2005 Estuaries Report Card for Southwest Florida

Full Technical Report

Coastal Venice
Lemon Bay
Charlotte Harbor
Pine Island Sound
Caloosahatchee River
Estero Bay
Wiggins Pass/Cocohatchee
Naples Bay
Rookery Bay
Ten Thousand Islands

CONSERVANCY
Of Southwest Florida

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The Conservancy of Southwest Florida is a non-profit organization. Since 1964, the Conservancy of Southwest Florida has provided education programs, scientific research, and policy advocacy to preserve Southwest Florida's natural environment and our quality of life.

Each and every citizen has the power to make a difference in his or her daily life and to get involved. To restore and protect the region's estuaries, the Conservancy suggests the following actions:

- make careful choices in everyday living to reduce the input of pollutants into our environment and waterways
- encourage elected officials to implement water resource policy initiatives that will improve water quality in our region and ensure a sufficient supply of clean water for the environment as well as for anthropogenic needs

The mission of the Conservancy of Southwest Florida: *Preserving Southwest Florida's natural environment… now and forever.*

For more information about the Conservancy of Southwest Florida, please visit our website at http://www.conservancy.org or write to us at:
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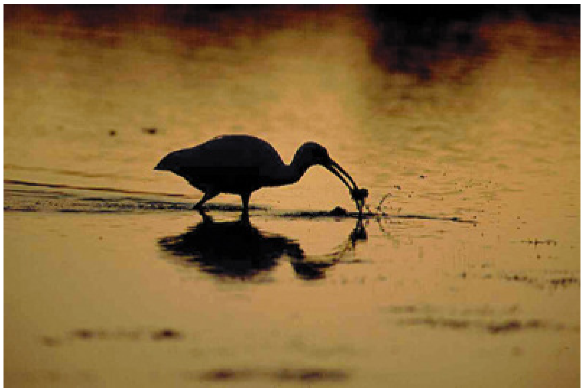
Commonly Used Acronyms

- ABM – Estero Bay Agency on Bay Management
- CHNEP – Charlotte Harbor National Estuary Program
- CREW – Corkscrew Regional Ecosystem Watershed
- CWA – Clean Water Act
- DEP – Department of Environmental Protection
- EPA – United States Environmental Protection Agency
- FDEP – Florida Department of Environmental Protection
- FLUCCS – Florida Land Use and Cover and Forms Classification System
- FNAI – Florida Natural Areas Inventory
- IWR – Impaired Waters Rule
- MFLs – Minimum Flow Levels
- OFW – Outstanding Florida Waters
- RB NERR – Rookery Bay National Estuarine Research Reserve
- SAV – Submerged Aquatic Vegetation
- SFWMD – South Florida Water Management District
- STORET – EPA's Environmental Database for Water Quality
- SWFFS – Southwest Florida Feasibility Study
- SWIM – Surface Water Improvement and Management
- SWFWMD – Southwest Florida Water Management District
- TMDL – Total Maximum Daily Load
- USACOE – U.S. Army Corps of Engineers
- WBID – Water Body Identification Number



1 BACKGROUND

Southwest Florida is home to some of the most beautiful and productive estuaries in the world. Mangrove estuaries, which dominate this region, are nurseries of the sea, providing valuable habitat for juvenile fish and shellfish. Nowhere in the nation is the link between estuarine habitat and fish production more obvious than in the Gulf of Mexico: ninety-five percent of the commercially and recreationally important species that inhabit the Gulf of Mexico use estuaries or bays during some portion of their life cycle.[1]

> Mangroves are an essential component of Florida's estuaries. They function as land stabilizers, prevent coastal erosion, protect our homes from the winds that accompany tropical storms and provide habitat for a variety of organisms. These forests act as a nursery and breeding ground for many organisms and serve as a starting place on the food web as falling organic material creates a nutrient source for plankton and algae. Most mangrove loss can be linked directly or indirectly to human impact, specifically the development of coastal areas and hydrologic alteration as wetlands are dredged, filled, created and destroyed.
>
> -Odum and McIver, 1990; Turner and Lewis, 1997

"Florida's estuarine, coastal and marine systems produce over $5 billion in fisheries and wildlife resources each year, buffer coastal areas from storms, absorb pollutants and provide amenities for coastal settlement, trade and tourism, including over 1 million boaters and divers per year. Hundreds of thousands of acres of seagrass meadows, salt marsh grasses and mangrove forests are critical habitats for sea trout, redfish, oysters and blue crabs, and a total of 80%–90% of the state's commercial and recreational fishery species."[2]

Each estuary is part of a larger watershed that encompasses surrounding wetlands, rivers and streams that feed into that estuary. For this reason, it is necessary to examine the entire watershed as a whole when analyzing the health of estuarine systems. All of the sewage treatment plants, faulty septic tanks, and storm drains that discharge from these coastal watersheds end up in estuarine systems and place critical habitats and biological communities at risk.

These critical estuarine habitats are rapidly being degraded as the coastal human population increases exponentially. Nationally, coastal counties are now home to more than half of the U.S. population, and it is predicted that another 15 million people will live along the U.S. coastline by 2015. This growth is dramatic in Southwest Florida, where the population of Collier County increased from approximately 16,000 in 1960 to more than 250,000 in 2000, with the Naples Metropolitan area having the second-fastest growth rate in the nation during the 1990s. Lee County's population increased seven-fold from 1960 to 2000.[3] Extensive land development is the primary threat to estuarine systems in Southwest Florida, with impacts from direct destruction of estuarine habitats as well as from upstream drainage projects that disrupt the timing and amount of freshwater flow into estuaries.

Pollution is significantly degrading the water quality. The Pew Ocean Commission Report found that two-thirds of our estuaries and bays were moderately or severely degraded by nutrient run-off (nitrogen and phosphorous compounds) from lawns, golf courses, and farm fields.[4] Several Southwest Florida estuaries and their tributaries have been designated as "impaired" by the Florida Department of Environmental Protection (FDEP) as a result of nutrient pollution, meaning that they do not meet the water quality standard for them to maintain their basic designated use – whether that be fishing, swimming, or for shellfish harvesting.[5]

The Conservancy of Southwest Florida is dedicated to protecting and conserving the natural environment of Southwest Florida. One of our primary goals is the protection of estuaries and coastal waters through strategic advocacy, scientific research, and action-oriented public education. Creating a sustained public will to protect and restore these estuaries requires educating the public to understand the function and condition of estuaries as well as the problems within them. Interest in our estuaries and their importance to a healthy Gulf of Mexico is building, as seen by the "Gulf in Peril" series published by the *Naples Daily News*. Scientists statewide have been studying estuaries for years and the Water Management Districts have large quantities of data from their water quality monitoring efforts used to create comprehensive watershed assessment reports (such as the 1999 Report for Estero Bay.) However, this information is not readily available or easily understandable to the general public. The Conservancy and other organizations, such as the Charlotte Harbor National Estuary Program (CHNEP), provide educational programs about estuaries to address this need.[6] The intent of this report is as an educational tool to advocate for improved water policy. The Estuaries Report Card provides an easily understood method of communicating scientific information about the health of the region's estuaries, using the best data available.

This report integrates detailed scientific information from many sources, using consistent indicators for which the data exists for the entire region, and converts this information into grades that represent Southwest Florida's estuarine health. For this initial report card, the Conservancy has relied on four main indicators of estuarine health, while acknowledging that there are significantly more potential indicators to use once sufficient data are available across the entire study area. With continued effort, there will be enough data to expand the number of indicators relied on for the Estuaries Report Card to create an even more accurate assessment of the health of Southwest Florida estuaries in the coming years. The report card analysis will be replicated every three years to determine the trends and to reflect the adaptive management of these watersheds and their water resources. It is ultimately intended that this report will be the beginning of many fruitful discussions and actions that will lead to greater protection of Southwest Florida's water-based resources.

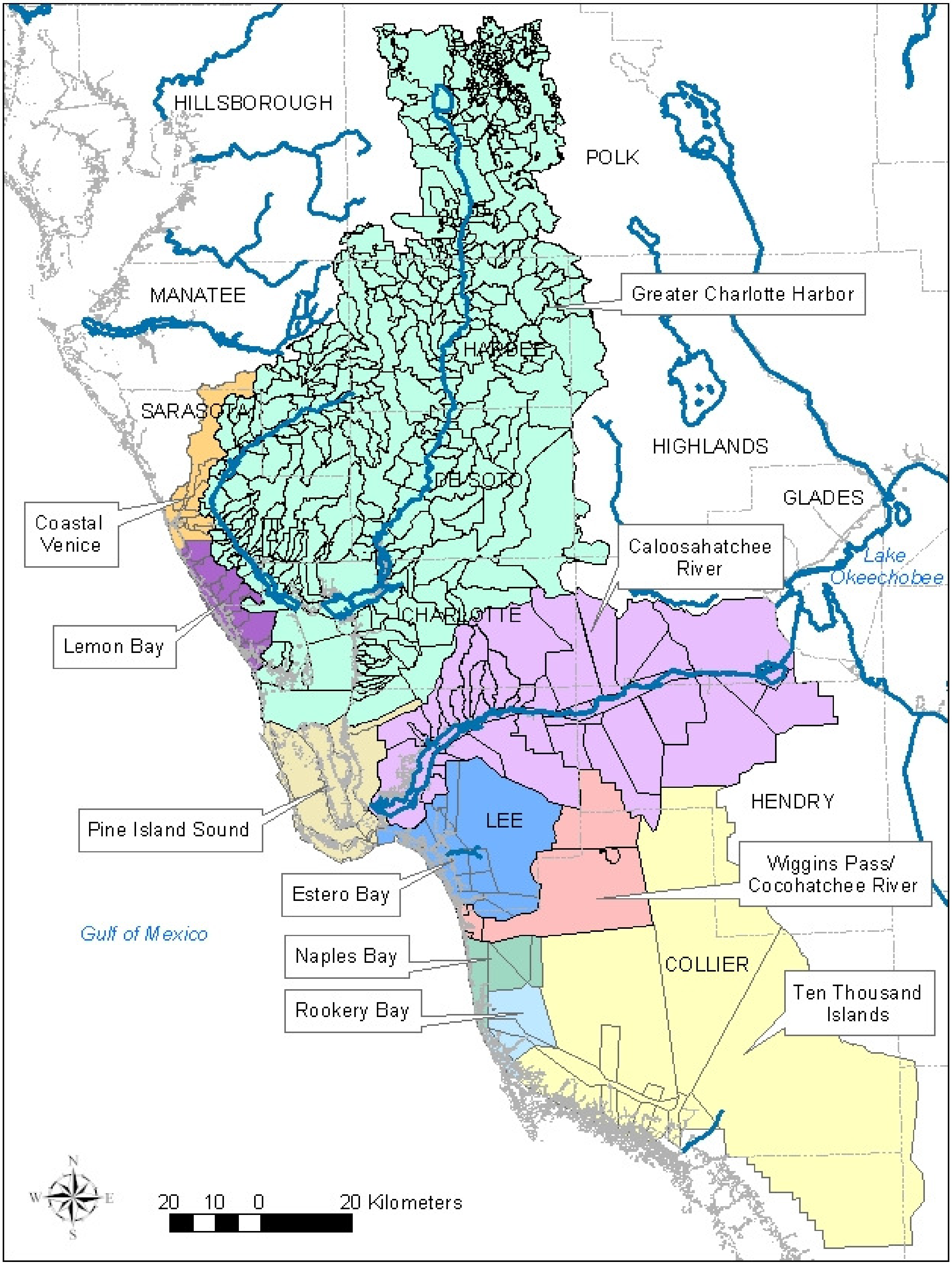
2 ESTUARIES INCLUDED IN THE 2005 ESTUARIES REPORT CARD

South Florida is a complex interconnected system of mangrove swamps marshes, sloughs, ponds, lakes, rivers, and estuaries that encompasses over 11,519,000 acres (18,000 square miles) in its entirety. The region ranges from north of Lake Okeechobee south toward the Florida Keys. The coastal counties of Southwest Florida include Charlotte, Lee and Collier. The Estuaries Report Card encompasses 10 estuaries in these counties, including: Charlotte Harbor; Lemon Bay; Coastal Venice; Pine Island Sound; the Caloosahatchee River; Estero Bay; Wiggins Pass/Cocohatchee River, Naples Bay; Rookery Bay; and the Ten Thousand Islands.

The boundaries for each of the estuaries and their watersheds are based on the Florida Department of Environmental Protection's (DEP) water body identifications (WBIDs), which depict the subbasins of each watershed.[7] Each estuary watershed discussed in the Report Card contains more than one WBID. The watershed for each estuary, with the exception of Naples Bay, Rookery Bay, and the Ten Thousand Islands, is based on DEP determinations of flow. With regard to the Naples Bay, Rookery Bay and the Ten Thousand Islands, existing water basins were re-aggregated to more accurately reflect existing drainage for these watersheds with the intent of conducting a more finely tuned analysis.

The following are descriptions of the 10 estuaries included in the Estuaries Report Card for Southwest Florida.

WATERSHEDS INCLUDED IN ESTUARIES REPORT CARD

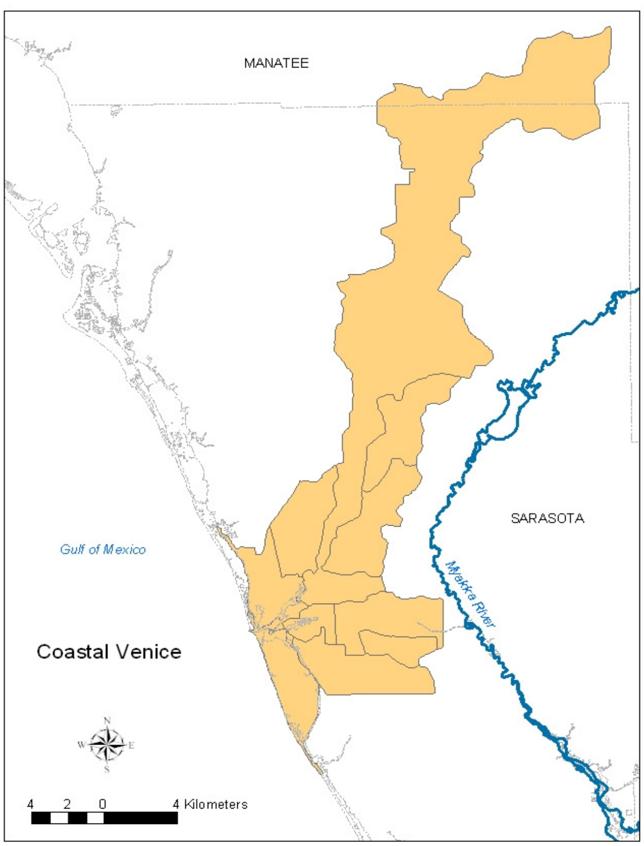


2.1 Coastal Venice

Coastal Venice is a 62,961-acre watershed that extends along the coast from the north of the Manasota Key bridge to the Venice inlet and stretches northeast, above the Myakka River, all the way into Manatee County. Its major waterways are Cow Pen Slough, Salt Creek, Curry Creek, Hatchett Creek, and Fox Creek, all of which feed into Donna and Roberts Bays and into the Gulf. Due to the small number of natural drainage ways and the almost surface-level water table, this watershed has been rigorously altered to improve drainage.[8] The major impacts to the watershed are development-related, including the increase of impervious areas along the shore and the increased freshwater inflows to the system, due to the widening of Cow Pen Slough.[9]

> "In the pre-development era…the area was covered with pine, scattered patches of water oak and numerous small swamps. The bay shoreline was an extensive growth of mangroves and marsh…changes occurred along the bays and creeks in the 1950s and 1960s. Mangroves and other filtering, biologically active waterfront fringe plants were replaced by seawalls and other manmade structures… By the early 1960s almost the entire shoreline of the estuary had been seawalled between the Albee Bridge and Hatchett Creek Bridge…"
> – Sea Grant, A Historical Geography of Southwest Florida Waterways

This watershed contains one of the first planned developments in Florida. The 250,000-acre city and agricultural area, planned by the Brotherhood of Locomotive Engineers, was the foundation of today's Venice.[10] This area is a popular diving and beach destination, famous for its shark teeth. "Some of these shark teeth are over a million years old, black and brown colored, ranging from a tiny eighth inch to three inches long."[11]



Coastal Venice presents numerous opportunities for fisherman: spotted seatrout, redfish, snook, mangrove snapper, Spanish mackerel, sheepshead, grouper, and whiting are just a few of the many species of fish that have been caught here.[12] This watershed is also home to many birds including cormorants, several species of herons and egrets, brown pelicans, ibises, ospreys, gulls, terns, bald eagles, wintering ducks, wood storks, roseate spoonbills, and the threatened Florida scrub jay.[13]

Significant natural areas in this watershed include Heritage Ranch Conservation Easement, Pinelands Reserve, Rocky Ford Preserve, and Caspersen Beach County Park. Communities within the Coastal Venice watershed include Venice, Venice Gardens, Shiney Town, and Manasota.

2.2 Lemon Bay

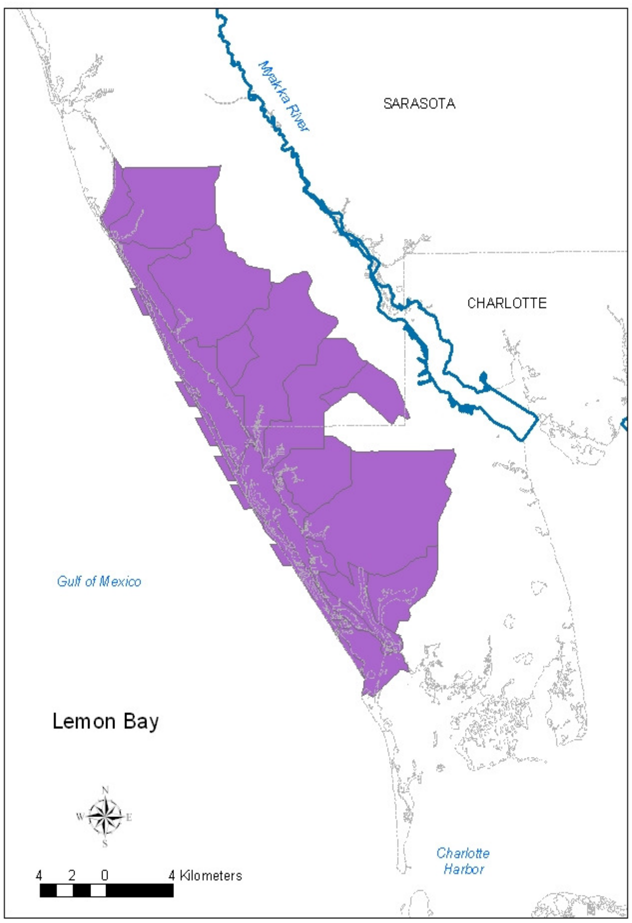
On the northwestern edge of Charlotte Harbor watershed lies Lemon Bay, a state aquatic preserve since 1986, that stretches from South Venice to the Gasparilla Causeway. The bay is seven miles long and varies in width from $^1/_8$ to $^1/_2$ mile with an average depth of six feet.[14] Lemon Bay, Fork, Rock, Oyster Buck, and Alligator creeks, Stump Pass, Gasparilla Pass, coastal regions, and barrier islands create a watershed totaling 63,331 acres.[15]

> "At the beginning of the 20th century, prior to the construction of any bridges to the barrier islands, it has been said that mullet would literally have to be brushed off women's petticoats while rowing across Lemon Bay…"
> Jonathan H. Cole, 1999

Designated as an Outstanding Florida Water, the bay is afforded extra protection from pollution, creating an area that is "bustling with live creatures, such as eagles, pinfish, pelicans, snook, shrimp, dolphins and manatees. Near shore, the seagrasses swaying with the tidal currents are key elements of this ecosystem."[16]

Important natural areas within this watershed are Cedar Point Environmental Park, Blind Pass Park, and Lemon Bay Park.

Many new developments are planned for this area. However, Sarasota County Planning and Development Services are working to create a plan, based on watershed features, to minimize the impact of upcoming development. Currently, significant communities within Lemon Bay Watershed are Rotunda, Grove City and Englewood.



2.3 Charlotte Harbor

Charlotte Harbor is the 17th largest estuary in America and the 2nd largest open-water estuary in the state of Florida.[17] The Greater Charlotte Harbor watershed includes the Peace and Myakka Rivers and is approximately 2,088,958 acres. Boca Grande Pass, between Gasparilla and Cayo Costa Islands, connects Charlotte Harbor to the Gulf of Mexico.

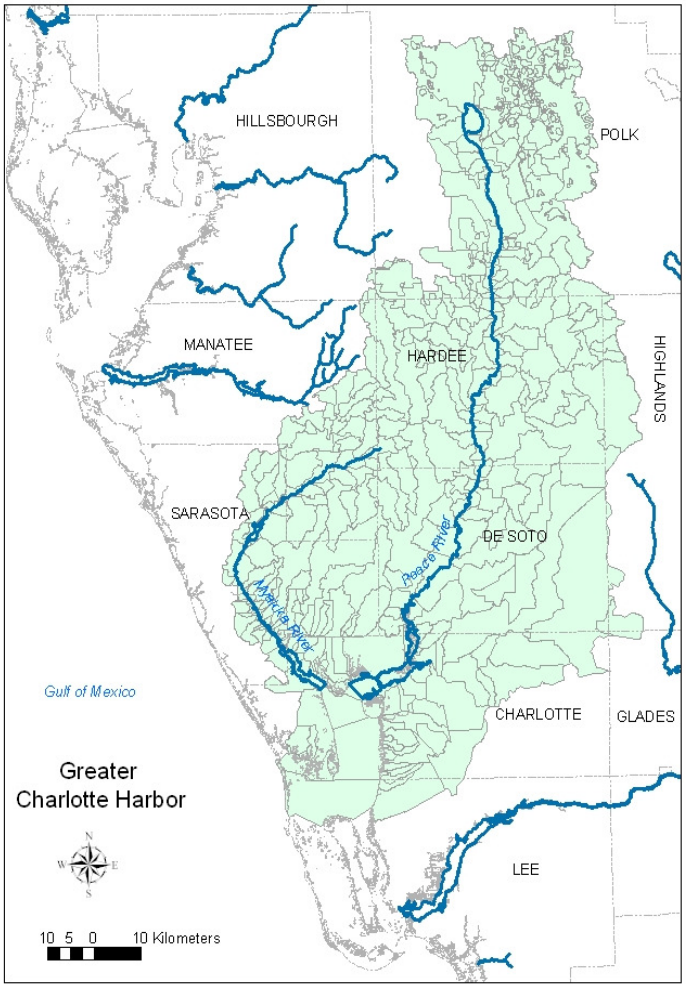
> "A century and a half ago dry prairie, covered with wire grass, carpeted much of the land from Lake Okeechobee southward, but settlers cleared the prairie and planted crops and a variety of exotic grasses. Little remains today of Florida's dry prairie; only three tracts…"
> Robert H. Mohlenbrock, Professor Emeritus, Plant Biology

Although much of Charlotte Harbor is shallow, on the earliest maps of the De Leon expedition, it is referred to as *Bahia Hondo*, which means "Deep Bay." Areas of deep water still extend up into the lower Myakka and Peace Rivers.[18] Sandy shelves make up the harbor walls, including Cape Haze on the west and Punta Gorda/Cape Coral on the east. These east and west walls are covered by seagrass beds which are critical habitat for juvenile fish and other wildlife. Currently, 86 of the state's endangered or threatened plant and animal species are found in this region.[19]

The Peace River, one of the two major Charlotte Harbor tributaries, was identified as one of the 10 most endangered rivers in the United States by the American Rivers organization based on the threat to the river from large-scale phosphate mining. Historically, the Peace river was a critical resource for Native Americans who were sustained by its abundant fisheries and wildlife. Today, the river is an important source of drinking water, economic vitality, recreation and commercial fishing.

The Myakka River, another vital piece of this watershed, winds through the most extensive remaining dry prairies in Florida and eventually empties into the northern end of Charlotte Harbor. This river is home to roseate spoonbills, sandhill cranes, herons, egrets, ibis and alligators, and is widely used for recreation.[20]

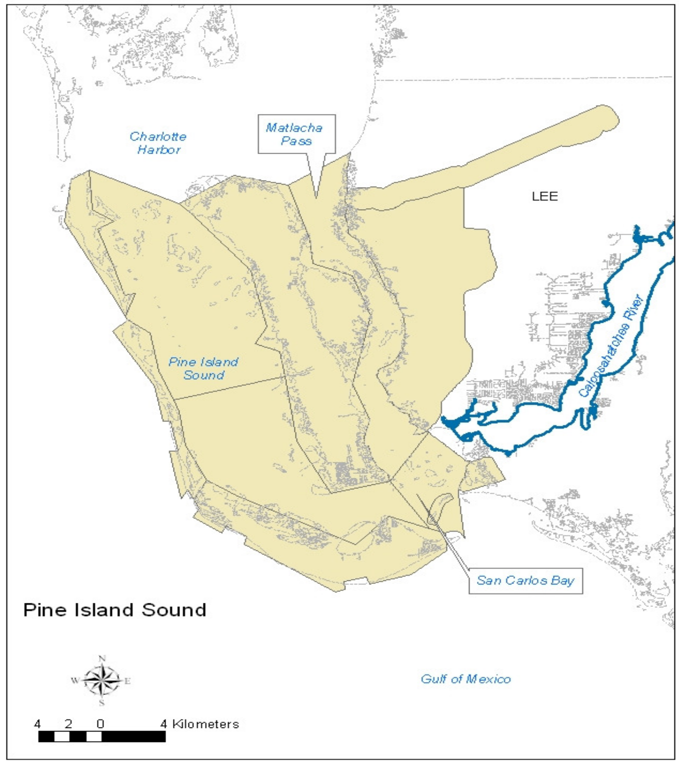
Charlotte Harbor was established as an "estuary of national significance" and accepted into the National Estuary Program in 1995. Currently, the Charlotte Harbor National Estuary Program (CHNEP) study area covers 2,815,988 acres (4,400 square miles). The CHNEP study area differs from the watershed for Charlotte Harbor itself by including Estero, Lemon, Dona, and Roberts Bays.



A remarkable feature of Charlotte Harbor is that most of the surrounding wetlands have been preserved as state buffer preserves. Significant natural areas include Gasparilla Sound/Charlotte Harbor Aquatic Preserve, Cape Haze Aquatic Preserve, Charlotte Harbor State Buffer Preserve/Cape Haze Units, Charlotte Harbor State Buffer Preserve/Punta Gorda Unit, Charlotte Flatwoods Environmental Park, Gasparilla Island State Park, and Island Bay National Wildlife Refuge.

The following communities are within the Charlotte Harbor Estuary Watershed: Punta Gorda, South Punta Gorda Heights, Tropical Gulf Acres, Pirate Harbor, Charlotte Beach, Rotonda, Placida, Boca Grande, Arcadia, Fort Ogden, Bartow, Bowling Green, Wauchula, and Ona.

2.4 Pine Island Sound



Pine Island Sound and its watershed encompass approximately 154,807 acres, including Pine Island Sound, Matlacha Pass and San Carlos Bay. Smaller water bodies include Tarpon Bay, Island Creek, Sanibel River, and Gator Slough Canal. Pine Island Sound and Matlacha Pass lie immediately south of Charlotte Harbor on either side of Pine Island, and connect south of Pine Island to form San Carlos Bay. The barrier islands of Cayo Costa, Captiva, and Sanibel insulate Pine Island Sound, Matlacha Pass, and San Carlos Bay from the Gulf of Mexico.

Flow patterns in the watershed connect the Pine Island Sound estuary to the Gulf of Mexico indirectly through Boca Grande Pass and directly through Captiva Pass, Red Fish Pass, and San Carlos Bay. Numerous small creeks and wetland areas on Pine Island provide fresh water to the estuary; however, most of the fresh water entering the estuary comes from direct rainfall and runoff from Western Cape Coral. Additional freshwater enters the sound from the Sanibel River and through periodic discharges from the Caloosahatchee River.[21]

The estuary contains extensive seagrass beds and large mangrove forests dominate the shorelines; both provide essential habitat for juvenile fish and wildlife.[22] The great egret, hunted to near extinction in the 1900s because of its extravagant plumes, currently inhabits Pine Island Sound.[23] Close to 200 species of birds live on or near Sanibel and Captiva islands, as well as dolphins, manatees, and alligators.

> "I recall one day in the '30s, traveling the Gulf beach to the Lighthouse to Blind Pass in a small boat with my friend…we traveled the full length of the island and did not encounter a single soul…By contrast, today things are rather different. In the early spring of 1977…Sanibel had the appearance of a tropical Coney Island."
> - George R. Campbell, 1978

Significant natural areas in the Pine Island Sound Estuary watershed include Pine Island Sound Aquatic Preserve, Matlacha Pass Aquatic Preserve, Charlotte Harbor State Buffer Preserve/Cape Coral Unit, Charlotte Harbor State Buffer Preserve/Pine Island Unit, J.N. "Ding" Darling National Wildlife Refuge, Sanibel-Captiva Conservation Foundation Lands, Cayo Costa State Park, Calusa Land Trust lands, Lee County 20-20 lands, and Pine Island National Wildlife Refuge.

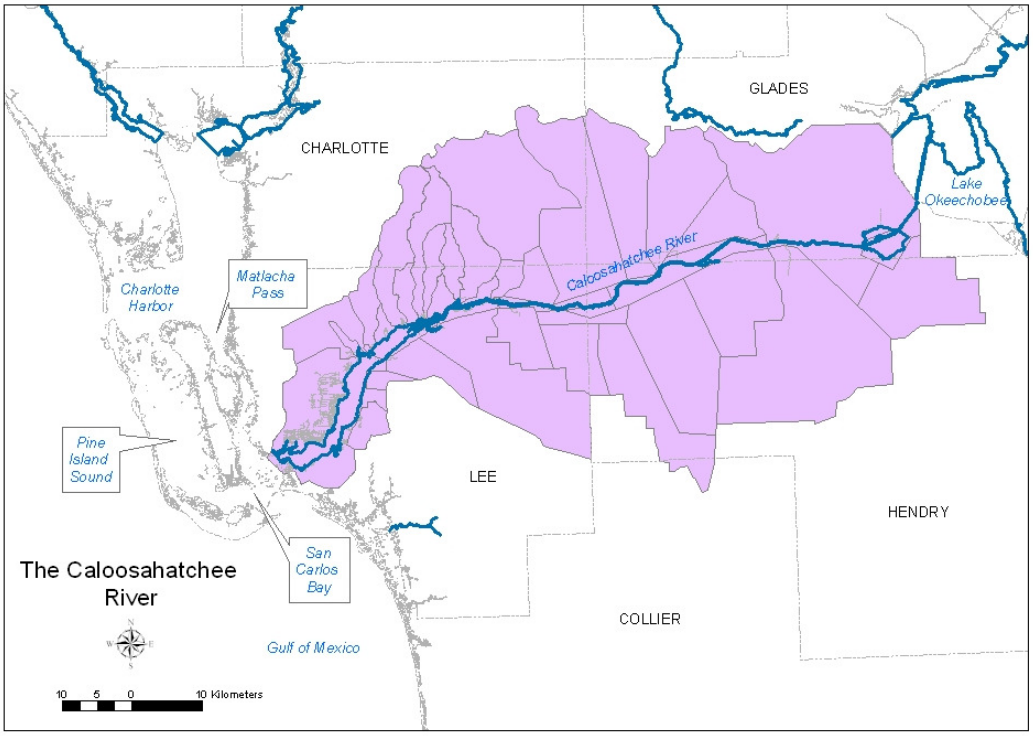
Communities within Pine Island Sound Watershed include Cape Coral, Waterway Estates, Shell Point Village, and Fort Myers.

2.5 Caloosahatchee River Estuary

The Caloosahatchee River and its estuary extend 70 miles from Lake Okeechobee to San Carlos Bay. Freshwater from sloughs and creeks, overland sheet flow and regulated discharges from Lake Okeechobee combine with tidal saltwater from the Gulf of Mexico to form the estuary. The Caloosahatchee River watershed extends from Lake Okeechobee to San Carlos Bay and encompasses approximately 859,318 acres.

Originally, the Caloosahatchee River was a shallow meandering stream with its headwaters near Lake Hicpochee.[24] It was not only a source of unlimited stores of food, but also the major thoroughfare for the pre-Columbian inhabitants of South Florida.[25] In 1882, the river was extended east to Lake Okeechobee by dredging. Since the 1930s, three water control structures have been constructed along the Caloosahatchee River to improve navigation and flood control. Moore Haven Lock and Ortona Lock were built in 1937. The Franklin Lock was constructed in the 1960s to act as a salinity barrier and now controls most of the freshwater entering the Caloosahatchee estuary.[26] The Central and South Florida Project, maintained by the South Florida Water Management District and the U.S. Army Corps of Engineers, connects the Caloosahatchee River to Lake Okeechobee, the Kissimmee River and the chain of lakes that feed it. Although the discharges from Lake Okeechobee have a significant impact on the health of the Caloosahatchee Estuary, DEP and the Water Management Districts do not officially view these as pieces of the same puzzle when drawing their boundaries, but as separate entities. Therefore, we did not include the Lake and its upstream watershed as part of the Caloosahatchee River Estuary watershed.

> "In 1882, the Caloosahatchee River, which runs east to west from the middle of the state, was extended by canal all the way to Lake Okeechobee--and South Florida panthers lost their most important land link to the central part of the state. While panthers were bountied and killed off throughout the rest of the state, they lingered south of the canal, stuck in inferior habitat."
> Ted Levin, Listening to Wildlife in the Everglades



Today, the Caloosahatchee watershed varies greatly west to east. The western portion contains urban areas, including the City of Fort Myers, Fort Myers Shores, North Fort Myers, Cape Coral, Lehigh Acres, Buckingham, and East Fort Myers. The central and eastern areas along the Caloosahatchee are largely agricultural. In the area north of the Caloosahatchee, in Charlotte and Lee counties, is the Babcock Ranch -- a 91 ,000 acre (142.19 square miles) ranch that is one of the most ecologically important areas in the region. The ranch contains cypress domes, swamps, mesic flatwoods, and wet prairies, all of which create an area that straddles Telegraph Swamp.[27]

Significant natural areas within this watershed include Babcock-Webb Wildlife Management Area, Prairie Pines Wildfire Preserve, Okaloacoochee Slough State Forest, and Canoe Slough Wildlife Management Area.

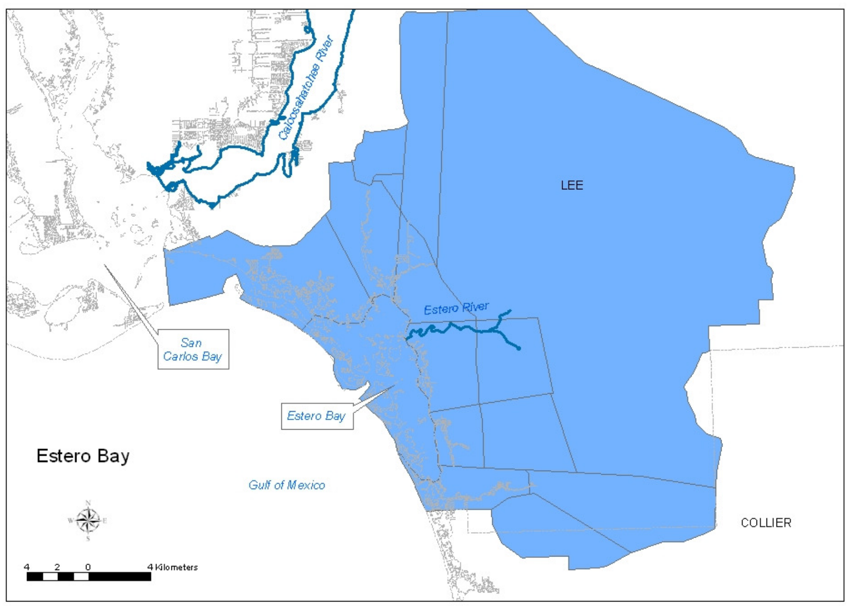
2.6 Estero Bay

Estero Bay is located three miles south of the Caloosahatchee. In combination with Estero Bay, the bordering chain of barrier islands creates a watershed totaling 201,021 acres. These islands are Estero Island, Long Key, Lovers Key, Black Island, Big Hickory Island and Little Hickory Island. The major passes in this watershed are New Pass, Big Carlos Pass and Matanzas Pass.

In 1978, *Environmental Sciences and Engineering* stated that "Estero Bay is considered to be one of the most productive and unpolluted estuaries in South Florida."

Four main tributaries exist in Estero Bay: Hendry-Mullock Creek, the Estero River, Spring Creek and the Imperial River. Similar to most of southern Florida, the Estero Bay Basin is comprised of low, flat terrain, wetlands and influenced by sheet-flow drainage patterns.

Estero Bay is a productive aquatic habitat that supports abundant and diverse fauna. Approximately 40 percent of the State's endangered or threatened species are found within this area.[28] Among them are the West Indian manatee, loggerhead sea turtle, Florida panther, bald eagle, big cypress fox squirrel, red-cockaded woodpecker and the snowy plover.[29] Estero Bay also provides habitat for nesting and migrating birds, and nursery areas for a variety of commercial and sport fisheries.



Estero Bay is surrounded by state-owned preserves. The northern half of Estero Bay was dedicated in December 1966 as the Estero Bay Aquatic Preserve, the state's first aquatic preserve. The southern half of Estero Bay was added to the Preserve during a 1983 session of the Florida Legislature.

Coastal areas in Estero Bay are moderately populated while the inland population remains lower, but both are rapidly being developed in response to a continuing influx of new residents. The interior land is used primarily for cattle, vegetable and citrus farms, and mining operations. In 1997, Florida's newest state university, Florida Gulf Coast University, opened its doors and has thus spurred new development in this area. The communities in the Estero Bay watershed include Bonita Springs, Fort Myers Beach, Estero, and San Carlos Park.

2.7 Wiggins Pass/Cocohatchee River Estuary

The Wiggins Pass/Cocohatchee River Estuary consists of a narrow strip of bays and channels. The Calusa Indians depended on resources, both plant and animal, that were part of the pass ecosystem during the 1600s; the Seminole Indians and early European settlers called the area home in the 1800s. The pass is named after the operator of a small trading post and Florida's first official homesteader, Joe Wiggins.[30] The total watershed for the Wiggins Pass/Cocohatchee Estuary is approximately 190,312 acres.

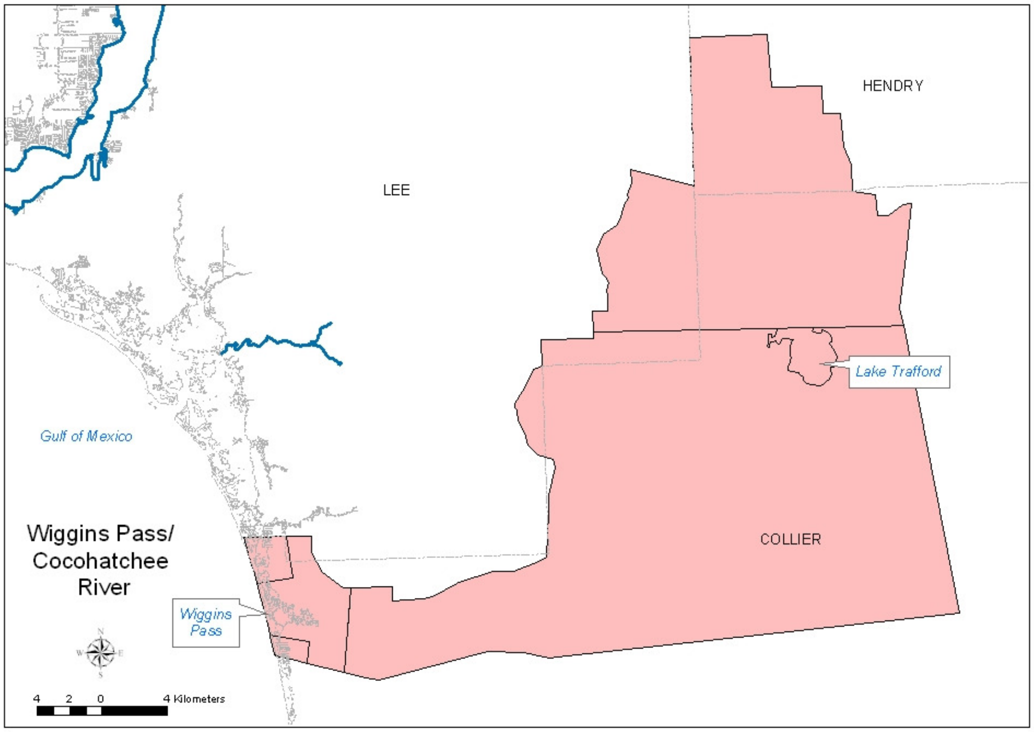
The portion of the estuary at the north end of Vanderbilt Beach is comprised of Delnor Wiggins State Park. The State Park portion of the estuary is a barrier island separated from the mainland by mangrove swamps and tidal creeks. Mangroves occupy 80 percent of the park, and their leaves provide a major source of nutrition for the marine animals that begin their lives in the backwater before entering the Gulf. In the winter season, the pass is frequented by the endangered West Indian Manatee.[31] Although the State Park portion of the estuary provides habitat for a wide range of wildlife, the adjacent uplands have been largely developed and shorelines have been modified by dredging, filling and seawall construction.[32]

> "In the 1600s, the Calusa Indians thrived around the pass by gathering wild plants, fishing and hunting. During the 1800s the Seminole Indians and early European settlers found refuge in this semi-tropical area. Joe Wiggins, for whom the pass is named, operated a small trading post and is the first homesteader on record."
> ExploreNaples.com, 2005

Groundwater seepage, rainfall and surface runoff from the area west of the coastal ridge are the primary ways in which freshwater enters this system. In addition, the Cocohatchee River and its canal systems discharge into the Wiggins Pass/Cocohatchee River Estuary. Communities within this watershed include Immokalee, Felda, and Bonita Springs, Vanderbilt, and Naples Park.

Corkscrew Regional Ecosystem Watershed (CREW) is a 60,000-acre section of land at the north end of Wiggins Pass/Cocohatchee containing a swamp, a 5,000-acre freshwater marsh called Corkscrew Marsh, and sections of almost every habitat type native to Florida. Thanks to the combined efforts of the CREW Trust and the South Florida Water Management District, acquisition and management has begun for much of this land, which provides aquifer recharge, natural flood protection, water purification, preservation of wildlife habitat, and public recreation. The National Audubon Society operates and manages the 11,000-acre Corkscrew Swamp Sanctuary (in the central portion of CREW) while the CREW Trust has acquired over 27,000 acres around the remainder of the watershed and has partnered with the Water Management District to manage these lands. The natural filtration of Corkscrew Marsh and

Corkscrew Swamp helps to improve the quality of the water being introduced into the north end of the Wiggins Pass/Cocohatchee watershed.[33] Though the headwaters of the watershed have been protected, the major wetland flowways have been diverted and constricted where the watershed approaches the coast as a result of drainage canals, roads, and development.



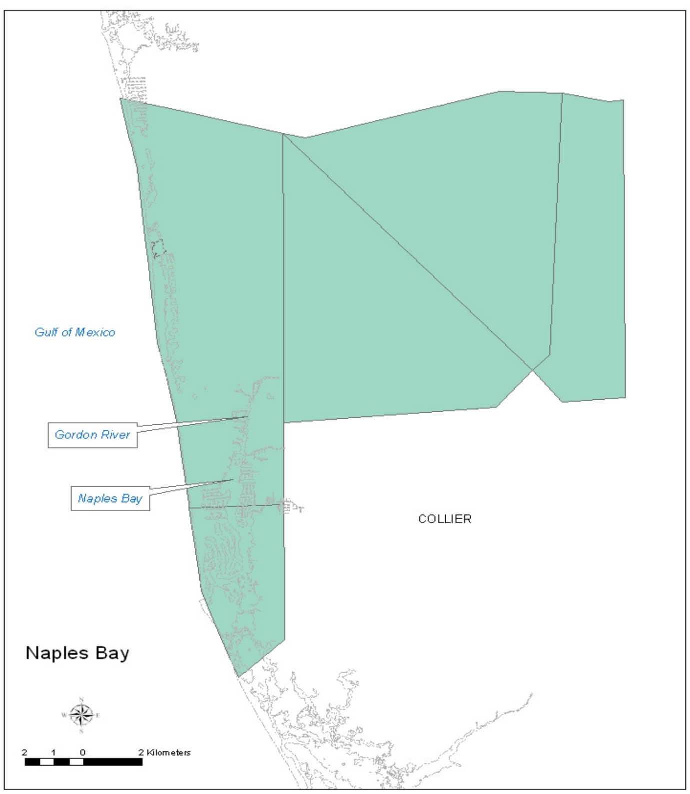
2.8 Naples Bay

Historically, Naples Bay was a shallow, mangrove-lined estuary with several inlets. "Massive changes were then begun in Naples Bay with the beginning of the dredged canal system…mangrove forests in Naples Bay were almost entirely destroyed…life became increasingly impossible for the current population of many plants and animals."[34] In addition, "major portions of the bay bottom have been excavated along the shoreline to increase the amount of waterfront property."[35]

> "The Bay of Naples has been partially filled with sand dredged from the bay itself and houses and streets occupy what was once good fishing water. The vast number of birds, geese, ducks, curlews, fish crows and others, which would line the beach in the morning for miles so numerous that the sands could hardly be seen, are gone and the flocks of curlews which flew steadily over town for an hour or more every evening are no more."
> Charlton W. Tebeau, historian, 1957

Prior to alteration, the dominant sources of fresh water to Naples Bay came from natural sheetflow and from the Gordon River.[36] Today, Naples Bay now also receives fresh water from runoff and from Golden Gate Canal, which drains fresh water from the northern end of the Golden Gate Estates development. The addition of the Golden Gate Canal has increased the bay's watershed from approximately 6,400 acres (10 square miles) to approximately 52,967 acres.

