borders the Escambia River and is on the Great Florida Birding Trail. The wetlands provide habitat for a number of rare plants and animals. A boardwalk traverses the northern portion of the site and provides access for water sampling and opportunities for visitor observation.	http://www.dep.state.fl.us/water/wastewater/dom/wetbayou.htm	1,010
Privately Managed					
Perdido Bay/Crown Point Preserve	Coastal Plains Institute	Escambia	The Crown Point Preserve contains a white-topped pitcher plant bog (wet prairie) on the eastern shores of Perdido Bay. Under a conservation easement with the State, the Coastal Plains Institute manages the property to restore and maintain in perpetuity.	http://www.coastalplains.org	169
Betty and Crawford Rainwater Perdido River Preserve	The Nature Conservancy	Escambia	This preserve is a wilderness area along the banks of the Perdido River that includes eight miles of river shoreline. The preserve harbors many of the region's rare plant species.	https://www.nature.org/	2,346

Sources: FNAI 2016a.