Most of the Naples Bay watershed is urbanized, with little open space and preserve area remaining. The City of Naples and its northward sprawl compose a majority of the western extent; other communities within this watershed include East Naples, The Moorings, Port Royal, Golden Gate City, and portions of the Golden Gate Estates. The northern portion of the Rookery Bay National Estuarine Research Reserve is the only significant natural reserve area left within this watershed.



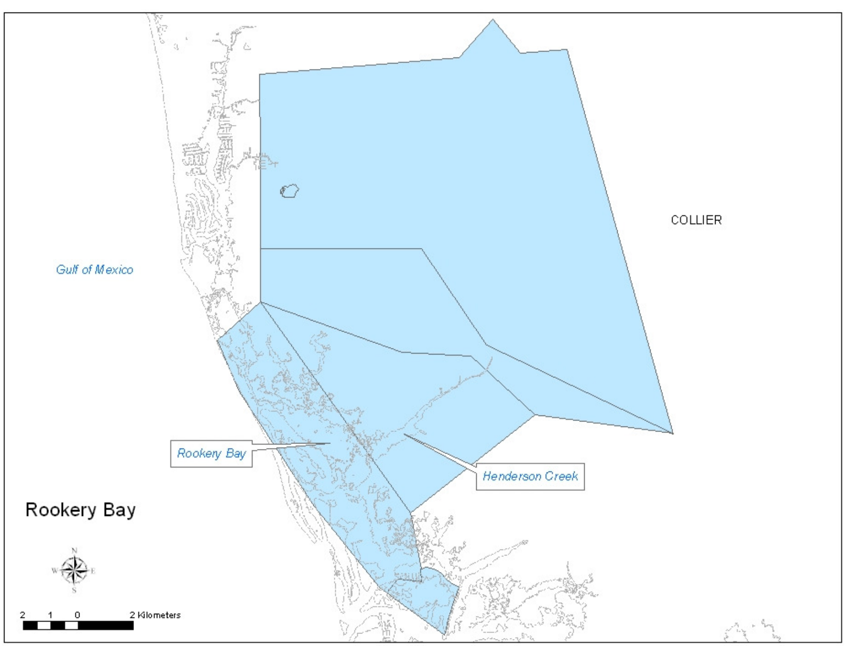
2.9 Rookery Bay

Rookery Bay's watershed covers 51,958 acres and its principal tributary is Henderson Creek. Two tidal inlets, one at the south end of the bay and one at the north, allow for exchange with coastal waters.[37] Communities within this watershed include Shell Island, Naples Manor, Belle Meade, and Fiddlers Creek.

> In the 1950s "an estimated forty thousand birds, especially curlews (pink spoonbills) flew in…it looked like a white sheet spread over it after they were all settled down for the night. One could see flocks a mile long flying in."
> Rob Storter, 1980

Rookery Bay Sanctuary was established in 1966 following a two-year effort by the Conservancy (then called the Collier County Conservancy) to acquire property around the Bay. In 1980, Rookery Bay was designated a National Estuarine Research Reserve. The Rookery Bay Sanctuary and surrounding uplands are typical of the sand hill region extending from Cape Romano on the south to the Caloosahatchee and Peace Rivers 35 miles to the north. Relatively high elevations, sandy, well-drained soils in the uplands with occasional sand dunes, coastal marshes, and limited runoff from the interior are common characteristics of this area.[38]

Located at the northern end of the Ten Thousand Islands on the gulf coast of Florida, the Rookery Bay Reserve represents one of the few remaining undisturbed mangrove estuaries in North America.[39] Rookery Bay National Estuarine Research Reserve (NERR) encompasses more than 110,000 acres (172 square miles) and includes uplands, marshes, mangrove forests, tidal creeks, and open-water areas, 15,000 acres of which fall within the Rookery Bay WBIDs. The remaining acres include the Ten Thousand Islands outside of Everglades National Park.[40] The Reserve's open water plays a vital role as a nursery area and feeding ground for many species of fish and aquatic invertebrates. In addition, the mangroves which surround the open water provide habitat to numerous fish, birds, crabs, snails and benthic invertebrates.

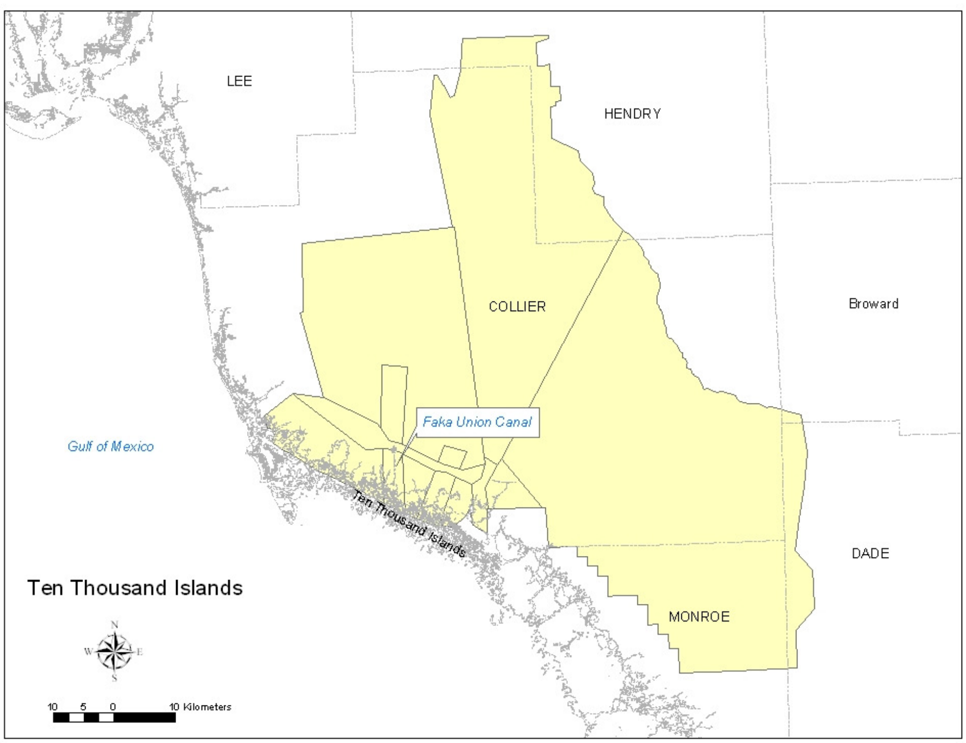


2.10 Ten Thousand Islands

Part of a watershed which covers approximately 1,132,639 acres, the coastal areas around the Ten Thousand Islands contain relatively inaccessible mangrove swamps and salt marshes that provide vital refuge, feeding areas and nursery grounds for south Florida's wildlife. "Sprawled between the dense mangrove swamps of Florida's southwest coast and the open waters of the Gulf of Mexico lies a tangled mass of islands, oyster bars, sandy spits, and other bits of land. In this productive estuarine environment, the tides are the pulse of life, and nearly every plant and animal living in the Ten Thousand Islands is influenced by them in some way."[41] "Constant change best describes the nature of the forces that shape the sandy beaches and mangrove swamps of Ten Thousand Islands. Storms, wave action, currents and other environmental factors constantly work to shape and reshape these communities."[42]

> "There are no other Everglades in the world. No other place combines a subtropical climate, a broad, shallow river, and a stunning diversity of plants and animals into such a complex and fragile ecosystem." Marjory Stoneman Douglas, 1947

The Ten Thousand Islands Watershed is actually a collection of small bays and their tributaries, beginning in the north at Tamiami Trail, with the eastern extent of the watershed reaching into Everglades National Park. On the western edge, both Royal Palm Hammock Creek, which terminates in Palm Bay, and the Blackwater River, which terminates in Blackwater Bay, begin in Collier-Seminole State Park. Palm Bay eventually splits, flowing into Goodland Bay and Sugar Bay. To the east of these bays is Buttonwood Bay, fed by the Whitney River. Flowing into Santina Bay are Pumpkin River by way of Pumpkin Bay, Faka Union Canal by way of Faka Union Bay, and Wood River all flow into Santina Bay. The Faka Union Canal drains what the remains of the old Southern Golden Gate Estates development which severely altered the area by dropping the watertable 4-7 feet, changing the habitat types found there. Now owned by the



state and renamed the Picayune Strand State Forest, restoration of this area is finally underway and will benefit not only the local plant and animal populations but downstream as flows are returned to their natural patterns. Just east of Faka Union, on the western border of Everglades National Park, the Fakahatchee River flows into Fakahatchee Bay. Within the 10,000 Islands lies Gate Bay, West Pass, Lance Cove, and Gaskin Bay, all fed by individual tributaries and sheetflow from the Everglades.

The Ten Thousand Islands are the southern extent of the Western Everglades. This area is vital to the Everglades conservation and restoration, encompassing more than a million acres of native habitat including wet prairies, pine islands, and cypress strands. Today, the rich estuarine, mangrove and marsh habitats attract hundreds of species of wildlife. "During the summer, as many as 10,000 wading birds roost on a small island in Pumpkin Bay."[43] "Great flocks of birds create roosts and rookeries here; the plentiful food and cover attract many ducks and other migratory fowl in season…It is upon these resources…that the economy of this county is built."[44] In 1996, 35,000 acres of the watershed was designated as the Ten Thousand Islands National Wildlife Refuge, which contains over 8,000 acres of mangrove forest and is home to a number of listed species including the West Indian manatee, bald eagle, peregrine falcon, wood stork, and the Atlantic loggerhead, green, and Kemp's Ridley sea turtles.[45]

Communities within Ten Thousand Islands include the towns of Royal Palm Hammock and Goodland.

3 INDICATORS OF ESTUARINE HEALTH

The range of indicators of estuarine health that can form the basis for an assessment like the Estuaries Report Card fit into three basic categories: (1) wildlife habitat, (2) species abundance and diversity, and (3) water quality. It is important to note that the indicators are usually directly or indirectly connected with water quality affecting habitat, habitat affecting species. Alternately, some species (such as oysters) can affect water quality and habitat. Ultimately, the selection of indicators for an assessment of current estuarine health depends upon knowledge of baseline or optimum conditions and upon the existence of comprehensive data throughout the region and over time. Baseline information and data exist for only a few of the indicators that would ideally be used for future Report Card analysis.

Prior to selecting indicators, the Conservancy reviewed the indicators used by the Charlotte Harbor National Estuary Program, the Estero Bay Agency for Bay Management, and other Estuary Programs' reports to compose a potential list of indicators of estuarine health. The complete list of indicators is shown below.

Table 1: Estuarine Health Indicators

Wildlife Habitat	Indicator Species Populations	Water Quality
Extent of Wetlands Remaining Extent of Conservation Lands Extent of Impervious Surface Extent of Mangroves Remaining Extent of Submerged Aquatic Vegetation/Seagrasses Remaining Extent of Invasive Exotic Species Infestation	Oyster Spotted Seatrout	Water Pollution Nutrients (Nitrogen and Phosphorous) Biological Oxygen Demand (BOD) Dissolved Oxygen (DO) Pathogens (Bacteria, Viruses, Protozoans, Fungi) Turbidity/Total Suspended Solids(TSS) Toxins Pesticides Metals (Lead, Copper, Arsenic, Mercury, Iron) Dissolved Solids Hydrology Current Flows

The Report Card requires assessment of all 10 Southwest Florida estuaries using the same indicators for each analysis; however, data does not exist across the board for all of the proposed indicators. For example, although data regarding the extent of mangroves and seagrasses in Charlotte Harbor was identified, similar data for Naples Bay and Wiggins Pass/Cocohatchee do not exist. Therefore, indicators relied upon for the 2005 Report were selected both by their dependability as indicators of estuarine health and by the availability of data for those indices across the entire extent of the study area.

The Conservancy will continue to research all of the proposed indicators and to expand the indicators used to assess the estuaries in future Report Cards as more data becomes available.

Two indicators were used to determine the Wildlife habitat grade for this Report Card: (1) Extent of Wetlands Remaining and (2) Extent of Public Conservation Lands. The Water Quality grade was determined by combining the scores for water pollution and hydrologic indicators.

The following is a summary of each possible or proposed indicator and why they are important. Research that has already been located regarding indicators for future analysis may be found in Appendix A.

3.1 Wildlife Habitat

Typically, a healthy ecosystem provides habitat for countless animal and plant species. Coastal wetlands, mangrove forests, and seagrass beds provide homes for many important species and in some cases (such as shellfish beds) continue to do so even after the animals that built them are no longer alive. Wildlife habitat loss is a major cause of population decline among coastal species. As habitats disappear in an area, organisms depending on them are also lost or displaced. The Charlotte Harbor National Estuary Program's Management Plan identified fish and wildlife habitat loss as one of the three "priority problems."[46]

The habitat indicators discussed below are critical for many species of crabs, fish and seabirds, as well as for smaller animals that provide food for these larger creatures. [47]

3.1.1 Extent of Wetlands Remaining

Wetlands may be defined as "lands that are transitional between terrestrial and aquatic systems where the water table is usually at or near the surface of the land and is covered by shallow water."[48] They are transition zones where flow of water, cycling of nutrients, and the energy of the sun meet to produce a unique ecosystem characterized by its hydrology, soils and vegetation.[49] Wetland plant species consist of a combination of grasses and rushes, brackish or salt water species of red, black and white mangroves, or typical freshwater marsh plants such as pickerelweed, cattail, and marsh grasses.[50]

Wetlands improve coastal water quality by filtering stormwater runoff, removing nutrients, contaminants and sediments.[51] They play a critical role in regulating the flow of water into a watershed. Excavation of drainage canals short-circuits surface water flow upstream and moves it rapidly down to the coastal water basin, while the passage of water through natural wetlands extends the purification process. This ensures the delivery of fresh water to the estuary at natural rates and volumes.[52] During times of high precipitation, wetlands may act as storage for floodwater, reducing the velocity of runoff and replenishing groundwater.[53] In addition, wetlands provide habitat for a wide variety of coastal birds, mammals, and fishery species.[54] Wetlands play an important role in maintaining estuarine health because wetland loss and degradation limit the amount of habitat available to support healthy populations of wildlife and marine organisms and decreases the land's natural ability to deal with seasonal flooding.[55] The loss of wetlands as an indicator is typically determined by evaluating historic versus current extent of remaining wetlands.

3.1.2 Extent of Conservation Lands

With the rapid development of coastal watersheds in Southwest Florida, pavement and lawns are rapidly replacing wetlands and other natural areas. The only sure means of protecting the ecological value and function of these wetlands and natural areas is to protect them through permanent conservation, either by public ownership or by conservation easements. Conservation lands are critical to the protection of estuaries and coastal watersheds. Conversely, land development can reduce the capability of the land to store and regulate the release of rainwater from the watershed and to cleanse it of particulates, nutrients, and other contaminants.[56] Covering the land with impervious surfaces and installing storm drain systems creates an imbalance in the flow patterns, timing and delivery of surface water. These activities may also prevent the recharge of ground water aquifers and impact the clarity of runoff. This may be evaluated as an indicator by comparing the total land area to the protected or conserved areas.

3.1.3 Extent of Impervious Surface

Impervious surfaces are the imprint of land development on the landscape. Imperviousness may result in specific changes in the hydrology, water quality, habitat structure and biodiversity within aquatic systems. These areas alter the shape of stream channels, raise the water temperature and sweep urban debris and pollutants into aquatic environments. These effects are measurable once impervious areas cover 10 percent of a watershed's surface.[57] The consequences of increased imperviousness include fewer fish and less diversity among fish and aquatic insects, as well as a general degradation of wetlands and river valleys. Thus, imperviousness is a useful indicator to measure the impact of land development within these systems. In addition, imperviousness is one of the few variables that can be explicitly quantified, managed and controlled at each stage of land development.[58] This indicator would explore the coverage of impervious area within a watershed.

3.1.4 Extent of Mangroves Remaining

Mangrove forests are important to the coastal environment for several reasons. First, their leaf litter, trunks, branches and seeds add organic material to the tidal water providing the basis of an elaborate food chain. Second, mangroves provide habitat, breeding grounds and nursery areas to many marine and terrestrial species, such as birds, mammals, crustaceans, and fishes.[59] In fact, mangroves provide habitat for an estimated 95 percent of commercial and recreational species in southern Florida. The prop roots of red mangroves "disperse wave energy, increase surface area for organisms such as sponges and mollusks, and provide shelter for marine organisms such as the gray snapper, spotted seatrout and red drum." [60]

Mangroves have been proposed as a means to monitor change in coastal environments by acting as indicators of global warming, climate change, storm effects, sea level change, pollution, and sedimentation rates.[61] In addition, mangroves are sensitive to oil and air pollution, as well as to alterations in the frequency of marine inundation or increased freshwater inundation.[62] The extent of mangroves remaining is evaluated by comparing the historic extent of mangroves to their current extent of coverage in each estuary. Growth rates and seedling health of the remaining population may also be important aspects to consider.

"Success…will not be measured solely by water quality improvements, but also by an increase in the bay's living resources, such as seagrass - which serves as a life support system for so many of the bay's aquatic inhabitants."[63]

3.1.5 Extent of Submerged Aquatic Vegetation (SAV)/ Seagrasses Remaining

Submerged Aquatic Vegetation (SAV), including seagrasses, perform many important functions for the estuarine ecosystem. SAV provides shoreline protection, sediment stabilization, and prevents sediment re-suspension. SAV provides food and habitat for microbes, invertebrates and vertebrates. It also improves water clarity, traps and cycles nutrients, and provides wave attenuation. Finally, SAV provides oxygen to water and sediments, sequesters carbon from the atmosphere, and exports organic carbon to adjacent ecosystems.[64]

In addition to their functional importance within the ecosystem, seagrasses are indicators of proper salinity and good water quality.[65] Seagrasses are susceptible to many known pressures such as pests, pollution, fishing activity and sea level change.[66] Dredge and fill projects, non-point source pollution from road runoff, septic systems and agricultural practices, and turbidity resulting from dredging are common causes of seagrass loss.[67] The extent of SAV remaining is estimated by comparing the acreage of submerged aquatic vegetation beds within each estuary to the estimated extent from the estuary's predevelopment condition. Diversity and physical condition of the beds are also important, since each seagrass type has slightly different biological demands. Bed composition or a composition change over time may indicate the presence of certain conditions or progressive alteration of the habitat.[68]

3.1.6 Extent of Invasive Exotic Species Infestation

Where humans tread, nuisance species often follow. Many of the problematic exotic species of Southwest Florida, such as Brazilian pepper (*Schinus terebinthifolius*) and Melaleuca (*Melaleuca quinquenervia*) are opportunistic and tend to invade in places where the native landscape has been disturbed or distressed.[69] Whether they are intentionally introduced, or hitchhike in the ballasts of ships or other anthropogenic mobile sources, these species may displace native species by occupying their ecological niche and habitat as well as by competing for food resources. Their ability to proliferate to unnatural proportions within a landscape is due to the lack of predators and pests of their native environment. Those that become invasive pose a major threat to the integrity and survival rate of native plant communities and decrease appropriate habitat for native animal species.[70] In fact, experts consider the "uncontrolled expansion of Brazilian pepper … one of the most serious ecological threats to the biological integrity of Florida's natural systems."[71] This indicator examines the percent cover of invasive exotic species and quantifies the pressure that these species are exerting on the native plants and animals in the watershed.

3.2 Species

Species abundance and diversity are generally accepted indicators of the health of an ecosystem; many species have very specific environmental requirements and are thus good indicators of subtle changes.[72] Certain species are particularly exceptional indicators of estuarine health because they spend most of their lives in estuaries and/or are dependent upon healthy estuaries to breed and to nurse their young. In addition, tracking species abundance and diversity is important to the marine and estuarine fishery industries that depend on these species for their livelihood. Currently, Florida realizes several billion dollars from recreational and commercial fisheries.[73]

3.2.1 Oyster Beds

The Eastern oyster (*Crassostrea virginica*) is commonly found in the Atlantic and along the Gulf Coast.[74] The Eastern oyster is ecologically important for several reasons. An individual oyster can filter 4-34 liters of water per hour, removing phytoplankton, particulate organic carbon, sediments, pollutants, and microorganisms from the water column.[75] As a result of the oysters' filtering, water clarity improves, as does light penetration and seagrass beds may increase. Oysters also build structures known as bars or reefs that provide other animals with habitat for food, shelter and breeding.[76]

Variation in water quality influences oyster spawning, larval settlement, growth and survival.[77] Changes in oyster condition or health are a reflection of changes in water quality. Since an oyster does not move throughout most of its juvenile and adult life, it is affected by shifts in area specific environmental factors. The oyster can provide an integrated measure of environmental contamination from weeks to months because it accumulates many contaminants (biological and chemical) as it filter feeds.[78] "Salinity and water quality conditions that yield enhanced distribution of healthy oyster reefs can be used as hydrological targets..."[79] This indicator reviews the oyster health and population of each estuary.

3.2.2 Spotted Seatrout

The spotted seatrout (*Cynoscion nebulosus*) can be found in a wide variety of habitats throughout Florida's estuarine and near-shore waters. Spotted seatrout tend to live in shallow, brackish waters over seagrass meadows and above oyster beds or rocky outcroppings. Deep holes and channels, sand flats, mangrove-fringed coves and shorelines are also inhabited by the spotted seatrout.[80]

The seatrout is an excellent species for use in assessing the water condition in Southwest Florida because is it is found in estuaries throughout most of its life cycle.[81] As spotted seatrout often live up to 10 years, they are subject to estuarine conditions for an extended period of time. The spotted seatrout also serves as an important trophic link within an estuary by feeding on fish and crustaceans found among seagrasses.[82] Further, the spotted seatrout is an important component of the recreational and commercial fisheries of the southeastern United States.[83] Despite its importance as an estuarine animal, there is evidence that the spotted seatrout moves considerably both daily and seasonally within an estuary. Thus, the usefulness of spotted seatrout in evaluating area-specific impacts may be limited.[84] This indicator would track trends in health and population structure by geographic region and review the numbers of spotted seatrout in each estuary to determine whether management is needed.

3.3 Water Quality

The health of marine and estuarine systems largely depends upon the quality of the water within that system. Coastal water quality is affected by both natural and anthropogenic factors, such as rainfall, tidal action, coastal development and changes in water flow patterns. Changes in these factors may lead to detrimental effects including changes in salinity, increases in harmful bacteria, and in extreme cases, hypoxia. These situations can severely compromise marine and estuarine health, which in turn endangers coastal species – seagrasses, manatees, and even humans – that rely on the waterbody.[85]

A.3.3.1 Water Pollution

Water quality monitoring is critical to assess whether a body of water is meeting state standards and supporting its associated beneficial uses. Examples of uses are drinking water supply, swimming, and aquatic life support. Each designated use has a specified set of water quality criteria that must be met. States may designate an individual water body for multiple beneficial uses.[86]

To determine whether a given water body can support its associated beneficial use, the state sets numeric water quality thresholds for various physical and chemical parameters. Physical and chemical numeric criteria may set maximum concentrations of pollutants, acceptable ranges of physical parameters, and minimum concentrations of desirable parameters such as dissolved oxygen.[87] DEP evaluates each water body for compliance with water quality standards using the Impaired Waters Rule and determines whether it is verified impaired, whether it should be on the planning list (the list of surface waters or segments for which assessments will be conducted to evaluate whether the water is impaired and a TMDL is needed, as provided in subsection 403.067(2), F.S.), whether it meets water quality standards, or whether the data are insufficient to determine compliance. The following are important water quality criteria for use as indicators of estuarine health in Southwest Florida.

3.3.1.1 Nutrients: Total Nitrogen and Total Phosphorous Compounds

Nutrients that have been dissolved in the water, such as nitrogen compounds (nitrites, nitrates, and ammonia) and phosphorus provide nourishment to plants. A continuous biochemical storage-release-cycling system supplies these nutrients to the ecosystem. Without these sources of nutrient replacement, the ecosystem would gradually become impoverished; however, high loads of these compounds may throw off estuarine balance and become dangerous to inhabitants by causing unnaturally large algal blooms and increasing the rate of eutrophication.

Eutrophication is the natural process of the aging of lakes and some estuaries, but human activities can greatly accelerate eutrophication by increasing the rate at which nutrients and organic substances enter aquatic ecosystems from their surrounding watersheds. Agricultural runoff, urban runoff, leaking septic systems, sewage discharges, eroded stream banks, and similar sources can increase the flow of nutrients and organic substances into aquatic systems. When high nutrient concentrations stimulate algal blooms, the water may be affected in two ways.[88] First, algal blooms can decrease light penetration which may cause aquatic grasses to die and result in the loss of the food and shelter for many underwater species. Second, the amount of dissolved oxygen is severely depleted during the decomposition of the algae. In some rare cases, such as that of red tide, algal blooms may even cause direct toxicity to other organisms it comes into contact with.

Chlorophyll a (Chl-a) and the Trophic State Index (TSI) are used as surrogate indicators for assessing nutrient enrichment and compliance.[89] Chl-a is a measure of phytoplankton biomass and plant abundance in the water. Phytoplankton is a direct and indirect source of food for many marine animals. Phytoplankton depend on certain conditions for growth and therefore are a good indicator of change in their environment.[90] TSI "incorporates water clarity, or transparency…the algal plant pigment chlorophyll a; and total phosphorus as indicators of lake productivity."[91]

Excessive algal growth (as measured by chlorophyll a) often leads to degraded water quality, causing noxious odors, oxygen depletion and fish kills, as well as harmful algal blooms. An increase in nutrient inputs, especially nitrogen, appears to be the cause of excessive algal growth and the subsequent decline of filter-feeding organisms like oysters, clams and mussels.[92]

State standards for nutrient impairment are as follows: (1) Streams must have an annual chl-a mean concentration of greater than 20 ug/l or data indicating that annual mean values have increased more than 50% over historical values for at least two consecutive years; (2) Lakes must have an increase in annual mean TSI over the assessment period (as indicated by a positive slope in means plotted vs. time) or the annual mean TSI has increased by more than 10 units over historical values; (3) Estuaries and their segments must have chl-a values increased by more than 50% over historical values for at least two consecutive years.[93]

3.3.1.1.1 Red Tide and Nutrients

Red tide is the result of a massive bloom of tiny, single celled algae called *Karenia brevis*, usually found in warm saltwater. In high concentrations, *K. brevis* may create a brownish-red sheen on the surface of the water, hence the name, red tide. Red tides originate offshore and may cover up to several hundred square miles of water in the Gulf of Mexico. *K. brevis* produces potent neurotoxins and are carried by winds and currents along the coast and into the estuaries. Filter feeding shellfish, such as oysters, clams, mussels and other bivalve mollusks that consume *K. brevis* concentrate the toxin in various organs. Whereas red tide toxins are deadly to fin fish, shellfish are unaffected. Manatees are particularly susceptible to the toxin, and hundreds have died during persistent blooms. These toxins are also incorporated into the air, which causes respiratory irritation to people along the shore. Although some scientists believe that red tide is caused or exacerbated by excess nutrients from land-based runoff, the causes of massive blooms along the Southwest Florida coast in recent years are still under investigation.[94]

3.3.1.1.2 Biological Oxygen Demand (BOD)

BOD is a measure of the amount of dissolved oxygen used by microorganisms to assimilate organic wastes.[95] BOD is the most commonly used parameter for determining the oxygen demand on the receiving water of a municipal or industrial discharge. The greater the BOD, the more rapidly oxygen is being depleted.

The rate of oxygen consumption in an estuary is affected by a number of variables, including temperature, the presence of certain kinds of microorganisms, and the type of organic and inorganic material in the water.[96] A high BOD indicates a large presence of organic matter in the water. Increases in organic matter may be caused by natural sources, such as leaf litter or anthropogenic sources. Major anthropogenic sources contributing to high levels of BOD in this region are wastewater treatment facilities, agricultural and urban runoff.[97]

3.3.1.1.3 Dissolved Oxygen (DO)

Dissolved Oxygen (DO) is an important indicator of estuarine health because fish, shellfish and other marine animals are affected by *anoxia* (no oxygen) and *hypoxia* (very low oxygen). Dissolved oxygen is the measure of the amount of gaseous oxygen dissolved in an aqueous solution. Oxygen is dissolved into water from the atmosphere by aeration, and as a natural product of photosynthesis. Natural stream purification processes require oxygen in order to provide support for aerobic life forms. As dissolved oxygen levels in the water column drop below 5.0 mg/l, the water quality criterion for marine and freshwater environments, aquatic life is put under stress.[98] The lower the concentration of DO the greater the stress. Oxygen levels that remain below 1-2 mg/l for a few hours can result in a loss of life.[99]

Reduction in dissolved oxygen may result from natural processes and/or human pollution. As bacteria decompose the algae, leading to an increase in bacterial activity, available oxygen is depleted. Current and accurate data on concentrations of DO in water are essential for documenting changes to the environment caused by natural phenomena and human activities.[100] However, historic information on the condition of the system is important here as well, due to natural fluctuations in DO levels based on temperature and salinity.

3.3.1.2 Pathogens (e.g, Bacteria, Viruses, Protozoans, and Fungi)

Pathogens act as infectious agents of disease, spreading illnesses such as cholera, salmonella, typhoid fever, and dysentery. High levels of pathogenic organisms in the water column are a human health concern.

Total Coliform bacteria "are a collection of relatively harmless microorganisms that live in large numbers in the intestines of man and warm- and cold-blooded animals."[101] They originate from soils, plants, and human and animal wastes. Alone, fecal coliform bacteria, a subgroup of total coliforms (including *E. coli*), generally do not pose a danger to people or animals, but they may indicate the presence of other disease-causing bacteria such as those which cause typhoid, dysentery, hepatitis A, and cholera.[102] Stormwater runoff, leaching from septic systems, and animal feedlots are common sources of fecal contamination. In order to protect human health, water quality criteria for fecal coliform should not exceed MPN or MF counts with a monthly average of 200 or a median value of 14 for marine and freshwater environments.[103]

Bacterial contamination in shellfish, primarily fecal coliform and *E. coli*, can pose a problem for human health if contaminated shellfish is consumed. Sources of contamination include sewage treatment plants, on-site sewage systems, farm animals, boater waste, pets and wildlife.[104] The Florida Department of Health keeps track of contamination levels in shellfish harvesting areas and determines whether the areas are open, closed or restricted for harvesting. Currently, the FDEP determination for impairment is based upon a *degradation* of harvesting status as opposed to the current harvesting status. This means that some areas with prohibited harvesting status are *not* listed as impaired due to their consistent status as prohibited; this also means that some conditional status locations *are* impaired, having been downgraded from permitted to conditional during the monitoring period.[105] The presence of shellfish harvesting restrictions due to bacterial contamination is an indicator of estuarine health.

3.3.1.3 Turbidity/Total Suspended Solids (TSS)

The amount of sunlight that reaches aquatic plants, such as seagrasses and phytoplankton, depends on the clarity of the water and turbidity. Turbid water results from the resuspension of sediments and other materials, which may be caused by natural or anthropogenic activities. The greater the TSS in the water, the murkier it appears and the higher the measured turbidity. Dredging operations, channelization, increased flow rates, floods, boat wakes, or too many bottom-feeding fish (such as carp) may stir up bottom sediments and increase the cloudiness of the water. If light penetration is reduced significantly and for a sufficient period of time, the growth of plants may be decreased, which would impact the organisms dependent upon them for food and cover.[106]

High concentrations of particulate matter can also cause shallow bays to fill in faster and smother benthic habitats, impacting associated organisms. As particles of silt, clay, and organic materials settle to the bottom newly hatched larvae can suffocate and sediment fills in spaces between rocks that could have been used by aquatic organisms as habitat. Fine particulate material can also clog or damage sensitive gill structures, decrease resistance to disease, prevent proper egg and larval development, and potentially interfere with feeding activities.

State water quality criteria require that turbidity remains less than or equal to 29 Nephelometric Turbidity Units (NTUs) above natural background conditions in marine and freshwater environments.[107]

3.3.1.4 Toxins: Pesticides and Metals

Since industrialization in the late 1940s and 1950s, the level of contaminants and toxic substances dispersed into estuaries has increased significantly.[108] These contaminants include pesticides, fungicides, herbicides, oils, greases, and heavy metals such as copper, mercury, and zinc. Toxins are introduced into estuaries through industrial discharges, runoff from lawns, streets and farmlands, urban development and boating. In addition, the estuary's own sediment may serve as a source by containing a buildup from years of toxic deposits.

Monitoring for the presence of toxins can provide information about possible effects on an estuary's community structure and populations.[109] Toxins in an estuary can directly affect even top predators through the process of bioaccumulation or biomagnification, whereby the concentrations of toxins accumulate in the flesh and increase every level up the food chain.[110]

3.3.1.4.1 Pesticides

Several of the pesticides widely used in Southwest Florida's watersheds are toxic to aquatic organisms. These include malathion, atrazine, bromacil, metolachlor, norflurazon, simazine, diazinon, and ethoprop.[111] Unfortunately, the State has not set water quality standards for very many pesticides, and insufficient monitoring of pesticides exists to date. The Conservancy has evaluated pesticide use in the coastal watersheds of Southwest Florida, including use by agriculture, golf courses, lawn maintenance, and mosquito control and found that lawn care was second only to agriculture in its impact on local waterways.[112] Without adequate pesticide monitoring in the watersheds, it may be necessary to utilize the pesticide loadings and the hazards of the pesticides to the watersheds as a means of assessing the impacts of pesticides on the health of the estuaries in future Report Cards. The Conservancy is also encouraging the South Florida Water Management District to expand its pesticide monitoring program to encompass additional areas of Southwest Florida's coastal watersheds, particularly where pesticide usage is high.

3.3.1.4.2 Metals

Waters containing high concentrations of metals "may become toxic, adversely affecting drinking water and disrupting growth and reproduction of aquatic organisms."[113] Heavy metals like mercury and lead may enter an estuary through rain or dry particulate matter and then build up in sediment and, when absorbed by plants, can pass into the food chain. For some metals, long-term exposure in even relatively small concentrations may lead to serious health effects.[114] "Symptoms such as lesions (skin damage) on fish, thinning of birds' egg shells, or birth defects appear as the level of toxin builds up."[115] The metals focused on for this report card are cadmium, mercury, iron, lead, and copper.

Cadmium may be airborne or carried by water and has many sources. Incineration of rubber and some plastics, plating from old cars and airplanes, some fungicides, and galvanized pipes, roofs, and cisterns are all potential sources of cadmium contamination. In humans, cadmium's specific effects are upon the thyroid resulting in high blood pressure or, in larger doses, kidney and liver failure, thickening of the arteries, and increased risk of heart attack.[116]

Mercury may also be an airborne pollutant released by incineration and fossil fuel combustion and converted to methyl mercury when it reaches the water. It may cause neurological problems and death in wildlife *and* humans. Even after emissions are stopped, sediment at the bottom of polluted waters may continue to pose a threat.[117] In addition, accumulation in fish tissue can be dangerous to those who eat the fish from mercury contaminated waters.

Iron, while not harmful unless in very large concentration, it influences the uptake of copper and lead, magnifying the toxic affects for those contaminants. This metal occurs naturally in groundwater and may be present in wastewater and stormwater due to corrosion.[118]

Lead accumulates in the body and affects the central nervous system, with pregnant women and children at the highest risk. Symptoms may be flu-like and continued exposure may cause kidney, nerve, and brain damage. Although small levels occur naturally, industry, pipes, fittings, solder, and the service connections of some household plumbing systems are common additional sources.[119]

Copper may be released into waterways due to its common use as a pesticide or from tar on rooftops. Copper is predominantly toxic in infants or adults with specific metabolic disorders. Less severe implications are unpleasant odor and taste of contaminated waters. Uptake of this metal is related to cadmium presence.[120]

3.3.1.5 Dissolved Solids

Dissolved Solids include a variety of substances including salts, metals, and organic compounds. Evaporation and river or canal water inflow are a few factors that control salinity throughout an ecosystem. Disruption in the volume, distribution, circulation and temporal patterns of freshwater discharges may place serious stress on the entire estuarine environment.

A chloride is a salt compound composed of chlorine and a metal, such as NaCl or $MgCl_2$.[121] Salinity is the measure of this salt content within the water. The measure of salinity within an estuary tells us how much freshwater has been mixed with seawater. There is a gradient in salt content that starts with high values in Gulf waters, decreases inward through the estuary, and drops at some distance up in the tidal tributaries.[122] Many aquatic organisms function optimally within a narrow range of salinity. Changes in salinity, above or below this range, may weaken organisms and cause them to succumb to biotic pressures such as predation, competition, disease, or parasitism.[123]

Conductance is the measure of water's ability to carry an electrical current and is used as an indirect measure of salinity. Conductivity is based upon the saturation of solids dissolved and suspended within the water, mostly dependant upon salts, the greater the concentration of solids the higher the conductance rate.[124]

3.3.2 Hydrology

The prominent stressor of an estuarine ecosystem is likely altered hydrology. Excessive freshwater withdrawals and over-drainage, or dramatic increases of freshwater flowing into an estuary are some alterations that take place as a result of anthropogenic activities. These hydrological changes can decrease water quality by increasing turbidity and nutrient loading, changing the water residence time in the estuary, and altering the natural salinity regime.

Restoration of historic hydrology helps return the balance of estuarine systems and their nursery grounds.[125] Restoring slower and more natural flow rates reduces the level of suspended particulates; therefore, increasing light penetration and photosynthesis. This, as well as decreasing the input of nutrients and pesticides, will aid in restoring seagrasses and other ecology to its former magnificence. This indicator is evaluated by assessing the hydrologic changes in the estuary over time.

3.3.3 Current Flows versus the Minimum Flows and Levels

In future report cards, the current flow of each estuary's tributaries, as compared to historic flow, will be incorporated as a sub-criterion of the hydrology indicator. Minimum flow levels (MFLs) are established by the Water Management Districts in Florida to protect water resources or an ecosystem from significant harm resulting from water withdrawals. MFLs define how often and for how long high, average, and low water levels and/or flows should be maintained to prevent significant harm. MFLs are determined based on evaluations of topography, soils, vegetation data collected within plant communities and other pertinent information associated with the water resource.

Hydrographs that represent existing conditions and MFL-defined condition are constructed for different water bodies. The distance between the two lines represents the water available or the water deficit, for 'reasonable-beneficial uses' that will not result in harm to water resources. These availabilities and deficits will be aggregated by estuary to determine the overall current flow status of each estuary's contributing watershed.[126] This indicator measures the contribution of each tributary's flow to the health of the overall estuary.

4 METHODOLOGY

This report assesses the health of each estuary based on two categories: Wildlife Habitat and Water Quality. A Wildlife Habitat grade was assigned, based on the percentage of wetlands remaining for each estuary watershed, with that grade being weighted by the percentage of conservation lands within the same watershed. Water pollution data was used to calculate the water quality grade for each estuary, and those grades were then weighted with hydrologic data.

4.1 Wildlife Habitat

Two measures of Wildlife Habitat were used for this Report Card: (1) Extent of Wetlands Remaining and (2) Extent of Public Conservation Lands. The baseline is the pre-development conditions of each estuary's watershed area. Wildlife Habitat was graded based on the assessment of the percentage of remaining wetlands within each estuary watershed, qualified with a plus (+) or minus (–) based on the percentage of conservation lands within that watershed.

The Extent of Wetlands Remaining for each of the estuaries was assessed by comparing the extent of predevelopment wetlands within each estuary's watersheds to the current estimated extent of wetlands (Appendix B). In order to calculate the Extent of Wetlands Remaining, the current wetland acreage was divided by the pre-development wetland acreage and multiplied by 100 to obtain a percentage. The percentage of the extent of wetlands remaining was assigned a letter grade according to the following scale: A (80-100%), B (60-79%), C (40-59%), D (20-39%), and F (19% or less).

This grade was then assigned a qualifying value based on the percentage of acres within the estuary's watershed that are held in Public Conservation Lands. The Public Conservation Lands percentage was graded independently and assigned a value on a scale of 36% and above (+), no qualifier for 24-35%, and 23% or less (-).

4.1.1 Extent of Wetlands Remaining

To assess the Extent of Wetlands Remaining for each of the estuaries, the estimated extent of predevelopment wetlands within each estuary's watersheds was compared with the current estimated extent of wetlands.

The Conservancy of Southwest Florida (The Conservancy) used the South Florida Water Management District's "Southwest Florida Feasibility Study" (SWFFS) Pre-Development Vegetation map[127] to determine the predevelopment wetland coverage for all watersheds except Charlotte Harbor, Lemon Bay and Coastal Venice, where we relied upon the Southwest Florida Water Management District (SWFWMD) pre-development vegetation GIS layer.

The data source used to calculate current wetlands remaining is the 1999 Florida Land Use dataset available from the South Florida Water Management District (SFWMD) website. The included wetlands data are the area location and classification of lands as defined by Florida Landuse and Cover and Forms Classification System (FLUCCS). Wetlands are any land area designated FLUCCS 600 or 6000 series.[128]

Acreages of each wetland habitat were calculated using X-Tools Pro 2.0 in ArcGIS. Acreages were summed using the statistics function in the attribute table. Details of the wetlands acreage for each estuary are also found in Appendix B.

Wetlands constructed for the treatment of storm water were generally not included in this analysis because they have a short lifespan and low rate of success. In addition, the quality of water discharged into treatment wetlands is degraded and does not provide suitable habitat for the species which rely on naturally occurring wetlands.[129]

4.1.2 Extent of Public Conservation Areas

Federal, state and local public conservation lands were identified for each estuary's watershed based on information provided by the FDEP, and the source for the conservation lands data was the Florida Natural Areas Inventory (FNAI,) which is Florida's most comprehensive database of public conservation lands, including boundaries for more than 1,400 federal, state and local managed areas. The managed areas shapefile September 2004 version was utilized in compiling the acreages references in this report.

For future Report Cards, The Conservancy intends to expand the Conservation Areas indicator to include privately held conservation lands or aquatic preserves and conservation easements. The individual conservation areas and their acreages that were used to attain the aggregated acreage totals are provided in Appendix C.

4.2 Water Quality

Florida's water quality standards, as set forth in the Impaired Waters Rule (IWR), were used as the baseline for each of the water quality indicators. To determine if a water body, identified by a WBID, met the State's water quality standards for each of the indicators, Florida's Verified or Draft Verified lists were utilized.

Although the Environmental Protection Agency's 303(d) list includes many waters that the State of Florida does not, this list has only been completely re-evaluated for Basin 1 Waters and since Basins 1, 2, and 3 have not been assessed, the use of the Environmental Protection Agency (EPA) list was not appropriate at this time. However, the state has agreed with the EPA on the new methodology for determining bacterial impairment and has agreed to use this new methodology when evaluating future basins, including 2 and 3.[130] Due to the fact that this agreement occurred after the completion of Group 1 analysis, the State has not adopted those waters which EPA added for Group 1, and will not until the next scheduled group 1 rotation in 2007, so the Conservancy has relied upon EPA's determinations for bacterial impairment for Group 1 Basins to ensure that a consistent set of data is evaluated for all of our focus basins.

The determination of the water pollution score for each watershed has two parts: (1) the acres of spatial impairment and (2) the severity of the impairment within those impaired acreages. First, for the spatial impairment, the total number of acres for each estuary was determined by totaling the acreage for each WBID within the estuary's watershed. Second, the acreages for the impaired WBIDs were totaled to determine the impaired acreage of the watershed. Finally, the acres of impairment within that watershed were divided into the total acres of the watershed and multiplied by 100 to yield the percent of the watershed that is legally impaired.

To determine the severity of the impairment within the impaired portion of the watershed, the possible impaired criteria were divided into six categories commonly associated with water pollutants: (1) Pathogens, including coliforms, other bacteria, viruses, protozoans, and fungi; (2) Oxygen-depleting Wastes, including DO and BOD; (3) Inorganic Pollutants, including metals, salts, and acids; (4) Nutrients; (5) Organic Compounds, including pesticides and herbicides; and (6) Other.[131] Then, each impaired WBID's acreage was multiplied by the number of categories for which it was impaired; these acreages were totaled, and divided by the total impaired acreage for the watershed multiplied by the 6 possible categories of impairment. It should be noted that while this method does count multiple categories of impairments as more severe than a single one, it does not account for the differences in toxicity levels of certain pollutants.

The final water pollution score was determined by weighting the spatial impairment more heavily than the severity of impairment (a weight of 2/3 to 1/3,) as it is intuitively more important that a given amount of a specified watershed does not meet requirements for its basic classification usage than the importance of severity within only that impaired portion. To combine the two impairment scores they were scaled, using the common 4.0 grade point scale then combined to determine the final Grade Point Average (GPA) for the watershed. This GPA was then assigned a letter grade, once again based upon the familiar 4.0 grade point scale.

$$\text{Water Pollution Score} = 100 \times \frac{2\,(\text{Spatial area of impairment}) + (\text{Degree of Impairment within those acreages})}{3}$$

For more detailed equations and calculations, see Appendices D and E.

It should be noted that the Conservancy had reservations about relying on the current WBID boundaries for the Wiggins Pass/Cocohatchee River, Naples Bay, Rookery Bay, and Ten Thousand Islands estuaries due to these WBIDs' inaccurate watershed boundaries and directional flows. The Conservancy considered utilizing the approach and water quality analysis in a report titled "Compilation, Evaluation, and Archiving of Existing Water Quality Data for Southwest Florida" (prepared by Tetra Tech, Inc. and Janicki Environmental on May 5, 2004 for the Jacksonville Army Corps of Engineers in support of the Southwest Florida Feasibility Study) for the Wiggins Pass/Cocohatchee River, Naples Bay, Rookery Bay, and Ten Thousand Islands estuaries instead. However, there were inaccuracies in these watershed and WBID boundaries as well, and in addition, the areas west and south of US 41 (Tamiami Trail) were not included within the study area at all. Therefore, it was decided that the SWFFS approach would be less accurate overall in depicting the local hydrology of these estuaries' watersheds and more difficult to rectify.

To mitigate the inaccuracies in the FDEP/EPA approach, several approaches were considered to create a more accurate depiction of the sub-basin boundaries and actual hydrology of those estuaries' watersheds. In order to rectify the inaccuracies, however, FDEP/EPA would need to re-delineate their current WBID and sub-basin boundaries for several estuaries in Collier County and create new WBIDs, as well as reanalyze all of the corresponding water quality data. The Conservancy is currently working with FDEP and other entities to accomplish this. For future Report Cards, the Conservancy hopes to utilize new more accurate FDEP/EPA WBID and sub-basin boundaries for increased accuracy of the water quality analysis and conclusions for these four estuaries.

For the purposes of conducting the analysis for this Report, the aforementioned modified approach of redistributing the existing sub-basin WBIDS (Appendix F) was utilized to more accurately depict watershed boundaries for the Wiggins Pass/Cocohatchee, Naples Bay, Rookery Bay, and Ten Thousand Island estuaries (as reflected in the estuaries' watershed maps in Chapter II.) In addition, WBID 3259L, the Blackwater River, originally in Ten Thousand Islands, has been split and a third of it distributed to the Naples Bay watershed to represent that this WBID feeds into both the Ten Thousand Island and Naples Bay watersheds.

Several of the estuaries in Southwest Florida are impacted by either too little freshwater flow, due to diversions of water from their watersheds, or too much freshwater flow, due to drainage features that push water out through the estuaries in the wet season. First, it should be noted that there is no baseline hydrology data for the watersheds included in our study area that predates alteration. In addition, there is no available current quantitative data for each of the estuaries in Southwest Florida. Therefore, though hydrology is arguably of equal importance as water pollution, the lack of quantitative data precludes it from being used equally for the analysis of water quality in each estuary watershed. Qualitative reports do exist for the degree of alteration and detailing freshwater flow problems in many of the estuaries. For some of the tributaries that flow into the estuaries, a minimum freshwater flow has been adopted by either the SWFWMD or the SFWMD using the best available scientific data to establish a minimum flow for preventing harm to the tributary or its downstream estuary. A minimum flow has been established for the Peace River and for the Caloosahatchee. However, since quantitative thresholds are not available for all of the water bodies covered, qualitative data on the current hydrological status of each estuary was collected and assessed. The hydrology scores were based on qualitative data regarding alteration of hydrology/flow characteristics to each watershed and the data is presented in Appendix G.

The letter grade for each estuary was based on the water pollution score in the common 4.0 grade scale of A (4.0-3.67), B (3.66-2.67), C (2.66-1.67), D (1.66-0.67), and F (0.66 and below). That grade was then assigned a plus (+) if the hydrology grade was assessed to be "Good," meaning that the watershed was determined to have been only slightly altered and does not present significant ecological detriment to the watershed. No qualifier was assigned if the hydrology was assessed to be "Fair," indicating that the watershed has been moderately altered presenting a degree of negative impact to the watershed. A minus (–) was assigned if the hydrology was assessed as "Poor," indicating significant alteration from historical conditions, presenting a substantial negative impact on the ecological integrity of the watershed.

5 REPORT CARD GRADES, CONCLUSIONS AND RECOMMENDATIONS

5.1 2005 Grades

5.1.1 Wildlife Habitat Grade

Percentage of Wetlands Remaining [A (80-100%), B (60-79%), C (40-59%), D (20-39%), and F (19% or less)] **Conservation Lands Acreage** [A (48-60%), B (36-47%), C (24-35%), D (12-23%) and F (11% or less)]

Estuary	Wetlands Remaining	Grade	Conservation Lands Acreage	Qualifier	Overall Wildlife Habitat Grade
Coastal Venice	48%	C	12%	-	C-
Lemon Bay	62%	B	13%	-	B-
Greater Charlotte Harbor	59%	C	15%	-	C-
Pine Island Sound	69%	B	60%	+	B+
Caloosahatchee	40%	C	7%	-	C-
Estero Bay	50%	C	22%	-	C-
Wiggins Pass/ Cocohatchee	67%	B	12%	-	B-
Naples Bay	13%	F	2%	-	F-
Rookery Bay	56%	C	26%	none	C
Ten Thousand Islands	94%	A	80%	+	A+

5.1.2 Water Quality Grade

Water Pollution, Final Grade Scale: A (4.0-3.67), B (3.66-2.67), C (2.66-1.67), D (1.66-0.67), and F (0.66 and below) **Hydrology** [A qualifying grade of "Good," resulting in a "+", "Fair," no qualifier, and "Poor," resulting in a "-"]

Estuary	Total Acreage	Final Water Pollution Grade	Hydrology Qualifier	Overall Water Quality Grade
Coastal Venice	62,961	Incomplete	Poor	Incomplete
Lemon Bay	63,331	C	Fair	C
Greater Charlotte Harbor	2,088,958	B	Poor	B-
Pine Island Sound	154,807	B	Fair	B
Caloosahatchee	859,318	C	Poor	C-
Estero Bay	201,021	D	Poor	D-
Wiggins Pass/ Cocohatchee	190,312	C	Poor	C-
Naples Bay	52,967	C	Poor	C-
Rookery Bay	51,958	B	Fair	B
Ten Thousand Islands	1,132,639	A	Poor	A-

5.1.3 Overall Watershed Health Grades

Estuary	Wildlife Habitat	Water Quality
Coastal Venice	C-	Incomplete
Lemon Bay	C-	C
Greater Charlotte Harbor	-	B-
Pine Island Sound	C+	B
Caloosahatchee	-	C-
Estero Bay	D-	D-
Wiggins Pass/ Cocohatchee	C-	C-
Naples Bay	F-	C-
Rookery Bay	C	B
Ten Thousand Islands	+	A-

5.2 Conclusions

The Southwest Florida Estuaries Report Card has compiled and evaluated indicators of health for the region's ten major estuarine watersheds, from Coastal Venice to the Ten Thousand Islands. These estuaries share similar characteristics but they differ significantly in the amount and timing of freshwater flows from their watersheds and in the amount of urban and agricultural development impacting their watersheds.

The hydrology of much of Southwest Florida has been altered by the Central and Southern Florida Project, the massive drainage and flood control project covering most of the region, as well as by roads, canals, and wetland fills for residential development and agricultural uses. Alterations in flow and timing have a significant impact on water quality and on the health of aquatic life within the estuaries and their watersheds. As urban development continues to crowd coastal watersheds of Southwest Florida, alterations of water flows to the estuaries will worsen unless flowway and wetland protection become priorities.

The estuaries of Southwest Florida all show some impact from human activity, even the relatively remote Ten Thousand Islands Estuary. Each estuary, including those that are significantly protected by conservation lands, has portions of its watershed that do not meet State water quality standards. For the more urbanized areas of each watershed it appears that the primary problems are with D.O. and nutrients, while the agricultural areas have problems with pesticides and metals. The metal impairment is predominantly due to copper, which is a component of some widely used pesticides.

In the process of creating the Report Card, The Conservancy has learned that, despite several governmental programs to monitor the environment of Southwest Florida, consistent and comprehensive data on important indicators of estuarine health are not collected throughout the region. As a result, this first Report Card has relied on a few key indicators of water quality and wildlife habitat.

Biological indicators of estuarine health may actually be more effective indicators and be more economical to monitor than chemical indicators of water quality that are relied upon in FDEP's impaired waters evaluation. In order for specific bioindicators to be utilized in a comparative analysis, sampling protocol and sampling intensity must be consistent across watersheds. For example, seagrass mapping exists for all of the watersheds except Wiggins Pass/Cocohatchee Estuary. This estuary would need to be surveyed for this indicator to be used as an evaluation tool in future Report Cards. Two other important biological indicators, oyster bed coverage and mangrove area, have only limited evaluation across Southwest Florida, but could be included in the Report Card if monitoring was expanded. Mangroves are essential habitat and their coverage area could be estimated with skilled evaluation of aerial photography. Similarly, land use changes, particularly increases in impervious surface coverage, can be estimated from aerial photography. Increases in impervious surfaces coverage are correlated with degraded water quality through stormwater runoff.

Even water quality data, though the most extensive, still has gaps. While Collier and Lee counties have sufficient current and historic data for evaluating the extent of water pollution, the Peace and Myakka sections of Charlotte Harbor, as well as the entire Coastal Venice watershed, need additional monitoring and analysis. There has been some pesticide monitoring for the Caloosahatchee watershed, but no routine monitoring exists in Collier County, where pesticide use is high. In addition, the Water Basin Identification (WBID) units in Collier County need to be reevaluated for redistribution and redelineation to more accurately reflect the local hydrology.

Below are specific conclusions for each of the estuaries evaluated.

5.2.1 Coastal Venice

With less than half of the original wetlands remaining and little land in conservation, the habitat grade for this watershed is a **C-**, one of the most developed urban watersheds in this study. While it is not always true, wildlife habitat and water quality grades have tended to coincide in this report which may indicate a pressing need for more conservation.

A water quality grade for Coastal Venice could not be determined. There are significant gaps in data from current sampling points and a lack of monitoring sites for this watershed, which make it impossible to determine the state or severity of impairment. Further research is needed to identify impairment and the steps required to protect this area. Hydrology in the area has been severely altered and there is a large possibility that natural systems may be heavily impacted due to these changes. The grade for Coastal Venice's water quality is an **Incomplete**.

5.2.2 Lemon Bay

With 62 percent of its original wetlands intact, Lemon Bay remains in the upper reaches of the grading range. However, while the Myakka State Forest and upper portion of Charlotte Harbor Preserve have protected large portions of this watershed, the overall small proportion of the watershed held in public conservation resulted in a negative (-) modifier. This may improve in the future, as groups like the Lemon Bay Conservancy are working to obtain more areas of ecological importance for conservation. The final wildlife habitat grade for Lemon Bay is a **B-**.[132]

Lemon Bay is moderately degraded with 55 percent of its watershed acreage impaired for at least one parameter. However, those areas which are impaired only score a 21 in severity, the midrange of the evaluated watersheds, as most of the impairment is for DO and coliform contamination. The Southwest Florida Water Management District released a report in May 2004 [133]which discussed nonpoint source pollution in Lemon Bay and recommended basin management strategies.

Water quality testing was conducted at six tributary inflows to the bay: Ainger Creek, Alligator Creek, Buck Creek, Forked Creek, Gottfried Creek, and Oyster Creek. They were measured for ammonia, nitrogen, NOx, salinity, orthophosphorus, phosphorus, color, total suspended solids, fecal coliform, and BOD.

Despite the proliferation of hydrologic alteration in this watershed, there is little indication that these alterations have had extensive detrimental effects in the area. This resulted in a "fair" determination for Lemon Bay hydrology, and a final water quality grade of **C**. The fact that a significant portion of this watershed is impaired for dissolved oxygen, with BOD as the common causative pollutant, points to the need for further research regarding historic and natural systems in the area in order to determine the source of BOD pollution.

5.2.3 Charlotte Harbor

Although much of the mangrove fringe around Charlotte Harbor proper has been preserved, Charlotte Harbor's wildlife habitat has been impacted by wetland loss in its watershed. Only 59 percent of wetlands remain, equivalent to a C on the Estuaries Report Card scale. As for public conservation lands, the Charlotte Harbor Proper portion has approximately 29 percent of its watershed fairly well protected. This resulted in a C grade and no modifier to the base grade. However, the Charlotte Harbor watershed including the Peace and Myakka is very large (2,088,958 acres) and does not offer the same degree of protection for the estuary, with only 14 percent of lands in public conservation. The overall Wildlife Habitat Grade for Greater Charlotte Harbor is a **C-**.

The water quality for Greater Charlotte Harbor, (including the Peace and Myakka Rivers), is only slightly tarnished with 16 percent of its spatial area impaired and a 22 percent score in severity of impairment for degraded areas, which resulted in a B. The primary impairment was for coliform bacteria (6% of the entire watershed), which is most likely a result of the widespread use of septic tanks in residential areas throughout the watershed. The bacterial contamination of shellfish within Charlotte Harbor Proper has led to a conditional shellfish harvesting designation. Other significant pollutants were nutrients (5%) and mercury (4%). Mercury levels in fish tissue have led to advisories against eating certain species of fish according to the 2004 verified impaired lists for the area.

While the portions of the watershed outside of Charlotte Harbor Proper appear to have less impairment, much of this is likely due to the fact that these WBIDs are outside of Basin 2 (most of the Peace/Myakka sections are found in Basin 3). Due to the basin rotation method, these sections have not been as extensively evaluated for as long, nor is the data available as comprehensive as that which is available for Basin 2 WBIDs, due to the fact that these areas are often unsampled of have insufficient data. The hydrology for the entire Charlotte Harbor has been significantly altered, with many of its tributaries affected by mining and development discharge into the system. This has detrimentally affected the water levels and allowed saltwater intrusion into the surficial aquifer system. A "poor" rating was assigned to the Greater Charlotte Harbor Watershed due to the degree of its hydrological alteration and the overall Water Quality grade is assessed to be a **B-.**

5.2.4 Pine Island Sound

Pine Island Sound waterbodies receive a fair amount of protection due to the amount of wetlands and conserved lands remaining within this watershed. Pine Island Sound watershed has 69 percent of its predevelopment wetlands intact, which is assessed as a B grade. Lee County and private organizations such as the Calusa Land Trust have preserved most of the remaining predevelopment wetlands in the Pine Island Sound watershed through public/private conservation ownership. In addition, it has 60 percent of the entire acreage of the watershed held in public conservation. This proportion of public land ownership is in the upper limit of the scoring category, and therefore, a plus (+) was assigned to the base grade. Overall, the Pine Island Sound received a **B+** for Wildlife Habitat.

The Pine Island Sound watershed is spatially impaired at 37 percent and a severity of 17 percent, which resulted in an overall B grade for Water Quality. The large spatial area of impairment is due to the shellfish harvesting classification downgrading of much of this estuary stemming from bacterial contamination. The bacteria assessed for contamination of shellfish are fecal coliform bacteria, indicating human waste, possibly from septic tanks and/or sewage treatment plants, has penetrated the system. In addition, the hydrology of Pine Island Sound has been slightly altered by the Cape Coral Canal and Drainage System and through the deepening and widening of a channel between the Caloosahatchee and San Carlos Bay. This resulted in a hydrological condition assessed as "fair." Combining these two scores, the overall Water Quality grade for Pine Island watershed is a **B**.

5.2.5 Caloosahatchee River

Much of the wildlife habitat has been lost in the Caloosahatchee watershed. The percentage of wetlands remaining from the predevelopment acreage is 40 percent, a grade of C. Very little land in the watershed is held in conservation (7%). The overall Wildlife Habitat grade is a **C-,** and indicates a pressing need to target environmental land acquisition efforts in this region, both for water quality and for wildlife habitat.

Given its direct connection to Lake Okeechobee, the Caloosahatchee, not surprisingly, has a compromised water pollution score, with 57 percent spatially impaired, and a 31 percent severity score, resulting in an overall water quality grade of C. The primary pollutants in this watershed are nutrients (29%), coliform bacteria (26%), and low DO (22%). It should be noted that for the purpose of the Report Card the Caloosahatchee watershed starts where the river begins at the C-43 Canal at Lake Okeechobee, and thus reflects both the DEP watershed boundary, as well as that of the Charlotte Harbor National Estuary Program. This means that the most polluted portion of the watershed, Lake Okeechobee and its tributaries upstream, have not been included. If this portion of the watershed had been included, the Caloosahatchee Estuary would probably be far more impaired than represented in this analysis.

Significant loads of nitrogen and phosphorous flow from Lake Okeechobee into the Caloosahatchee during the wet season from farming operations around the lake and in the Kissimee River watershed. In addition, nutrients discharged from the agricultural operations along the river and from the urban areas from La Belle to Cape Coral contribute to nutrient enrichment and low DO in the river. Bacterial impairment likely results from a combination of septic tanks and sewage treatment plants both around the Lake and within the Caloosahatchee watershed.

Two water bodies of the Caloosahatchee have been classified by FDEP as impaired due to elevated levels of malathion, a pesticide used on a variety of crops and for mosquito control. The Conservancy has identified data from the SFWMD that was not utilized by FDEP when evaluating impaired waters that shows elevated levels of several pesticides, particularly herbicides, in the Caloosahatchee, including possible human carcinogens and pollutants toxic to aquatic organisms. Although these data were not utilized in the calculations for this Report Card, they give further weight to the conclusion that pesticide contamination could be a significant problem in the Caloosahatchee, especially given that a section of the river where pesticides are found is used by Lee County as a drinking water source.[134] Furthermore, the presence of significant levels of herbicides in the water column of the river raises the concern that seagrasses could be impacted. No reported studies concerning the effects of these herbicides dissolved in water on seagrasses were located.

The Caloosahatchee hydrology has been dramatically altered by the Central and Southern Florida Project, which dumps high flows of freshwater into the river from Lake Okeechobee during the wet season and severely restricts flows from the Lake during the dry season. A regulatory Minimum Flow has been established at 300 cubic feet per second (cfs) for the Caloosahatchee. This is the level below which significant harm to the estuary will result. This Minimum Flow has been violated for much of the time since it was established. During the wet season, flows sometimes exceed 13,000 cfs, which is more than four times the flow that is considered damaging to seagrass beds, due to the low salinity caused by freshwater inundation. The high degree of alteration to the hydrology of this watershed, in concert with the significant negative effects of this alteration on water quality, benthic fauna, submerged vegetation, and fisheries, this estuary watershed has been assessed to have "poor" hydrological conditions that result in an overall score of **C-** for Water Quality.

5.2.6 Estero Bay

The percentage of wetlands remaining from the predevelopment condition of Estero Bay's watershed is 50 percent, a C on the grading scale. These wetlands will continue to disappear rapidly if the area is further developed. From 1998 to 2002, over 3,000 acres of wetlands in Lee and Collier Counties were filled through USACOE permits. Many of these wetlands were in the Estero Bay watershed.[135] As of 2005, only 22 percent of the entire watershed is held in public conservation, which suggests a need to intensify acquisition efforts of environmentally sensitive lands, including upland buffer areas within this watershed. Much of the headwaters for the watershed are in the Density Reduction/Groundwater Resource Land Use Area of Lee County, a land use designation for private land in the area created to restrict development. Thousands of acres have been taken out of this designation to permit development, including the development of Florida Gulf Coast University and surrounding gated golfing communities. The temporary hold on comprehensive plan amendments in this area which would allow increased density ended September 1, 2005. This area will need to be watched carefully in the coming year. The overall Wildlife Habitat grade for this watershed is **C-.** These grades highlight the need for a concerted effort to improve the water quality and protection of Estero Bay, the state's first aquatic preserve.

The majority of the Estero Bay watershed area is impaired for at least one water pollution parameter, with 73 percent, almost three quarters of the watershed present on a verified list. Most of this area is impaired for at least two parameters (low DO and high nutrients) providing a 35 percents severity score. These conditions, coupled with the severity of impairment score (35%), place Estero Bay among the most severely affected of Southwest Florida's estuaries. Water quality in the Estero Bay watershed has declined in the past years despite the fact that much of the watershed is classified as Outstanding Florida Waters (OFW) with a "no degradation" standard, violating the State implemented OFW rule. All of the tributaries to Estero Bay are impaired for low DO and high nutrients and some tributaries are impaired for high copper and bacteria concentrations. Bacterial contamination of shellfish has led to a conditional harvesting designation for the Bay.

According to the Estero Bay Agency for Bay Management, tributary flow into Estero Bay has been altered through drainage canals and other water management features during both the wet and dry seasons.[136] This has resulted in high peaks of freshwater flows during the wet season when water control structures are opened, and little discharge during the dry season. Over drainage has lowered the water table, and has resulted in a reduction of wetlands in the watershed, harming aquatic life in the estuary by destroying habitat for those species that depend on it such as wading birds, amphibians, and native fishes. Therefore, the hydrological condition has been assessed as poor, resulting in an overall Water Quality grade of **D-**. These grades highlight the need for a concerted effort to improve the water quality and protection of Estero Bay, the state's first aquatic preserve.

5.2.7 Wiggins Pass/Cocohatchee River Estuary

The Wiggins Pass/Cocohatchee watershed has a large percentage of wetlands remaining (67%) from predevelopment conditions; yet a fairly small percentage (12%) of publicly owned conservation lands. This is a reflection of private ownership of major flowways and coastal wetlands. The overall Wildlife Habitat grade is assessed as a **B-**, indicating that this estuary has the potential to preserve much of its original wildlife habitat by focusing on land acquisition by government agencies or conservation easements on private lands. There may also be large privately owned areas that are in conservation easements that were not included in the percentage of conservation lands in this assessment.

Significant water quality problems in the Wiggins Pass/Cocohatchee River watershed stem primarily from the Cocohatchee River, Cocohatchee Canal and Vanderbilt Lagoon. Each of these waters have been significantly altered and impacted by road building and land development activities. The nutrient impairment of Lake Trafford, caused by the decayed aquatic plant muck on the bottom, also contributed to the high percentage of impairment within this watershed.[137] Wiggins Pass/Cocohatchee watershed is severely impaired, having 69 percent of its spatial area impaired, and a severity of impairment score of 33%, resulting in a C grade for water pollution. The portion of the watershed near Wiggins Pass, including Water Turkey Bay, has been designated as OFW, but significant degradation has occurred. The primary pollutants are low D.O. (68% of the watershed impaired) and iron (65%). It has been determined that the low DO in the Cocohatchee River is caused by excess nitrogen compounds, likely resulting from runoff of fertilizers from agricultural and residential use. The canal has low DO due to BOD, which could also be the result of nutrient enrichment causing algae and aquatic weed blooms that produce BOD when they die. The restoration of Lake Trafford, which involves the removal of deep nutrient-rich muck, should improve the water quality of that part of the watershed. However, long-term management of the lake should be considered in order to perpetuate the water quality benefits of this effort in the future.

The hydrology of the watershed has been significantly altered, warranting a "Poor" hydrological score. Prior to development in the area, the Cocohatchee Flowway was 20 miles wide, allowing sheet flow of freshwater from the Corkscrew Swamp to reach the Imperial and Cocohatchee Rivers. Agriculture, land development and road building narrowed the flowway first to 2 miles where it crosses the Lee County line and then to 2,000 feet where it enters the Cocohatchee Canal. The South Florida Water Management District has issued a wetlands filling permit that would narrow the flowway again to around 200 feet in order to permit the construction of a large residential golfing community. To date, this construction has not yet begun because the federal wetlands filling permit has not been approved. The overall Water Quality score, comprised of both water pollution and hydrology assigned to Wiggins Pass/Cocohatchee is a **C-**.

5.2.8 Naples Bay

It is not surprising for such an urban estuary to be accompanied by a significant loss of wetlands and little land in conservation. For instance, over 75% of the original mangroves in Naples Bay have been destroyed for urban development.[138] For the watershed as a whole, only 13 percent of the original wetlands remain (F grade), coupled with an extremely low percentage of lands held in public conservation (2%). The overall Wildlife Habitat Grade for Naples Bay is an **F-**. Remaining mangrove wetlands in Naples Bay and the Gordon River can still be preserved, although most of them are in private ownership. Purchase of wetlands by Collier County or the use of conservation easements or development restrictions could result in more certain preservation.

Naples Bay watershed has a significant degree of water quality impairment. Seventy-nine (79) percent of the watershed area is impaired and the severity of impairment score is 17%, which yields a C on the water pollution scale. These impairments are due to coliform bacteria (30%) and low DO (49%), which is related to BOD pollution, found predominantly in the watershed's canals. The Gordon River suffers from low DO, but no BOD samples have been taken to determine whether BOD is the causative pollutant, although to date the City of Naples Waste Water Treatment Plant is permitted to discharge up to 16,000 pounds per day of BOD into the River. While the level of treatment by this plant was improved several years ago, the plant still occasionally discharges BOD into the River. Naples Bay itself does not have sufficient monitoring data to evaluate water quality for DO or BOD. The Naples Bay watershed is clearly impacted by stormwater runoff from urban residential and commercial areas, including roads. Runoff from much of the City of Naples, for instance, flows untreated into the Bay, as does runoff from much of Northern Golden Gate Estates and urbanized areas north of Naples Bay. The Bay experiences a flushing and striation effect from the tremendous volumes of water released down the Golden Gate Canal in the wet season that dilutes the levels of pollution and pushes the pollution off-shore, which prevents water quality from appearing worse than it does.

When the Golden Gate Canal was built to drain the Northern Golden Gate Estates canals, it drastically altered the hydrology of the area, connecting over 70 square miles of watershed to the Bay that were not previously connected. As a result, freshwater flows increased during the wet season by 20 to 40 times those of historic flows, altering the sensitive balance that once supported fish, oysters, and seagrasses in the Bay.[139] In addition, much of the Bay itself has been altered by dredging and filling for residential development and navigation and by seawall construction. Due to the severe alteration of the watershed, both in terms of the boundaries of the bay and the expansion of the watershed, the hydrological condition of the watershed is deemed "poor." Therefore, the Water Quality grade for the entire watershed is a **C-**.

5.2.9 Rookery Bay

As of 2005, 56 percent of Rookery Bay's original wetlands remain within the watershed, which signifies a C grade. The wetlands preservation in protected areas, to date, is exemplary. However, only 26 percent of the entire acreage within this watershed is held in public conservation and a great deal of development has occurred in the northern portion of the watershed. This makes those wetlands vulnerable and highlights the need for additional acquisition efforts in this area. The overall Wildlife Habitat score for Rookery Bay watershed is a **C**.

A large portion of the Rookery Bay watershed is the Rookery Bay National Estuarine Research Reserve, which has been protected from development since the 1960s. As a result, only 17 percent of the watershed's area is impaired and those areas that are degraded have only a 17% severity of impairment score. This impairment is for low DO in one water body, the Blackwater River, based on elevated phosphorous levels and equates to a B on the water pollution grading scale. However, Henderson Creek Canal waterbody should have been included in the Rookery Bay area by DEP, which would result in additional impairment. The Blackwater River WBID that DEP designated as impaired is actually a canal running alongside the Tamiami Trail and not all of its flow finds its way into Rookery Bay. Restoring some of the original hydrology to end changes in drainage are planned, along with additional culverts, to permit flows under the highway. When more is learned about local hydrology, more accurate understanding of the health of the Rookery Bay system and plan development for its continued protection can occur.

The water quality of the Rookery Bay watershed is increasingly threatened by land development in the Henderson Creek headwaters, along the Henderson Creek Canal, and in other drainage areas to the Bay. Thousands of acres of residential communities are planned for this area in the next few years, and without great care, water quality will further decline due to stormwater runoff containing nutrients and other pollutants. In addition, the Lely Area Stormwater Improvement Program, would increase drainage into the watershed from residential development discharge east of Rookery Bay. Careful planning and design may still prevent water quality degradation.

The hydrology of the Rookery Bay watershed has been altered by development north of the Reserve. The alteration of the freshwater entering Rookery Bay's primary tributary, Henderson Creek, from the historic sheetflow to a roadside canal, has resulted in decreased water retention during the wet season and hypersaline conditions in Henderson Creek during periods of drought.

However, Rookery Bay's hydrology does not show the degree of negative impacts observed in other estuaries, so the hydrology is assessed as "Fair." The overall water quality grade for Rookery Bay was assessed to be **B**.

5.2.10 Ten Thousand Islands

The Ten Thousand Islands watershed is outstanding with regard to Wildlife Habitat. Ninety-four percent (94%) of wetlands (an A grade) remain from its predevelopment condition, which is the highest proportion of any of the estuary watersheds studied in this report. In addition, the proportion of conservation lands that are publicly held is also the highest, at 80 percent, a plus (**+**). This creates a combined **A+** Wildlife Habitat grade for the Ten Thousand Island Estuary watershed.

The Ten Thousand Islands is a large estuarine area comprised of several individual bays that are connected to the Gulf of Mexico. The watershed is exceptional in the degree of relatively inaccessible mangrove forests and salt marshes that provide vital refuge, feeding areas and nursery grounds for Southwest Florida's aquatic life. However, this watershed is also home to an expansive area of subdivision development known as the Golden Gate Estates, originally designed for up to 500,000 residents. Miles of canals were dug and roads were built without regard to the impacts on the estuary. While the northern part of the Estates, which sends most of its drainage to Naples Bay, is being rapidly populated, the Southern Golden Gate Estates area, south of I-75, is slated for restoration. There are four large canals that drain the southern Estates: the Prairie, Merritt, and Miller canals which merge into Faka Union canal. The Faka Union canal then exits into the Faka Union Bay and Ten Thousand Islands Estuary. The Faka Union Canal, as well as the canal that runs along Tamiami Trail (US 41), have the lowest water quality in the watershed. The Ten Thousand Islands watershed is 6 percent spatially impaired, with an 18 percent severity of impairment, yielding a water pollution grade of A. The primary impairments are low DO (2%) and bacteria in shellfish (3%).

The hydrology has been altered substantially in major portions of the watershed. In Southern Golden Gate Estates, an 86 square-mile (55,247 acre) area where roads and canals were built as infrastructure for development, the habitat alteration is characterized as fairly extreme. While a major restoration project has been started to fill the canals in Southern Golden Gate Estates (Picayune Strand State Forest), the current hydrology is still significantly altered from historical conditions so as to present a substantial negative impact to the ecological integrity of the watershed and is assessed to be "poor." Therefore, the overall Water Quality grade for the Ten Thousand Islands is an **A-**.

5.3 Recommendations

The results of the *Estuaries Report Card* reflect the fact that all ten of Southwest Florida's estuaries have been negatively impacted by human activities. Additionally, there is a need for improvement in all of the estuaries, from the most impacted to the most pristine. Several agencies and organizations are working to monitor these estuaries and to address known problems through scientific research, regulatory policies, watershed management plans, land acquisition, and restoration programs. Their efforts have prevented further decline in the health of our estuaries and there is hope for the future in programs such as the Charlotte Harbor National Estuary Program, the Total Maximum Daily Loads program (TMDL)of the FDEP, the Comprehensive Everglades Restoration Plan, and the State and county land acquisition that are targeting critical flowways and wetlands for preservation. Based on this snapshot of the health of our estuaries, it is clear that the problems are not being addressed in a comprehensive fashion and that the root causes—water pollution, habitat destruction, and hydrological disruptions—continue to pose a mounting threat, given the escalating threat of overdevelopment of Southwest Florida's coastal watersheds. Primarily, current laws and regulations must be implemented and enforced. If nothing else were improved, adherence to these would improve the health of many of our waterbodies and protect the remaining natural function. As regulatory agencies work to improve the legal efficiency of the system, we will continue to investigate ways to improve effectiveness by working with other interested parties.

With the understanding that most policy makers and members of the public support the protection and restoration of Southwest Florida's estuaries, for our economy as well as for our quality of life, the Conservancy offers the following recommendations for improving estuarine health.

5.3.1 General Recommendations

5.3.1.1 Comprehensive Monitoring and Consistent Indicators

Monitoring of indicators of the health of Southwest Florida's estuaries varies considerably from estuary to estuary, both in the coverage of monitoring sites and in the types of indicators monitored. The Conservancy recommends that agencies and organizations responsible for monitoring take a regional approach by developing and maintaining adequate monitoring stations throughout all watersheds. Four agencies are currently in the best position to bring this about: (1) the United States Environmental Protection Agency, which has oversight over Florida's water quality programs and administers the National Estuary Program and the Gulf of Mexico Program; (2) the Florida Department of Environmental Protection, which administers the Total Maximum Daily Loads Program and evaluates water quality data for the Impaired Waters List; (3) the South Florida Water Management District, which monitors water flows and water quality in Lee, Collier, Hendry and Glades Counties, and part of Charlotte County; and (4) the Southwest Florida Water Management District, which monitors water flows and water quality in Charlotte and Sarasota Counties. Counties, such as Lee and Collier, perform much of the water quality monitoring, sometimes under contract with State agencies, and should continue to be involved as well. These agencies should coordinate the coverage of monitoring stations for efficient use of resources and should determine whether water bodies have sufficient monitoring to evaluate their water quality.

In addition, a more comprehensive and consistent list of indicators should be developed that may be monitored across all of Florida's estuaries to provide the basic tools for comparison. We have identified a list of potential indicators that may be used to characterize the health of estuaries. There is a need for more comprehensive monitoring for biological indicators that may actually be more representative of the health of our estuaries than the water quality indicators that are commonly monitored. These indicators include oyster bed and seagrass coverage, as well as other indicator species, such as spotted seatrout and blue crabs. We need scientists and agencies to develop a consensus set of indicators that will be monitored in all of Southwest Florida's estuaries. Of course, the practicality and expense of monitoring should be considered, and it may be cost-effective to substitute some forms of biological monitoring for chemical water quality monitoring, as long as the chemical monitoring is not necessary for determining compliance with water quality standards.

Another set of indicators that should be further developed is the habitat indicators, including wetlands coverage and conservation lands. While pre-development wetlands coverage estimates were available for part of Southwest Florida as part of the development of baseline conditions for the Southwest Florida Feasibility Study, Everglades Restoration, no source provides a comprehensive coverage for the entire state and information must be compiled from a number of smaller, localized studies making it more difficult and increasing the possibility for error in analysis. It would be greatly beneficial if a more comprehensive coverage layer was developed in consultation with scientists who developed the methodology for estimating historic wetlands coverage. Current estimates of land coverage by wetlands and public conservation lands are provided by the Florida Natural Areas Inventory at Florida State University. Additional land coverage data would be important for evaluating the health of estuaries, including the coverage of mangrove wetlands and the extent of privately owned conservation lands, such as those under conservation easement for mitigation purposes.

Indicators of land use change and water flows should be further developed and utilized. The extent of impervious surface is an important indicator of the impact of land use impacts on water quality and hydrology that should be utilized in future evaluations of estuarine health. The Southwest Florida Regional Planning Council has the ability to successfully create this layer and are the logical organization to spearhead this effort.

Monitoring data should be compiled by a central organization and be made publicly available. A better understanding of the overall picture of Southwest Florida's water quality will help to develop adaptive management practices and more precisely address the issues affecting our watersheds.

5.3.1.2 Pesticide Monitoring

Agencies involved in water quality monitoring in Southwest Florida should develop and implement a pesticide monitoring plan to monitor for high-use, high-hazard pesticides at strategically selected monitoring sites. Although Southwest Florida has few sources of toxic chemical releases from industrial facilities, it has large areas devoted to agriculture and high levels of pesticide use. In addition, pesticides are used on golf courses and lawns and are sprayed from planes and helicopters for mosquito control in populated areas. Despite the high usage of pesticides, inadequate pesticide monitoring is being done in the region. The South Florida Water Management District has implemented a monitoring system in the Picayune Strand in Collier. However, given the widespread application of pesticides in Collier, monitoring needs to occur throughout the county, outside the Picayune Strand. Pesticide monitoring is expensive, but a well-designed monitoring plan makes efficient use of resources by focusing on monitoring sites where pesticides are most likely to be found and by focusing on those pesticides most likely to be present. Unfortunately, the Florida Department of Environmental Protection has adopted water quality standards for only a few pesticides, but toxicological testing data exist on most pesticides and permit an assessment of the potential effects of levels found in the environment.

5.3.1.3 Improvements in Stormwater Treatment

Because most of the impaired water quality in Southwest Florida's estuaries is related to stormwater runoff, there needs to be dramatic improvements made in stormwater treatment systems throughout the region. This will require retrofits for older urban areas, where most of the stormwater runs off into estuaries without treatment, and upgraded treatment requirements for new urban developments in the region. More of Southwest Florida's communities are being required to obtain National Pollutant Discharge Elimination System permits which encourage treatment retrofits to improve water quality. These retrofits will be expensive, and some communities are creating stormwater utilities, which can levy property taxes for this purpose. State and federal grants and loans are also available for financing retrofits. For the past two years the Florida Legislature has appropriated funding for the South Florida Water Management District to address stormwater issues for certain watersheds in Southwest Florida, including Naples Bay and Estero Bay. These watershed initiatives are helpful and should be coordinated with watershed management plans and restoration plans to ensure that they address these pressing problems for the health of the estuaries.

Existing urban areas can also benefit from pollution prevention, which can be practiced by individual homeowners through reductions in fertilizer usage and landscape watering. The Florida Yards and Neighborhoods Program, sponsored by the University of Florida Institute for Food and Agricultural Sciences, provides public education and assistance to local governments in developing measures to reduce stormwater runoff of pollutants. In addition, required education for landscaping and law service professionals prior to licensing and mandatory follow-up audits to ensure compliance would help to decrease commercial and public property stormwater runoff.

For new developments, the rules that govern stormwater treatment were inadequate and are being improved. These rules presumed that a certain volume of stormwater runoff detention in stormwater treatment ponds associated with new development will ensure that water discharged from these ponds meets State water quality standards. While these "presumptive criteria" addressed suspended solids removal, they were not addressing dissolved pollutants such as nutrients. Some governments, including Lee County, have required stormwater discharge monitoring for major new developments in an attempt to determine whether the current design standards are adequately protecting water quality. As an enforcement mechanism, however, this approach is difficult because remedial actions in a built-out residential community would be onerous and might involve individual homeowners. The South Florida Water Management District is currently working with the Conservancy and other stakeholders to draft a new rule that will provide more guidance and more stringent regulatory requirements for water quality certification. Rule development of the Southeast Florida Basin Rule was presented to and approved by the Governing Board of the District in May 2005 and is currently underway.

For agriculture, improved stormwater treatment through Best Management Practices should also be considered. The Department of Agriculture and Commercial Services is working to develop these standards and the water management districts could benefit from performing a study of the major stormwater runoff discharges from agricultural areas in the region to determine the extent of their contributions to nutrient loading. Pesticides should also be included in enhanced monitoring of agricultural areas. A program to reduce nutrient loading through Best Management Practices and construction of stormwater treatment areas, similar to those that have been adopted for the Everglades Agricultural Area or the Lake Okeechobee watershed should also be considered.

5.3.1.4 Implementation of Total Maximum Daily Loads

The state surface water quality criteria are the "minimum levels which are necessary to protect the designated uses of a water body."[140] Above this specified threshold level the waterbody is unsuitable for use according to its designation. A Total Maximum Daily Loads (TMDL) is the "maximum amount of a pollutant that a waterbody can receive and maintain its designated use,"[141] which designates the total polluted input a waterbody can handle before it reaches an unsuitable threshold. Currently, the Florida DEP monitors and permits point-source pollution in an effort to keep levels below the surface water quality criteria levels, but there are few measures in place to monitor or control non-point-source pollution. For this reason, the TMDL Program implemented by the Florida DEP will be an extremely important tool in improving water quality in our estuaries. The Conservancy recommends that the DEP continue to move forward without delay in developing TMDLs for those water bodies on the Verified Impaired Waters List in the region, including those that the EPA has maintained or placed on the list using the federal agency's ultimate authority under the Federal Clean Water Act (CWA). The EPA has disagreed with certain criteria used by DEP for removing water bodies from the Impaired List or for restricting those that are placed on the List. By working collaboratively more might be accomplished. Instead of disputing the List approved by the EPA, the FDEP should take the lead, with EPA's assistance, in developing TMDLs for all impaired waters in Southwest Florida.

Given that many of the impaired water bodies in Southwest Florida are impaired due to stormwater runoff, the implementation of TMDLs in the region will require a different approach from watersheds where industrial point sources are the primary causes of impairment. Instead of reducing individual point sources through tightened permit limits, the approach in this region will need to involve watershed management planning, stormwater treatment retrofits, protection of critical wetlands flowways, and improved stormwater management for new development. This implementation will necessarily involve local governments, land developers, watershed protection groups, and other stakeholders.

TMDL development has begun with the first 52 TMDLs approved at the end of 2004 and another 61 currently in draft form.[142] There should be a sense of urgency in working together to develop watershed management plans for improving water quality in impaired water bodies among all those interested in the health of Southwest Florida's estuaries. A good example of a voluntary approach for water quality improvements is the Estero Bay Nutrient Management Partnership, funded by the EPA and administered by the Southwest Florida Watershed Council.

5.3.1.5 Watershed Management Plans

The Conservancy recommends that a watershed management plan be developed for each estuary in Southwest Florida. Watershed management is a process of integrated decision-making regarding uses and modifications of lands and waters within a watershed. This process provides a chance for stakeholders to balance diverse goals and uses for environmental resources, and to consider how their cumulative actions may affect long-term sustainability of these resources. "Watershed management establishes a framework for integrated decision-making where the goals include: (1) assessing the nature and status of the watershed ecosystem; (2) defining the short-term and long-term goals for the system; (3) determining the objectives and actions needed to achieve selected goals; (4) assessing both benefits and costs of each action; (5) implementing the desired actions; (6) evaluating actions and their effects on progress toward goals; and (7) re-evaluating goals and objectives as part of an iterative process."[143]

Watershed management plans have been developed for some of the region's estuaries. For instance, the Charlotte Harbor NEP developed a detailed watershed management plan for Charlotte Harbor, Pine Island Sound, the Caloosahatchee, and Estero Bay. In addition, Everglades Restoration Plans have been developed for the Caloosahatchee and areas that impact the Ten Thousand Islands Estuary, such as Picayune Strand State Forest (Southern Golden Gate Estates). There are also Surface Water Improvement and Management (SWIM) Plans for those bodies of water that have been designated SWIM water bodies, such as Charlotte Harbor and Estero Bay. However, estuaries need management attention, and some of the aforementioned plans are not comprehensive in addressing water quality, hydrology and wildlife habitat. A comprehensive management plan, like that already developed for Charlotte Harbor would benefit all Southwest Florida estuaries. These plans are helpful in identifying solutions and tracking the progress of restoration and protection efforts.

5.3.1.6 Southwest Florida Feasibility Study and Restoration Projects

The Southwest Florida Feasibility Study was launched as part of the Comprehensive Everglades Restoration Plan (CERP) in 2001 to "investigate water resources problems and opportunities in all or parts of Lee, Collier, Hendry, Glades, Charlotte, and Monroe counties." Southwest Florida was not as well studied as the remainder of the Everglades, and detailed plans for restoration that were formulated in the CERP for other areas were not possible for most of Southwest Florida. According to the Project Management Plan, the purpose of the study is "to determine the feasibility of making structural, non-structural, and operational modifications and improvements in the region in the interest of environmental quality, water supply, and other purposes." The Study was supposed to have a draft report by August of 2004 and to be completed by March of 2005, but it has been delayed several times. To date, the draft report has not been completed and has now extended its proposed deadline to 2008. In the interim, many of the areas that will be needed for restoration are being developed to house the rapidly growing population in coastal counties. Important wetlands flowways, such as the Cocohatchee Flowway in Collier County, will likely be lost before the restoration plans for this region are finalized. Because the restoration plan for the Western Everglades, which encompasses much of the watersheds of Southwest Florida's estuaries, depends upon the Southwest Florida Feasibility Study the

Conservancy recommends that this Study be expedited and that acquisition of land for restoration projects begin in advance of the completion of the Study.

5.3.1.7 Minimum Flows and Levels and Water Reservations

To prevent the hydrology of Southwest Florida's estuaries from further deteriorating, the Conservancy recommends that the two water management districts adopt minimum flows and levels and water reservations for the major watersheds in each of the estuaries, with priority given to those estuaries that are the most impacted. Minimum Flows and Levels and Water Reservations are provided for in Florida's Water Law. Minimum Flows are the threshold below which serious harm results to the flora and fauna of the water body. The Southwest Florida Water Management District has approved a Minimum Flow for the Upper Peace River, but has not yet adopted it in the rulemaking process. The South Florida Water Management District has adopted a Minimum Flow for the Caloosahatchee River, but this has not been effective in ensuring that the river receives sufficient freshwater in the dry season. Both agencies have set timetables for developing further Minimum Flows, but not all of the impacted watersheds are on these lists. For instance, Estero Bay is the only other Southwest Florida watershed on the South Florida Water Management District priority list. These agencies should move forward with adoption of Minimum Flows for all of the region's major watersheds.

Water Reservations are needed for each of the watersheds. Water Reservations are intended to reserve water necessary for the protection of fish and wildlife or the public safety from consumptive use permitting. As more demands are placed on the water resources of Southwest Florida, the natural systems need a "permit" to ensure that freshwater needed for healthy estuaries is not permitted for use in agricultural irrigation or public water supply. The mere suggestion that a Water Reservation be developed for the Caloosahatchee has triggered a reaction from land developers who have sought to amend Florida Water Law to make it more difficult to adopt a reservation. The Water Reservation provision should be preserved intact and used by the two water management districts to reserve water as soon as feasible for the protection of fish and wildlife in priority basins where consumptive use permits consume significant portions of the water, such as the Peace and Caloosahatchee Rivers. All of the watersheds would benefit from developing water budgets that are necessary for Minimum Flows or Water Reservations, so that potential conflicts between consumptive uses and the natural system can be identified in advance.

5.3.2 Recommendations for Specific Estuaries

5.3.2.1 Coastal Venice

According to the CHNEP Synthesis of Existing Information, there are at least 30 already *identified* point sources of pollution, no streamflow gauges, and only one rainfall monitoring station in the Coastal Venice Basin.[144] Without these monitoring devices it is incredibly difficult to determine the health of the region. In a watershed that covers a north to south stretch of over 20 miles, the average precipitation may change drastically from one section to another and anthropogenic alterations of natural systems may affect flows in unexpected ways. Streamflow gages, rainfall monitoring stations, and permanent water quality monitoring stations must be installed in the currently unsampled Water Body Identifications (WBIDs), which make up more than half of this watershed. In addition, there needs to be an immediate concerted effort to place protective easements over the remaining wetlands and to acquire or place conservation easements over more environmentally sensitive land in order to protect and restore the ecological integrity and wildlife habitat value of the Coastal Venice watershed.

5.3.2.2 Lemon Bay

A restoration initiative for the Lemon Bay area is in the works. The first phase, led by the Southwest Florida Water Management District (SWFWMD) and Sarasota county commission, allocated $1.3 million towards stormwater improvements and natural systems restoration within the Lemon Bay watershed.[145] This project is aimed to offset years of human alterations to natural systems by reducing structural flooding along the northern branch and by creating a more natural tidal ecosystem, which should enhance water quality and improve fish and wildlife habitat. Support for projects similar to this need to continue in addition to support for the Englewood Water District's Wastewater System Master Plan's efforts to centralize waste systems and decrease septic tank dependence in the Lemon Bay watershed. Finally, the SWFWMD 's Charlotte Harbor SWIM plan identifies the development of a nutrient budget for Lemon Bay as a priority project. Water quality monitoring should be continued and expanded to determine the effectiveness of these projects and detect the sources of known impairments such as BOD. Further, a more involved study of the bathymetric properties of the Bay would be helpful in determining future actions.

5.3.2.3 Charlotte Harbor

Although the Charlotte Harbor Preserve area significantly contributes to the protection of the coastal portion of this watershed, the interior still needs help. The **"-"** qualifier of the Wildlife Habitat grade indicates that continued acquisition efforts are needed in this watershed. In addition, new phosphate mining operations are being planned and permitted in the region for 100,000 acres – an expansion of more than 50 percent. "These mines reduce the average annual flows of the Peace River and have sent flows of slurry, containing uranium and radium, into the river causing miles of devastation." Because of significant problems associated with phosphate mining, the American Rivers Association has placed the Peace on its top ten list of America's Most Endangered Rivers, recommending that new mining permits should not be issued and that minimum flows should be set immediately to conserve and protect drinking water and wildlife habitat.[146] The Conservancy supports the imposition of a moratorium on new permits for phosphate mining until an independent environmental impact study is performed that addresses the cumulative impacts of past and planned mines including a technical review of the impacts of large clay settling areas.

Other studies should move forward as well: an evaluation of seagrass coverage would be useful for Charlotte Harbor because of the unique configuration of the estuary. Much of Charlotte Harbor is shallow, with sandy shelves making up the harbor walls, including Cape Haze to the west and Punta Gorda/Cape Coral to the east. These east and west walls are covered by seagrass beds – essential habitat for juvenile fish and other wildlife.[147] While more research is required, current studies suggest that Lake Hancock in the upper Peace River portion of Charlotte Harbor requires better management. Buffer zones must be established to protect surrounding areas from further development and ensure wildlife habitat protection. Cleanup of the lake bottom and removal of nutrient-rich sediment as well as the addition of filtration marshes will help to improve the water quality within in Lake Hancock and within its outflow waterways.

The Conservancy echoes the recommendations of the Charlotte Harbor National Estuary Program (CHNEP) for the Coastal Venice, Lemon Bay, Greater Charlotte Harbor, Pine Island Sound, and Caloosahatchee watersheds. CHNEP proposes that to develop TMDLs for their region, (1) better surface water/groundwater monitoring networks at selected wells in the Peace River and Myakka River basins need to be expanded and (2) that the groundwater and surface water model parameters for the Peace and Myakka River basins be developed through analysis and processing of field data and statistical techniques. Maximum withdrawals, based on the minimum flows established, must be determined for the Peace and Myakka watersheds. Additionally, instead of deep-well injection, the proper treatment and discharge or reuse of wastewater effluent to maintain minimum flows should be encouraged. The CHNEP also recommends that additional research be carried out to identify and fill flow data gaps, and that local governments development and implement Stormwater Management Plans.

Finally, CHNEP has identified a number of actions which would be beneficial to the entire watershed. Those actions include: (1) protecting current unaltered hydrology and restoring historic water tables and surface water flows; (2) encouraging efficient water use, reclamation, treatment and reuse; (3) identifying the impacts of septic system use and addressing those impacts by providing sanitary alternatives; (4) removing exotic vegetation, enhancing wildlife habitat along shorelines, and restoring wetland areas that have been negatively affected by development; (5) developing public environmental education programs to improve awareness of habitat and wildlife issues, encourage responsible boating practices, decrease recreational impacts on seagrass communities, and encourage smart water use; and (6) reduce contaminants from dock operations and developing and distributing signs and maps that identify sensitive areas for boaters to avoid. In already developed areas, improvements may be made by addressing abandoned wells and non-point source pollution from stormwater runoff and by promoting plans such as the Florida Yards and Neighborhoods program.

5.3.2.4 Pine Island Sound

Currently, Matlacha has "no stormwater system that could detain or cleanse rainfall before it reaches tidal waters"; therefore fertilizer, oils, and other toxins are swept directly into the Gulf.[148] This water monitoring program needs support, and stormwater treatment options in the area should be studied immediately. Options for stormwater treatment should also be evaluated for St. James City and concerted efforts made to expedite the improvement or removal of septic systems and to implement water quality monitoring in this area. Dependence upon septic systems in a large portion of the Pine Island communities is most likely linked to the bacterial impairment of shellfish in Pine Island Sound. These issues must be addressed for protection of aquatic and human health and options for rectification must be evaluated as discussed in the Greater Pine Island Community Plan Update. Also, a coalition of stakeholders in the Pine Island area should be created while there are still opportunities to address the issues in the Land Trust's 38 identified sensitive endangered areas. Acquisition efforts of the Sanibel-Captiva

Conservation Foundation, Lee 20/20, and the Calusa Land Trust are vital to this estuary and should be supported.

The Conservancy supports further research and CHNEP's suggestion to use a three-dimensional model to investigate the potential benefits of the Sanibel Causeway removal and bridge redesign, taking natural circulation patterns into consideration. In addition to modeling, efforts to support this method with actual field-tested data should be initiated.

5.3.2.5 Caloosahatchee

Currently, the Caloosahatchee River is the focus of several projects that are part of Everglades Restoration, including the Southwest Florida Feasibility Study, the C43 Project, and other projects involving Lake Okeechobee. Though recent events may have altered the potential to protect the entirety of the 90,000 acre Babcock Ranch, conservation of environmentally sensitive portions of this land must continue to be a priority. The Babcock land is not only a vital area for the regional freshwater recharge and filtering, but is the strategic missing piece in an existing conserved lands corridor that stretches from Lake Okeechobee to the Gulf of Mexico.

In addition to acquisition, certain actions may be taken to improve the current situation. Increasing storage and treatment along the Caloosahatchee River would filter out pollutants and improve the timing and distribution of the releases to more closely mimic natural seasonal flows. Restoring natural flowways for storage, protecting aquifer recharge areas, and making water quality improvements, will benefit wildlife habitats (including Telegraph Creek, Lake Hicpochee, the Lehigh/Buckingham region, and the Caloosahatchee River oxbows) and should drastically improve conditions within the river and the estuary.

5.3.2.6 Estero Bay

The obvious impact of nutrient loading (and the probable resulting impairment for DO) in Estero Bay provides a path to restoration and protection. Studies regarding nutrient sources and efforts to decrease loading should be the focus of efforts here. Support of the Estero Bay Nutrient Management Partnership is paramount. In addition, the creation of filter marshes within the watershed and increased protection of existing open space through conservation easements or land acquisition would help to improve the quality of water.

The SFWMD's South Lee County Plan and the Regional Planning Council's Lee County Mitigation Plan should also be implemented. These plans will aid in the correction of previous alterations to the hydrology of the area, restore natural flow patterns to Estero Bay, and will protect current resources. CHNEP believes that "current development standards don't work well, even in areas designated OFW," therefore they need to be improved.[149] The degradation of Estero Bay over time, despite its designation as an Outstanding Florida Water, means that current requirements are not stringent or properly enforced to provide adequate protection, and these standards must be reevaluated for their appropriateness as sustainable practices.

5.3.2.7 Wiggins Pass/Cocohatchee River

There has been a great deal of alteration to this system, while at the same time there is little information on the effects of those alterations. Therefore, in order to understand what the true impacts of local development have been, research should be conducted on the ecological effects of hydrologic alterations and the source of the iron and D.O. impairments. In those areas which have yet to be developed, the acquisition efforts of Conservation Collier and the CREW Land Trust are of paramount importance – including the acquisition of Camp Keais Strand and the Cocohatchee flowway are paramount for protection of historic flowways. Essential wetland areas such as Winchester Head, Unit 53 wetlands, and lands within the Corkscrew Regional Ecosystem Watershed are also important acquisition targets.

Finally, the creation of a stakeholders' forum group for the preservation and protection of the Cocohatchee flowway and watershed would be beneficial for consolidating assets to spur on the progress of important issues.

5.3.2.8 Naples Bay

To preserve and recover the ecological integrity of the Naples Bay watershed, steps to acquire environmentally sensitive lands and place them into protection, and to address water quality degradation are essential watershed management tasks that must be undertaken immediately to rectify the grave situation facing this estuary. Conservation Collier has begun to address environmental land acquisition within this region and the Naples Bay Watershed Initiative has begun to address the watershed management tasks, but it is imperative that both of these programs receive renewed funding in the future in order to restore the degraded water quality of Naples Bay. While more stringent best management practice requirements can assist in decreasing the impact of new development, retrofitting projects need to be a focus in this watershed to address water quality problems stemming from existing developments. In addition, concerted efforts should be made to protect what little green space is still available, such as the Gordon River Greenway. Restoration of the bay will also play an important role in revitalizing this area. Florida Gulf Coast University's community oyster restoration program should continue and expansion of projects similar to this should be considered.

5.3.2.9 Rookery Bay

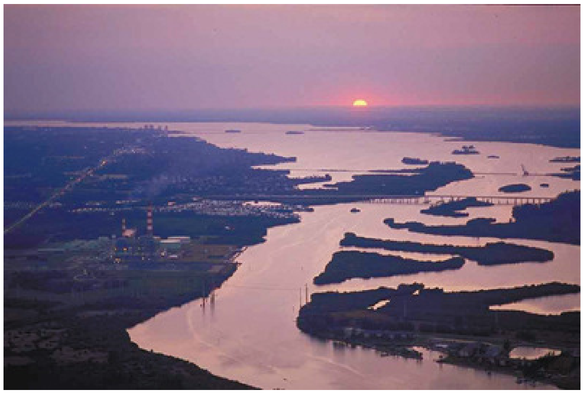
The Rookery Bay National Estuarine Research Reserve has performed extensive research on the needs of this watershed and the Conservancy supports its efforts to protect and restore the area. In particular, reestablishing the connection between the Belle Meade and Rookery Bay, continued monitoring of pesticide-sensitive species, conducting research to identify human-induced habitat changes, and supporting CARL programs and the Deltona Settlement Agreement are priorities for action.

It is equally important to sustain educational components; Rookery Bay's and the Conservancy's educational program includes efforts to create and air Public Service Announcements that promote coastal stewardship, training for the ecotourism industry, and continued development of educational and interpretive materials. These efforts must be supported. They will help to ensure public understanding of the importance of protection and support of the watershed's restoration needs.

5.3.2.10 Ten Thousand Islands

The restoration of Picayune Strand State Forest should continue. In addition, the areas that have been detrimentally affected by the alteration of the Southern Golden Gate Estates need to be revitalized. Northern Golden Gate Estates needs to have stormwater retrofits incorporated to improve the quality of water entering the Southern Golden Gates Estates / Picayune Strand, which eventually flows into Ten Thousand Islands. Additionally, the developed portion of the estates needs to be moved onto municipal water and waste water so as to reduce its dependency on well on septic, increasing treatment of wastewater overall.

In conclusion, this assessment reveals that our estuaries are in crisis and reflects an urgent need for regulatory reform to offset human disruption of the natural systems. The pollution of Southwest Florida's estuaries and other associated environmental problems are predominately caused by rapid land development. Implementing growth management policies and changing how we individually interact with nature will greatly determine whether our water quality is preserved and our core wildlife habitat areas and flowways remain intact. The fact that these estuaries are less than they once were should not deter us from taking action. In fact, their historical condition must be remembered, in order to gain a sense of what we have lost, and to create a vision of what we may hope to recover.



APPENDIX A
Summary of Data for Indicators of Estuarine Health Proposed for Future Estuaries Report Cards

Sufficient data to use the majority of the proposed indicators of estuarine health for the 2004 Estuaries Report Card was not available. The information that was identified for those indicators is discussed in this Appendix. The Conservancy will continue its work to build upon this information so that these indicators may be used in future Report Cards. As such, this Appendix includes a list of ongoing research projects.

The indicators are discussed below by category.

A.1 Wildlife Habitat

A.1.1 Conservation Lands

Aerial Extent of Public Conservation Lands for grading this Report Card (Chapter IV) was utilized. Work on identifying additional conservation lands, including privately held conservation lands for use in future Report Cards will continue.

A.1.1.1 Ongoing Research

- Coastal Conservation Corridor project (funded in part by FWS) -- Mary Bryant, GIS Specialist, The Nature Conservancy, 1413 Boulevard of the Arts, Sarasota, FL 34236, p: 941-366-3130, 941-366-4140
- The Lee County Mitigation Plan map
- Judy Warwick in Tallahassee - the State's land acquisition person for Collier. 850-245-2669

A.1.2 Area of Imperviousness

Data regarding the areas of impervious surfaces for any of the eight estuary's watershed was not located. The Conservancy will continue to search for such data to use in future report cards.

A.1.3 Aerial Extent of Mangroves Remaining

Information regarding mangrove acreage in Charlotte Harbor, Lee County, Naples Bay and Rookery Bay was located. Since the early 1900s, mangrove communities in South Florida have steadily disappeared.[1] Much of South Florida's shoreline has been bulkheaded for development or impounded by dikes. It is estimated that Lee County has lost 19 percent of its original mangroves.[2] Statewide estimates vary on total mangrove losses. In 1977, Lindall and Saloman estimated conservative mangrove losses of 3 to 5 percent, however, more recent work indicates a 23 percent loss of mangrove acreage.[3] The Conservancy will continue to look for data relating to the acreage of mangroves in Southwest Florida

A.1.3.1 Charlotte Harbor:

Charlotte Harbor is one of the least urbanized estuarine areas in Florida, yet it has seen changes in its historic mangrove coverage. A 1983 report indicates that from 1945 to 1980, the mangrove acreage in Charlotte Harbor increased 10%.[4] Researchers believe the increase in mangrove coverage resulted from the creation spoil islands. These islands, are by-products of dredging, provide suitable habitat for mangrove colonization.

While the total acreage of mangroves in Charlotte Harbor increase during the mid-20th century, urban areas in the watershed, including Placida, Port Boca Grande, and Punta Gorda encountered decreases in mangrove coverage. Punta Gorda alone suffered 59% of the total losses. Those losses were attributed to waterfront development eliminating the fringe mangroves. [5]

A.1.3.2 Pine Island Sound

"Pine Island mangrove forests were devastated by dredge-and- fill developments that continued until the mid-1970's, when the state of Florida realized the tragic consequences of this activity. Permits continue to be granted to destroy small mangrove areas, often without adequate mitigation. Mangrove restoration is easy to do but rarely conducted, and the constant attrition will eventually prove costly. Satellite photography suggests that we have lost about 10% of our island's mangroves in the last 100 years. Of the remaining mangrove forests, about two-thirds have been preserved and about one-third remains endangered."[6]

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[1] Lugo, A.E. and S.C. Snedaker. 1974. "The ecology of mangroves". *Annual Review of Ecology and Systematics 5:39-64*.

[2] Estevez, E. D. *et al.* 1981. *Charlotte Harbor Estuarine Ecosystem Complex and the Peace River: A Review of Scientific Information*. Report to Southwest Florida Regional Planning Council by Mote Marine Laboratory, Sarasota, Florida

[3] Lewis R. R. *et al.* 1985. "Mangrove habitat and fishery resources of Florida". *Florida Aquatic Habitat and Fishery Resources. Eustis: Florida Chapter, American Fisheries Society, Florida, 281-336.*

[4] McPherson, B.F. and R.L. Miller. 1993. "Causes of light attenuation in estuarine waters of Southwestern Florida." In: L.J. Morris and D.A. Tomasko (eds.). *Proceedings and Conclusions of Workshops On: Submerged Aquatic Vegetation Initiative and Photosynthetically Active Radiation*. Special Publication SJ93-SP13. Palatka, FL: St. Johns River Water Management District, pp. 227-234.

[5] [DEP] Florida Department of Environmental Protection. 2000. "What are Mangroves?" *Florida's Mangroves: "Walking Trees"*. < http://www.floridaplants.com/horticulture/mangrove.htm> Accessed 2004 Oct. 15.

[6] Calusa Land Trust and Nature Preserve of Pine Island. 2002. Web page for "Environmental Overview".

A.1.3.3 Caloosahatchee River Watershed

Approximately 2,995 acres of mangroves are found in the Lower Caloosahatchee River Subbasin.[7] Mangrove shoreline habitats have decreased in spatial extent and in function. Large areas of mangroves have been lost or fragmented through dredge-and-fill activities. In addition mangroves are sensitive to alterations in upland drainage. In some areas, drainage for agricultural and urban development has reduced overland flows of freshwater to mangroves. This results in an increased amount of concentrated runoff, which in turn changes the salinity balance, reduces the flushing of detritus, and washes nutrients directly into the estuary without the benefit of filtration by the mangrove system.[8]

A.1.3.4 Estero Bay

"While historically the rivers in the Estero Bay Watershed had extensive marsh or mangrove fringes, some of these have been lost to development."[9]

A.1.3.5 Wiggins Pass/Cocohatchee River

"The Corkscrew water sheet becomes the Cocohatchee River and eventually flows into the gulf through Wiggins Pass. Everything upstream and in the immediate area has an impact on this important basin. Close to home, truncation of water sheet-flows in the area between Vanderbilt Beach and Clam Pass has resulted in a major loss of mangroves, an important estuarian resource."[10]

A.1.3.6 Naples Bay

"To date, more than 75 percent of the original mangrove forest surrounding the Bay has been destroyed, mostly for residential dredge and fill projects decades ago."[11]

A.1.3.7 Rookery Bay

Mangrove forests are the most extensive vegetated habitat in the Rookery Bay Preserve.[12] Approximately 80% (36,030 Acres) of preserve are mangrove forest.

<http://www.calusalandtrust.org/env.htm> Accessed 2004 Oct. 15.

[7] Post, Buckley, Schuh, and Jernigan. 1999. *Synthesis of Technical Information.* Technical Report No. 99-02. 2 Vols. North Fort Myers, Fl: Charlotte Harbor National Estuary Program.

[8] Ernest Estevez, 1998. *The Story of Greater Charlotte Harbor Watershed.* Charlotte Harbor National Estuary Program, Fort Myers, Florida, 135 pp.

[9] [SFWMD] South Florida Water Management District. 2000. "Secondary Basin Descriptions". *Estero Bay and Watershed Assessment.* < http://www.sfwmd.gov/org/exo/ftmyers/report-text/volb/ch_4_secondarybasins.pdf> Accessed 2004 Oct. 15.

[10] Commissioner Frank Halas, May 2003. *Our Water Resource & Vanderbilt Lagoon: Commissioner's Commentary for May, 2003.*

[11] Conservancy of Southwest Florida. 1999. *Position Statement for Hamilton Harbor.*

A.1.3.8 Ten Thousand Islands

"A majority of the Ten Thousand Islands region (actually the islands number in the hundreds) is protected within Everglades National Park. The recent establishment of the 20,000-acre Ten Thousand Island National Wildlife Refuge provides management for most of the remainder of the region. Globally, mangrove habitats are as critical and perhaps as threatened as the world's rain forests. Everglades National Park protects 90 percent of all the mangroves in Florida."[13]

A.1.3.9 Ongoing Research

One ongoing research project regarding the acreage of mangrove in southwest Florida was identified:

- Jeff Ueland, FSU, Jsu1257@garnet.acns.fsu.edu: Currently mapping Southwest Florida mangrove distribution using TM satellite data. Expect to complete project by end of summer, 2004.

A.1.4 Aerial Extent of Seagrasses

Data regarding seagrass coverage in Charlotte Harbor, Pine Island Sound, Caloosahatchee River, Rookery Bay and Ten Thousand Islands was obtained. The Conservancy will continue to work on locating data regarding seagrass for use in future Report Cards.

A.1.4.1 Charlotte Harbor

Research indicates that the acreage of seagrass in Charlotte Harbor has fluctuated since the mid-20th century. Using aerial photographs, researchers estimate that seagrass in Charlotte Harbor declined approximately 30% from the late 1950s to the 1980s. [14] Recent studies of seagrass in Charlotte Harbor indicate a 5% increase in seagrass in the harbor. Researchers believe that dredging, pollution, and poor water clarity have been the cause of seagrass decline in Charlotte Harbor.

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[12] "U.S. Coral Reef Task Force. "U.S. Coral Reef Task Force Meets in Washington, D.C., to Provide Progress Reports on Implementation of the National Action Plan to Conserve Coral Reefs." *NOAA Magazine* 3 Feb. 2004. http://noaanews.noaa.gov/magazine/stories/mag129.htm

[13] Rick Ferren. 1999. "Ten Thousand Islands". *Longstreet Highroad Guide to the Florida Keys & Everglades.* <http://sherpaguides.com/florida/western_everglades/ten_thousand_islands.html> Accessed 2004 Oct. 15.

[14] Kurz, Raymond C. Phd, David A. Tomasko, Phd., Diana Burdick, Rhomas F. Ries, Keith Patterson, and Robert Finck. 1999. *Summary of Recent Trends in Seagrass Distribution in Southwest Florida Coastal Waters*. Southwest Florida Water Management District, Surface Water Improvement and Management (SWIM) Program.

A.1.4.2 Pine Island Sound, including San Carlos Bay

Generally, seagrass and benthic macroalgae are abundant in Pine Island Sound and Matlacha Pass.[15]

A.1.4.3 Caloosahatchee Estuary

Since the construction of the Franklin Lock in the 1960s, seagrass in the lower Caloosahatchee River has decreased significantly.[16] These losses are attributed to anthropogenic activities, especially large land development projects, causeway construction, and alteration of freshwater inflow patterns.

A.1.4.4 Estero Bay

No information regarding aerial extent of seagrass was located for this estuary.

A.1.4.5 Wiggins Pass

No information regarding aerial extent of seagrass was located for this estuary.

A.1.4.6 Naples Bay

No information regarding aerial extent of seagrass was located for this estuary.

A.1.4.7 Rookery Bay and Ten Thousand Islands

The Rookery Bay National Estuarine Preserve estimates that approximately 1,700 acres of seagrass exist in Rookery Bay and parts of the Ten Thousand Islands.[17]

A.1.4.8 Other Possible Sources of Information

- Southwest Florida Water Management District: Aerial photos taken on a biennial basis, began in 1992 (GIS Maps on web)
- Department of Environmental Protection. Florida Marine Research Institute Aerial photos, 1982 and 1992.

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[15] Science Subgroup. 1996. *South Florida Ecosystem Restoration: Scientific Information Needs*. Report to the Working Group of the South Florida Ecosystem Restorative Task Force. <http://everglades.fiu.edu/taskforce/scineeds/sub10.pdf> Accessed 2004 Oct. 15.

[16] [SFWMD] South Florida Water Management District. 1993. *Estuary Research Plan*. West Palm Beach, Florida.

[17] Wilson, Renee. Personal Interview at Rookery Bay National Estuarine Research Reserve.

A.1.4.9 Ongoing Research

Several ongoing research studying regarding seagrass coverage in Southwest Florida were identified. We will continue to follow these studies for use in future report cards. The studies are:

- Florida Department of Environmental Protection, Charlotte Harbor Aquatic Preserve: Mapping 50 sites in Charlotte Harbor and 5 sites in Estero Bay. Began mapping in 1999. Are currently doing and QA/QS and then will provide the data to the Sanibel Captiva Conservation Foundation for analysis. Expect the information to be available in 1 year.[18]
- Adams, A.J., and B.D. Robbins. *Examining Effects of Freshwater Flow Alterations on Seagrass-Associated Fishes in Charlotte Harbor, FL*. Mote Marine Laboratory.[19]
- S. A. Bortone, J. Greenawalt and E. Milbrandt. *Seagrass Community Assessments in Pine Island Sound/Caloosahatchee River*. Sanibel-Captiva Conservation Foundation, Marine Laboratory. (MOTE Marine Laboratory)
- C.A. Corbett[1], T.K. Barnes[2], P.H. Doering[2], K.A. Madley[3], J.A. Ott[4], D.A. Tomasko. Issues with Using Seagrass Coverage as an Indicator of Ecosystem "Health" in Charlotte Harbor, Florida

A.2 Species

A.2.1 Manatees

Aerial surveys of manatees and information on manatee mortality data were obtained. Aerial surveys have been conducted 21 times since 1991 to meet State of Florida statute 370.12 (4) requiring annual, impartial, scientific benchmark census of the manatee population.[20] Unfortunately, there are distinct problems with the manatee data. "Manatees are difficult to count because they are often in areas with poor water clarity, and their behavior, such as resting on the bottom of a deep canal, may make them invisible." [21] In addition, the results from the aerial surveys "are highly variable, and do not reflect actual population trend. For example, statewide counts on 16 and 27 January 2000 differed by 36% (1,629 and 2,222, respectively)."[46] As such, it is difficult to determine the size of the total population.

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[18] Spoke to Katie (via Heather Stafford, 941-575-5861) on January 28, 2004.

[19] Robbins, B.D. 2002. *Examining effects of freshwater flow alterations in seagrass-associated fishes in Charlotte Harbor, Fl.* MOTE Marine Laboratory's Charlotte Harbor Initiative. <http://www.mote.org/~robbins/CharlotteHarborConference/CHC2003/Abstracts.htm> Accessed 2004 Oct. 15.

[20] [FWC] Florida Fish and Wildlife Conservation Commission. 2004. *Manatee Synoptic Surveys*. <http://www.floridamarine.org/features/view_article.asp?id=15246> Accessed 2004 Oct. 15.

[21] Van Meter, V.B. 1989. *The Florida Manatee*. A report prepared for Florida Power & Light Company. <http://www.floridaconservation.org/psm/manatee/manatee%20booklet.pdf> Accessed 2004 Oct. 15.

Dr. Holly Edwards provided the 2004 manatee population statistics for Lee, Collier and Monroe counties: 37 manatees were recorded in the vicinity of Lee county, 194 in Collier county, and 43 were recorded in Monroe county and the Everglades.[22]

A.2.1.1 Information Identified

Following is a list of the reports identified and reviewed regarding the manatee population:

- Population Viability Analysis of the Florida Manatee, Dec. 2002, Florida Gulf Coast University
- Manatee Research Program, Mote Marine Laboratory – conducting aerial surveys to determine manatee distribution, trends.
- Nabor, Peter; Patton, Geoffrey; and MOTE Marine Laboratory. "Manatee Aerial Survey Program 1987 Final Report: Studies of the West Indian Manatee, Anna Maria to Northern Charlotte Harbor and the Myakka River" 5 July 1988. http://www.mote.org/techreps/127/127.pdf
- MOTE Marine Laboratory. "Aerial Studies of the West Indian Manatee (*Trichechus manatus*) on the West Coast of Florida from 1985-1990: A Comprehensive Six Year Study". 3 March 1992. http://www.mote.org/techreps/246/246.pdf
- Florida Department of Environmental Protection. Florida Marine Research Institute – Manatee Aerial Surveys. Requested CD-ROM from FMRI on survey data and flight paths (have – GIS data)
- Koelsch, J.K., T.D. Pitchford, "Florida Manatees *(Trichechus Manatus Latirostus)* in Charlotte Harbor" *In* Sally Treat (Ed.) Proceedings of 1997, The 1997 Charlotte Harbor Public Conference and Tech. Symposium (from Regional Planning Council)
- D.S. Duncan, J.L. Regis, R.V. Nostrom, G.R. Brooks and John E. Reynolds III. "Manatee Distribution and Shallow Stratigraphy in Charlotte Harbor: A Search for Seeps". E-mailed 3/25/04

A.2.1.2 Ongoing Research:

There are several ongoing studies regarding the manatee populations, which it will continue to monitor for future report cards. Those studies are:

- Reid, James P., et al. "Movements and Habitat Requirements of Radio Tagged Manatees in Southwest Florida; Implications for Restoration Assessment". U.S. Geological Survey, Center for Aquatic Resource Studies, Sirenia Project.-James Reid responded 4/25/04, working on sites in southern Ten Thousand Islands, provided the following websites:
- Stith, Brad; Easton, Dean; Reid, Jim; Lefebvre, Lynn W.; and Don DeAngelis. "Structure and Parameterization of an Agent-based Manatee Model for Southwest Florida". U.S. Geological Survey. Florida Integrated Science Center, Sirenia Project. http://cars.er.usgs.gov/posters/Manatee/Agent_Based_Manatee_Model/agent_based_manatee_model.html

[22] Edwards, Holly. Personal interview. 15 March 2004. Florida Marine Research Institute.

- Butler, Susan M.; Reid, James P.; and Bradley M. Stith. "Detailed Movements and Habitat Use Patterns of Radio Tagged Manatees in the Western Everglades". U.S. Geological Survey. Florida Integrated Science Center, Gainesville. http://cars.er.usgs.gov/posters/Manatee/Manatees_in_West_Everglades/manatees_in_west_everglades.html
- Lefebvre, L.W. "Predicting effects of hydrologic restoration on manatees along the southwest coast of Florida". Sirenia Project. End date: 04/01/2005.
- McIvor, C.C., L.W. Lefebvre. "Impacts of hydrological restoration on three estuarine communities of the Southwest Florida coast and on associated animal inhabitants". End date: 04/01/2005
- Save the Manatee Club. Florida Manatee Status Statement Manatee Population Status Working Group. 28 April 2000. http://www.savethemanatee.org/population2.htm
- Doyle, Terry. "Manatee Aerial Surveys in Summer: The Ten Thousand Islands Case Study". US Fish and Wildlife Service. Sirenia Project. - assesses the impacts of the Comprehensive Everglades Restoration Project
- Langtimm, Catherine. Preforms statistical analysis on Patch Occupancy Rate or Proportion of Area Occupied. Methodology published in Ecology (2003).
- Edwards, Holly and Kari Higgs. "Manatee Individual Photo-Identification System (MIPS) and Estimation of Survival Rates". FMRI. Id 564 manatees in Southwest Florida
- Haubold, Elsa and Richard O. Flamm. Preformed selected modeling efforts
  - Stage based models--estimates change in population size
  - Individual Based Models
- McDonald, Sara and Richard O. Flamm. "Florida Manatees (Trichechus manatus latirostris) and the Caloosahatchee River, Lee County, Florida: A Regional Assessment". FMRI

A.2.2 Oyster Populations

There is limited information regarding the oyster population in Southwest Florida. Some of the reports identify the landings of oysters in Southwest Florida in general, but are not able to be broken down to determine the amount of oysters in each estuary.[23] In addition, Professor Aswani Volety from the Florida Gulf Coast University (FGCU) has studied the effects of seasonal and water quality parameters in the Caloosahatchee River. However, Professor Volety could not provide quantitative reports of oyster reefs or distribution.

For Charlotte Harbor, Pine Island Sound, Estero Bay, Wiggins Pass/Cocohatchee River, Naples Bay, Rookery Bay and Ten Thousand Islands, no information was identified. However, in Caloosahatchee, "there has been a decrease in the oyster population in the Caloosahatchee and surrounding estuary due to increased sediment loads resulting from man induced alterations in the natural hydrology. Discharges from Lake Okeechobee have resulted in increased sediment loads, which in turn, have detrimental effects on oysters and other filter feeding bivalves".[24]

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[23] The National Marine Fisheries Service provides yearly landings for the Eastern Oyster on the west coast of Florida from 1950 to 2002.

[24] [SFWMD] South Florida Water Management District. 2004. *Monitoring and Assessment Plan (MAP) Part 1 - Monitoring and Supporting Research, Appendix A: Conceptual Ecological Models*.

Other possible sources of information include the following:

- Micheal Saverse. "Late Holocene History of Oyster Reef Development in Estero and Caloosahatchee Estuaries". MOTE Marine Laboratory's Charlotte Harbor Initiative. E-mailed 03/25/04 waiting for reply http://www.mote.org/~robbins/CharlotteHarborConference/CHC2003/Abstracts.htm#Savarese

A.2.2.1 Ongoing Research

- Doering, Peter. Habitat Use of *Vallisneria americana* Beds in the Caloosahatchee River. South Florida Water Management District. Estuaries Projects.

A.2.3 Spotted Sea Trout

Information regarding spotted sea trout landings for both the Southwest Florida region[25] and for each of the local counties[26] was located. For example, in Lee County there is clear evidence of a decrease in the spotted seatrout is shown in the decline on catch-per-unit-effort from 1986 to 1995.[27] No spotted sea trout data relating to each of the individual estuaries was found.

A.2.4 Blue Crabs

Data regarding the average annual blue crab landings for Southwest Florida was identified.[28]

A.2.5 Ichthyoplankton

One report outlines the distribution of ichthyoplankton in the Ten Thousand Islands.[29]

<http://www.evergladesplan.org/pm/recover/recover_docs/cerp_monitor_plan/map_app_a_calossahatchee.pdf> Accessed 2004 Oct. 15.

[25] Murphy, Michael D. 2003. *A stock assessment of spotted seatrout Cynoscion nebulosus in Florida: status of the stocks through 2001*. St. Petersburg, Florida: Florida Fish and Wildlife Conservation Commission. <http://www.floridamarine.org/engine/download_redirection_process.asp?file=rev_draftsst03_revisio_5317.pdf&objid=20805&dltype=article> Accessed 2004 Oct. 15.

[26] Florida Marine Research Institute. Commercial Fisheries Landings in Florida. http://www.floridamarine.org/features/view_article.asp?id=19224

[27] Bortone, S.A. and M.A.Wilzbach. 1997. "Status and Trends of the Commercial and Recreational Landings of Spotted Seatrout (Cynoscion nebulosus): South Florida." *Florida Center for Environmental Studies Technical Publication No.2*. Palm Beach Gardens, FL.47 pp.

[28] Murphy, M.D., C.A. Myer, and A.L. McMillen-Jackson. 2001. *A stock assessment for blue crab, Callinectes sapidus, in Florida waters*. St. Petersburg, Florida: Florida Fish and Wildlife Commission. <http://www.floridamarine.org/images/articles/12050/blcrab01_1851.pdf> Accessed 2004 Oct. 15.

[29] Collins, L.Alan and J.H. Finucane. 1984. "Ichthyoplankton Survey of the Estuarine and Inshore Waters of the Florida Everglades, May 1971 to February 1972." *NOAA Technical Report NMFS 6, U.S. Department of Commerce.*

A.3 Hydrology and Water Quality

A.3.1 Hydrology

A.3.1.1 Historic Flowways

Qualitative narrative descriptions of alteration in hydrology from each watershed's historical hydrological condition will be used to weight the water quality grade (as in the 2004 Estuaries Report Card).

A.3.1.2 Current Flows for each of the WBIDS

The current flow data for each estuary will be used to weight the water quality grade for each watershed in future Estuaries Report Card. The information that follows provides the total size of the estuary, its watershed, and the most recent flow data for each tributary.

A.3.1.2.1 Charlotte Harbor

The surface area of Charlotte Harbor is 805 km^2 while the entire drainage area encompasses an area of 13,000 km^2.[30]

Data from the United States Environmental Protection Agency (EPA) indicated that in 1999 the average daily inflow into Charlotte Harbor was 1 m^3/s.[31] While 1994 EPA data indicated the total freshwater inflow into Charlotte Harbor was 161-173 m^3/s (5,700 – 6,100 ft^3/s).[32] Finally, a 1995 – 96 report of tidal flow for parts of Charlotte Harbor states that the mean daily freshwater inflow volume (cubic feet x 10^{10} for water years 1995 and 1996) for the Charlotte Harbor Estuarine System is 0.012.[33]

South Florida Water Management District flow data for one of the tributaries of Charlotte Harbor, Alligator Creek is:

- 1975 (lat: 26°53"42' long: 81°58"30') min: 1.100 cfs mean: 17.925 cfs max: 185.000 cfs std. dev. 32.30
- 1982 (lat: 26°53"08' long: 82°00"22') min: 0.000 cfs mean: 0.000 cfs max: 0.000 cfs std. dev. .00

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[30] Gulfbase.org. 2002. Resource Database for the Gulf of Mexico. <http://www.gulfbase.org/bay/view.php?bid=charlotte> Accessed 2004 Oct. 15.

[31] Gulfbase.org. 2002. Resource Database for the Gulf of Mexico. <http://www.gulfbase.org/bay/view.php?bid=charlotte> Accessed 2004 Oct. 15.

[32] [USEPA] US Environmental Protection Agency. 1994. *Freshwater Inflow Action Agenda for the Gulf of Mexico. First Generation Management Committee Report*. Stennis Space Center, MS.

[33] DelCharco, M.J. 1998. *Tidal flow in Selected Areas of Tampa Bay and Charlotte Harbor, Florida, 1995-96*. <http://80-library.fgcu.edu.lp.hscl.ufl.edu/chnep/107b.pdf> Accessed 2004 Oct. 15.

A.3.1.2.2 Pine Island Sound

- Pine Island Sound Upper
- Matlacha Pass
- Pine Island Sound Lower
- North Captiva Island
- Captiva Island
- Pine Island
- San Carlos Bay
- Punta Rasa Cove
- South Urban Cape Coral

Data has been collected from the SFWMD DBHYDRO website

A.3.1.2.2.1 Courtney Canal @ Cape Coral
lat: 26°34"40' long: 81°59"07'

Year	Min	Max
1986	0	4.900
1987	0	71.000
1988	0	36.000
1989	0	41.000
1990	0	34.000
1991	0	44.000
1992	0	133.000
1993	0	61.000
1994	0	55.000
1995	0	210.000
1996	0	91.000
1997	0	160.000
1998	0	191.000
1999	0	220.000
2000	0	193.000
2001	0	194.000
2002	0	180.000
2003	0	191.000
2004	0	21.000

A.3.1.2.2.2 Horseshoe Canal Lat: 26°40''50' Long: 82°02''18'

Year	Min	Max
1987	1.600	355.000
1988	0	154.000
1989	0	208.000
1990	0	216.000
1991	0.640	318.000
1992	0	438.000
1993	1.200	243.000
1994	0	154.000
1995	0	1,060.000
1996	0	257.000
1997	0	326.000
1998	0	580.000
1999	0	319.000
2000	0	315.000
2001	0	819.000
2002	0	225.000
2003	0	600.000
2004	0.310	26.000

A.3.1.2.2.3 Mackinac Canal @ Cape Coral Lat: 26°38''10' Long: 81°57''28'

Year	Min	Max
1986	0	0
1987	0	72.000
1988	0	17.000
1989	0	0
1990	0	0
1991	0	82.000
1992	0	221.000
1993	0	78.000
1994	0	30.000
1995	0	291.000
1996	0	38.000

A.3.1.2.2.4 San Carlos Canal @ Cape Coral
Lat: 26°36"12' Long: 81°57"53'

Year	Min	Max
1986	0	3.700
1987	0	89.000
1988	0	44.000
1989	0	30.000
1990	0	35.000
1991	0	59.000
1992	0	128.000
1993	0	86.000
1994	0	25.000
1995	0	150.000
1996	0	61.000
1997	0	58.000
1998	0	58.000
1999	0	86.000
2000	0	153.000
2001	0	330.000
2002	0	258.000
2003	0	311.000
2004	18.000	108.000

A.3.1.2.2.5 Shadroe Canal @ Cape Coral Lat: 26°39"06' Long: 81°57"53'

Year	Min	Max
1987	0.970	174.000
1988	0	94.000
1989	0	31.000
1990	0	32.000
1991	0	67.000
1992	0	198.000
1993	0	141.000
1994	0.160	102.000
1995	0	674.000
1996	0	276.000
1997	0.720	343.000
1998	0	438.000
1999	0	164.000

- Gator Slough Canal

Discharges at State Road 765 for May, June, July, August, and September averaged 20 cfs, 30-250 cfs, 150-300 cfs, 150-30 cfs, and 30-100 cfs respectively.

The combined discharges from all weirs of the North CCDS for 5 water years, 1987-1992, were reported by Russell and Kane (1995). Peak discharges ranged from 500 cfs (1989 and 1990) to 1,500 cfs (1987 and 1992). From 1988 to 1990 flows approached 0 cfs at the end of the dry season, with extended periods below 10 cfs during every year. Salinity was reported to range from 11 ppt to 30 ppt.[34]

A.3.1.2.3 Caloosahatchee Estuary

The watershed for the Caloosahatchee Estuary from Lake Okeechobee to San Carlos Bay is 1338 square miles.

Flow data has been obtained for canals S-79, S-78, CR-04.8T and CR-00.2T.[35]

A.3.1.2.3.1 Canal S-79 (lat: 26°43"26' long: 81°41"54')[36]

Year	Min	Mean	Max
2002	0.000	2,818.962	8,709.691
2003	0.000	2,788.316	13,965.179

A.3.1.2.3.2 Canal S-78 (lat: 26°47"23' long: 81°18"10')[37]

Year	Min	Mean	Max
2002	42.923	1,728.001	6,949.505
2003	86.400	2,088.446	8,775.021

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[34] Chamberlain, Bob. 2003. *Freshwater Inflow to Matlacha Pass: DRAFT Performance Measures for Gator Slough and Cape Coral Canals.*

[35] [SFWMD] South Florida Water Management District. 2000. Web page for *Caloosahatchee River Project*. <http://www.sfwmd.gov/org/ema/envmon/wqm/cr/crindex.html> Accessed 2004 Oct. 15.

[36] [SFWMD] South Florida Water Management District. 2000. Web page for *Caloosahatchee River Project*. <http://www.sfwmd.gov/org/ema/envmon/wqm/cr/crindex.html> Accessed 2004 Oct. 15.

[37] [SFWMD] South Florida Water Management District. 2000. Web page for *Caloosahatchee River Project*. <http://www.sfwmd.gov/org/ema/envmon/wqm/cr/crindex.html> Accessed 2004 Oct. 15.

A.3.1.2.3.3

Flow data for the S-79 area of the Caloosahatchee has also been retrieved from the DBHYDRO site for years 1966-2003: (lat 26°43''26' long 81°41''54')

Year	Min (cfs)	Mean (cfs)	Max (cfs)	Std. Dev.
1966	10.000	3,408.988	7,930.000	2,305.10
1967	10.000	664.540	5,970.000	1,005.39
1968	10.000	1,835.325	10,000.000	2,616.06
1969	10.000	3,427.400	10,100.000	3,011.63
1970	10.000	3,704.068	21,400.000	3,908.85
1971	10.000	560.474	5,760.000	908.99
1972	10.000	297.893	4,960.000	624.06
1973	10.000	799.871	4,920.000	1,013.90
1974	10.000	2,198.756	15,100.000	3,999.61
1975	10.000	584.115	4,780.000	849.13
1976	3.800	469.271	6,670.000	686.29
1977	1.500	575.643	4,610.000	872.19
1978	1.800	975.686	6,910.000	1,391.94
1979	4.300	2,151.079	11,400.000	2,746.19
1980	2.400	1634.449	7230.000	
1981	0	675.408	12900.000	
1982	0.600	1760.162	17300.000	
1983	2.500	3867.933	15500.000	
1984	2.700	2711.280	11700.000	
1985	0	990.927	9650.000	
1986	2.900	1332.244	10600.000	
1987	4.600	1700.022	12600.000	
1989	4.500	1001.690	6780.000	
1990	2.000	585.595	5,980.000	
1991	5.800	1,273.905	6,650.000	
1992	7.500	1,299.663	15,500.000	
1993	1.100	1,699.785	10,500.000	
1994	7.800	2,256.199	9,490.000	
1995	7.000	4,668.559	13,800.000	
1996	0.000	1,296.245	9,890.000	
1997	0.000	1,044.677	8,600.000	
1998	0.000	3,610.280	12,700.000	
1999	0.000	2,180.792	10,200.000	
2000	0.000	853.882	5,230.000	1,284.29

A.3.1.2.3.4 S-79: (lat: 26°43''26' long: 81°41''54')

Year	Min	Mean	Max	Std. Dev.
1998	0	1,329.832	10,992.028	
1999	0	1,389.544	7,855.250	
2000	0	992.426	5,515.082	
2001	0	1,358.312	21,166.154	
2002	0	2,196.102	11,262.227	
2003	0	2,788.316	13,965.179	

A.3.1.2.3.5 S-79 (lat: 26°43''26' long: 81°41''54')

Year	Min	Mean	Max	Std. Dev.
1996	0	1,371.145	9,281.000	
1997	0	960.104	8,767.000	
1998	0	3,476.378	13,652.000	
1999	0	2,081.290	10,104.000	
2000	0	846.080	5,010.000	
2001	0	1,240.071	16,178.000	
2002	0	1,988.490	11,518.000	
2003	0	3,545.797	15,864.000	
2004	0	1,504.910	4,384.000	

A.3.1.2.3.6

- Billy Creek
- Orange River

Orange River near Ft. Myers (DBHYDRO)
Lat: 26°40"01' Long: 81°43"55'

Year	Min	Max
1935	0.050	0.050
1936	0.010	4,900.000
1937	0.020	850.000
1938	0	790.000
1939	0	685.000
1940	0	1,270.000
1941	0	810.000
1942	0.030	283.000
1943	0	1,320.000
1944	1.800	301.000
1945	0	1,020.000
1946	0	417.000
1990	2.900	92.000
1991	4.300	1,160.000
1992	2.300	2,040.000

- Tidal Caloosahatchee
- Yellow Fever Creek
- Manual Branch
- Daughtrey Creek
- Trout Creek
- Glichrest Drain - Powel
- Stoud Creek
- Owl Creek
- Popash Creek
- Wyoua Creek

A picture of all the monitoring sites done by the SFWMD can be found at: <http://www.sfwmd.gov/curre/sitemaps/flowmonitoring.pdf>

A.3.1.2.4 Estero Bay

The Estero Bay is approximately 15 square miles and it watershed it approximately 293 square miles and includes the following water bodies.

- Estero Bay
- Estero Bay Wetlands
- Oak Creek
- Hendry Creek

The Hendry Creek Basin includes approximately 18 square miles of the Estero Bay Watershed in coastal Lee County and is located along the length of Hendry Creek from Estero Bay to College Parkway and Woodland Boulevard.[38]

- Estero River

The Estero River Basin includes 71 square miles in the Estero Bay Watershed in Lee County. The basin extends northeast from Estero Bay, sharing its western boundary with the Spring Creek Basin until it reaches S.R. 82. Both S.R. 41 and I-75 are major north-south transportation corridors in the eastern half of the basin. Another major feature in the Estero River Basin is the newly established Gulf Coast University, located just east of I-75 between Alico and Corkscrew roads.

A.3.1.2.4.1 Estero N (lat: 26°26''31' long: 81°47''44') units in cfs

Year	Min	Mean	Max
1987	0	8.323	2.03.000
1988	0	2.015	27.000
1989	0	0.006	0.390
1990	0	0.092	12.000
1991	0	3.460	51.000
1992	0	5.912	151.000
1993	0	0.858	26.000
1994	0	4.196	142.000
1995	0	29.807	366.000
1996	0	4.766	121.000
1997	0	7.869	250.000
1998	0	14.530	216.000
1999	0	16.370	204.000

[38] [SFWMD] South Florida Water Management District. 1998. *Estero Bay—State of the Bay Report.* <http://www.sfwmd.gov/org/exo/ftmyers/proj/StateOfTheBay1.html> Accessed 2004 Oct. 15.

A.3.1.2.4.2 Estero S (lat: 26°25''44' long: 81°47''35') units in cfs

Year	Min	Mean	Max
1987	1.500	17.094	281.00
1988	0.060	8.364	116.000
1989	0.100	2.038	46.000
1990	0.20	2.895	44.000
1991	0.200	11.210	106.000
1992	0.210	14.618	307.000
1993	0.120	4.165	48.000
1994	0.080	15.921	200.000
1995	0.310	48.645	410.000
1996	0.000	8.125	82.000
1997	0.050	10.129	220.000
1998	0.310	18.833	185.000
1999	0.000	18.671	267.000

A.3.1.2.4.3 Imperial River

The Imperial River Basin includes 84 square miles in the Estero Bay Watershed and covers 27% of the watershed. The basin is the largest in Lee County and is located south of the Spring Creek basin and extends northeast beyond the coastal basins to S.R. 82. Major developments in the basin are located west of I-75 and include Bonita Beach, Bonita Bay, and Bonita Springs.

Data has been obtained for the Imperial River flow from the DBHYDRO website (lat: 26°26''06' long: 81°45''19') flow is in cfs

Year	Min	Mean	Max
1940	0.000	169.853	2890.000
1941	2.800	127.269	518.000
1942	1.500	51.962	321.000
1943	1.000	74.579	509.000
1944	1.100	28.979	400.000
1945	0.710	99.008	1120.000
1946	0.710	69.886	483.000
1947	1.500	223.992	2400.000
1948	0.900	88.140	1110.000
1949	0.600	103.384	906.000
1950	0.600	31.122	841.000
1951	0.500	113.443	2680.000
1952	0.600	59.855	526.000
1953	0.700	97.785	762.000
1954	0.700	42.639	273.000
1987	24.000	164.980	526.000

Imperial River flow, continued

Year	Min	Mean	Max
1988	5.300	69.641	505.000
1989	3.300	27.692	349.000
1990	2.000	25.844	284.000
1991	8.300	151.990	671.000
1992	2.700	135.893	1030.000
1993	6.600	59.395	431.000
1994	8.900	127.321	637.000
1995	16.000	346.578	2000.000
1996	10.000	53.530	232.000
1997	5.300	53.282	374.000
1998	11.000	115.885	485.000
1999	7.000	201.185	935.000

A.3.1.2.4.4 Ten Mile Canal

The Ten Mile Canal is approximately 68 square miles.

Wet season river and creek flow rates

Gage Station	Max (cfs)	Min (cfs)
Ten Mile Canal at US41	1287	0
Ten Mile Canal at Park Road Bridge	1076	68
Ten Mile Canal at Tamiami Weir	967	19
Ten Mile Canal at Six Mile Cypress Parkway	609	17
Ten Mile Canal at Daniels Parkway	379	0
Ten Mile Canal at Crystal Drive	61.7	7
Ten Mile Canal at Briar Cliff	1073	1.4
Ten Mile Canal at Colonial Drive	77	0
Hendry Creek at Old Gladiolus	12	0
Imperial River at Old US41	1180	0.54
Imperial River at Matheson	860	0
Imperial River at Orr Road	736	0
Kehl Canal At Bonita Grand Road	400	11

A.3.1.2.4.5 Ten Mile Canal at Control Near Estero, Fl
04/05 13:15 5.52 ft 0.87 (?)[39]

Ten Mile Canal at US41 Peak annual surface flows[40]

Date	Flow (cfs)
6-22-96	308.9
7-13-97	206.9
9-27-98	140.2
1-27-99	155.4
9-6-00	290.0
6-16-01	285.8
10-26-02	77.5
3-28-04	127.2
7-2-04	129.2
9-29-05	122.8
8-28-06	229.2

**also has recurrence interval, standing water depth and peak flow, avg. annual and monthly loads (pollutant delivered to Mullock Creek by Ten Thousand Island)

A.3.1.2.4.6 Spring Creek

The Spring Creek Basin includes 11 square miles in the Estero Bay Watershed in Lee County and is associated with the Spring Creek tributary to the southern half of Estero Bay. The basin extends east from Estero Bay to I-75 in the northern portion of the basin and includes most of the area south of the City of Coconut to just north of the Imperial River. S.R. 41 bisects the basin north to south and C.R. 887 traverses the eastern half of the basin.

39 [USGS] US Geological Survey. 2004. *Real-time data for Florida.* <http://waterdata.usgs.gov/fl/nwis/current/?type=flow&group_key=basin_cd> Accessed 2004 Oct. 15.

40 Tammen, Howard Needles, and Bergendoff. 1978. *Gordon River Watershed Surface Water Management System Plan and Design*. Collier County, Fl.

Flow data has been accumulated for Spring Creek by USGS from the years 1987-1999.

A.3.1.2.3.6.1 Spring Creek Headwater Near Bonita Springs 04/05 2.94 ft 8.50 (?)[41]

A.3.1.2.3.6.2 lat: 26°21''43' long: 81°47''26' (flow cfs)[42]

Year	Min	Mean	Max	Std. Dev.
1987	3.700	13.471	38.000	7.18
1988	0.150	4.457	49.000	7.10
1989	0.000	2.883	23.000	3.25
1990	0.000	5.028	59.000	6.81
1991	0.520	8.232	42.000	7.27
1992	0.110	12.372	234.000	23.60
1993	0.090	8.376	102.000	12.51
1994	0.090	9.180	117.000	15.76
1995	0.320	24.539	269.000	38.52
1996	0.600	5.931	121.000	9.20
1997	0.000	5.564	120.000	12.73
1998	0.250	8.596	239.000	16.75
1999	0.190	15.414	465.000	39.08

- Lakes Park
- Mullock Creek

The Mullock Creek Basin includes less than 11 square miles of the Estero Bay Watershed in coastal Lee County. The basin extends from Estero Bay east along the length of Mullock Creek, north to Alico Road and east to Three Oaks Parkway, just west of I-75. Although residential areas occur over much of the basin, it is largely undeveloped west of S.R. 41.

41 [USGS] US Geological Survey. 2004. *Real-time data for Florida.* <http://waterdata.usgs.gov/fl/nwis/current/?type=flow&group_key=basin_cd> Accessed 2004 Oct. 15.

42 [SFWMD] South Florida Water Management District. 2004. Web page for SFWMD's Corporate environmental database which stores hydrologic, meteorologic, hydrogeologic and water quality data. <http://www.sfwmd.gov/org/ema/dbhydro/ > Accessed 2004 Oct. 15.

A.3.1.2.4.7 Data was obtained for Six Mile Cypress Creek N NR Ft.Myers (DBHYDRO) (lat: 26°31''21' long: 81°51''16') units in cfs

Year	Min	Mean	Max
1987	0.010	1.200	1.200
1988	0	697.000	697.000
1989	0	46.000	46.000
1990	0	262.000	262.000
1991	0	89.000	89.000
1992	0	641.000	641.000
1993	0	285.000	285.000
1994	0	159.000	159.000
1995	0	860.000	860
1996	0	112.000	112
1997	0	306.000	306
1998	0	250.000	250
1999	0	96.000	96

A.3.1.2.4.8 Six Mile Cypress Creek S NR Ft. Myers (lat: 26°31''06' long: 81°51''16') (DBHYDRO website)

Year	Min	Mean	Max
1987	0	0.275	0.910
1988	0	0.169	1.900
1989	0	0.384	7.300
1990	0	11.678	140.00

A.3.1.2.5 Wiggins Pass Estuary/Cocohatchee Estuary

- Little Hickory Bay
- Cocohatchee River
- Vanderbilt Way
- Drainage to Corkscrew
- Lake Trafford

*** **In some reports Lake Trafford is classified as part of Estero Bay's watershed basin.**

- Cocohatchee River Canal

Several data points along the Cocohatchee River Canal have collected water flow data. (DBHYDRO)

A.3.1.2.5.1 Spillway on Cocohatchee Canal: Structure 1 at Palm River Road (lat: 26°16''22' long: 81°46''47')

Year	Min	Mean	Max
1994	0.306	107.167	272.093
1995	0	90.963	554.182
1996	0	26.310	144.113
1997	0	9.289	78.053
1998	0	26.020	189.593
1999	0	37.319	495.161
2000	24.918	29.825	42.165
2001	0	55.479	481.608
2002	0	46.405	260.070
2003	0	97.554	432.995
2004	0	12.945	94.704

A.3.1.2.5.2 Weir overflow on Cocohatchee Canal: Structure 1 at Palm River Road (lat: 26°16''22' long: 81°46''47')

Year	Min	Mean	Max
1994	0	0.199	11.824
1995	0	1.858	39.898
1996	0	0.239	19.424
1997	0	0	0.004
1998	0	0.005	1.368
1999	0	0.030	4.924
2000	0	0	0
2001	0	0.005	1.055
2002	0	0.002	0.751
2003	0	0.077	10.473
2004	0	0	0.016

A.3.1.2.5.3 Location from GPS position (lat: 26°16''23' long: 81°45''33')

Year	Min	Mean	Max
1996	0	46.313	202.159
1997	0	8.239	60.970
1998	0	32.937	473.296
1999	-4.257	90.034	794.256
2000	0	18.014	201.545
2001	0	72.974	789.307
2002	0	59.041	460.945
2003	0	120.454	597.878
2004	0	10.425	76.801

A.3.1.2.5.4 Cocohatchee River Canal near Naples Park (lat: 26°17''01' long: 81°45''59')

Year	Min	Mean	max
1966	0	57.280	190.000

A.3.1.2.5.5 Cocohatchee River Canal at Willoughby acres bridge (lat: 26°16''22' long 81°45''50')

Year	Min	Mean	Max
1968	6.100	23.696	79
1969	5	32.480	172
1970	0.960	24.348	154
1971	0	34.082	244
1972	3.7	25.396	135
1973	1.5	53.846	454
1974	0	46.113	409
1975	0.84	15.764	91
1976	0.98	14.646	111
1977	0.66	21.365	166
1978	0.85	27.401	192
1979	2.4	25.959	241
1980	6	29.100	184
1981	0.4	27.744	214
1982	0.65	57.179	273
1983	5.000	82.746	331
1984	0	43.924	185

A.3.1.2.6 Naples Bay

The Naples Bay watershed is approximately 120 square miles.

- Naples Bay
- Center of Outer Clam B
- Gordon River

A.3.1.2.6.1 Gordon River at Naples, Fl (lat: 26°10''22' long: 81°47''05') (DBHYDRO website)

Year	Min	Mean	Max
1982	0	0	0

- Gordon River Canal
- Henderson Creek Canal

"Henderson Creek basin drains approximately 47.7 square miles."[43]

A.3.1.2.6.2 Henderson Creek Canal near Naples, Fl (lat: 26°05''59' long: 81°41''12')

Year	Min	Mean	Max
1968	13.000	26.377	63.000
1969	3.700	16.969	84.000
1970	3.100	32.909	220.000
1971	0.100	18.245	246.000
1972	3.000	22.425	250.000
1973	0.000	21.561	323.000
1974	0.000	23.637	106.000
1975	0.000	30.107	169.000
1976	1.400	20.150	140.000
1977	0.600	38.201	242.000
1978	1.600	28.117	114.000
1979	1.500	15.822	58.000
1980	1.400	19.368	65.0000
1981	1.200	19.766	116.000
1982	0.000	24.481	104.000
1983	1.400	36.084	95.000
1984	2.800	18.773	76.000

[43] Rookery Bay National Estuarine Research Reserve. 1996. *Rookery Bay Advance Identification of Wetlands Project*.

A.3.1.2.6.2 Henderson Creek Canal near Naples, Fl (continued)

Year	Min	Mean	Max
1981	0	0	0
1982	-99.990	31.000	31.000
1983	-99.990	74.000	74.000
1984	2.800	48.000	48.000

- Golden Gate Canal

Flow data has been collected from several areas along the Golden Gate Canal by the South Florida Water Management District (DBHYDRO)

A.3.1.2.6.3 Golden Gate Canal near Sunniland (lat: 26°16''46' long: 81°33''40')

Year	Min	Mean	Max
1977	13.000	24.162	65.000
1978	1.700	27.541	111.000
1979	0.000	37.043	181.000
1980	10.000	26.210	77.000
1981	5.400	30.566	125.000
1982	0.500	34.886	118.000
1983	0.000	39.835	109.000
1984	9.300	29.459	82.000

A.3.1.2.6.4 Golden Gate Canal Weir #1 (Bear Paw) at Airport Rd. (lat: 26°10''04' long: 81°46''04')

Year	Min	Mean	Max
1964	80	162.870	303
1965	41	275.622	986
1966	89	405.378	2240
1967	39	351.855	1650
1968	30	398.306	1970
1969	56	329.537	1120
1970	42	329.079	1290
1971	0.050	307.085	3060
1972	41	339.087	1720
1973	10	413.526	1790
1974	0.100	424.981	1980
1975	0	190.841	845
1976	6.800	271.735	1320

A.3.1.2.6.4 Golden Gate Canal Weir #1 (Bear Paw) at Airport Rd. (continued)

Year	Min	Mean	Max
1977	0.000	276.985	1500
1978	37.000	238.236	868
1979	19	286.564	1740.000
1980	55	256.301	1080
1981	17	251.501	1400
1982	11	310.030	1520
1983	40	424.460	2420
1984	1.500	291.283	1350

1989	44.914	72.320	144.529
1990	0.000	155.653	965.713
1991	4.297	533.044	1908.395
1992	0.000	389.002	1993.452
1993	4.235	336.211	1469.772
1994	0.000	303.499	1336.078

Year	Min	Mean	Max
1994	74.579	200.182	719.946
1995	-182.696	546.704	3085.638
1996	0	178.267	1168.113
1997	0	171.611	972.118
1998	0	329.183	1997.961
1999	0	362.951	2318.888
2000	0	156.776	1436.424
2001	0	360.938	2797.964
2002	0	26.580	252.133
1981	0	333.333	1000.000
1982	0	83.333	1000.000
1983	0	90.909	1000.000
1984	128	246.286	579.000

A.3.1.2.6.5 Golden Gate Canal Weir #3 at 17th Ave west of 941

Year	Min	Mean	Max
1977	53	99.011	280
1978	40	148.805	648
1979	6.3	147.141	714
1980	10	111.339	335
1981	15	127.764	324
1982	0.000	219.860	1270
1983	50.000	323.712	1640
1984	20.000	193.033	752

A.3.1.2.6.6 Golden Gate Canal Weir #4

Year	Min	Mean	Max
1994	0	0	0
1995	0	0	0
1996	0	0	0

A.3.1.2.7 Rookery Bay

- Rookery Bay

Rookery Bay has a surface area of 1,034 acres and a mean depth of 1 meter.

- Henderson Creek

Freshwater input to Rookery Bay comes primarily from Henderson Creek at the northeastern corner of the Reserve. This creek, with an average water depth of 0.8 meters and a mean flow rate of 2,073,600 cubic feet per day, drains the Belle Meade Water District.[44] During 1970, the average discharge at the Henderson Creek Canal station was 25 cfs. [45]

- Lake Avalon
- Run off to Gulf

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[44] [CDMO/NERRS] Centralized Data Management Office/ National Estuarine Research Reserve System. Web page for Rookery Bay. < http://cdmo.baruch.sc.edu/hpages/RKB/sitedescription.html> Accessed 2004 Oct. 15.
[45] [DEP] Florida Department for Environmental Protection. 2000. Web page for Rookery Bay National Estuarine Research Preserve. <http://www.dep.state.fl.us/coastal/activities/research/rookery.htm> Accessed 2004 Oct. 15.

A.3.1.2.8 Ten Thousand Islands, including Marco Estuary

- Run off to Gulf
- Ferguson River
- Baron River Canal N.
- Barron River Canal S.

A.3.1.2.8.1 Barron River near Everglades (lat: 25°58''01' long: 81°20''59') collected by DBHYDRO

Year	Min	Mean	Max
1952	0.000	65.554	118.000
1953	12.00	73.099	146.000
1954	53.000	96.214	140.000
1955	9.000	104.055	242.000
1956	0.1000	24.385	87.000
1957	3.000	101.573	201.000
1958	97.000	186.238	237.000
1959	7.000	157.090	263.000
1960	45.000	123.929	195.000
1961	7.000	78.732	208.000
1962	1.000	95.085	292.000
1963	11.000	64.019	200.000

A.3.1.2.8.1 Barron River near Everglades (continued)

Year	Min	Mean	Max
1966	12.000	117.214	262.000
1967	3.600	83.425	202.000
1968	15.000	136.943	234.000
1969	17.000	137.723	260.000
1970	15.000	169.332	283.000
1971	6.600	84.409	257.000
1972	4.200	82.515	227.000
1973	0.300	91.570	256.000
1974	1.700	81.343	254.000
1975	0.000	69.158	227.000
1976	5.800	93.749	237.000
1977	7.700	89.482	231.000
1978	12.000	115.830	248.000
1979	9.100	112.902	270.000
1980	18.000	99.066	206.000
1981	0.600	57.857	197.000
1982	0.000	120.692	258.000
1983	28.000	172.636	270.000
1984	26.000	125.139	216.000
1985	0	66.959	199.000
1986	0	97.387	209.000
1987	0.240	112.285	208.000
1988	0	68.874	195.000
1989	0	3.074	17.000
1990	0	10.895	130.000
1991	0.900	68.779	157.000
1992	11.000	64.257	144.000
1993	5.900	64.164	107.000
1994	12.000	53.945	103.000
1995	12.000	91.733	258.000
1996	0	70.630	162.000
1997	6.500	59.884	157.000
1998	3.300	78.425	214.000
1999	6.500	77.062	140.000
2000	58.000	63.556	70.000
1981	0	0	0
1982	0	0	0
1983	0	0	0
1984	0	0	0
1985	17.000	74.333	184.000

- Blackwater River
- West Collier
- Faka Union Canal

Data has been collected by the South Florida Water Management District in three areas of the Faka Union Canal.

A.3.1.2.8.2 Faka Union Canal at Weir #1 (US. 41 near Copeland)

Year	Min	Mean	Max
1969	145.000	344.395	604.000
1970	48.000	380.723	1170.000
1971	0	372.204	3190.000
1972	0	197.289	1460.000
1973	0	255.789	1400.000
1974	0	326.462	1590.000
1975	0	266.088	1190.000
1976	1.000	118.566	527.000
1977	1.000	155.516	545.000
1978	1.000	260.721	831.000
1979	0	118.902	777.000
1980	9.700	175.375	1140.000
1981	0	213.346	1210.000
1982	0	376.136	1740.000
1983	0	380.062	1110.000
1984	0	190.700	817.000

1981	0	0	0
1982	0	0	0
1983	0	0	0
1984	58.000	169.143	258.000
1984	10.000	483.342	997.100
1985	0	265.197	1661.000
1986	-2.183	259.291	632.377
1987	0	430.396	982.657
1988	-4.630	149.080	749.608
1989	-3.958	115.408	529.203
1990	-14.647	156.011	556.034
1991	6.456	407.839	1149.752
1992	-16.500	251.842	978.915
1993	-20.359	168.931	666.057
1994	-16.633	304.587	1146.239

A.3.1.2.8.2 Faka Union Canal at Weir #1 (continued)

Year	Min	Mean	Max
1995	9.406	672.495	2245.392
1996	-319.117	207.394	1155.413
1997	-33.577	289.331	841.727
1998	-20.062	324.881	1904.770
1999	-50.540	384.993	2119.357
2000	-36.259	4.519	93.596
2000	41.996	423.782	1340.519
2001	-17.376	519.616	2265.222
2002	-11.102	442.407	1487.144
2003	-5.401	543.761	1662.513
2004	143.439	297.999	630.388

A.3.1.2.8.3 Faka Union Canal near Deep Lake (lat: 26°03''43' long: 81°31''24')

Year	Min	Mean	Max
1977	12.000	27.500	53.000
1978	3.400	59.693	285.000
1979	1.000	59.154	362.000
1980	2.000	59.174	256.000
1981	0.000	63.580	335.000
1982	1.500	165.023	636.000
1983	9.600	212.775	529.000
1984	44.000	107.714	290.000

A.3.1.2.8.4 Faka Union Canal near Sunniland (lat: 26°16''17' long: 81°31''43')

Year	Min	Mean	Max
1977	0	0	0
1978	0	1.123	9.800
1979	1.000	12.922	157.000
1980	0	12.163	134.000
1981	2.000	10.325	100.000
1982	2.000	27.731	170.000
1983	3.300	23.634	126.000
1984	0	14.191	137.000

A.3.1.2.8.5 Tamiami Canal

Flow data has been collected on the Tamiami Canal at two sites by the South Florida Water Management District

A.3.1.2.8.5.1 Tamiami Canal Outlets, 40-mile bend to Monroe, Fl

Year	Min	Mean	Max
1963	5.000	311.011	2790.000
1964	2.000	179.169	1080.000
1965	0	192.767	948.000
1966	0	497.684	3800.000
1967	0	182.830	1330.000
1968	0.600	380.312	1740.000
1969	20.000	621.616	2090.000
1970	1.900	198.224	1160.000
1971	0	185.691	2320.000
1972	0	511.857	2600.000
1973	0	552.765	3040.000
1974	0	251.169	1100.000
1975	0	318.261	2360.000
1976	0	437.749	2370.000
1977	0	277.545	1100.000
1978	14.000	307.627	1680.000
1979	0	181.871	1060.000
1980	0	161.170	1160.000
1981	0	410.637	2320.000
1982	0	576.097	2600.000
1984	0.710	959.306	1100.000
1985	172.000	1495.808	2360.000
1986	0.810	503.906	2370.000
1987	1.500	466.674	1100.000
1988	0.880	493.168	1680.000
1989	0	1221.328	1060.000
1990	0	161.170	1720.000
1991	0	410.637	1370.000
1992	0	576.097	1970.000
1993	48.000	452.616	1810.000
1994	0.710	959.306	4760.000
1995	172.000	1495.808	6110.000
1996	0.810	503.906	1860.000
1997	1.500	466.674	2140.000
1998	0.880	493.168	1780.000

Tamiami Canal Outlets, 40-mile bend to Monroe, Fl (continued)

Year	Min	Mean	Max
1999	0	1221.328	7270.000
2000	0	227.803	2120.000
2001	0	479.450	2360.000
2002	0	518.074	2030.000
2003	2.700	630.468	2330.000
2004	87.000	147.852	249.000

1982	0	0	0
1983	104.000	419.667	886.000
1984	10.000	260.857	1130.000
1985	0	149.500	1690.000

1980	49.000	192.400	350.000

A.3.1.2.8.5.2 Tamiami Canal Outlets Monroe to Carnestown Fl

Year	Min	Mean	Max
1960	53.000	1520.746	6010.000
1960	0	138.647	2390.000
1962	0	355.773	4220.000
1963	2.000	244.137	3660.000
1964	1.000	286.399	1110.000
1965	5.000	320.479	1570.000
1966	7.000	548.482	5440.000
1967	0	217.814	1590.000
1968	0.500	529.121	2770.000
1969	3.800	756.607	4470.000
1970	14.000	548.430	2940.000
1971	0	492.259	4980.000
1972	0	169.718	1420.000
1973	0	332.175	1950.000
1974	0	240.091	1670.000
1975	0	240.232	1880.000
1976	00	380.897	1770.000
1977	0	334.903	1950.000
1978	0.020	225.174	793.000
1979	0	353.106	2190.000
1980	0	207.263	1510.000
1981	0	299.309	4400.000

A.3.1.2.8.5.2 Tamiami Canal Outlets Monroe to Carnestown Fl (continued)

Year	Min	Mean	Max
1982	0	764.924	5040.000
1983	0	731.852	6000.000
1984	0.100	309.593	1910.000
1985	0	385.630	5220.000
1986	0.320	414.435	2060.000
1987	7.700	369.162	1780.000
1988	0	338.771	1940.000
1989	0	389.079	2660.000
1990	0	274.591	2510.000
1991	0	499.009	1910.000
1992	0	463.486	3290.000
1993	0	498.131	1970.000
1994	0	648.744	3530.000
1995	0	857.940	3770.000
1996	0	393.114	2750.000
1997	0.360	473.322	3070.000
1998	0	436.898	2600.000
1999	0	657.560	4640.000

1982	0.000	0.000	0.000
1983	137.000	457.500	890.000
1984	0.000	160.952	1840.000
1985	0.000	394.667	3980.000

A.3.2 Salinity

Salinity in Southwest Florida's estuaries is usually lowest during the wet season (July through September) and highest during the dry season (January through March. Variations in salinity are controlled by the amount and timing of freshwater inflow and in response to tidal fluctuations.[46]

Salinity may range from fresh (less than 1 part per thousand) to seawater (35 parts per thousand). There are three main salinity regimes: stratified, partially mixed and fully mixed. Coastal water is considered stratified when salinity is distinctly lower at the surface level near the bottom than it is near the top. Partially mixed salinity occurs when tidal currents generate enough turbulence to cause vertical mixing but are not strong enough to cause a uniform salinity regime throughout the water column. Fully mixed salinity occurs when enough turbulence is caused to mix the water column uniformly. Even when salinity is fully mixed, salinity will still vary between riverine and oceanic ends.

Salinity regimes are important to determine the distribution and types of organisms found within an estuary. R.O. McLean and S.D. Cave identify several ways to classify salinity within the water:

Freshwater	less than 0.18 ppt	infrahaline
Brackish	0.18 ppt	oligohaline
	0.18 – 1.8 ppt	mesohaline
	1.8 – 30 ppt	polyhaline
Seawater	30 – 35 ppt	ultrahaline
	greater than 35 ppt	metahaline

In addition, R.O McLean and S.D. Cave divided an estuary up into regions according to the salinity ranges, which prevail:

Head – where freshwater enters; with maximum salt penetration, the salinity rises to 5 ppt
Upper Reaches – 5-18 ppt
Middle Reaches – 18-25 ppt
Lower Reaches – 25-30 ppt
Mouth – equal to that of adjacent sea

A.3.2.1 Charlotte Harbor

The total average salinity of the Charlotte Harbor region is 13 ppt. Charlotte Harbor can be broken down into (1) the River Reaches including the Tidal Peace, Myakka and Caloosahatchee Rivers, typically high in salinity (less than 20 ppt), (2) the Upper Harbor comprised of Boca Grande region (east and north to the Peace and Myakka Rivers), and (3) the Lower Harbor including Pine Island Sound, Matlacha Pass, and San Carlos Bay--generally uniform in salinity and higher than the upper harbor.

[46] McPherson P.S. *et al.* 1996. "A presynaptic inositol-5-phosphatase." *Nature* 379: 353-57

Studies done during 1959, 1966 and 1967 indicate an average salinity range for Charlotte Harbor of 20.0-34.2 ppt. Near surface salinity values have been found for Charlotte Harbor from October 2002-Febuary 2004. All values have then been compared to the averaged data from 1993 to 2000.[47]

A.3.2.1.1 Salinity in Charlotte Harbor

February	2004	12.74-35.26 ppt
January	2004	5.77-34.03 ppt
December	2003	8.55-36.08 ppt
November	2003	6.69-35.54 ppt
October	2003	0.1-36.53 ppt
September	2003	0.10-33.12 ppt
August	2003	0.18-33.89 ppt
July	2003	0.12-30.90 ppt
June	2003	5.31-34.89 ppt
May	2003	5.39-35.97 ppt
April	2003	15.24-36.94 ppt
March	2003	5.22-35.34 ppt
February	2003	0.73-35.54 ppt
January	2002	11-33.74 ppt
December	2002	16-33.13 ppt

A.3.2.2 Pine Island Sound

To date salinity and turbidity data has been found for the months of February 2002 to December 2002 and September 2003. The Division of Aquaculture recorded the data every thirty minutes.[48]

Matlacha Pass: A 1984 study documented that salinities ranged from 12 ppt near shore to 18 ppt toward the middle of the estuary. Due to breaches in the spreader system, concentrated freshwater moved toward the south, yielding surface salinities of only 1-2 ppt at SR 78 Bridge and 9-12 ppt near the bottom. As the wet season came, the trend reversed, low salinities returned and extended farther into Matlacha Pass reaching 9-12 ppt.

During 1995, salinity ranged from 30 ppt (± 5) on the surface and near bottom when discharge from all five weirs of the North Cape Coral Drainage System was less than 100 cfs. The salinity fell sharply in June to 11 ppt as discharges increased to nearly 1,500 cfs. Bottom salinity remained less than 20 ppt until discharges declined to 200-300 cfs.
In July 2003 several hydrological targets were set for Matlacha Pass:[49]

[47] Charlotte Harbor Environmental Center, Inc. 2004. Web page for surface salinity values. <http://checflorida.org/chec/salinity_mo_10_02.htm> Accessed 2004 Oct. 15.

[48] Florida Aquculture.com. 2004. Web page for Pine Island data archives. <http://www.floridaaquaculture.com/Sondes/archives/PineIsland/sonde_archives_PineIsland.htm> Accessed 2004 Oct. 15.

[49] Chamberlain, Bob. 2003. *Freshwater Inflow to Matlacha Pass: DRAFT Performance Measures for Gator Slough and Cape Coral Canals.*

1. Combined minimum freshwater flow of 10 cfs over the weirs of the North Cape Coral Drainage System (CCDS)
2. Combined average annual flow from the North CCDS weirs ≤ 100 cfs
3. Combined flow from the North CCDS weirs never reaches ≥ 1,000 cfs
4. Combined flow from the North CCDS weirs is never ≥ 500 cfs for longer than a month
5. Preferred average wet season flow ≤ 200 cfs

A.3.2.3 Caloosahatchee

Studies done on the Caloosahatchee River in 1967, 1968 and 1971 identify a range of 0-30 ppt for salinity.

Volety et al. (2003) stated that "flows between 500 and 2,000 cfs would result in salinities of 16-28 ppt at all stations, conditions that are favorable to sustain and enhance oyster populations in the Caloosahatchee Estuary".

Ecological Targets set for the Caloosahatchee state salinity should not exceed 20 ppt for longer than one day at Ft. Myers. We must limit occurrence of salinity < 15 ppt at Cape Coral Bridge and maintain a salinity of > 5 ppt at Piney Point. In addition, the average monthly salinity at Sanibel Causeway must be maintained at ≥ 25 ppt.

A.3.2.4 Estero Bay

Several hydrological targets have been established for the tributaries of Estero Bay based on regression analysis.[50]

Ten Mile Canal: Minimize days of average discharge that exceeds daily mean flows of 290 cfs. Maximize days of daily mean flows of 5-35 cfs. Thus, maintain flows that hold salinities at 15-25 ppt at the Mullock Creek Station

Estero River: Minimize number of days that average river discharge exceeds mean flows of 31 cfs. Maximize days of daily mean flows of 3-9 cfs. Thus, maintain flows that hold salinities at 15-25 ppt.

Imperial River: Minimize days of average river discharge that exceed daily mean flows of 390 cfs. Maximize days of daily mean flows of 7-23 cfs. Thus, maintain flows that hold salinities at 15-25 ppt.

A.3.2.5 Naples Bay

Gordon Pass normally maintains a salinity of 34-35 ppt. The central portion of Naples Bay can range from 20-35 ppt.

[50] Thomas, Daryl. 2003. *Freshwater Inflow Performance Measures: Estero Bay*.

A.3.2.6 Rookery Bay

Salinity ranges from 18.5 ppt to 39.4 ppt (between May and October) for Rookery Bay.[51] Salinity and turbidity statistics were located for the upper and lower Henderson Creek, Blackwater River, Fakahatchee Bay, Faka Union Bay, and Big Marco Pass for 2001 and 2002 (every half hour).[52]

A.3.2.7 Ten Thousand Islands

Salinity and turbidity data for several points within the Ten Thousand Islands watershed is available from the SFWMD.[53] The average salinity of the Ten Thousand Islands is 17 ppt.

Other sources of information include the IWR raw data, the Janicki Report, and STORETs.

A.3.3 Pesticides

A PhD Toxicologist donated time to survey the pesticides that are being applied to the Estuaries' watersheds for lawn care, mosquito control, gulf course and agriculture. A Hazard Index (HI) based on the toxicity of the pesticides and the amount of the pesticide that is applied was developed. The Hazard Index was "not intended to be a quantitative risk assessment" but rather "to indicate which water drainage areas are most likely to be impaired due to pesticide use and which pesticides are most likely to be causing the greatest impacts in specific Southwest Florida waterways." The relative risk scoring utilized for each chemical scoring category was constructed on scales that are "generally logarithmic in nature" and "chosen to provide a good spread of values as well as to penalize those chemicals that are particularly persistent, bioaccumulative, or toxic." The Hazard Index scores were then utilized to determine if certain WBIDS were at High Risk, Moderate Risk, Low but Measurable Risk or whether Pesticide Indices were Present with No Measurable Risk.[54]

A.3.3.1 Charlotte Harbor

(Note: The Peace and Myakka River WBIDS were not included in the Pesticide Hazard Information Analysis.)

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[51] [RBNERR] Rookery Bay National Estuarine Research Reserve. 2004. Homepage for RookeryBay.org. <http://www.rookerybay.org/facts.htm> Accessed 2004 Oct. 15.

[52] [CDMO] Centralized Data Management Office. 2004. *Rookery Bay (RKB) Florida Water Quality Data*. <http://cdmo.baruch.sc.edu/rkb.html> Accessed 2004 Oct. 15.

[53] [SFWMD] South Florida Water Management District. 2004. *Ten Thousand Islands Project Area*. <http://www.sfwmd.gov/org/ema/envmon/wqm/coastal/tti.html> Accessed 2004 Oct. 15.

[54] Judith M. Hushon, Ph.D. 2004. *Pesticides in Southwest Florida Waterways: A Report Card.* The Conservancy of Southwest Florida.

A.3.3.1.1 Marine Water Bodies in Charlotte Harbor

WBID	Waterbody Segment	Pesticide Hazard Index
2065A	Charlotte Harbor Upper	N/A
2065B	Charlotte Harbor Mid	N/A
2065C	Charlotte Harbor Mid	N/A
2065D	Charlotte Harbor Lower	Present
2073	Mangrove Point Canal	N/A
2092B	Gasparilla Island	Present
3240P	North Urban Cape Coral	Present

A.3.3.1.2 Fresh Water Bodies in Charlotte Harbor

WBID	Waterbody Segment	Pesticide Hazard Index
2063	N. Fork Alligator Creek	N/A
2066	Direct Run off to Bay	Present
2071	No. Prong Alligator Creek	Present
2074	Alligator Creek	Present
2074A	Alligator Creek	Present
2077	Direct Run off to Bay	Present
2079	Whidden Creek	Present
2080	Catfish Creek Bayou	Present
2081	Alligator Creek	N/A
2082A	Pirate Canal	N/A
2082B	Yucca Pen Creek	Present
2083	Direct Run off to Bay	Present
2084	Mound Creek	Present
2085	Direct Run off to Bay	Present
2086	Winegourd Creek	Present
2087	Direct Run off to Bay	Present
2088	Direct Runoff to Bay	Present
2089	Boggess Hole Outflow	Present
2090	Direct Runoff to Bay	Present
2091	Direct Runoff to Bay	Present
2092A	Direct Runoff to Bay	N/A
2093	Direct Runoff to Bay	Present

A.3.3.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Pesticide Hazard Index
2093A	Hog Branch	Present
2094	Bear Branch	Present
3240T	Gilchrest Drain	Present

A.3.3.2 Pine Island Sound

A.3.3.2.1 Marine Water Bodies in Pine Island Sound

WBID	Waterbody Segment	Pesticide Hazard Index
2065E	Pine Island Sound Upper	N/A
2065F	Matlacha Pass	Present
2065G	Pine Island Sound lower	Present
2065H	San Carlos Bay	N/A
2065H A	Sanibel Island Causeway	N/A
2092C	North Captiva Island	Present
2092D	Captiva Island	Present
2092E	Pine Island	Medium
3240O	Punta Rasa Cove	N/A
3240S	South Urban Cape Coral	Present

A.3.3.2.2 Fresh Water Bodies in Pine Island Sound

WBID	Waterbody Segment	Pesticide Hazard Index
2082C	Gator Slough Canal	Present
2092F	Sanibel Island	Present

A.3.3.3 Caloosahatchee River

A.3.3.3.1 Marine Water Bodies in the Caloosahatchee River

WBID	Waterbody Segment	Pesticide Hazard Index
3240A	Tidal Caloosahatchee	Medium
3240B	Tidal Caloosahatchee	Medium
3240E	Yellow Fever Creek	Medium
3240I	Manuel Branch	Present

A.3.3.3.2 Fresh Water Bodies in Caloosahatchee River

WBID	Waterbody Segment	Pesticide Hazard Index
3240C	Tidal Caloosahatchee	Medium
3240F	Daughtrey Creek	Present
3240G	Trout Creek	Present
3240H	Whiskey Creek	Present
3240L	Gilchrest Drain–Powel	Medium
3240M	Stroud Creek	Present
3240N	Owl Creek	Present
3240Q	Popash Creek	Present
3240R	Wyoua Creek	Present
3240J	Billy Creek	Medium
3240K	Orange River	Medium
3236	Telegraph Swamp	Present
3236A	Telegraph Creek	Present
3235A	West Caloosahatchee	Present
3235B	West Caloosahatchee	Medium
3235C	Cypress Creek	Present
3235D	Jack's Branch	Medium
3235E	Bee Branch	Present
3235F	Pollywog Creek	Present
3235G	Cypress Branch	Present
3235H	Hickey Creek	Present
3235I	Bedman Creek	Medium
3235J	Dog Canal	Medium

A.3.3.3.2 Fresh Water Bodies in Caloosahatchee River (continued)

WBID	Waterbody Segment	Pesticide Hazard Index
3235K	Townsend Canal	Present
3235L	Townsend Canal	High
3235M	Goodno Canal	Medium
3235N	Roberts Canal	High
3237A	East Caloosahatchee	Medium
3237B	Long Hammock Creek	Medium
3237C	Lake Hicpochee	Present
3237D	Ninemile Canal	High

A.3.3.4 Estero Bay

A.3.3.4.1 Marine Water Bodies in Estero Bay

WBID	Waterbody Segment	Pesticide Hazard Index
3258A	Estero Bay Wetlands	Present
3258B1	Hendry Creek Marine	Present
3258C1	Estero Bay Drainage Marine	Medium
3258D1	Estero River Marine	Present
3258E1	Imperial River Marine	Medium
3258F	Oak Creek	Present
3258H1	Spring Creek Marine	Present
3258I	Estero Bay	Present

A.3.3.4.2 Fresh Water Bodies In Estero Bay

WBID	Waterbody Segment	Pesticide Hazard Index
3258B	Hendry Creek	Present
3258C	Estero Bay Drainage	Medium
3258D	Estero River	Present
3258E	Imperial River	Medium
3258G	Tenmile Canal	Medium
3258H	Spring Creek	Present
3258X	Lakes Park	Present

A.3.3.5 Wiggins Pass Estuary

A.3.3.5.1 Marine Water Bodies In Wiggins Pass Estuary

WBID	Waterbody Segment	Pesticide Hazard Index
3259A	Cocohatchee River	Present
3259Y	Vanderbilt Waterway	Present
3259Z	Little Hickory Bay	Present

A.3.3.5.2 Fresh Water Bodies in Wiggins Pass Estuary

WBID	Waterbody Segment	Pesticide Hazard Index
3259B	Cocohatchee River Canal	Very High
3259W	Lake Trafford	High
3259X	Drainage to Corkscrew	High

A.3.3.6 Naples Bay

A.3.3.6.1 Marine Water Bodies In Naples Bay

WBID	Waterbody Segment	Pesticide Hazard Index
3259G	Naples Bay	Present
3259Q	Center of Outer Clam Bay	High

A.3.3.6.2 Fresh Water Bodies in Naples Bay

WBID	Waterbody Segment	Pesticide Hazard Index
3259C	Gordon River	High
3259D	Gordon River Canal	Medium
3259F	Golden Gate Canal	Medium

A.3.3.7 Rookery Bay

A.3.3.7.1 Marine Water Bodies in Rookery Bay

WBID	Waterbody Segment	Pesticide Hazard Index
3259H	Henderson Creek Canal	Medium
3259J	Rookery Bay	Present

A.3.3.7.2 Fresh Water Bodies in Rookery Bay

WBID	Waterbody Segment	Pesticide Hazard Index
3259E	Henderson Creek Canal	Medium
3259K	Runoff to Gulf	Present
3259T	Lake Avalon	Medium

A.3.3.8 Ten Thousand Islands

A.3.3.8.1 Marine Water Bodies in Ten Thousand Islands

WBID	Waterbody Segment	Pesticide Hazard Index
3259M	Runoff to Gulf	Medium
3259N	Runoff to Gulf	Present
3259P	Ferguson River	N/A
3259R	Runoff to Gulf	N/A
3259S	Runoff to Gulf	N/A
3261A[ϕ]	Barron River Canal	Present

[ϕ] WBID is not on the EPA 303d list, however, it is included on the DEP water assessment report

A.3.3.8.2 Fresh Water Bodies in Ten Thousand Islands

WBID	Waterbody Segment	Pesticide Hazard Index
3259I	West Collier	Medium
3259L	Blackwater River	Medium
3259O	Faka Union Canal	N/A
3261B	Tamiami Canal	Present
3261C	Baron River Canal North	Very High
3261D	Tamiami Canal	Present

APPENDIX B
Percentage of Wetland Remaining For Each Estuary Watershed

B.1 Charlotte Harbor

The Charlotte Harbor watershed encompasses 211,902.4 acres in total land area. The current total area of wetlands within the Charlotte Harbor Estuary watershed, excluding the Peace and Myakka Rivers is 43,238.4 acres.

	Pre-development (Acres)	Pre-development (%)	Current (Acres)	Current (%)	Percent Remaining (%)
Wetlands	55,832.8	26.3%	43,238.4	20.4%	77.6%
Total Land Area	211,902.4	100.0%	211,902.4	100.0%	---

B.2 Pine Island Sound

The Pine Island Sound watershed encompasses 154,807.0 acres in total land area. The total area of wetlands within the Pine Island Sound Estuary watershed is 28,486.4 acres.

	Pre-development (Acres)	Pre-development (%)	Current (Acres)	Current (%)	Percent Remaining%
Wetlands	43,037.9	27.8%	28,486.4	18.4%	66.2%
Total Land Area	154,807.0	100.0%	154,807.0	100.0%	---

B.3 Caloosahatchee River

The Caloosahatchee River watershed encompasses 858,096.0 acres in total land area. The total area of wetlands within the Caloosahatchee River watershed is 148,398.7 acres.

	Pre-Development (Acres)	Pre-Development (%)	Current (Acres)	Current (%)	Percent Remaining %
Wetlands	340,479.2	39.7%	148,398.7	17.3%	43.6%
Total Land Area	858,299.0	100.0%	858,299.0	100.0%	---

B.4 Estero Bay

The Estero Bay watershed encompasses 201,021.0 acres. The current total area of wetlands within Estero Bay is 58,341.0 acres.

	Pre-Development (Acres)	Pre-Development (%)	Current (Acres)	Current (%)	Percent Remaining %
Wetlands	104,698.2	52.1%	58,341.0	29.0%	55.7%
Total Land Area	201,021.0	100.0%	201,021.0	100.0%	---

B.5 Wiggins Pass/Cocohatchee River

The Wiggins Pass/Cocohatchee River watershed encompasses 190,311.0 acres. The current total area of wetlands within the Wiggins Pass Estuary is 74,333.0 acres.

	Pre-Development (Acres)	Pre-Development (%)	Current (Acres)	Current (%)	Percent Remaining %
Wetlands	102,967.6	94.2%	74,333.0	68.0%	72.2%
Total Land Area	190,311.0	100.0%	190,311.0	100.0%	---

B.6 Naples Bay

The Naples Bay watershed encompasses 52,966.9 acres. The current total area of wetlands within Naples Bay is 15,049.0 acres.

	Pre-Development (Acres)	Pre-Development (%)	Current (Acres)	Current (%)	Percent Remaining %
Wetlands	32,732.0	61.8%	15,049.0	28.4%	46.0%
Total Land Area	52,966.9	100.0%	52,966.9	100.0%	---

B.7 Rookery Bay

The Rookery Bay watershed encompasses 52,619.5 acres. The current total area of wetlands within Rookery Bay is 36,834.0 acres.

	Pre-Development (Acres)	Pre-Development (%)	Current (Acres)	Current (%)	Percent Remaining %
Wetlands	39,858.1	74.7%	36,834.0	69.0%	92.4%
Total Land Area	53,344.0	100.0%	53,344.0	100.0%	---

B.8 Ten Thousand Islands

The Ten Thousand Islands watershed encompasses 1,131,153.6 acres. The current total area of wetlands within the Ten Thousand Islands is 888,442.8 acres.

	Pre-Development (Acres)	Pre-Development (%)	Current (Acres)	Current (%)	Percent Remaining %
Wetlands	935,403.6	82.1 %	884,442.8	77.6%	94.5%
Total Land Area	1,139,900.0	100.0%	1,139,900.0	100.0%	---

APPENDIX C
Calculating the Percentage of Conservation Lands In Each Estuary Watershed

The acreage of publicly held conservation lands was derived from the Florida Department of Environmental Protection (FDEP) list of conservation lands owned or managed by the state and federal governments (as in its 305(b) report) and the Florida's Natural Areas Inventory (FNAI), a non-profit organization administered by Florida State University, who also maintains a list of conservation lands.

C.1 Charlotte Harbor (Excluding the Peace and Myakka River Basins)

The list of conservation lands for Charlotte Harbor (excluding the Peace and Myakka River Basins) is as follows:

Conservation Lands Name	Acreage
Alligator Creek	146.1
Bocilla Preserve (Within Charlotte Harbor WBIDs)	167.8
Cayo Costa State Park (Within Charlotte Harbor WBIDs)	21.6
Charlotte Flatwoods	504.4
Charlotte Harbor Buffer Preserve	77.7
Charlotte Harbor Environmental Center	126.6
Charlotte Harbor Preserve State Park (Within Charlotte Harbor WBIDs)	2,3891.8
Fred C. Babcock-Cecil M. Webb Wildlife Management (Within Charlotte Harbor WBIDs)	21,656.4
Gasparilla Island State Park	126.3
Island Bay National Wildlife Refuge	29.0
Prairie Pines Preserve	142.1
Yucca Pens Preserve	194
Yucca Pens Unit (Within Charlotte Harbor WBIDs)	13,685.1
Total:	**60,768.9 Acres**

C.1.1 Charlotte Harbor (Including the Peace and Myakka River Basins)

The list of conservation lands for Charlotte Harbor (including the Peace and Myakka River basins) is as follows:

Conservation Lands Name	Acreage
Tenoroc Fish Management Area (Within Charlotte/Peace/Myakka WBIDs)	6,965.3
Saddle Creek County Park	734.0
Saddle Creek Sanctuary	524.5
Lake Hancock Circle B Bar Reserve	1,267.0
Upper Peace River Corridor	3,347.0
Lake Wales Ridge National Wildlife Refuge (Within Charlotte/Peace/Myakka WBIDs)	42.0
Lake Wales Ridge Wildlife and Environmental Area	38.8
Lakeland Highlands Scrub (Within Charlotte/Peace/Myakka WBIDs)	239.1
Clear Springs	1,439.0
IMC - Peace River Park	460.0
Hines Conservation Easement	1,647.3
Homeland	1,923.0
Peace River Hammock	42.0
Bowlegs Creek	920.0
South Peace River	365.0
Saddle Blanket Lakes Preserve (Within Charlotte/Peace/Myakka WBIDs)	334.7
Little Payne Creek	272.0
Paynes Creek Historic State Park	396.2
Headwaters at Duette Park (Within Charlotte/Peace/Myakka WBIDs)	292.9
Duette Park (Within Charlotte/Peace/Myakka WBIDs)	335.8
The Preserve	1,350.0
Lake Manatee Lower Watershed (Within Charlotte/Peace/Myakka WBIDs)	938.4
IMC Well Field Property Preserve (Within Charlotte/Peace/Myakka WBIDs)	73.0
Beker (Within Charlotte/Peace/Myakka WBIDs)	568.8
Highlands Hammock State Park (Within Charlotte/Peace/Myakka WBIDs)	9,252.7
Upper Myakka River Watershed	2,357.2
Lake Wales Ridge Wildlife and Environmental Area (Within Charlotte/Peace/Myakka WBIDs)	418.1
Myakka River State Park (Within Charlotte/Peace/Myakka WBIDs)	37,198.9

C.1.1 Charlotte Harbor (Including the Peace and Myakka River Basins) (continued)

Conservation Lands Name	Acreage
Pinelands Reserve (Within Charlotte/Peace/Myakka WBIDs)	1,713.3
Bright Hour Watershed (Within Charlotte/Peace/Myakka WBIDs)	32,241.3
Myakkahatchee Creek Conservation Easement	5,010.0
T. Mabry Carlton, Jr. Memorial Reserve	24,565.0
Rocky Ford Preserve (Within Charlotte/Peace/Myakka WBIDs)	650.2
Lewis Longino Preserve	3,802.0
Myakka Pines	21.5
Myakkahatchee Creek Environmental Park	198.7
Myakka River	3,913.5
Deer Prairie Creek	6,140.3
North River Road	217.5
RV Griffin Reserve (GDC)	5,931.6
Jelks Preserve	603.0
Lower Peace River Corridor	1,987.6
Warm Mineral Springs Creek	1.1
Myakka Forest Addition	3.1
Myakka State Forest (Within Charlotte/Peace/Myakka WBIDs)	4,887.0
Audubon-Pennington Nature Park	9.7
Prairie/Shell Creek	610.0
Tippecanoe Environmental Park	354.0
Ollie's Pond Park	41.3
Hathaway Park	39.0
Sunrise Park	40.5
Fred C. Babcock-Cecil M. Webb Wildlife Management (Within Charlotte/Peace/Myakka WBIDs)	48,900.0
Alligator Creek	146.1
Charlotte Harbor Environmental Center	126.6
Yucca Pens Unit (Within Charlotte/Peace/Myakka WBIDs)	13,685.1
Charlotte Flatwoods	504.4
Island Bay National Wildlife Refuge	29.0
Yucca Pens Preserve	194.0
Prairie Pines Preserve (Within Charlotte/Peace/Myakka WBIDs)	142.1
Gasparilla Island State Park	126.3
Bocilla Preserve (Within Charlotte/Peace/Myakka WBIDs)	167.8
Charlotte Harbor Buffer Preserve (Within Charlotte/Peace/Myakka WBIDs)	77.7
Cayo Costa State Park (Within Charlotte/Peace/Myakka WBIDs)	21.6
Charlotte Harbor Preserve State Park (Within Charlotte/Peace/Myakka WBIDS)	29,634.6
Total:	**260,479.2 Acres**

C.2 Pine Island Sound

The list of conservation lands for the Pine Island Sound watershed is as follows:

Conservation Lands Name	Acreage
Yucca Pens Unit (Within Pine Island WBIDs)	522.2
Bocilla Preserve (Within Pine Island WBIDs)	26.9
Randell Research Center	19.7
Pine Island Sound Aquatic Preserve	54,176.0
Matlacha Pass National Wildlife Refuge	563.9
Matlacha Pass Aquatic Preserve	12,511.0
Charlotte Harbor Buffer Preserve	332.1
Pine Island Flatwoods Preserve	596.6
Charlotte Harbor State Preserve State Park (Within Pine Island WBIDs)	12,187.1
St. James Creek Preserve	116.2
Galt Preserve	160.1
J.N. Ding Darling National Wildlife Refuge	6,222.8
Norberg Research Natural Area	105.2
Sanibel Captiva Conservation Foundation Lands	1,657.0
Cayo Costa State Park	2,611.9
Pine Island National Wildlife Refuge	467.3
Estero Bay Preserve State Park (Within Pine Island WBIDs)	329.7
Total:	**92,605.7 Acres**

C.3 Caloosahatchee River

The list of conservation lands for the Caloosahatchee River Watershed is as follows:

Conservation Lands Name	Acreage
Fisheating Creek Wildlife Management Area (Within Caloosahatchee River WBIDs)	20.4
Nicodemus Slough	2,026.4
Fred C. Babcock-Cecil M. Webb Wildlife Management Area (Within Caloosahatchee River WBIDs)	18,436.7
Moya Sanctuary	193.4
Popash Creek Preserve	319.4
Persimmon Ridge Preserve	36.1
Prairie Pines Wildfire Preserve	2,555.9
Caloosahatchee Basin Storage Reservoir	9,047.4
Caloosahatchee Regional Park	763.8
C.G. MacLeod Park	9.5
Hickey Creek Mitigation Park Wildlife and Environmental Area	763.8
Yellow Fever Creek Park	339.5

C.3 Caloosahatchee River (continued)

Conservation Lands Name	Acreage
Caloosahatchee National Wildlife Refuge	9.5
Alva Scrub Preserve	172.3
Hickey's Creek Mitigation Park	281.8
Caloosahatchee Creeks Park	1,270.7
Manatee Park	21.4
C-43 Basin Aquifer Storage Part 1	1,012.3
Powell Creek Park	77.0
Orange River Park	59.8
Hickey's Creek/Greenbriar Connector	65.8
Greenbriar Swamp Park	389.1
Caloosahatchee Ecoscape	161.4
Old Bridge Park	48.2
Hickory Swamp Park	67.2
Okaloacoochee Slough Wildlife Management Area	2,923.7
Okaloacoochee Slough State Forest (Within Caloosahatchee River WBID)	13,784.6
Canoe Slough Wildlife Management Area	7,486.7
Charlie's Marsh Park	20.9
4 Mile Cove Ecological Park	174.4
Deep Lagoon Park	249.6
Charlotte Harbor Preserve State Park (Within Caloosahatchee River WBIDs)	625.9
Six Mile Cypress Slough Preserve (Within Caloosahatchee River WBIDs)	2.8
Wild Turkey Strand Park (Within Caloosahatchee River WBIDs)	4.4
Estero Bay Park State Park	141.2
Total:	**63,563 Acres**

C.4 Estero Bay

The list of conservation lands for the Estero Bay Watershed is as follows:

Conservation Lands Name	Acreage
Calusa Nature Center and Planetarium	101.0
Six Mile Cypress II	64.0
Conservation 2020 Site #216	43.1
Flag Pond Preserve	75.7
Lakes Park	285.6
Eagle Lake Preserve	41.1
Six Mile Cypress Slough Preserve	2,036.4
Wild Turkey Strand Preserve	2,640.7
Estero Bay Buffer Preserve	238.2
San Carlos Bay – Bunche Beach Preserve	718.9
Imperial Marsh Preserve	236.0
Corkscrew Regional Mitigation Bank	643.5
Gator Hole Preserve	176.8
Matanzas Pass Preserve	56.6
Koreshan State Historic Site	194.7
Estero Bay Preserve State Park (Within Estero Bay WBIDs)	10,844.0
Mound Key Archaeological State Park	119.9
Lovers Key State Park	1,411.8
Big Hickory Island Preserve	263.5
Pine Lake Preserve	126.5
Corkscrew Regional Ecosystem Watershed (Within Estero Bay WBIDS)	11,697.7
Critical Flowway	24.4
Imperial River Preserve	40.5
Estero Bay Aquatic Preserve	11,300.0
Total:	**43,380.6 Acres**

C.5 Wiggins Pass/Cocohatchee River

The list of conservation lands for the Wiggins Pass/Cocohatchee River Watershed is as follows:

Conservation Lands Name	Acreage
Lake Trafford Impoundment	624.9
Corkscrew Swamp Sanctuary	10,895.0
Corkscrew Regional Ecosystem Watershed (Within Wiggins Pass WBIDs)	11,685.0
Barefoot Beach Preserve	342.0
Delnor-Wiggins Pass State Park	166.0
Total:	**23,712.9 Acres**

C.6 Naples Bay

The Conservation Lands in the Naples Bay watershed are as follows:

Conservation Lands Name	Acreage
Rookery Bay Aquatic Preserve and National Estuarine Research Reserve (Within Naples Bay WBIDs)	1,092.2
Conservancy of Southwest Florida Naples Nature Center	14.0
Naples Preserve	9.5
Total:	**1,115.7 Acres**

C.7 Rookery Bay

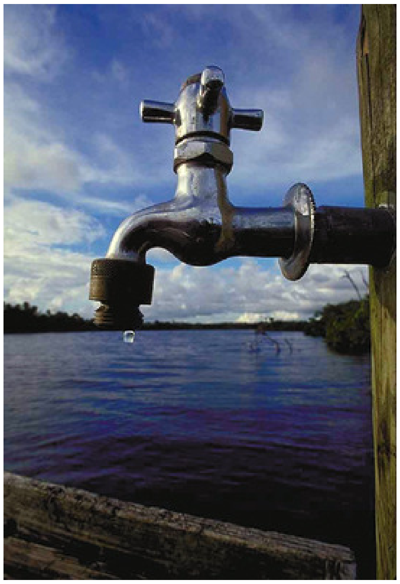
The list of conservation lands for the Rookery Bay Watershed is as follows:

Conservation Lands Name	Acreage
Rookery Bay Aquatic Preserve and National Estuarine Research Reserve (Within Rookery Bay WBIDs)	13,737.5
Total:	**13,737.5 Acres**

C.8 Ten Thousand Islands

The list of conservation lands for the Ten Thousand Islands Watershed is as follows:

Conservation Lands Name	Acreage
Okaloacoochee Slough State Forest (Within TTI WBIDs)	18,446.5
Rookery Bay Aquatic Preserve and National Estuarine Research Reserve (Within TTI WBIDs)	14,461.9
Ten Thousand Islands National Wildlife Refuge	19,650.0
Big Cypress National Park (Within TTI WBIDs)	612,599.2
Cape Romano – Ten Thousand Islands Aquatic Preserve	53,913
Collier-Seminole State Park	7,271.8
Fakahatchee Strand Preserve State Park	71,291.9
Florida Panther National Wildlife Refuge	26,529.0
Picayune Strand State Forest	69,974.9
Everglades National Park	14,687.2
Jentgen Parcel	78.9
Total:	**908,904.3 Acres**



APPENDIX D
Water Quality: Parameters for Impairment For Each Estuary Watershed

D.1 Water Quality Data for Chlorophyll a, Dissolved Oxygen, Fecal Coliform, Nutrient Load, Turbidity, Metals and Pesticides

The baseline the Conservancy utilizes to assess the water quality indicators are the water quality standards set by the state of Florida. To determine if a water body meets the water quality standard for each of the indicators, FDEP's and EPA's assessments of water quality under §303(d) of the Clean Water Act (CWA) were used.

D.1.1 Understanding Florida's §303(d) Lists

Under §303(d) of the Clean Water Act (CWA), states are required to identify water bodies that do not meet, or are projected to not meet, state water quality standards and report those water bodies to EPA.[55] The CWA requires EPA to review the lists submitted by the states and either approve or disapprove the lists.[56] If EPA disapproves the state list, then it is required to identify the water bodies that should be included on the states §303(d) list. Once a water body is added to the state's §303(d) List and approved by EPA, it may only be "delisted" if EPA approves the delisting.

Florida initially submitted a §303(d) list in 1998, which was approved by EPA. Subsequently, the state legislature enacted the Total Maximum Daily Load statute[57] in 2000 and the FDEP

[55] 33 U.S.C. §303(d)(1); see also Guidance for 2004 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d) and 305(b) of the Clean Water Act, Watershed Branch, Assessment and Watershed Protection Division, Office of Wetlands, Oceans, and Watersheds, Office of Water, United States Environmental Protection Agency, July 21, 2003.
[56] 33 U.S.C. §303(d)(2).
[57] 403.067 Fla. Stat.

promulgated the Impaired Waters Rule (IWR)[58] to implement that statute. Under the IWR, Florida creates two lists of water bodies. Water bodies on the Planning List and Water Bodies on the Verified List. Only water bodies on the Verified List are submitted by Florida to EPA as not meeting state water quality standards. To chronologically approach identifying the water bodies that do not meet state water quality standards, the state has divided the state water bodies into five (5) basins – Group 1 Basins, Group 2 Basins, Group 3 Basins, Group 4 Basins and Group 5 Basins and is sequentially reviewing each basin. Florida's 1998 §303(d) List is revised for each basin as FDEP submits its list of water bodies for each Group.

The state adopted its list for Group 1 Basins in 2003 and EPA approved in part and disapproved in part that list in June 11, 2003.[59] EPA's June 11, 2003 Decision Document accepted Florida's additions to the §303(d) list and it also accepted Florida's request to delist certain water bodies. The June 11, 2004 Decision Document also kept certain water bodies from the 1998 §303(d) List on the §303(d) List that Florida identified on the Planning List, but not the Verified List. As Florida did not request the EPA approve the delisting of those waters, the CWA requires that they remain on the §303(d) List. Finally, in the June 11, 2003 Decision Document, EPA disapproved part of FDEP's list based on the failure to list some water bodies on the §303(d) list because the causative pollutant has not been identified. In those instances, EPA added waters to Florida's §303(d) List. Where EPA approved FDEP's additions to or deletions from the 1998 §303(d) List, those additions or deletions are final. EPA's decision to keep water bodies on the 1998 §303(d) List that Florida did not list on the Verified List and did not request to be delisted are also final. The water bodies that EPA added to the list have not been finalized, as EPA has not responded to the comments received during the period for public comment.[60]

FDEP Adopted the List of Verified Waters for Group 2 Basins in May 2004. The period for the public to challenge the list ended June 30, 2004. As of July 14, 2004, the Adopted List of Verified Waters for Group 2 Basins had not been sent to EPA. FDEP issued the Draft List of Verified Waters for Group 3 Basins in June 2004. Draft list was subject to public comment until August 9, 2004. After that date, it was revised and then open for additional public comment until the end of October 2004. Adopted Lists of [Group 3 Basin] Waters to be Proposed for Delisting from 1998 303(d) were adopted in June of 2005.[61]

Five of the estuaries reviewed in this report card are in Group 1 Basins – Estero Bay, Wiggins Pass/Cocohatchee, Naples Bay, Rookery Bay, and Ten Thousand Islands. Pine Island Sound and the lower portion of Charlotte Harbor are in Group 2 Basins. The upper reaches of Charlotte Harbor (the Peace and Myakka Rivers) and the Caloosahatchee Estuary are in Group 3 Basins.

Since the process of finalizing Florida's §303(d) list takes many months and often more than a year, relying only on the finalized listed will not give an accurate assessment of the water bodies that do not meet state water quality standards. To capture the best possible assessment of the

[58] (62-303 F.A.C.)
[59] EPA Decision Document Regarding Department of Environmental Protection's §303(d) List Amendment Submitted on October 1, 2002 and Subsequently Amended on May 12, 2003, EPA Region 4 Water Management Division, June 11, 2003.
[60] Per July 14, 2004 telephone call with Jennifer Eason, EPA Region 4 TMDL coordinator for Florida. Ms. Eason stated that she expected the EPA additions to Florida's §303(d) List to be finalized shortly.
[61] http://www.dep.state.fl.us/water/tmdl/adopted_gp3.htm

water quality in the estuaries, EPA's approved and proposed §303(d) List, as well as FDEP's Adopted and Draft Verified Lists were used. As such, to identify the water bodies in Group 1 Basins that do not meeting water quality standards the Conservancy used the Florida's §303(d) List in EPA's June 11, 2003 Decision Document. The Conservancy used both the 1998 §303(d) List and FDEP's Adopted List of Verified Waters to identify the water bodies in Group 2 Basins that did not meet water quality standards. Finally for the Group 3, Basin waters, the Conservancy used the 1998 §303(d) List and FDEP's draft List of Verified Waters.

D.1.2 Limitations of the §303(d) Lists

Both EPA and Florida require some data or information before a water body is listed as not meeting water quality standards. In several instances, however, not being listed on the §303(d) list does not mean EPA and/or FDEP have determined that the water body is not impaired. It could mean that no data exists to evaluate the water body, or insufficient data exists to make such a determination. The FDEP's reports for each of the basin groups found at <http://www.dep.state.fl.us/water/tmdl/index.htm> indicate whether the WBID is not impaired or whether there was insufficient data or no data for the WBID.

In addition, the WBID boundaries for the water basins and watersheds of Wiggins Pass/Cocohatchee, Naples Bay, Rookery Bay, and the Ten Thousand Island estuaries have significant inaccuracies. The Conservancy modified the FDEP watershed boundaries utilizing the existing WBIDs to create more accurate watershed boundaries in these estuary watersheds for the purposes of this report. However, to achieve an even greater accuracy, the WBID boundaries themselves need to be redelineated and new WBIDs created to truly portray the hydrology of these areas. The Conservancy is working with the regulatory agencies and other entities to do this and will incorporate the new boundaries in future report cards when they are finalized.

D.2 The Data for the Water Quality Parameters

Following is the water quality data for each of the estuaries. The data for each estuary is divided into marine waters and fresh waters. To determine the number of water quality parameters that are considered impaired for a particular water body, the number of parameters listed on Florida's List of Verified Waters (either draft or adopted) and the number of parameters on the EPA approved 2003 303(d) list were counted. If the same parameter is listed on both lists, it is only counted once. As added information, Florida's Planning Lists (either draft or verified) were included as well.

D.2.1 Charlotte Harbor

D.2.1.1 Marine Water Bodies in Charlotte Harbor

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern:[62]
1991A	Myakka River	N/A[63]	Nutrients (Chlorophyll *a*)	N/A	1
1991B	Myakka River	N/A	N/A	N/A	0
1991C	Myakka River	Mercury (in Fish Tissue)	DO	Mercury (in Fish Tissue)	3
			Nutrients (hist. Chlorophyll *a*)	Nutrients	
2026	Myakka-hatchee Creek	Nutrients (Chlorophyll *a*)	N/A	N/A	1
2048A	Sam Knight Creek	N/A	DO	N/A	1
2055	Tippecanoe Bay	N/A	Nutrients (Chlorophyll *a*)	N/A	1
2041A	Shell Creek Below Hendrickson Dam	N/A	Iron	N/A	2
			Nutrients (Chlorophyll *a*)		
2046	Little Alligator Creek	N/A	N/A	N/A	0

[62] The number in this column indicates the number of parameters that have been identified as indications of impairment for the water body by Florida or EPA. It includes parameters on the draft Planning List, the draft Verified List and EPA's 2003 303(d) List. If a parameter is on the EPA 2003 303(d) List and either Florida's draft Planning or Verified List, it is only counted one time.
[63] N/A means that there are no water quality parameters for the WBID on the particular list.

D.2.1.1 Marine Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
2054	Myrtle Slough	BOD Coliform (Fecal) Coliform (Total) DO Nutrients (Chlorophyll *a*)	N/A	BOD Coliform (Fecal) DO Nutrients (Chlorophyll *a*) Coliform (Total)	5
2056A	Peace R Lower Estuary	Mercury (in Fish Tissue)	N/A	DO Mercury (in Fish Tissue) Nutrients	3
2056B	Peace R Mid Estuary	Mercury (in Fish Tissue) Nutrients (Chlorophyll *a*)	N/A	DO Mercury (in Fish Tissue) Nutrients (Chlorophyll *a*)	3
2056C	Peace R Upper Estuary	N/A	DO Iron Nutrients (Chlorophyll *a*) and (hist. Chlorophyll *a*)	N/A	3
2056D	Alligator Bay	N/A	N/A	N/A	0
2060	Myakka Cutoff	N/A	N/A	N/A	0
2061	Dir Runoff to Stream	N/A	N/A	N/A	0

D.2.1.1 Marine Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
2064	Direct Runoff to Bay	N/A	N/A	N/A	0
2069	Punta Gorda Isles CA	N/A	N/A	N/A	0
2070	Punta Gorda Isles 2 CA	N/A	N/A	N/A	0
2065A	Charlotte Harbor Upper	Nutrients	Iron	N/A	3
		Chlorophyll *a*	DO		
			Mercury		
2065B	Charlotte Harbor Mid	Nutrients/ Chlorophyll *a*	Mercury	N/A	1
2065C	Charlotte Harbor Mid	N/A	Bacteria (in shellfish)	N/A	1
2065D	Charlotte Harbor Lower	N/A	N/A	N/A	0
2073	Mangrove Point Canal	N/A	DO	N/A	1
2092B	Garparilla Island	N/A	N/A	N/A	0
3240P	North Urban Cape Coral	N/A	N/A	N/A	0

D.2.1.2 Fresh Water Bodies in Charlotte Harbor

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1867	Unnamed Creek	N/A	N/A	N/A	0
1869A	Wingate (Johnson) Creek	N/A	N/A	N/A	0
1869B	Myakka River (Upper)	Coliform (Fecal) DO Nutrients (Chlorophyll *a*)	N/A	N/A	0
1869C	Myakka River (Upper)	N/A	N/A	N/A	0
1877A	Myakka River (Upper)	N/A	Coliform (Fecal) Coliform (Total) DO	N/A	3
1877B	Myakka River (Upper)	N/A	N/A	N/A	0
1877C	Myakka River North Fork	N/A	N/A	N/A	0
1882	Johnson Creek	N/A	N/A	N/A	0
1894	Young Creek	N/A	N/A	N/A	0
1902	Taylor Creek	N/A	N/A	N/A	0
1908	Coker Creek	N/A	N/A	N/A	0
1917	Long Creek	N/A	N/A	N/A	0
1918	Unnamed Ditch	N/A	N/A	N/A	0
1919	Sand Slough	N/A	N/A	N/A	0
1920	Owen Branch	N/A	N/A	N/A	0
1922	Boggy Creek	N/A	N/A	N/A	0

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1927	Oglebay Creek	N/A	N/A	N/A	0
1933	Owen Creek	N/A	Coliform (Fecal)	Coliforms DO Nutrients Total Suspended Solids (TSS) and Turbidity	4
1935	Maple Creek	N/A	N/A	N/A	0
1940	Howard Creek	Coliform (Fecal)	DO	N/A	1
1942	Tatum Sawgrass Slough	N/A	N/A	N/A	0
1943	Indian Creek	N/A	N/A	N/A	0
1946	Unn Drain	N/A	N/A	N/A	0
1949	Unnamed Creek	N/A	N/A	N/A	0
1952	Sand Branch	N/A	N/A	N/A	0
1955	Wildcat Slough	N/A	Coliform (Fecal) DO	N/A	2
1958	Mud Lake Slough	Coliform (Fecal) Coliform (Total) DO		Coliforms (fecal) DO Nutrients Coliform (total) Total Suspended Solids (TSS) And Turbidity	5

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1960	Unn Ditch	N/A	N/A	N/A	0
1967	Bud Slough	N/A	N/A	N/A	0
1970	Sardis Branch	N/A	N/A	N/A	0
1972	Myakka River	Coliform (Total)	DO	N/A	1
1973	Mossy Island Slough	N/A	N/A	N/A	0
1976	Big Slough Canal	N/A	DO	Coliforms (total)	4
				Coliforms (fecal)	
				DO	
				Nutrients	
1978	Deer Prarie Creek	BOD	N/A	BOD	3
		Coliform (Fecal)		DO	
		DO		Nutrients	
1981	Lower Lake Myakka	N/A	N/A	N/A	0
1981A	Lower Lake Myakka Dr	N/A	N/A	N/A	0
1981B	Myakka River	Biology	DO	Coliforms (total)	7
				Coliforms (Fecal)	
		Mercury (in water)	Iron	DO	
			Nutrients (Chlorophyll *a*)	Nutrients	
				Total Suspended Solids (TSS) and Turbidity	
1981C	Upper Lake Myakka	Biology	N/A	Biology	1
1981D	Upper Lake Myakka Dr	N/A	N/A	N/A	0

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1988	Fish Camp Drain	Conductance	N/A	N/A	1
1989	Unnamed Ditch System	N/A	N/A	N/A	0
1990	Shiney Town Slough	N/A	N/A	N/A	0
1991D	Myakka River	Conductance	DO Nutrients (hist. Chlorophyll *a*)	N/A	2
1998	Unnamed Creek	N/A	N/A	N/A	0
1999	Unn Drain	N/A	N/A	N/A	0
2000	Unnamed Canal System	N/A	N/A	N/A	0
2004	Unn Ditch	N/A	N/A	N/A	0
2005	Unnamed Ditch	N/A	N/A	N/A	0
2006	Unnamed Creek	N/A	N/A	N/A	0
2007	Unnamed Creek	N/A	N/A	N/A	0
2010	Unnamed Ditch System	N/A	N/A	N/A	0
2011	Unnamed Creek	N/A	N/A	N/A	0
2012	Unnamed Ditch System	N/A	N/A	N/A	0
2013	Unnamed Ditch System	N/A	N/A	N/A	0-
2014	Deer Prairie Slough	DO Nutrients (Chlorophyll *a*)	N/A	BOD DO Nutrients	3
2019	Unnamed Creek	N/A	N/A	N/A	0

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
2022	Unnamed Creek	N/A	N/A	N/A	0
2023	Unnamed Canal System	N/A	N/A	N/A	0
2024	Unnamed Ditch	N/A	N/A	N/A	0
2025	Unnamed Canal System	N/A	N/A	N/A	0
2026A	Warm Mineral Spring	N/A	N/A	N/A	0
2027	Unnamed Canal System	N/A	N/A	N/A	0
2029	Unnamed Creek	N/A	N/A	N/A	0
2031	Unnamed Creek	N/A	N/A	N/A	0
2032	Unnamed Ditch System	N/A	N/A	N/A	0
2034	Unnamed Creek	N/A	N/A	N/A	0
2036	Unnamed Creek	N/A	N/A	N/A	0
2037	Unnamed Creek	Conductance	N/A	N/A	0
2038	Unnamed Creek	Nutrients (Chlorophyll *a*)	N/A	Nutrients	1
2043	Unnamed Canal	N/A	N/A	N/A	0
2045	Rock Creek	N/A	N/A	N/A	0
2048B	Huckaby Creek	N/A	N/A	N/A	0
2053	Trailer Park Canal	N/A	N/A	N/A	0
1488	Lake Fannie Outlet	N/A	Nutrients (Chlorophyll *a*)	N/A	1

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
14881	Swan Lake	N/A	N/A	N/A	0
14882	Lake Fannie	N/A	Nutrients (TSI)	N/A	1
1488A	Lake Smart	pH	Nutrients (TSI)	DO Nutrients Unionized Ammonia	4
1488B	Lake Rochelle	pH	Nutrients (TSI)	N/A	1
1488C	Lake Haines	pH	Nutrients (TSI)	Coliforms DO Nutrients	3
1488C1	Gum Lake	N/A	N/A	N/A	0
1488D	Lake Alfred	Nutrients (TSI)	N/A	DO Nutrients	2
1488D1	Grass Lake	N/A	N/A	N/A	0
1488D2	Lake Griffin	N/A	N/A	N/A	0
1488D3	Lake Camp	N/A	N/A	N/A	0
1488E	C of Lake IDA in Winte	N/A	N/A	N/A	0
1488F	Center of Citrus Lake	N/A	N/A	N/A	0
1488G	Silver Lake in Polk Co	N/A	N/A	N/A	0
1488H	C of Gem Lake in Winte	N/A	N/A	N/A	0
1488P	Lake Martha	N/A	N/A	N/A	0
1488Q	Lake Maude	N/A	Nutrients (TSI)	N/A	1
1488R	Lake Idyl	N/A	N/A	N/A	0
1488S	Lake Buckeye	N/A	Nutrients (TSI)	N/A	1
1488T	Lake Cummings	N/A	N/A	N/A	0
1488U	Lake Connie	N/A	Nutrients (TSI)	N/A	1
1488V	Lake Swoope	N/A	N/A	N/A	0

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1488W	Lake Lucerne	N/A	N/A	N/A	0
1488W1	Terrie Pond	N/A	N/A	N/A	0
1488X	Lake George	N/A	N/A	N/A	0
1488Y	Lake Pansy	N/A	Nutrients (TSI)	N/A	1
1488Z	Lake Echo	N/A	N/A	N/A	0
1492	Lake Tracy Outlet	N/A	N/A	N/A	0
14921	Lake Tracy	N/A	N/A	N/A	0
14922	Lake Joe	N/A	N/A	N/A	0
1497	Saddle Creek	Biology	DO	Fecal Coliform	3
1497A	Crystal Lake	Nutrients (TSI) pH	N/A	DO Nutrients Unionized Ammonia	3
1497B	Lake Parker	Copper Lead pH Turbidity	Nutrients (TSI)	Nutrients	1
1497C	Lake Tenoroc	DO	N/A	DO	1
1497D	Lake Gibson	Copper pH	Lead Nutrients (TSI)	N/A	2
497D1	Lake Cargo	pH	Nutrients (TSI)	N/A	1
1497E	Lake Bonny	Copper	Lead Nutrients (TSI)	Nutrients	2
1500	Channelized Stream	N/A	N/A	N/A	0
15001	Little Lake Hamilton	N/A	N/A	N/A	0
15002	Middle Lake Hamilton	N/A	N/A	N/A	0
15003	Lake Confusion	N/A	N/A	N/A	0
15004	Lake Hester	N/A	N/A	N/A	0
15005	Lake Brown	N/A	N/A	N/A	0

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1501	Lake Lena	pH	Nutrients (TSI)	Nutrients	1
1501A	Lake Lena Run	Biology Coliform (Fecal) Coliform (Total) DO	N/A	Coliforms DO Nutrients Total Suspended Solids (TSS) and Turbidity	4
1501B	Lake Arianna North	Nutrients (TSI) pH	N/A	Nutrients	1
1501C	Lake Aretta	N/A	N/A	N/A	0
1501D	Dinner Lake	N/A	N/A	N/A	0
1501E	Lake Arianna S Drain	N/A	N/A	N/A	0
1501F	Lake Arianna N Drain	N/A	N/A	N/A	0
1501V	Spirit Lake	N/A	Nutrients (TSI)	N/A	1
1501W	Sears Lake	DO pH	N/A	N/A	0
1501X	Lake Thomas	N/A	N/A	N/A	0
1501Z	Lake Whistler	N/A	N/A	N/A	0
1504	Lake Hamilton Outlet	N/A	N/A	N/A	0
15041	Lake Hamilton	N/A	N/A	N/A	0
1504A	Lake Henry	pH	N/A	N/A	0
1510	Lake Eva Outlet	N/A	N/A	N/A	0
15101	Lake Eva	N/A	N/A	N/A	0
15102	Lake Butler	N/A	N/A	N/A	0

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1521	Lake Lulu	Conductance DO	Nutrients (TSI) Unionized Ammonia	Nutrients DO	3
1521A	Lake Winterset	N/A	Nutrients (TSI)	N/A	1
1521A1	River Lake	N/A	N/A	N/A	0
1521B	Lake Eloise	pH	Nutrients (TSI)	Nutrients	1
1521C	Lake Lulu Run	N/A	N/A	N/A	0-
1521C1	Lake Lulu Outlet	N/A	N/A	N/A	0
1521D	Lake Shipp	pH	Nutrients (TSI)	DO Nutrients	2
1521E	Lake May	N/A	Nutrients (TSI)	Nutrients	1
1521F	Lake Howard	pH	Nutrients (TSI)	Nutrients	1
1521G	Lake Mirror	N/A	Nutrients (TSI)	Nutrients	1
1521G1	Spring Lake	N/A	N/A	N/A	0
1521H	Lake Cannon	N/A	Nutrients (TSI)	Coliforms DO Nutrients	3
1521I	Lake Hartridge	N/A	Nutrients (TSI)	N/A	1
1521J	Lake Idylwild	N/A	Nutrients (TSI)	N/A	1
1521K	Lake Jessie	pH	Nutrients (TSI)	Nutrients	1
1521L	Lake Marianna	Nutrients (TSI) pH	N/A	N/A	0
1521N	Ina Lake	N/A	N/A	N/A	0
1521O	Lake Roy	N/A	N/A	N/A	0
1521P	Deer Lake	N/A	N/A	N/A	0

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1521Q	Lake Blue	Nutrients (TSI)	N/A	N/A	0
		pH			
1521R	Lake Blue Drain	N/A	N/A	N/A	0
1539	Peace Creek Dr Canal	BOD	Coliform (Fecal)	BOD	6
		Biology		Coliforms	
		Mercury (in Fish Tissue)		DO	
				Mercury (in Fish Tissue)	
				Nutrients	
			DO	Total Suspended Solids (TSS) and Turbidity	
1539A	Lake Star – Open Wate	N/A	N/A	N/A	0
1539B	Mountain Lake	N/A	N/A	N/A	0
1539C	Lake Annie	N/A	N/A	N/A	0
1539D	Lake Otis	N/A	N/A	N/A	0
1539E	C of Lake Florence In	N/A	N/A	N/A	0
1539F	Lake Lee	N/A	N/A	N/A	0
1539 P	Lake Dexter	N/A	N/A	N/A	0
1539Q	Lake Ned	Nutrients (TSI)	N/A	N/A	1
1539R	Lake Daisy	Nutrients (TSI)	N/A	N/A	2
		pH			
1539S	Lake Ring	N/A	N/A	N/A	0
1539X	Lake Miriam	N/A	N/A	N/A	0
1539Y	Link Lake	N/A	N/A	N/A	0
1539Y1	Link Lake Outlet	N/A	N/A	N/A	0

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1539Z	Lake Menzie	N/A	N/A	N/A	0
1545	Unnamed Drain	N/A	N/A	N/A	0
1548	Lake Elbert	Nutrients (TSI)	N/A	N/A	1
1548A	Lake Elbert Outlet	N/A	N/A	N/A	0
1549A	Banana Lake Canal	pH	DO Unionized Ammonia Nutrients (Chlorophyll *a*)	Coliforms DO Nutrients Total Suspended Solids (TSS) and Turbidity	5
1549B	Banana Lake	pH Turbidity	DO Nutrients	DO Fluoride Nutrients Unionized Ammonia	4
1549B1	Lake Stahl	DO	N/A	N/A	0
1549C	Lake Bentley	pH	Nutrients (TSI)	N/A	1
1549X	Hollingsworth Lake	pH Turbidity	Coliform (Fecal) Copper Lead Nutrients (TSI) Unionized Ammonia	N/A	5

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1580	Wahneta Farms Drain Ca	Coliforms (Total)		Coliforms	4
		DO		DO	
				Nutrients	
				Turbidity	
1582A	Mined Area	N/A	N/A	N/A	0
1582B	Mined Area	N/A	N/A	N/A	0
1586	Mined Area	N/A	N/A	N/A	0
1588	Lake Mcleod Outlet	N/A	N/A	N/A	0
1588A	Lake Mcleod	N/A	N/A	N/A	0
1589	Lake Mable	N/A	N/A	N/A	0
1589A	Lake Mable Outlet	N/A	N/A	N/A	0
1590	Lake Myrtle Outlet	N/A	N/A	N/A	0
1590A	Lake Ruby-Bess	Iron	N/A	N/A	0
1590B	Lake Myrtle	N/A	N/A	N/A	0
1590C	Rattlesnake Lake	N/A	N/A	N/A	0
1590D	Lake Hart	N/A	N/A	N/A	0
1590E	Reeves Lake	N/A	N/A	N/A	0
1590Z	Lake Ruby-Bess Outlet	N/A	N/A	N/A	0
1598	Gaskin Branch	N/A	N/A	N/A	0
1602	Unnamed Ditches	N/A	N/A	N/A	0
1608	Unnamed Slough	N/A	N/A	N/A	0
1611	Mine Area	N/A	N/A	N/A	0
1613	Peace Cr Trib Canal	Biology	DO	Coliforms	4
		Coliform (Total)	Nutrients (Chlorophyll *a*) and (hist. Chlorophyll *a*)	DO	
				Nutrients	
				Turbidity	

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1613A	Lake Blue South	Iron	N/A	N/A	0
1613B	Lake Gordon – Open Wat	N/A	N/A	N/A	0
1613C	Lake Gordon (SW) - OPE	N/A	N/A	N/A	0
1613D	Lake Parker – Open Wat	N/A	N/A	N/A	0
1613E	Lake Belle	N/A	N/A	N/A	0
1616	Mined Area	N/A	N/A	N/A	0
1617	Lake Effie Outlet	Nutrients (TSI)	N/A	Nutrients	1
1617A	Lake Effie	N/A	N/A	N/A	0
1622	Lake Garfield	N/A	Nutrients (TSI)	N/A	1
1622A	Boggy Branch	N/A	N/A	N/A	0
1622B	Lake Garfield Outlet	N/A	N/A	N/A	0
1622C	Lake Garfield Outlet	N/A	N/A	N/A	0
1623A	Peace R AB Thorton BR	Conductance	DO	N/A	1
1623B	Peace R AB Horse CK	Conductance DO	N/A	N/A	0
1623C	Peace R AB Joshua CK	Biology Mercury (in Fish Tissue)	N/A	DO Mercury (in Fish Tissue) Nutrients Total Suspended Solids (Tss) and Turbidity	4

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1623D	Peace R AB Charlie CK	Mercury (in Fish Tissue)	N/A	Coliforms Mercury (in Fish Tissue) Nutrients Total Suspended Solids (TSS) and Turbidity	4
1623E	Peace R AB Oak CK	Mercury (in Fish Tissue) Turbidity	N/A	Mercury (in Fish Tissue) Nutrients Total Suspended Solids (TSS) and Turbidity	3
1623F	Peace R AB Troublesome	N/A	N/A	N/A	0
1623G	Peace R AB LTL Charlie	N/A	N/A	N/A	0
1623H	Peace R AB Payne CK	Coliform (Fecal) Mercury (in Fish Tissue)	N/A	Coliforms DO Mercury (in Fish Tissue) Nutrients	3
1623I	Peace R AB Whidden CK	N/A	N/A	N/A	0

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1623J	Peace R AB Bowlegs CK	BOD	Coliform-Fecal	Coliforms	6
		Mercury (in Fish Tissue) Mercury (in Water)	DO	DO	
			Nutrients (hist. Chlorophyll *a*) And (Chlorophyll *a*)	Mercury (in Fish Tissue)	
				Nutrients	
				Total Suspended Solids (TSS) and Turbidity	
				BOD	
1623K	Saddle CK AB L Hancock	Coliform (Fecal)	DO	Coliforms	4
		pH	Nutrients (Chlorophyll *a*)	DO	
		Turbidity		Nutrients	
				Total Suspended Solids (TSS) and Turbidity	
1623L	Lake Hancock	pH	DO	DO	3
		Turbidity	Nutrients (TSI)	Nutrients	
				Unionized Ammonia	
1623M	Eagle Lake	N/A	Nutrients (TSI)	N/A	1
1623M1	Grassy Lake	DO	N/A	N/A	0
1623M2	Millsite Lake	N/A	N/A	N/A	0
1623N	Eagle Lake Outlet	N/A	N/A	N/A	0
1623S	Lake Hancock Outlet	N/A	N/A	N/A	0

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1623X	Reclaimed Mine Cut Lake	N/A	Nutrients (TSI)	N/A	1
1626	West Wales Drainage CA	Biology pH	DO	DO Nutrients Turbidity	3
1629	Brush Lake Outlet	N/A	N/A	N/A	0
1629A	Brush Lake	N/A	N/A	N/A	0
1631	Bear Branch	N/A	N/A	N/A	0
1634	Mule Island Ditches	N/A	N/A	N/A	0
1638	Mined Area	N/A	N/A	N/A	0
1644A	Mined Area	N/A	N/A	N/A	0
1644B	Mined Area	N/A	N/A	N/A	0
1646	Mined Area	N/A	N/A	N/A	0
1647	Surveyors Lake	pH	N/A	N/A	1
1647A	Gadua Lake – Open Wate	N/A	N/A	N/A	0
1647B	Surveyors Lake Drain	N/A	N/A	N/A	0
1672	Mined Area	N/A	N/A	N/A	0
1677A	Bowlegs Creek	pH	DO	N/A	2
1677B	Bowlegs CK AB Boggy CA	N/A	N/A	N/A	0
1677C	Lake Buffum	pH	N/A	N/A	0
1677C1	Lake Lizzie	N/A	N/A	N/A	0
1679	Sink Branch	N/A	N/A	N/A	0
1699	McCullough Creek	N/A	N/A	N/A	0
1718	Mined Area	N/A	N/A	N/A	0
1720	Mined Area	N/A	N/A	N/A	0

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1722	Boggy Branch	N/A	N/A	N/A	0
1727	Mined Area	N/A	N/A	N/A	0
1728	Mined Area	N/A	N/A	N/A	0
1734	Mined Area	N/A	N/A	N/A	0
1735	Unnamed Drain	N/A	N/A	N/A	0
1737	Mined Area	N/A	N/A	N/A	0
1740	Mined Area	N/A	N/A	N/A	0
1741	Mined Area	N/A	N/A	N/A	0
1744	Mined Area	N/A	N/A	N/A	0
1745	Mined Area	N/A	N/A	N/A	0
1746	Mined Area	N/A	N/A	N/A	0
1748	Mill Creek	N/A	N/A	N/A	0
1750	Payne Creek	N/A	N/A	N/A	0
1751	Whidden Creek	N/A	N/A	DO	3
				Nutrients	
				Total Suspended Solids (TSS) and Turbidity	
1752	Mined Area	N/A	N/A	N/A	0
1757A	Payne Creek	N/A	N/A	DO	2
				Nutrients	
1757B	Payne Creek	Coliform (Total)	N/A	Coliforms	2
				Nutrients	
1759	Unnamed Run	N/A	N/A	N/A	0
1763A	Charlie CK AB Peace R	N/A	N/A	N/A	0
1763B	Charlie CK AB Oak CK	N/A	N/A	N/A	0
1763C	Charlie Creek	N/A	N/A	N/A	0
1763D	Charlie CK AB Old Town	N/A	N/A	N/A	0

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1764	Unnamed Run	N/A	N/A	N/A	0
1765	Mined Area	N/A	N/A	N/A	0
1766	Mined Area	N/A	N/A	N/A	0-
1767	Unnamed Run	N/A	N/A	N/A	0
1769	Payne Creek	N/A	N/A	N/A	0
1772	Unnamed Run	N/A	N/A	N/A	0
1773	Sandy Gully	N/A	N/A	N/A	0
1774	Little Charlie Creek	Coliform (Fecal)	N/A	Coliforms	2
		Coliform (Total)		Nutrients	
		Nutrients (Chlorophyll *a*)			
1775	Unnamed Run	N/A	N/A	N/A	0
1776	Old Town Creek	N/A	N/A	N/A	0
1776A	Chilton Lake – Open Wa	N/A	Nutrients (TSI)	N/A	1
1777	Parker Branch	N/A	N/A	N/A	0
1781	Gilshey Branch	N/A	N/A	N/A	0
1786	Mined Area	N/A	N/A	N/A	0
1787A	Horse CK AB Peace R	Coliform (Fecal)	N/A	BOD	4
				Coliforms	
				DO	
				Nutrients	
1787B	Horse CK AB Bushy CK	pH	N/A	N/A	0
1791	Mined Area	N/A	N/A	N/A	0
1794	Hickey Branch	N/A	N/A	N/A	0

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1795	Bowling Green Run	N/A	N/A	N/A	0
1796	Payne Creek	N/A	N/A	N/A	0
1799	Unnamed Run	N/A	N/A	N/A	0
1801	Mined Area	N/A	N/A	N/A	0
1802	Gum Swamp Branch	N/A	N/A	N/A	0
1805	Unnamed Run	N/A	N/A	N/A	0
1808	Unnamed Ditches	N/A	N/A	N/A	0
1814	Hog Branch	N/A	N/A	N/A	0
1815	Unnamed Ditch	N/A	N/A	N/A	0
1817	Coons Bay Branch	N/A	N/A	N/A	0
1818	Plunder Branch	N/A	N/A	N/A	0
1820	Doe Branch	N/A	N/A	N/A	0
1821	Shirttail Branch	N/A	N/A	N/A	0
1822	Lake Dale Branch	N/A	N/A	N/A	0
1824	Mitchell Hammock Drain	N/A	N/A	N/A	0
1826	Brushy Creek	N/A	N/A	N/A	0
1827	Bee Branch	N/A	N/A	N/A	0
1835	Max Branch	N/A	N/A	N/A	0
1836	West Fork Horse Creek	N/A	N/A	N/A	0
1837	Buckhorn Creek	N/A	N/A	N/A	0
1838	Lettis Creek	N/A	N/A	N/A	0

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1839	Troublesome Creek	N/A	N/A	N/A	0
1844	Thomson Branch	Coliform (Fecal) Coliform (Total) Nutrients (Chlorophyll *a*)	N/A	Coliforms Nutrients	2
1845	Hickory Branch	N/A	N/A	N/A	0
1851	Hog Lake Outlet	N/A	N/A	N/A	0
18511	Hog Lake	N/A	N/A	N/A	0
1852	Unnamed Branch	N/A	N/A	N/A	0
1854	Unnamed Branch	N/A	N/A	N/A	0
1857	Little Charlie Bowlegs	N/A	N/A	N/A	0
1857A	Lake Schumacher - Open	pH	N/A	N/A	0
1863	Hickory Creek	N/A	N/A	N/A	0
1866	Hickory Creek	N/A	N/A	N/A	0
1870	Fivemile Gully	N/A	N/A	N/A	0
1871	Alligator Branch	Coliform (Fecal) Coliform (Total)	DO	Coliforms DO Nutrients	3
1873	Oak Creek	N/A	N/A	N/A	0
1878	Mineral Branch	N/A	N/A	N/A	0

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1879	Jackson Branch	N/A	N/A	N/A	0
1884	Unnamed Stream	N/A	N/A	N/A	0
1886	Indian Mound Drain	N/A	N/A	N/A	0
1897	Oak Creek	DO	N/A	N/A	0
1904	Elder Creek	N/A	N/A	N/A	0
1905	Unnamed Run	N/A	N/A	N/A	0
1907	Punch Gully	N/A	N/A	N/A	0
1915	Cypress Creek	N/A	N/A	N/A	0
1921	Limestone Creek	N/A	DO	Coliforms DO Nutrients Total Suspended Solids (TSS) and Turbidity	4
1928	Fish Branch	N/A	N/A	N/A	0
1934	Osborn Branch	N/A	N/A	N/A	0
1939	Brandy Branch	N/A	N/A	Nutrients	1
1939A	C Will Outfall at Conv	DO Nutrients (Chlorophyll *a*)	N/A	DO Nutrients	2
1944	Buzzard Roost Branch	N/A	N/A	N/A	0
1945	Sand Gully	N/A	N/A	N/A	0
1948	Bear Branch	DO Nutrients (Chlorophyll *a*)	N/A	DO Nutrients	2

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1950A	Joshua CK AB Peace R	Biology	N/A	N/A	0
		Coliform (Fecal)			
1950A	Joshua Cr. AB Honey Cr	N/A	N/A	N/A	0
1956	Hampton Branch	N/A	N/A	N/A	0
1957	Unnamed Stream	N/A	N/A	N/A	0
1959	Walker Branch	N/A	N/A	N/A	0
1962	Prairie Creek	DO	Conductance	DO	5
			Dissolved Solids	Nutrients	
				Turbidity	
1963	Lake Slough	N/A	N/A	N/A	0
1964	Cow Slough	N/A	N/A	N/A	0
1965	Mare Branch	N/A	N/A	N/A	0
1969	Oak Hill Branch	N/A	N/A	N/A	0
1974	Unnamed Branch	N/A	N/A	N/A	0
1977	Honey Run	N/A	N/A	N/A	0
1980	MC Bride Slough	N/A	N/A	N/A	0
1986	Unnamed Slough	N/A	N/A	N/A	0

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
1995	Myrtle Slough	BOD	N/A	Coliforms	4
		Coliform (Fecal)		Nutrients	
		Coliform (Total)		DO	
		DO		BOD	
		Nutrients (Chlorophyll *a*)			
1997	Hawthorne Creek	Biology	N/A	Coliforms	2
		Coliform (Fecal)		Nutrients	
		Coliform (Total)			
		Nutrients (Chlorophyll *a*)			
2001	Hog Bay	N/A	N/A	N/A	0
2003	Unnamed Ditches	N/A	N/A	N/A	0
2008	Thornton Branch	N/A	N/A	N/A	0
2020	Gannet Slough	N/A	N/A	N/A	0
2028	Unnamed Ditches	N/A	N/A	N/A	0
2033	Unnamed Drain	N/A	N/A	N/A	0
2033Z	Lake Suzy	N/A	Nutrients (TSI)	N/A	0
2035	Lee Branch	N/A	N/A	N/A	0
2040	Myrtle Slough	Coliform (Fecal)	Chloride	N/A	3
			Conductance		
			Dissolved Solids		

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
2041	Shell Creek	DO Nutrients (hist. Chlorophyll *a*)	Chloride Conductance Dissolved Solids	N/A	3
2041B	Shell Creek Reservoir (Hamilton Reservoir)	N/A	DO	N/A	1
2044	Cypress Slough	N/A	N/A	N/A	0
2047	Manchester Way (Unnamed Canal)	Conductance DO	N/A	N/A	0
2048C	Flopbuck Creek	N/A	N/A	N/A	0
2056E	Runoff	Conductance	DO	N/A	1
2058	Unnamed Ditch	N/A	N/A	N/A	0
2059	Cleveland Chem Ditch	N/A	N/A	N/A	0
2062	NO. Fork Alligator CR	N/A	N/A	N/A	0
XX13	Lake Blue Drain	N/A	N/A	N/A	0
XX17	Lake Blue	N/A	N/A	N/A	0
XXX6	Lake Arianna South	N/A	N/A	N/A	0
063	N. Fork Alligator Creek	N/A	Dissolved Oxygen	N/A	1
2066	Direct Run off to Bay	N/A	N/A	N/A	0
2071	No. Prong Alligator Creek	Dissolved Oxygen Turbidity	N/A	Coliforms DO Turbidity	3

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
2074	Alligator Creek	N/A	N/A	N/A	0
2074A	Alligator Creek	N/A	N/A	N/A	0
2077	Direct Run off to Bay	N/A	N/A	N/A	0
2079	Whidden Creek	N/A	N/A	N/A	0
2080	Catfish Creek Bayou	N/A	N/A	N/A	0
2081	Alligator Creek	N/A	N/A	N/A	0
2082A	Pirate Canal	N/A	N/A	N/A	0
2082B	Yucca Pen Creek	N/A	N/A	N/A	0
2083	Direct Run off to Bay	N/A	N/A	N/A	0
2084	Mound Creek	N/A	N/A	N/A	0
2085	Direct Run off to Bay	N/A	N/A	N/A	0
2086	Winegourd Creek	N/A	N/A	N/A	0
2087	Direct Run off to Bay	Dissolved Oxygen	N/A	N/A	0
2088	Direct Runoff to Bay	N/A	N/A	N/A	0
2089	Boggess Hole Outflow	N/A	N/A	N/A	0
2090	Direct Runoff to Bay	N/A	N/A	N/A	0
2091	Direct Runoff to Bay	N/A	N/A	N/A	0
2092A	Direct Runoff to Bay	N/A	N/A	N/A	0

D.2.1.2 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on Planning List (June 2004)	Florida Group 3 Draft List of Waters on Verified List (June 2004)	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
2093	Direct Runoff to Bay	N/A	N/A	N/A	0
2093A	Hog Branch	N/A	N/A	N/A	0
2094	Bear Branch	N/A	N/A	N/A	0
3240T	Gilchrest Drain	N/A	N/A	N/A	0

D.2 Pine Island Sound

D.2.1 Marine Water Bodies in Pine Island Sound

WBID	**Waterbody Segment**	**Florida Group 2 Adopted List of Waters on the Planning List**	**Florida Group 2 Adopted List of Waters on the Verified List**	**2003 - 303(d) Approved by EPA Appendix L**	**Number of Parameters of Concern**
2065E	Pine Island Sound Upper	N/A	Bacteria (in Shellfish)	N/A	1
2065F	Matlacha Pass	Mercury (in fish tissue)	N/A	Mercury	1
2065G	Pine Island Sound lower	N/A	N/A	N/A	0
2065H	San Carlos Bay	N/A	N/A	N/A	0
2065H A	Sanibel Island Causeway	N/A	N/A	N/A	0
2092C	North Captiva Island	N/A	N/A	N/A	0

D.2.1 Marine Water Bodies in Pine Island Sound (continued)

WBID	Waterbody Segment	Florida Group 2 Adopted List of Waters on the Planning List	Florida Group 2 Adopted List of Waters on the Verified List	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
2092D	Captiva Island	N/A	N/A	N/A	0
2092E	Pine Island	N/A	N/A	N/A	0
3240O	Punta Rasa Cove	N/A	N/A	N/A	0
3240S	South Urban Cape Coral	Nutrients (Chlorophyll)	N/A	N/A	0

D.2.2 Fresh Water Bodies in Pine Island Sound

WBID	Waterbody Segment	Florida Group 2 Adopted List of Waters on the Planning List	Florida Group 2 Adopted List of Waters on the Verified List	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
2082C	Gator Slough Canal	Nutrients (Chlorophyll) Dissolved Oxygen	N/A	N/A	0
2092F	Sanibel Island	N/A	Nutrients (TSI)	N/A	1

D.3 Caloosahatchee River

D.3.1 Marine Water Bodies in the Caloosahatchee River

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on the Planning List (June 2004)	Florida Group 3 Draft List of Waters on the Verified List (June 2004)	2003 303(d) List Approved by EPA, Appendix L	Number of Parameters of Concern
3240A	Tidal Caloosahatchee	N/A	Nutrients Copper DO Fecal Coliform	N/A	4
3240B	Tidal Caloosahatchee	N/A	(Nutrients) Chlorophyll *a* DO Fecal Coliform	N/A	3
3240E	Yellow Fever Creek	N/A	DO	DO	1
3240E-1	Hancock Creek	N/A	Nutrients Do Fecal Coliform	N/A	3
3240I	Manuel Branch	Malathion Iron	Copper Fecal Coliform Lead Total Coliform Biology DO	Nutrients, DO	7
3240J	Billy Creek	N/A	DO	Nutrients	3

D.3.2 Fresh Water Bodies in Caloosahatchee River

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on the Planning List (June 2004)	Florida Group 3 Draft List of Waters on the Verified List (June 2004)	2003 303(d) List Approved by EPA, Appendix L	Number of Parameters of Concern
3240C	Tidal Caloosahatchee	N/A	Nutrients (Chl a) DO Fecal Coliform	N/A	3
3240F	Daughtrey Creek	N/A	DO	DO Nutrients	2
3240G	Trout Creek	N/A	DO Fecal Coliform	Coliform BOD DO	3
3240H	Whiskey Creek	N/A	Fecal Coliform DO	N/A	2
3240L	Gilchrest Drain–Powel	N/A	Fecal Coliform DO Nutrients	N/A	3
3240M	Stroud Creek	N/A	Fecal Coliform Chlorophyll *a*	N/A	2
3240N	Owl Creek	N/.A	DO Fecal Coliform	N/A	2
3240Q	Popash Creek	N/A	Chlorophyll a DO Fecal Coliform	N/A	3
3240R	Wyoua Creek	DO	N/A	N/A	0
3240K	Orange River	N/A	N/A	N/A	0
3236	Telegraph Swamp	N/A	N/A	N/A	0
3236A	Telegraph Creek	N/A	N/A	DO	0
3235A	West Caloosahatchee	Mercury	Lead DO Iron Malathion	N/A	4
3235B	West Caloosahatchee	DO	N/A	N/A	0

D.3.2 Fresh Water Bodies in Caloosahatchee River (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on the Planning List (June 2004)	Florida Group 3 Draft List of Waters on the Verified List (June 2004)	2003 303(d) List Approved by EPA, Appendix L	Number of Parameters of Concern
3235C	Cypress Creek	DO	N/A	N/A	0
		Fecal Coliform			
3235D	Jack's Branch	Chlorophyll *a*	N/A	N/A	0
3235E	Bee Branch	Copper	N/A	N/A	0
		DO			
		Fecal Coliform			
		Lead			
3235F	Pollywog Creek	DO	N/A	N/A	0
		Fecal Coliform			
		Iron			
		Lead			
		Total Coliform			
3235G	Cypress Branch	DO	N/A	N/A	0
		Iron			
3235H	Hickey Creek	N/A	DO	N/A	0
3235I	Bedman Creek	N/A	N/A	N/A	0
3235J	Dog Canal	DO	N/A	N/A	0
		Lead			
		Copper			
3235K	Townsend Canal	DO	Lead	N/A	2
		Malathion	Copper		
3235L	Townsend Canal	DO	N/A	N/A	0
		Lead			
		Copper			
3235M	Goodno Canal	DO	N/A	N/A	0
		Iron			
		Fecal Coliform			
3235N	Roberts Canal	N/A	N/A	N/A	0
3237A	East Caloosahatchee	BOD	Iron	DO	4
		DO		Nutrients	
		Nutrients		BOD	

D.3.2 Fresh Water Bodies in Caloosahatchee River (continued)

WBID	Waterbody Segment	Florida Group 3 Draft List of Waters on the Planning List (June 2004)	Florida Group 3 Draft List of Waters on the Verified List (June 2004)	2003 303(d) List Approved by EPA, Appendix L	Number of Parameters of Concern
3237B	Long Hammock Creek	N/A	Nutrients	N/A	2
			DO		
3237C	Lake Hicpochee	DO	Total Coliform	Nutrients	3
		Nutrients	Lead		
3237D	Ninemile Canal	DO	Fecal Coli from	N/A	2
			Lead		

D.4 Estero Bay

D.4.1 Marine Water Bodies in Estero Bay

WBID	Waterbody Segment	Florida Group 1 Assessment Report List of Potentially Impaired	Florida Group 1 Assessment Report List of Verified Impairment	2003 - 303(d) Partially Approved by EPA Appendix L	Number of Parameters of Concern
3258A	Estero Bay Wetlands	N/A	N/A	N/A	0
3258B 1	Hendry Creek Marine	Copper	DO	DO	3
		Lead	Chlorophyll *a*	Chlorophyll *a*	
			Fecal Coliforms	Fecal Coliforms	
3258C 1	Estero Bay Drainage Marine	DO	N/A	N/A	0
3258D 1	Estero River Marine	N/A	Chlorophyll *a*	Chlorophyll a	4
			Copper	Copper	
			DO		
			Fecal Coliforms	DO	
3258E 1	Imperial River Marine	DO	Copper	Copper	11
3258F	Oak Creek	N/A	N/A	N/A	0
3258H 1	Spring Creek Marine	N/A	Chlorophyll *a*	Chlorophyll a	3
			Copper	Copper	
			DO	DO	
3258I	Estero Bay	N/A	N/A	N/A	0

D.4.2 Fresh Water Bodies In Estero Bay

WBID	Waterbody Segment	Florida Group 1 Assessment Report List of Potentially Impaired	Florida Group 1 Assessment Report List of Verified Impairment	2003 - 303(d) Partially Approved by EPA Appendix L	Number of Parameters of Concern
3258B	Hendry Creek	N/A	Chlorophyll *a*	Chlorophyll *a*	2
			DO	DO	
3258C	Estero Bay Drainage	Cadmium	Chlorophyll *a*	Chlorophyll *a*	2
			DO	DO	
3258D	Estero River	DO	N/A	DO	0
3258E	Imperial River	N/A	DO	DO	2
			Chlorophyll *a*	Chlorophyll *a*	
3258G	Tenmile Canal	DO	N/A	DO	0
3258H	Spring Creek	DO	N/A	DO	0
3258X	Lakes Park	N/A	N/A	N/A	0

D.5 Wiggins Pass Estuary

D.5.1 Marine Water Bodies In Wiggins Pass Estuary

WBID	Waterbody Segment	Florida Group 1 Assessment Report List of Potentially Impaired	Florida Group 1 Assessment Report List of Verified Impairment	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
3259A	Cocohatchee River	Mercury (in fish tissue)	DO	DO	3
				Coliforms	
				BOD	
3259Y	Vanderbilt Waterway	N/A	N/A	N/A	0
3259Z	Little Hickory Bay	N/A	N/A	N/A	0

D.5.2 Fresh Water Bodies in Wiggins Pass Estuary

WBID	Waterbody Segment	Florida Group 1 Assessment Report List of Potentially Impaired	Florida Group 1 Assessment Report List of Verified Impairment	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
3259B	Cocohatchee River Canal	N/A	DO	DO Iron—*Appendix I states that FL wanted to add Iron, but the Group 1 Assessment Report does not reflect that*	2
3259W	Lake Trafford	Turbidity	TSI	TSI Nutrients	2
3259X	Drainage to Corkscrew	DO	N/A	N/A	0

D.7 Naples Bay

D.7.1 Marine Water Bodies In Naples Bay

WBID	Waterbody Segment	Florida Group 1 Assessment Report List of Potentially Impaired	Florida Group 1 Assessment Report List of Verified Impairment	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
3259G	Naples Bay	Chlorophyll *a*	N/A	Nutrients	1
3259Q	Center of Outer Clam Bay	N/A	N/A	N/A	0

D.6.2 Fresh Water Bodies in Naples Bay

WBID	Waterbody Segment	Florida Group 1 Assessment Report List of Potentially Impaired	Florida Group 1 Assessment Report List of Verified Impairment	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
3259C	Gordon River	DO	N/A	DO	3
		Coliforms		BOD	
				Coliforms	
3259D	Gordon River Canal	N/A	DO	DO	1
3259E	Henderson Creek Canal	DO	N/A	DO	1
3259F	Golden Gate Canal	DO	N/A	DO	1

D.7 Rookery Bay

D.7.1 Marine Water Bodies In Rookery Bay

WBID	Waterbody Segment	Florida Group 1 Assessment Report List of Potentially Impaired	Florida Group 1 Assessment Report List of Verified Impairment	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
3259H	Henderson Creek Canal	DO	N/A	DO	1
3259J	Rookery Bay	N/A	N/A	N/A	0

D.7.2 Fresh Water Bodies in Rookery Bay

WBID	Waterbody Segment	Florida Group 1 Assessment Report List of Potentially Impaired	Florida Group 1 Assessment Report List of Verified Impairment	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
3259K	Runoff to Gulf	N/A	N/A	N/A	0
3259T	Lake Avalon	N/A	N/A	N/A	0
[Ψ]3259L1	Blackwater River	N/A	DO	DO	1

[Ψ] WBID 3259L as it is currently delineated straddles both the Rookery Bay and Ten Thousand Islands watersheds. After meeting with water quality experts from various environmental agencies, including the Department of Environmental Protection and South Florida Water Management District, it was agreed that this WBID should be

D.8 Ten Thousand Islands

D.8.1 Marine Water Bodies in Ten Thousand Islands

WBID	Waterbody Segment	Florida Group 1 Assessment Report List of Potentially Impaired	Florida Group 1 Assessment Report List of Verified Impairment	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
3259 M	Runoff to Gulf	N/A	N/A	Fecal Coliforms	1
3259N	Runoff to Gulf	N/A	N/A	N/A	0
3259P	Ferguson River	N/A	N/A	N/A	0
3259R	Runoff to Gulf	N/A	N/A	N/A	0
3259S	Runoff to Gulf	N/A	N/A	N/A	0
3261A	Barron River Canal	Cadmium Mercury	N/A	N/A	0

D.8.2 Fresh Water Bodies in Ten Thousand Islands

WBID	Waterbody Segment	Florida Group 1 Assessment Report List of Potentially Impaired	Florida Group 1 Assessment Report List of Verified Impairment	2003 - 303(d) Approved by EPA Appendix L	Number of Parameters of Concern
3259I	West Collier	DO	N/A	N/A	0
3259I1	West Collier	?	?	?	?
3259L2	Blackwater River	N/A	DO	DO	1
3259O	Faka Union Canal	DO	N/A	N/A	0
3261B	Tamiami Canal	DO Fish (Mercury)	N/A	DO Mercury Cadmium	3
3261C	Barron River Canal North	DO Fish (Mercury)	N/A	DO	1
3261D	Tamiami Canal	N/A	N/A	N/A	0

split to more accurately depict water flows. An official proposal from the Conservancy to do so is forthcoming. The original WBID has been split in two in this report – 3259L1, one third of the total acreage and 3259L2, two thirds of the total acreage.

APPENDIX E

Water Quality: Calculation of Percentage of Impairment For Each Estuary Watershed

E.1 Charlotte Harbor

For Charlotte Harbor, the percentage of acres of impaired for the entire estuary watershed was calculated, including the Peace and Myakka Rivers portions. The percentage of impairment for Charlotte Harbor Proper was also calculated. There is a significant difference in the percentage of impairment when the Peace and Myakka Rivers are included in the evaluation.

E.1.1 Marine Water Bodies in Charlotte Harbor (Incl. Peace and Myakka Rivers)

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern:[64]	Total Acreage of Impairment
1991A	Myakka River	11,227	1	11,227
1991B	Myakka River	6,487	0	0
1991C	Myakka River	3532	3	10,596
2026	Myakka-hatchee Creek	1530	1	1530
2048A	Sam Knight Creek	3706	1	3706

[64] The number in this column indicates the number of parameters that have been identified as indications of impairment for the water body by Florida or EPA. It includes parameters on the draft Planning List, the draft Verified List and EPA's 2003 303(d) List. If a parameter is on either of Florida's draft Planning or Verified List and the EPA 2003 303(d) List it is only counted once.

E.1.1 Marine Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern:[65]	Total Acreage of Impairment
2055	Tippecanoe Bay	2116	1	2116
2041A	Shell Creek Below Hendrickson Dam	7490	2	14,980
2046	Little Alligator Creek	5057	0	0
2054	Myrtle Slough	22,520	5	112,600
2056A	Peace R Lower Estuary	5863	3	17,589
2056B	Peace R Mid Estuary	3582	3	10,746
2056C	Peace R Upper Estuary	7309	3	21,927
2056D	Alligator Bay	464	0	0
2060	Myakka Cutoff	2376	0	0
2061	Dir Runoff to Stream	1373	0	0
2064	Direct Runoff to Bay	453	0	0
2069	Punta Gorda Isles CA	729	0	0
2070	Punta Gorda Isles 2 CA	691	0	0
Totals		86,505	23	207,017

E.1.2 Marine Water Bodies in Charlotte Harbor (Charlotte Harbor Proper)

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Total Acreage of Impairment
2065A	Charlotte Harbor Upper	12,092	3	36,276
2065B	Charlotte Harbor Mid	28,690	1	28,690
2065C	Charlotte Harbor Mid	9551	1	9551
2065D	Charlotte Harbor Lower	36,903	0	0
2073	Mangrove Point Canal	2748	1	2748
2092B	Garparilla Island	1308	0	0
3240P	North Urban Cape Coral	21,952	0	0
Totals		113,244	6	77,265

[65] The number in this column indicates the number of parameters that have been identified as indications of impairment for the water body by Florida or EPA. It includes parameters on the draft Planning List, the draft Verified List and EPA's 2003 303(d) List. If a parameter is on either of Florida's draft Planning or Verified List and the EPA 2003 303(d) List it is only counted once.

E.1.3 Fresh Water Bodies in Charlotte Harbor (Incl. Peace and Myakka Rivers)

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Acreage of Impairment
1867	Unnamed Creek	3783	0	0
1869A	Wingate (Johnson) Creek	5244	0	0
1869B	Myakka River (Upper)	1884	0	0
1869C	Myakka River (Upper)	5005	0	0
1877A	Myakka River (Upper)	14,525	3	43,575
1877B	Myakka River (Upper)	1554	0	0
1877C	Myakka River North Fork	134	0	0
1882	Johnson Creek	2750	0	0
1894	Young Creek	3662	0	0
1902	Taylor Creek	1716	0	0
1908	Coker Creek	4293	0	0
1917	Long Creek	4306	0	0
1918	Unnamed Ditch	5498	0	0
1919	Sand Slough	1205	0	0
1920	Owen Branch	5364	0	0
1922	Boggy Creek	1218	0	0
1927	Oglebay Creek	9424	0	0
1933	Owen Creek	12,294	4	49,176
1935	Maple Creek	2851	0	0
1940	Howard Creek	9218	1	9218
1942	Tatum Sawgrass Slough	9702	0	0
1943	Indian Creek	4754	0	0
1946	Unn Drain	1657	0	0
1949	Unnamed Creek	4670	0	0
1952	Sand Branch	2874	0	0
1955	Wildcat Slough	7669	2	15,338
1958	Mud Lake Slough	11,408	5	57,040
1960	Unn Ditch	1484	0	0
1967	Bud Slough	4154	0	0
1970	Sardis Branch	2540	0	0
1972	Myakka River	389	1	389
1973	Mossy Island Slough	11370	0	0
1976	Big Slough Canal	34,275	4	137,100
1978	Deer Prarie Creek	20,962	3	62,886
1981	Lower Lake Myakka	590	0	0
1981A	Lower Lake Myakka Dr	1473	0	0

E.1.3 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Acreage of Impairment
1981B	Myakka River	8784	7	61,488
1981C	Upper Lake Myakka	962	1	962
1981D	Upper Lake Myakka Dr	5512	0	0
1988	Fish Camp Drain	2394	1	2394
1989	Unnamed Ditch System	19,534	0	0
1990	Shiney Town Slough	6792	0	0
1991D	Myakka River	15,317	2	30,634
1998	Unnamed Creek	3661	0	0
1999	Unn Drain	3704	0	0
2000	Unnamed Canal System	10,014	0	0
2004	Unn Ditch	1339	0	0
2005	Unnamed Ditch	3318	0	0
2006	Unnamed Creek	2498	0	0
2007	Unnamed Creek	2636	0	0
2010	Unnamed Ditch System	21,399	0	0
2011	Unnamed Creek	1165	0	0
2012	Unnamed Ditch System	484	0	0
2013	Unnamed Ditch System	858	0	0
2014	Deer Prairie Slough	3283	3	9849
2019	Unnamed Creek	267	0	0
2022	Unnamed Creek	1784	0	0
2023	Unnamed Canal System	2348	0	0
2024	Unnamed Ditch	981	0	0
2025	Unnamed Canal System	2393	0	0
2026A	Warm Mineral Spring	106	0	0
2027	Unnamed Canal System	2589	0	0
2029	Unnamed Creek	622	0	0
2031	Unnamed Creek	3051	0	0
2032	Unnamed Ditch System	1260	0	0
2034	Unnamed Creek	2690	0	0
2036	Unnamed Creek	288	0	0
2037	Unnamed Creek	209	0	0
2038	Unnamed Creek	1292	1	1292
2043	Unnamed Canal	2900	0	0
2045	Rock Creek	1207	0	0
2048B	Huckaby Creek	427	0	0
2053	Trailer Park Canal	585	0	0
1488	Lake Fannie Outlet	9245	1	9245
14881	Swan Lake	12	0	0

E.1.3 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Acreage of Impairment
14882	Lake Fannie	837	1	837
1488A	Lake Smart	1252	4	5008
1488B	Lake Rochelle	580	1	580
1488C	Lake Haines	724	3	2172
1488C1	Gum Lake	161	0	0
1488D	Lake Alfred	640	2	1280
1488D1	Grass Lake	9	0	0
1488D2	Lake Griffin	14	0	0
1488D3	Lake Camp	45	0	0
1488E	C of Lake IDA in Winte	17	0	0
1488F	Center of Citrus Lake	4	0	0
1488G	Silver Lake in Polk Co	52	0	0
1488H	C of Gem Lake in Winte	3	0	0
1488P	Lake Martha	84	0	0
1488Q	Lake Maude	307	1	307
1488R	Lake Idyl	19	0	0
1488S	Lake Buckeye	70	1	70
1488T	Lake Cummings	99	0	0
1488U	Lake Connie	238	1	238
1488V	Lake Swoope	86	0	0
1488W	Lake Lucerne	396	0	0
1488W1	Terrie Pond	40	0	0
1488X	Lake George	51	0	0
1488Y	Lake Pansy	50	1	50
1488Z	Lake Echo	69	0	0
1492	Lake Tracy Outlet	1047	0	0
14921	Lake Tracy	135	0	0
14922	Lake Joe	11	0	0
1497	Saddle Creek	38,383	3	115,149
1497A	Crystal Lake	27	3	81
1497B	Lake Parker	2103	1	2103
1497C	Lake Tenoroc	23	1	23
1497D	Lake Gibson	480	2	960
497D1	Lake Cargo	54	1	54
1497E	Lake Bonny	268	2	536
1500	Channelized Stream	3403	0	0
15001	Little Lake Hamilton	368	0	0
15002	Middle Lake Hamilton	107	0	0
15003	Lake Confusion	15	0	0

E.1.3 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Acreage of Impairment
15004	Lake Hester	8	0	0
15005	Lake Brown	18	0	0
1501	Lake Lena	207	1	207
1501A	Lake Lena Run	7833	4	31,332
1501B	Lake Arianna North	486	1	486
1501C	Lake Aretta	737	0	0
1501D	Dinner Lake	40	0	0
1501E	Lake Arianna S Drain	855	0	0
1501F	Lake Arianna N Drain	2283	0	0
1501V	Spirit Lake	208	1	208
1501W	Sears Lake	79	0	0
1501X	Lake Thomas	54	0	0
1501Z	Lake Whistler	77	0	0
1504	Lake Hamilton Outlet	5748	0	0
15041	Lake Hamilton	2186	0	0
1504A	Lake Henry	858	0	0
1510	Lake Eva Outlet	821	0	0
15101	Lake Eva	171	0	0
15102	Lake Butler	16	0	0
1521	Lake Lulu	303	3	909
1521A	Lake Winterset	509	1	509
1521A1	River Lake	50	0	0
1521B	Lake Eloise	1161	1	1161
1521C	Lake Lulu Run	713	0-	0
1521C1	Lake Lulu Outlet	9076	0	0
1521D	Lake Shipp	281	2	562
1521E	Lake May	43	1	43
1521F	Lake Howard	623	1	623
1521G	Lake Mirror	124	1	124
1521G1	Spring Lake	24	0	0
1521H	Lake Cannon	334	3	1002
1521I	Lake Hartridge	437	1	437
1521J	Lake Idylwild	97	1	97
1521K	Lake Jessie	190	1	190
1521L	Lake Marianna	497	0	0
1521N	Ina Lake	8	0	0
1521O	Lake Roy	66	0	0
1521P	Deer Lake	116	0	0

E.1.3 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Acreage of Impairment
1521Q	Lake Blue	53	0	0
1521R	Lake Blue Drain	262	0	0
1539	Peace Creek Dr Canal	33,802	6	202,812
1539A	Lake Star – Open Wate	146	0	0
1539B	Mountain Lake	128	0	0
1539C	Lake Annie	437	0	0
1539D	Lake Otis	144	0	0
1539E	C of Lake Florence In	65	0	0
1539F	Lake Lee	44	0	0
1539 P	Lake Dexter	148	0	0
1539Q	Lake Ned	63	1	63
1539R	Lake Daisy	128	2	256
1539S	Lake Ring	3	0	0
1539X	Lake Miriam	194	0	0
1539Y	Link Lake	26	0	0
1539Y1	Link Lake Outlet	751	0	0
1539Z	Lake Menzie	20	0	0
1545	Unnamed Drain	1537	0	0
1548	Lake Elbert	172	1	172
1548A	Lake Elbert Outlet	469	0	0
1549A	Banana Lake Canal	11,003	5	55,015
1549B	Banana Lake	255	4	1020
1549B1	Lake Stahl	32	0	0
1549C	Lake Bentley	51	1	51
1549X	Hollingsworth Lake	354	5	1770
1580	Wahneta Farms Drain Ca	4121	4	16,484
1582A	Mined Area	52	0	0
1582B	Mined Area	93	0	0
1586	Mined Area	1884	0	0
1588	Lake Mcleod Outlet	913	0	0
1588A	Lake Mcleod	398	0	0
1589	Lake Mable	114	0	0
1589A	Lake Mable Outlet	654	0	0
1590	Lake Myrtle Outlet	2552	0	0
1590A	Lake Ruby-Bess	260	0	0
1590B	Lake Myrtle	325	0	0
1590C	Rattlesnake Lake	65	0	0
1590D	Lake Hart	70	0	0
1590E	Reeves Lake	21	0	0

E.1.3 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Acreage of Impairment
1590Z	Lake Ruby-Bess Outlet	135	0	0
1598	Gaskin Branch	3217	0	0
1602	Unnamed Ditches	4811	0	0
1608	Unnamed Slough	1032	0	0
1611	Mine Area	6520	0	0
1613	Peace Cr Trib Canal	14,862	4	59,448
1613A	Lake Blue South	118	0	0
1613B	Lake Gordon – Open Water	158	0	0
1613C	Lake Gordon (SW) - OPE	85	0	0
1613D	Lake Parker – Open Water	190	0	0
1613E	Lake Belle	33	0	0
1616	Mined Area	1013	0	0
1617	Lake Effie Outlet	1504	1	1504
1617A	Lake Effie	102	0	0
1622	Lake Garfield	525	1	525
1622A	Boggy Branch	302	0	0
1622B	Lake Garfield Outlet	40	0	0
1622C	Lake Garfield Outlet	10,265	0	0
1623A	Peace R AB Thorton BR	7314	1	7314
1623B	Peace R AB Horse CK	15,781	0	0
1623C	Peace R AB Joshua CK	24,588	4	98,352
1623D	Peace R AB Charlie CK	7304	4	292,116
1623E	Peace R AB Oak CK	4320	3	12,960
1623F	Peace R AB Troublesome	12728	0	0
1623G	Peace R AB LTL Charlie	3163	0	0
1623H	Peace R AB Payne CK	6549	3	19,647
1623I	Peace R AB Whidden CK	846	0	0
1623J	Peace R AB Bowlegs CK	25,052	6	150,312
1623K	Saddle CK AB L Hancock	4182	4	16,728
1623L	Lake Hancock	4529	3	13,587
1623M	Eagle Lake	647	1	647
1623M1	Grassy Lake	56	0	0
1623M2	Millsite Lake	135	0	0
1623N	Eagle Lake Outlet	4513	0	0
1623S	Lake Hancock Outlet	7083	0	0
1623X	Reclaimed Mine Cut Lake	168	1	168
1626	West Wales Drainage CA	4557	3	13,671
1629	Brush Lake Outlet	1177	0	0
1629A	Brush Lake	33	0	0

E.1.3 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Acreage of Impairment
1631	Bear Branch	3030	0	0
1634	Mule Island Ditches	2636	0	0
1638	Mined Area	1096	0	0
1644A	Mined Area	802	0	0
1644B	Mined Area	777	0	0
1646	Mined Area	14,158	0	0
1647	Surveyors Lake	291	1	291
1647A	Gadua Lake – Open Water	26	0	0
1647B	Surveyors Lake Drain	9535	0	0
1672	Mined Area	12,258	0	0
1677A	Bowlegs Creek	12,383	2	24,766
1677B	Bowlegs CK AB Boggy CA	19,491	0	0
1677C	Lake Buffum	1433	0	0
1677C1	Lake Lizzie	95	0	0
1679	Sink Branch	8514	0	0
1699	McCullough Creek	6010	0	0
1718	Mined Area	334	0	0
1720	Mined Area	166	0	0
1722	Boggy Branch	5507	0	0
1727	Mined Area	641	0	0
1728	Mined Area	614	0	0
1734	Mined Area	506	0	0
1735	Unnamed Drain	2556	0	0
1737	Mined Area	212	0	0
1740	Mined Area	12,314	0	0
1741	Mined Area	2234	0	0
1744	Mined Area	534	0	0
1745	Mined Area	631	0	0
1746	Mined Area	625	0	0
1748	Mill Creek	299	0	0
1750	Payne Creek	873	0	0
1751	Whidden Creek	388	3	1164
1752	Mined Area	10,440	0	0
1757A	Payne Creek	1139	2	2278
1757B	Payne Creek	17,850	2	35,700
1759	Unnamed Run	1262	0	0
1763A	Charlie CK AB Peace R	16,640	0	0
1763B	Charlie CK AB Oak CK	13,884	0	0
1763C	Charlie Creek	13,284	0	0

E.1.3 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Acreage of Impairment
1763D	Charlie CK AB Old Town	6652	0	0
1764	Unnamed Run	1369	0	0
1765	Mined Area	248	0	0
1766	Mined Area	1217	0	0
1767	Unnamed Run	1542	0	0
1769	Payne Creek	5818	0	0
1772	Unnamed Run	1755	0	0
1773	Sandy Gully	2793	0	0
1774	Little Charlie Creek	17,367	2	34,734
1775	Unnamed Run	905	0	0
1776	Old Town Creek	12,966	0	0
1776A	Chilton Lake – Open Water	22	1	22
1777	Parker Branch	3952	0	0
1781	Gilshey Branch	2139	0	0
1786	Mined Area	1677	0	0
1787A	Horse CK AB Peace R	40,267	4	161,068
1787B	Horse CK AB Bushy CK	24,167	0	0
1791	Mined Area	1116	0	0
1794	Hickey Branch	2867	0	0
1795	Bowling Green Run	905	0	0
1796	Payne Creek	1635	0	0
1799	Unnamed Run	897	0	0
1801	Mined Area	1076	0	0
1802	Gum Swamp Branch	6614	0	0
1805	Unnamed Run	2190	0	0
1808	Unnamed Ditches	3564	0	0
1814	Hog Branch	4561	0	0
1815	Unnamed Ditch	6822	0	0
1817	Coons Bay Branch	1251	0	0
1818	Plunder Branch	3281	0	0
1820	Doe Branch	5709	0	0
1821	Shirttail Branch	2407	0	0
1822	Lake Dale Branch	6113	0	0
1824	Mitchell Hammock Drain	1498	0	0
1826	Brushy Creek	18,544	0	0
1827	Bee Branch	8722	0	0
1835	Max Branch	3335	0	0
1836	West Fork Horse Creek	8434	0	0
1837	Buckhorn Creek	11,774	0	0

E.1.3 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Acreage of Impairment
1838	Lettis Creek	3946	0	0
1839	Troublesome Creek	10,026	0	0
1844	Thomson Branch	4156	2	8312
1845	Hickory Branch	2122	0	0
1851	Hog Lake Outlet	3171	0	0
18511	Hog Lake	30	0	0
1852	Unnamed Branch	6710	0	0
1854	Unnamed Branch	3044	0	0
1857	Little Charlie Bowlegs	41,951	0	0
1857A	Lake Schumacher - Open	11	0	0
1863	Hickory Creek	1674	0	0
1866	Hickory Creek	4610	0	0
1870	Fivemile Gully	3271	0	0
1871	Alligator Branch	13,028	3	39,084
1873	Oak Creek	14,375	0	0
1878	Mineral Branch	2885	0	0
1879	Jackson Branch	1399	0	0
1884	Unnamed Stream	2176	0	0
1886	Indian Mound Drain	4027	0	0
1897	Oak Creek	40,351	0	0
1904	Elder Creek	3978	0	0
1905	Unnamed Run	2450	0	0
1907	Punch Gully	2855	0	0
1915	Cypress Creek	4757	0	0
1921	Limestone Creek	19,121	4	76,486
1928	Fish Branch	17,560	0	0
1934	Osborn Branch	1696	0	0
1939	Brandy Branch	9782	1	9782
1939A	C Will Outfall at Conv	663	2	1326
1944	Buzzard Roost Branch	9137	0	0
1945	Sand Gully	9276	0	0
1948	Bear Branch	2341	2	4682
1950A	Joshua CK AB Peace R	21,792	0	0
1950B	Joshua Cr. AB Honey Cr	7358	0	0
1956	Hampton Branch	2619	0	0
1957	Unnamed Stream	9488	0	0
1959	Walker Branch	2391	0	0
1962	Prairie Creek	64,570	5	322,850
1963	Lake Slough	6202	0	0

E.1.3 Fresh Water Bodies in Charlotte Harbor (continued)

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Acreage of Impairment
1964	Cow Slough	89,025	0	0
1965	Mare Branch	4685	0	0
1969	Oak Hill Branch	6898	0	0
1974	Unnamed Branch	6474	0	0
1977	Honey Run	10191	0	0
1980	MC Bride Slough	3380	0	0
1986	Unnamed Slough	6007	0	0
1995	Myrtle Slough	15,583	4	62,332
1997	Hawthorne Creek	17,616	2	35,232
2001	Hog Bay	7812	0	0
2003	Unnamed Ditches	4275	0	0
2008	Thornton Branch	12,597	0	0
2020	Gannet Slough	10,611	0	0
2028	Unnamed Ditches	1733	0	0
2033	Unnamed Drain	3868	0	0
2033Z	Lake Suzy	2	0	0
2035	Lee Branch	4524	0	0
2040	Myrtle Slough	21,310	3	63,930
2041	Shell Creek	31,704	3	95,112
2041B	Shell Creek Reservoir (Hamilton Reservoir)	2977	1	2977
2044	Cypress Slough	4723	0	0
2047	Manchester Way (Unnamed Canal)	4296	0	0
2048C	Flopbuck Creek	522	0	0
2056E	Runoff	26,067	1	26,067
2058	Unnamed Ditch	3367	0	0
2059	Cleveland Chem Ditch	4529	0	0
2062	NO. Fork Alligator CR	2567	0	0
1501B1	Lake Arianna South	555	0	0
Subtotals		**1,787,399**	**129**	**2,630,741**

E.1.4 Fresh Water Bodies in Charlotte Harbor (Charlotte Harbor Proper)

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Acreage of Impairment
2063	N. Fork Alligator Creek	4829	1	4829
2066	Direct Run off to Bay	18,924	0	0
2071	No. Prong Alligator Creek	5816	3	17,448
2074	Alligator Creek	8139	0	0
2074A	Alligator Creek	5901	0	0
2077	Direct Run off to Bay	2155	0	0
2079	Whidden Creek	2753	0	0
2080	Catfish Creek Bayou	5272	0	0
2081	Alligator Creek	4124	0	0
2082A	Pirate Canal	5884	0	0
2082B	Yucca Pen Creek	2382	0	0
2083	Direct Run off to Bay	549	0	0
2084	Mound Creek	1400	0	0
2085	Direct Run off to Bay	206	0	0
2086	Winegourd Creek	1658	0	0
2087	Direct Run off to Bay	283	0	0
2088	Direct Runoff to Bay	1163	0	0
2089	Boggess Hole Outflow	412	0	0
2090	Direct Runoff to Bay	196	0	0
2091	Direct Runoff to Bay	1858	0	0
2092A	Direct Runoff to Bay	347	0	0
2093	Direct Runoff to Bay	272	0	0
2093A	Hog Branch	2401	0	0
2094	Bear Branch	1711	0	0
3240T	Gilchrest Drain	20,023	0	0
Totals		**98,658**	**4**	**22,277**

E.1.5 Total Acres of Impairment for the Entire Charlotte Harbor Watershed

	Total Acreage	Total Number of Impairment	Total Acres Impaired	Percentage of Impairment
Marine Water Bodies in Charlotte Harbor (Incl. Peace and Myakka Rivers)	86,505	23	207,017	239%
Marine Water Bodies in Charlotte Harbor (Charlotte Harbor Proper)	113,244	6	77,265	68%
Fresh Water Bodies In Charlotte Harbor (Incl. Peace and Myakka Rivers)	1,787,399	129	2,630,741	147%
Fresh Water Bodies In Charlotte Harbor (Charlotte Harbor Proper)	98,658	4	22,277	23%
Totals	**2,085,806**	**162**	**2,937,300**	**141%**

E.1.6 Total Acres of Impairment for Charlotte Harbor Watershed Excluding the Peace and Myakka Rivers

	Total Acreage	Total Number of Impairment	Total Acres Impaired	Percentage of Impairment
Marine Water Bodies in Charlotte Harbor (Charlotte Harbor Proper)	113,244	6	77,265	68%
Fresh Water Bodies In Charlotte Harbor – (Charlotte Harbor Proper)	98,658	4	22,277	23%
Totals	**211,902**	**10**	**99542**	**46.97%**

E.2 Pine Island Sound

E.2.1 Marine Water Bodies in Pine Island Sound

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Total Acreage of Impairment
2065E	Pine Island Sound Upper	28,507	1	28,507
2065F	Matlacha Pass	14,941	1	14,941
2065G	Pine Island Sound lower	20,755	0	0
2065H	San Carlos Bay	5275	0	0
2065HA	Sanibel Island Causeway	448	0	0
2092C	North Captiva Island	3775	0	0
2092D	Captiva Island	4016	1	4016
2092E	Pine Island	31,158	0	0
3240O	Punta Rasa Cove	1160	0	0
3240S	South Urban Cape Coral	23,189	1	23,189
Totals		**133,224**	**4**	**70,653**

E.2.2 Fresh Water Bodies in Pine Island Sound

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Total Acreage of Impairment
2082C	Gator Slough Canal	7714	2	15,428
2092F	Sanibel Island	13,869	1	13,869
Totals		**21,583**	**3**	**29,297**

E.2.3 Total Acres of Impairment for Pine Island Sound

	Total Acreage	Total Number of Impairments	Total Acres Impaired	Percentage of Impairment
Marine Water Bodies in Pine Island	133,224	4	70,653	53%
Fresh Water Bodies In Pine Island	21,583	3	29,297	136%
Totals	**154,807**	**7**	**99,950**	**65%**

E.3 Caloosahatchee River

E.3.1 Marine Water Bodies in the Caloosahatchee River

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Total Acreage of Impairment
3240A	Tidal Caloosahatchee	52,037	5	260,185
3240B	Tidal Caloosahatchee	12,432	4	49,728
3240E	Yellow Fever Creek	17,887	2	35,774
3240I	Manuel Branch	2842	9	25,578
3240J	Billy Creek	13,053	3	39,159
Totals		**98,251**	**23**	**410,424**

E.3.2 Fresh Water Bodies in Caloosahatchee River

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Total Acreage of Impairment
3240C	Tidal Caloosahatchee	9399	3	28,197
3240F	Daughtrey Creek	19,071	1	19,071
3240G	Trout Creek	13,092	3	39,276
3240H	Whiskey Creek	6081	0	0
3240L	Gilchrest Drain–Powel	7745	1	7745
3240M	Stroud Creek	6465	3	19,395
3240N	Owl Creek	5653	2	11,306
3240Q	Popash Creek	13,128	2	26,256
3240K	Orange River	53,628	1	53,628
3236	Telegraph Swamp	53,545	0	0
3236A	Telegraph Creek	4121	1	4121
3235A	West Caloosahatchee	5719	5	28,595
3235B	West Caloosahatchee	16,305	1	16,305
3235C	Cypress Creek	8449	1	8449
3235D	Jack’s Branch	55,889	1	55,889
3235E	Bee Branch	33,254	0	0
3235F	Pollywog Creek	35,769	3	107,307
3235G	Cypress Branch	16,747	2	33,494
3235H	Hickey Creek	13,156	1	13,156
3235I	Bedman Creek	5250	1	5250
3235J	Dog Canal	16,616	0	0
3235K	Townsend Canal	2005	1	2005
3235L	Townsend Canal	33,616	0	0
3235M	Goodno Canal	35,428	2	70,856

E.3.2 Fresh Water Bodies in Caloosahatchee River (continued)

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Total Acreage of Impairment
3235N	Roberts Canal	47,029	1	47,029
3237A	East Caloosahatchee	104,380	5	521,900
3237B	Long Hammock Creek	94,105	1	94,105
3237C	Lake Hicpochee	6138	1	6138
3237D	Ninemile Canal	38,195	1	38,195
Totals		**759,978**	**48**	**1,309,880**

E.3.3 Total Acres of Impairment for Caloosahatchee River

	Total Acreage	Total Number of Impairments	Total Acres Impaired	Percentage of Impairment
Marine Water Bodies in Caloosahatchee	98,251	23	410,424	418%
Fresh Water Bodies In Caloosahatchee	759,978	48	1,309,880	172%
Totals	**858,229**	**71**	**1,720,304**	**200%**

E.4 Estero Bay

E.4.1 Marine Water Bodies in Estero Bay

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Total Acreage of Impairment
3258A	Estero Bay Wetlands	13,927	0	0
3258B1	Hendry Creek Marine	6920	5	34,600
3258C1	Estero Bay Drainage Marine	4602	1	4602
3258D1	Estero River Marine	5472	4	21,888
3258E1	Imperial River Marine	4270	2	8540
3258F	Oak Creek	6129	0	0
3258H1	Spring Creek Marine	2951	3	8853
3258I	Estero Bay	11,344	0	0
Total		**55,615**	**15**	**78,483**

E.4.2 Fresh Water Bodies In Estero Bay

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Total Acreage of Impairment
3258B	Hendry Creek	533	2	1066
3258C	Estero Bay Drainage	110,553	2	221,106
3258D	Estero River	5738	1	5738
3258E	Imperial River	10,535	2	21,070
3258G	Tenmile Canal	9596	1	9596
3258H	Spring Creek	6080	1	6080
3258X	Lakes Park	2371	0	0
Totals		**145,406**	**9**	**264,656**

E.4.3 Total Acres of Impairment for Estero Bay

	Total Acreage	Total Number of Impairments	Total Acres Impaired	Percentage of Impairment
Marine Water Bodies in Estero Bay	55,615	15	78,483	141%
Fresh Water Bodies In Estero Bay	145,406	9	264,656	182%
Totals	**201,021**	**24**	**343,139**	**171%**

E.5 Wiggins Pass/Cocohatchee River:

E.5.1 Marine Water Bodies In Wiggins Pass/Cocohatchee River

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Total Acreage of Impairment
3259A	Cocohatchee River	6597	3	19,791
3259Y	Vanderbilt Waterway	677	0	0
3259Z	Little Hickory Bay	1617	0	0
Totals		**8,891**	**3**	**19,791**

E.5.2 Fresh Water Bodies in Wiggins Pass/Cocohatchee River

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Total Acreage of Impairment
3259B	Cocohatchee River Canal	123,293	2	246,584
3259W	Lake Trafford	2182	2	4364
3259X	Drainage to Corkscrew	55,946	0	0
Totals		**181,420**	**4**	**250,948**

E.5.3 Total Acres of Impairment for Wiggins Pass/Cocohatchee River

	Total Acreage	Total Number of Impairments	Total Acres Impaired	Percentage of Impairment
Marine Water Bodies in Wiggins Pass	8891	3	19,791	223%
Fresh Water Bodies In Estero Bay	181,420	4	250,948	138%
Totals	**190,311**	**7**	**270,739**	**142%**

E.6 Naples Bay

E.6.1 Marine Water Bodies In Naples Bay

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Total Acreage of Impairment
3259G	Naples Bay	3991	1	3991
3259Q	Center of Outer Clam Bay	51	0	0
Totals		**4042**	**1**	**3991**

E.6.2 Fresh Water Bodies in Naples Bay

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Total Acreage of Impairment
3259C	Gordon River	15,980	3	47,940
3259D	Gordon River Canal	12,875	1	12,875
3259F	Golden Gate Canal	13,205	1	13,205
3259E	Henderson Creek Canal	6865	1	6865
Totals		**48,925**	**6**	**80,885**

E.6.3 Total Acres of Impairment for Naples Bay

	Total Acreage	Total Number of Impairments	Total Acres Impaired	Percentage of Impairment
Marine Water Bodies in Naples Bay	4042	1	3991	99%
Fresh Water Bodies In Naples Bay	48,925	6	80,885	165%
Totals	**52,967**	**7**	**84,876**	**160%**

E.7 Rookery Bay

E.7.1 Marine Water Bodies In Rookery Bay

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Total Acreage of Impairment
3259H	Henderson Creek Canal	29,196	1	29,196
3259J 3259J1[66]	Rookery Bay Tarpon Bay	6896 824	0 ---	0 ---
Totals		**36,916**	**1**	**29,196**

E.7.2 Fresh Water Bodies in Rookery Bay

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern	Total Acreage of Impairment
[67]3259L1	Blackwater River	8747	1	8747
3259K	Runoff to Gulf	7728	0	0
3259T	Lake Avalon	53	0	0
Totals		**16,528**	**1**	**8747**

[66] Although WBID 3259J1 (listed as Tarpon Bay, 824 acres) is delineated on DEP maps, it is not included in the Impaired Waters list. Because 3259J1 contains no water quality testing stations and appears to share flow with 3259J these two acreages have been joined for this section.

[67] WBID 3259L as it is currently delineated straddles both the Rookery Bay and Ten Thousand Islands watersheds. After meeting with water quality experts from various environmental agencies, including the Department of Environmental Protection and South Florida Water Management District, it was agreed that this WBID should be split to more accurately depict water flows. The original WBID has been split in two in this report – 3259L1, one third of the total acreage and 3259L2, two thirds of the total acreage.

E.7.3 Total Acres of Impairment for Rookery Bay

	Total Acreage	Total Number of Impairments	Total Acres Impaired	Percentage of Impairment
Marine Water Bodies in Rookery Bay	36,916	1	29,196	79%
Fresh Water Bodies In Rookery Bay	16,528	1	8747	53%
Totals	**53,444**	**2**	**37,943**	**71%**

E.8 Ten Thousand Islands

E.8.1 Marine Water Bodies in Ten Thousand Islands

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern"	Total Acreage of Impairment
3259M	Runoff to Gulf	39,118	1	39,118
3259N	Runoff to Gulf	7790	0	0
3259P 3259I1[68]	Ferguson River West Collier	7609 2823	0 ---	0 ---
3259R	Runoff to Gulf	8541	0	0
3259S	Runoff to Gulf	6872	0	0
3261A	Barron River Canal	6379	2	12,758
Totals		**79,132**	**3**	**51,876**

E.8.2 Fresh Water Bodies in Ten Thousand Islands

WBID	Waterbody Segment	Total Acreage	Number of Parameters of Concern"	Total Acreage of Impairment
3259I	West Collier	201,321	0	0
3259L2	Blackwater River	26,243	1	26,242
3259O	Faka Union Canal	11,763	0	0
3261B	Tamiami Canal	508,807	3	1,527,057
3261C	Barron River Canal North	302,175	1	301,458
3261D	Tamiami Canal	10,459	0	0
Totals		**1,060,768**	**5**	**1,854,757**

[68] Although WBID 3259I1 (listed as West Collier, 2,823 acres) is delineated on DEP maps, it is not included in the Impaired Waters list. Because 3259I1 contains no water quality testing stations and its direction of flow leads into 3259P these two acreages have been joined for purposes of this section.

E.8.3 Total Acres of Impairment for Ten Thousand Islands

	Total Acreage	**Total Number of Impairments**	**Total Acres Impaired**	**Percentage of Impairment**
Marine Water Bodies in Rookery Bay	79,132	3	51,876	66%
Fresh Water Bodies In Rookery Bay	1,060,768	5	1,854,757	175%
Totals	**1,139,900**	**8**	**1,906,633**	**167%**

APPENDIX F
Hydrology Information For Each Estuary Watershed

F.1 Charlotte Harbor

“Seasonal fluctuations in salinity in Charlotte Harbor occur primarily in response to the seasonal fluctuations in freshwater inflow from the Peace, Myakka, and Caloosahatchee River basins. Other sources of freshwater to the harbor are rainfall, runoff from coastal areas, ground-water seepage and domestic and industrial effluent. Streamflow in the Peace and Myakka Rivers is unregulated, except for one low-water dam in the upper Myakka basin. Discharge in these rivers, therefore, tends to correspond to rainfall patterns in the basins. Discharge in the Peace and Myakka Rivers tends to peak in August and September when rainfall totals generally are greatest.”[69]

However, despite nearly all the wetlands surrounding Charlotte Harbor being state buffer preserves and publicly owned, the historic flowways in Charlotte Harbor have been altered. Many of the tributaries flowing into Charlotte Harbor have been altered by mining and development. For example, the streamflow in parts of the Peace River decreased substantially from 1931 to 1984, probably because of groundwater withdrawals in the basin. The “tidal canals and streams in the coastal area surrounding Charlotte Harbor derive their flow from surface runoff and the surficial aquifer system. Construction of canals and ditches has had a pronounced effect on the water level in the surficial aquifer system. Sea-level canals transport saltwater inland and, at the same time, cause existing freshwater in the surficial aquifer to drain off into the canals. The deep tide canals at the eastern end of Sanibel Island have permanently lowered the water table. Canals have allowed saltwater intrusion in the surficial aquifer system in Charlotte County.”[70]

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[69] Stoker, Yvonne E. 1992. “Salinity distribution and variation with freshwater inflow and tide, and potential changes in salinity due to altered freshwater inflow in the Charlotte Harbor estuarine system, Florida.” *Water-resources investigations report: 92-4062. 30 pp.* Tallahassee, FL: U. S. Dept. of the Interior, U. S. Geological Survey.

[70] Hammett, K. M. 1988. *Land Use, Water Use, Streamflow, and Water-Quality Characteristics of the Charlotte Harbor Inflow Area, Florida.* US Geological Survey, prepared in cooperation with the Florida Department of Environmental Regulation.

Therefore, because Charlotte Harbor watershed has been significantly altered from historical conditions negatively impacting the ecological integrity of the watershed, it received a "Poor" Hydrological grade.

F.2 Pine Island Sound

Although much of the Pine Island watershed is preserved, the historic flowways in portions of the watershed have been altered. The Cape Coral Canal and Drainage System (CCDS) was constructed during the last half of the twentieth century to support urban development. The CCDS consists of 404 miles of freshwater and estuarine canals.

In addition, San Carlos Bay has been drastically altered by human activities. Originally, the connection between the Caloosahatchee River and San Carlos Bay occurred at a shoal of 5.5 feet deep. The shoal was broken and oyster bars removed in 1882 by the U.S. Army Corps of Engineers to create a 7-foot deep, 100-foot wide channel. The channel was widened in 1910 to 200 feet and 12-foot depth to accommodate the passage of steamboats.[71]

The Cape Romano-Pine Island Sound area has also been affected by "major land use changes from the Big Cypress National Preserve to suburban and agricultural." Further it is stated for the region, that "we now have five years of data in the record and can now begin to discuss trends. So far, not much is evident. The largest interannual variations seem to be driven by freshwater releases from the Caloosahatchee River."[72]

Therefore, as the Pine Island Sound watershed is determined to have been moderately altered overall such as to present a degree of negative impact to the watershed, it has been assessed a "Fair" grade.

F.3 Caloosahatchee

The historic flowway of the Caloosahatchee River was significantly altered during the last century. Today, the Caloosahatchee River is the major western outlet from Lake Okeechobee. Historically, it was a shallow meandering stream with headwaters near Lake Hicpochee. The river was extended to Lake Okeechobee in 1884 by dredging. The Caloosahatchee River system "has undergone further modification as part of the central and south Florida Flood Control Project and Okeechobee waterway, including further deepening and widening of the canal (now C-43 canal) and the placement of navigational locks and water control structures."[73]

The Caloosahatchee River Watershed is now affected by Lake Okeechobee and the flood control projects. During the rainy season, fresh water is released from Lake Okeechobee to the Caloosahatchee River to prevent flooding in the lake. This significantly increases the flow of

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[71] Savarese, Michael, and Heather Rein. 2003. *Southwest Florida Regional Restoration Coordination Team Report to the South Florida Ecosystem Restoration Working Group: Restoration and Science Project Recommendations.*

[72] Boyer, Joseph N. 2003. *FY2003 Cumulative Report to the South Florida Water Management District.* Southeast Environmental Research Center, Florida International University, Miami.

[73] Gleason, Patrick J. (editor). 1984. *Environments of South Florida; Present and Past II.* Memoir 2, 2ed. Coral Gables, Miami Geological Society.

fresh water into the Caloosahatchee Estuary. During the dry season, fresh water flowing down the Caloosahatchee River is limited to provide sufficient water for the Lake Okeechobee agricultural lands. As such, the Caloosahatchee River receives too much fresh water during the rainy season, and not enough water during the dry season.

"The natural pattern (quantity and timing) of freshwater flow into the Caloosahatchee estuary has been disrupted due to its unnatural connection to Lake Okeechobee, water control structures on the river, the network of channelized tributaries and drainage canals in the basin, and urban and agricultural demands. Periodic regulatory releases from Lake Okeechobee are made to the estuary via the river. During such releases, the volume of freshwater entering the estuary can be >10,000 cfs. These releases usually occur during the latter part of the dry season when the freshwater inflow would naturally be at its lowest. Because of these discharges, the freshwater flow into the estuary exceeds historical volume, especially in the dry season. Conversely, when regulatory discharges are not occurring, unnaturally low freshwater inflow can occur during the dry season due to high water demand for agricultural and urban uses. The network of channelized tributaries and drainage canals exacerbates the excessive discharge problem.

Several studies indicate this altered flow pattern impacts the Caloosahatchee Estuary. Discharges >6000 cfs from Franklin Lock cause the entire estuary to become oligohaline and can decrease salinity in the outer embayments, San Carlos Bay and Marlacha Pass. Submerged vegetation in the estuary has decreased significantly since installation of Franklin Lock. Other studies suggest impacts on water quality, benthic fauna, and fisheries."[74]

The average long term (1996,-1994) mean daily discharge through S-79 falls between 300-3,000 cfs. Lake Okeechobee only accounts for about 25 percent of the total discharge while rainfall runoff from the basin contributes 75 percent of the remaining discharge through S-79 during the wet season.[75]

Further, "preliminary findings indicate that inflows to the Caloosahatchee Estuary ideally should have mean monthly values between 300 cfs and 2,801 cfs. Currently, the mean daily flows range from 0 cfs to more than 13,652 cfs."[76]

Therefore, because the Caloosahatchee watershed has been significantly altered from historical conditions negatively impacting the ecological integrity of the watershed, it received a "Poor" Hydrological grade.

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[74] Science Subgroup. 1996. "South Florida Ecosystem Restoration: Scientific Information Needs." *Report to the Working Group of The South Florida Ecosystem Restoration Task Force*. <http://everglades.fiu.edu/taskforce/scineeds/sub10.pdf> Accessed 2004 Oct. 15.

[75] Doering, P.H. *et al.* 2002. "Using submerged aquatic vegetation to establish minimum and maximum freshwater inflows to the Caloosahatchee estuary, Florida." *Estuaries.* 25(6b).

[76] [SFWMD] South Florida Water Management District. 2000. "Natural Resources". *Lower West Coast Water Supply Plan*. <http://www.sfwmd.gov/org/wsd/wsp/lwc/pdfs/support/lwcsup4.pdf> Accessed 2004 Oct. 15.

F.4 Estero Bay

Studies of the Estero Bay watershed since the 1970s indicate that several of the tributaries in the watershed have been modified. Some of the flowways have been increased, some decreased, while others have been altered by pollution caused by development. The Estero Bay State of the Bay Report states that since 1970, the size of the Hendry Creek and the Spring Creek watersheds have remained approximately the same. The Estero River basin has increased from 60 square miles to 69 square miles.[77] The Imperial River watershed has decreased from 103 square miles to 92 square miles since 1970.[78] In addition to the changes in the size of the tributaries, development, rock mining, and agriculture have altered the historic flowways in the Estero Bay watershed.

The Mullock Creek basin was altered by the construction of Ten Mile Canal. Ten Mile Canal flows into Mullock Creek which then discharges into Estero Bay. The Ten-Mile Canal was excavated about 1920 to intercept sheetflow from 10 square miles of the Six-Mile Cypress Slough Basin and waters south to Mullock Creek and Estero Bay.[79] This opened lands west of the canal to farming. As the economic climate changed, residential, commercial, industrial and institutional development replaced gladiolus farms. The Ten Mile Canal watershed has grown to 68 square miles, with 55 belonging to Six Mile Cypress. Including the Mullock Creek watershed, which is still the receiving body, the entire subbasin is approximately 78 square miles in size.[80]

"Drainage activity took place within the Estero watershed throughout the 20th century; by 1970, the drainage patterns of the basin had been largely altered to what they are today. There are now ten recognizable subbasins within the Estero watershed. They are: the Barrier Islands, Hendry Creek, Ten Mile Canal/Six Mile Slough/Mullock Creek, Estero River/Halfway Creek, Spring Creek, Imperial River, Leitner Creek, Oak Creek, Corkscrew Swamp and Lake Trafford. Some of the watersheds are relatively undeveloped while one such as Ten Mile Canal/Mullock Creek is the drainage path for portions of the city of Fort Myers. Water control structures to slow drainage and contaminant retention are present on the major rivers, but lacking on the major creeks. Surges of fresh water can reduce salinity, increase turbidity and carry nutrients that have detrimental effects on seagrass beds and the spawning and nursery habitats of many fish species." [81]

"The characteristics of the water in the bay and its tributaries are in a continued state of flux due to daily and seasonal rainfall and tidal influences. The timing of the inflows (hydroperiod)

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[77] [SFWMD] South Florida Water Management District. 1998. *Estero Bay—State of the Bay Report.* <http://www.sfwmd.gov/org/exo/ftmyers/proj/StateOfTheBay1.html> Accessed 2004 Oct. 15.

[78] Mitchell-Tapping, H.J. *et al.* 1999/2000. *Research studies in Estero by Aquatic Preserve, Lee county, Florida.* Fort Myers, FL: Estero Bay Marine Laboratory.

[79] [SFWMD] South Florida Water Management District. 2000. "Secondary Basin Descriptions". *Estero Bay and Watershed Assessment.* < http://www.sfwmd.gov/org/exo/ftmyers/report-text/volb/ch_4_secondarybasins.pdf> Accessed 2004 Oct. 15.

[80] Mitchell-Tapping, H.J. *et al.* 1999/2000. *Research studies in Estero by Aquatic Preserve, Lee county, Florida.* Fort Myers, FL: Estero Bay Marine Laboratory.

[81] [SFWMD] South Florida Water Management District. 2000. "Secondary Basin Descriptions". *Estero Bay and Watershed Assessment.* < http://www.sfwmd.gov/org/exo/ftmyers/report-text/volb/ch_4_secondarybasins.pdf> Accessed 2004 Oct. 15.

affects the bay's capacity to function optimally as a nursery for marine species. The absence of hydroperiod data is a serious gap in the analysis of the State of the Bay. Due to manmade alterations in the watershed, surface water modeling may be the only way to develop a water management plan that will restore and preserve the bay's marine environment and to identify the most critical sources or activities that impact the bay. The cumulative effects of control structures in canals, rivers, and creeks; wetland loss; projected land use; and water demand need to be parameters in the model."[82]

"Freshwater inflow into the Estero Bay estuary generally peaks in September. Flows measured in the Imperial River from 1940 to 1952 indicate that flow in dry months (December to May) averages only about 7% of the total annual inflow. Tidally induced flows in Estero Bay are far greater than freshwater inflow. Because freshwater inflow into Estero Bay is low, salinities at the mouths of the rivers and creeks in the Estero Basin seldom fall below 10 ppt during the rainy season."[83]

In addition, "according to several reports, surface runoff and altered freshwater flows impact water quality greatest within this watershed. Warm, slow moving, estuarine water bodies such as Estero and Imperial Rivers have some naturally low water-quality characteristics such as low DO. Therefore, these may be more susceptible to water-quality impacts resulting from changes in land use." Moreover, "saltwater intrusion into local aquifers has resulted from inadequate recharge of groundwater. This occurrence has been attributed to surface hydrology modifications such as drainage canal construction. The construction of canals has increased surface water flow such that aquifers are not recharging, thereby allowing saltwater to infiltrate. The Ten Mile Canal was constructed circa 1920 to drain a 70 square mile area for agricultural uses. The canal directs this water into Mullock Creek, a tributary of Estero Bay. Generally, this watershed does not have the extensive drainage network of the surrounding areas, but the construction of roads and other berms has still significantly altered the hydrology of the area."[84]

Currently, the assessment of the Bay has been that "tributary flows to Estero Bay have been altered through enhancements to drain land surfaces during wet season and retain water behind weirs and salinity barriers during dry season. This has resulted in a spiked hydroperiod with little discharge in the dry season and sharp peaks during rain events, particularly when water control structures are opened. The lack of surface water retention on the landscape and the elimination of gradual sheetflow delivery to the estuary has shortened freshwater wetland hydroperiods. Surface water table elevations are rapidly lowered and drought conditions are accentuated incurring exotic vegetation to invade into wetlands and an increased severity of fire season. Fisheries and wildlife dependent on depressional wetlands and riparian habitats lose valuable breeding periods and nursery habitats as the hydrologic systems acts as a flush plumbing mechanism. In some areas, wading bird breeding is truncated and fails as wetlands drain too quickly and vital food concentration is lost. Amphibians such as gopher frogs and tree

[82] [SFWMD] South Florida Water Management District. 1998. *Estero Bay—State of the Bay Report.* <http://www.sfwmd.gov/org/exo/ftmyers/proj/StateOfTheBay1.html> Accessed 2004 Oct. 15.
[83] Post, Buckley, Schun, & Jernigan. 1999. *Synthesis of technical information. Technical Report No. 99-02. 2 Vols.* North Fort Myers, FL: Charlotte Harbor National Estuary Program.
[84] [USACE] US Army Corps of Engineers. 2000. "Appendix E: US Environmental Protection Agency Water Quality Study". *Environmental Impact Statement on Improving the Regulatory Process in Southwest Florida.* <http://www.saj.usace.army.mil/permit/hot_topics/SFLAEIS/PDF_Files/deise.pdf> Accessed 2004 Oct. 15.

frogs are unable to complete reproductive life-cycles. Exotic fish, amphibians, and plants dominate."[85]

Therefore, because the Estero Bay watershed has been significantly altered from historical conditions such as to negatively impact the ecological integrity of the watershed, it received a "Poor" Hydrological grade.

F.5 Wiggins Pass/Cocohatchee Estuary

The construction of the Cocohatchee Canal, developments in the uplands, and dredging of the Wiggins Pass estuary have altered the historic flowway of the Wiggins Pass watershed. The Cocohatchee Canal increased the freshwater discharge into the Wiggins Pass estuary.[86] The estuary has been dredged several times as part of Collier County's Inlet Management Plan. The dredging has created a deeper channel though the estuary.

Historically, sheetflow from Lake Trafford flowed south to the Cocohatchee River and into Estero Bay. But like Corkscrew Swamp and the Imperial River basins, development has altered sheetflows. Much of the sheetflow of water from northeast to southwest in the basin has been obstructed by a series of elevated grades and dikes in the interstate area between Corkscrew Road on the north and County Road 846 on the south. Like other interior portions of the watershed, sheetflows vary with the magnitude of storm events.

"Surface water from the more interior areas of Flint Pen Strand and Bird Rookery Swamp are drained into the Estero Bay and the Wiggins Pass/Cocohatchee River Estuarine System through the Imperial River, Spring Creek, and the Cocohatchee Canal."[87]

Therefore, because the Wiggins Pass/Cocohatchee Estuary watershed is determined to have been moderately altered through the inflow from the Cocohatchee Canal and the watershed has been negative impacted to a degree, but has not been determined to be severely degraded as a result. Thus, it has been assessed a "Fair" grade.

F.6 Naples Bay

The Naples Bay watershed has been significantly altered by development and the creation of the Golden Gate Canal System. The Naples Bay watershed was originally about ten square miles. The watershed expanded more that ten fold to approximately 120 square miles when the Golden Gate Canal system was built. Historically, the major sources of freshwater to Naples Bay were the Gordon River, Haldeman Creek, Rock Creek, and direct run-off from the city of Naples, providing a combined discharge of approximately 100 cubic feet per second. The construction of

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[85] [SWFRPC] Southwest Florida Regional Planning Council. 2004. *State of the Bay Update: Trends and Analysis.* <http://www.swfrpc.org/ABM/StateoftheBay/2004.pdf> Accessed 2004 Oct. 15.

[86] Gleason, Patrick J. (editor). 1984. *Environments of South Florida; Present and Past II.* Memoir 2, 2ed. Coral Gables, Miami Geological Society.

[87] [USACE] US Army Corps of Engineers. 2000. "Appendix E: US Environmental Protection Agency Water Quality Study". *Environmental Impact Statement on Improving the Regulatory Process in Southwest Florida.* <http://www.saj.usace.army.mil/permit/hot_topics/SFLAEIS/PDF_Files/deise.pdf> Accessed 2004 Oct. 15.

Golden Gate Canal has considerably increased the flow of freshwater into the Bay in the wet season to as much as 1,500 cfs. In contrast, during the dry season in April, discharge to the Bay drops to near zero.

While the Golden Gate Canal system increased the size of the Naples Bay Watershed, it decreased the size of one of the originally tributaries to Naples Bay – the Gordon River. "The Gordon River Watershed was over 25 square miles in size, extending NE from Naples Bay beyond the present intersection of SR 951 and SR 846. With development that has occurred in the area, specifically the construction of Airport Road (SR 31) and the Golden Gate Canal System, the watershed has been significantly reduced to 8.5 square miles."[88]

"Historically, the major sources of freshwater to Naples Bay were the Gordon River, Haldeman Creek, Rock Creek, and direct run-off from the city of Naples providing a combined discharge of approximately 100 cubic feet per second (cfs). The construction of Golden Gate Canal has considerable increased the flow of freshwater into the Bay in wet season to as much as 1,500 cfs. In contrast, during the dry season in April discharge to the Bay drops to near zero."[89] As a result, the water of Naples Bay "no longer flows into the bay in the same amounts or at the same times as it used to – altering the sensitive balance that once supported fish, oysters, and seagrasses in the bay." [90]

Therefore, because the Naples Bay watershed has been significantly altered from historical conditions such as to negatively impact the ecological integrity of the watershed, it received a "Poor" Hydrological grade.

F.7 Rookery Bay

Although much of Rookery Bay is within the Rookery Bay Aquatic Preserve, its watershed has been altered by development north of the preserve. The primary tributary feeding Rookery Bay is Henderson Creek. "Historically, Henderson Creek received freshwater through surface water sheetflow. Currently freshwater enters Henderson Creek through Henderson Creek Canal, which receives water from the US 41 Canal and Belle Meade."[91]

In addition, "residences, golf courses and agriculture in the headwaters of Henderson Creek may influence water quality in this estuarine system."[92] The Rookery Bay watershed has an increased potential for non-point source pollution runoff and a decreased retention time from channelization of the surface water flow. "Rookery Bay has been described as a "transitional" estuary in terms of its location between high-energy (erosional forces) coastline to the north and

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[88] CH_2M Hill. 1980. *Gordon River Watershed Study*. NA11977.D.O. Naples, Fl

[89] [USACE] US Army Corps of Engineers. 2000. "Appendix E: US Environmental Protection Agency Water Quality Study". *Environmental Impact Statement on Improving the Regulatory Process in Southwest Florida*. <http://www.saj.usace.army.mil/permit/hot_topics/SFLAEIS/PDF_Files/deise.pdf> Accessed 2004 Oct. 15.

[90] Staats, Eric. 2004 Jan. 26. "Election 2004: Candidates address Naples Bay as an Issue". *Naples Daily News.* < http://www.naplesnews.com/npdn/news/article/0,2071,NPDN_14940_2604207,00.html> Accessed 2004 Oct. 15.

[91] Shirley, Michael *et al.* 1997. *Rookery Bay National Estuarine Research and The Ten Thousand Islands Aquatic Preserve Estuarine Habitat Assessment.* NA670Z0463.

[92] Shirley, Michael *et al.* 1997. *Rookery Bay National Estuarine Research and The Ten Thousand Islands Aquatic Preserve Estuarine Habitat Assessment.* NA670Z0463.

the lower energy. Physical water quality is characterized by large fluctuations in salinity and low flushing due to the small size of adjacent upstream watershed. Freshwater arrives into Rookery Bay via Henderson Creek to the west and Stopper Creek to the northwest. Tidal exchange is low due to the presence of oyster bars and low flushing of the shallow creeks that feed into the Bay. Hypersaline conditions can result during periods of drought." [93]

As the Rookery Bay watershed has been slightly altered such as to not present significant ecological detriment to the watershed and the fluctuations in salinity are also attributed to natural factors, its hydrological condition is determined to be "Good".

F. 8 Ten Thousand Islands

Much of the Ten Thousand Islands watershed has been preserved, yet like the Rookery Bay watershed, it too has been altered by upstream development. Some of the tributaries feeding the Ten Thousand Islands remain largely intact, while others have been altered.

One of the many tributaries feeding the Ten Thousand Islands is Blackwater River. "Located approximately 12 miles from downtown Naples, this river is relatively remote and has much of its watershed intact. The hydrology has been slightly altered from the US 41 canal, however, most surface water sheetflow entering Blackwater River enters through natural wetland flowways."[94]

On the other hand, the FakaUnion Canal, which drains the western portion of Golden Gate Estates, a watershed of approximately 234 square miles, also flows into the Ten Thousand Islands. The FakaUnion Canal increased the amount and frequency of freshwater flowing into Ten Thousand Islands.

"The influence of freshwater input from the Everglades is very significant to this region. Large salinity variations are the norm, being driven by both climatic events and water management practices. No hypersaline events were observed, as 2003 was a normal year of precipitation."[95]

However, another source cites that the sugar growing industry has seriously altered the hydrology that flows in and through the Ten Thousand Island watershed. It describes the "consequence of maintaining a drained area in the middle of the Everglades watershed. The Everglades now is cut off from Lake Okeechobee, which periodically overflowed its banks into the River of Grass. Besides being polluted, the water now fails to move at the right depth at the right time over the right space. The disrupted flow to Everglades National Park and Florida Bay has caused a 90 percent loss of wading birds and serious damage to the fishing grounds,

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[93] [USACE] US Army Corps of Engineers. 2000. "Appendix E: US Environmental Protection Agency Water Quality Study". *Environmental Impact Statement on Improving the Regulatory Process in Southwest Florida.* <http://www.saj.usace.army.mil/permit/hot_topics/SFLAEIS/PDF_Files/deise.pdf> Accessed 2004 Oct. 15.
[94] Shirley, Michael *et al.* 1997. *Rookery Bay National Estuarine Research and The Ten Thousand Islands Aquatic Preserve Estuarine Habitat Assessment.* NA670Z0463.
[95] Boyer, Joseph N. 2003. *FY2003 Cumulative Report to the South Florida Water Management District.* Southeast Environmental Research Center, Florida International University, Miami.

including the Ten Thousand Islands and the Florida Keys. In addition, 68 species of plants and animals found in South Florida are threatened or endangered."[96]

Therefore, because the Ten Thousand Islands watershed is determined to have been moderately altered overall such as to present a degree of negative impact to the watershed, it has been assessed a "Fair" grade.

[96] Friends of the Everglades. 2004. Web page displaying an online letter to members of congress. <http://www.everglades.org/sugarletter.html> Accessed 2004 Oct. 15.

APPENDIX G
Scoring with Collier Estuaries Based on FDEP Basin Boundaries

The Conservancy proposes using 21 indicators in three different categories – Wildlife Habitat, Species, and Hydrology/Water Quality – to assess the estuaries. The Report Card is intended to assess all eight of the Southwest Florida estuaries using the same indicators. Unfortunately, data do not exist across the board for many of the proposed indicators. For example, while the Conservancy identified data regarding the aerial extent of mangroves and seagrasses in Charlotte Harbor, similar data for Naples Bay and Wiggins Pass do not exist. At this stage sufficient data exist to utilize indicators of Wildlife Habitat and Water Quality.

This Chapter discusses the data the Conservancy identified for Aerial Extent of Public Conservation Lands, Wetlands Aerial Extent, and the Hydrology/Water Quality indicators. This is the information the Conservancy relied on to grade each of the estuaries.

The data identified for the remaining Wildlife Habitat, Species, and Hydrology/Water Quality Indicators are discussed in Part IV-B of this report. The Conservancy will continue to research all of the proposed indicators, and intends to expand the indicators used to assess the estuaries in future Report Cards.

G.1 Wildlife Habitat

Wildlife habitat in the estuary itself and in its watershed is an important indicator of estuarine health. Two measures of wildlife habitat were utilized for this Report Card: (1) aerial extent of wetlands within the estuary and its watershed; and (2) aerial extent of conservation lands within the estuary and its watershed. Both of these can be compared to an historic baseline: for wetlands, a pre-development vegetation map assembled by the South Florida Water Management District as part of the Southwest Florida Feasibility Study was utilized as the baseline; for conservation lands, the pre-development baseline is assumed to be the entire area of the estuaries and their watersheds (all conservation). The percentage of current habitat as compared to the baseline provides the score for assigning a grade for wildlife habitat for each estuary.

G.1.1 Wetlands Aerial Extent

To assess the wetlands aerial extent for each of the estuaries, the Conservancy compared the estimated extent of predevelopment wetlands within each estuary's watersheds with the current estimated extent of wetlands. The Conservancy relied on the South Florida Water Management District's SWFFS Pre-Development Vegetation map[97] to determine the predevelopment wetland coverage. FDEP provided the Conservancy with the figures for the current wetland extent. Please note that the pre-development wetlands acreage does not include all of Peace and Myakka and 7 WBIDs in Charlotte Harbor. Details of the wetlands acreage for each estuary are found in Appendix A.

Estuary	Pre-development Wetlands Acreage	Current Wetlands Acreage	Percentage of Baseline
Charlotte Harbor (excl. Peace/Myakka watershed)	46,501	43,238	93
Pine Island Sound	22,228	29,459	128
Caloosahatchee	304,543	148,399	48
Estero Bay	112,610	58,341	52
Wiggins Pass	111,445	73,560	66
Naples Bay	29,954	11,102	37
Rookery Bay	54,728	34,782	64
Ten Thousand Islands	1,035,692	888,236	86

[97] [SFWMD] South Florida Water Management District. 2004. Web page for GIS data distribution. <http://spatial1.sfwmd.gov/sfwmdxwebdc/dataview.asp?query=unq_id=1080> Accessed 2004 Oct. 15.

G.1.2 Aerial Extent of Conservation Areas

The Conservancy identified the federal, state and local public conservation lands for each estuary's watershed based on information provided by the Florida Department of Environmental Protection (FDEP) and from the Florida Natural Areas Inventory. For future Report Cards, the Conservancy intends to expand the Conservation Areas indicator to include privately held conservation lands or aquatic preserves and conservation easements. The individual conservation areas and their acreage are provided in Appendix B.

Estuary	Total Acreage	Conservation Areas Acreage	Percentage of Baseline
Charlotte Harbor (excl. Peace/Myakka watershed)	211,902	61,800	29
Charlotte Harbor (incl. Peace/Myakka watershed)	2,090,821	361,993	17
Pine Island Sound	154,808	91,177	59
Caloosahatchee	858,096	50,133	6
Estero Bay	201,021	34,551	17
Wiggins Pass	190,312	22,580	12
Naples Bay	39,762	24	6
Rookery Bay	57,077	15,000	26
Ten Thousand Islands	1,137,078	296,616	26

G.2 Water Quality/Hydrology

G.2.1 Water Quality

For this first *Estuaries Report Card*, the Conservancy is relying on the following Water Quality indicators to assess the health of each estuary: 1) Chlorophyll a; 2) Dissolved Oxygen; 3) Biochemical Oxygen Demand; 4) Nutrients; 5) Fecal Coliform Bacteria; 6) Turbidity; and 7) Metals. The baseline for each of these indicators is the state water quality standards, as defined in 62-303.530 F.A.C. We have assumed that the waters of this region's estuaries and coastal watersheds met all water quality standards prior to development impacts in the region. To determine if a water body currently meets state water quality standards for Charlotte Harbor, Pine Island Sound, the Caloosahatchee River, and Estero Bay, the Conservancy is relying on the Florida §303(d) List approved in part by EPA in the June 11, 2003 Decision Document, the state list of Verified Impaired Waters for Group 1 Basins, and the state list of Potentially Impaired Waters for Group 1 Basins for the estuaries in Lee and Charlotte Counties.

For Wiggins Pass/Cocohatchee River, Naples Bay, Rookery Bay, and the Ten Thousand Islands, the Conservancy relied on a report titled "Compilation, Evaluation, and Archiving of Existing Water Quality Data for Southwest Florida" prepared by Tetra Tech, Inc. and Janicki Environmental on May 5, 2004 for the Jacksonville Army Corps of Engineers in support of the Southwest Florida Feasibility Study. The reason that the Conservancy did not rely on the EPA June 11, 2003 Decision Document for the latter estuaries was that the Conservancy has serious concerns as to the accuracy of the watershed boundaries and Water Basin ID (WBID) boundaries for Collier County as they are purported in that document and is seeking to rectify those inaccuracies. For illustrative purposes, the water quality watershed boundaries for the WBIDs and their aggregated subbasins, with the resulting analysis as it would be if based on the EPA June 11, 2003 Decision Document, is included as Appendix G.

To determine the water quality grade for each estuary the Conservancy calculated the percentage of acres of impairment for each estuary's watershed. First, the Conservancy determined the total number of acres for each estuary by totaling the acreage for each WBID within the estuary's watershed.

Second, the Conservancy determined the acres of impairment for each estuary's watershed. To do this, the Conservancy determined the number of water quality indicators for which each WBID failed to meet the state water quality standards. Using the §303(d) lists, the Conservancy identified whether each WBID in each estuary meets the water quality indicators. Once the Conservancy identified the number of indicators for which a WBID does not meet the state water quality standards, the Conservancy multiplied that number times the acreage of the WBID. Finally, the Conservancy totaled that number to determine the acres of impairment for each estuary.

The last step is to divide the acres of impairment within that watershed by the total acres of the watershed. This yields the percentage of impairment for each watershed.

The following table presents the percentage of impaired water quality for each estuary and its watershed. Appendix C presents the impaired water quality parameters for each waterbody within each estuary and its watershed as well as a discussion of the Florida Impaired Waters List and the EPA 303(d) list. Appendix D presents the total acreage of impairment for each waterbody within each estuary with totals for each watershed.

Estuary	Total Acreage	Acreage of Impaired Water Quality	Percentage of Impaired Water Quality
Charlotte Harbor (incl. Peace/Myakka watershed)	2,090,821	2,689,579	129
Pine Island Sound	154,807	99,950	65
Caloosahatchee	858,096	1,680,500	196
Estero Bay	201,021	343,139	171
Wiggins Pass	190,312	209,991	110
Naples Bay	39,762	71,671	180
Rookery Bay	57,077	42,400	74
Ten Thousand Islands	1,137,078	1,918,486	169

G.2.2 Hydrology

Several of the estuaries in Southwest Florida are impacted by either too little freshwater flows, due to diversions of water from their watersheds, or too much freshwater flow, due to drainage features that push water out through the estuaries in the wet season. There is no currently available quantitative evaluation of the hydrology of each of the estuaries in Southwest Florida, but reports exist of freshwater flow problems in many of the estuaries.

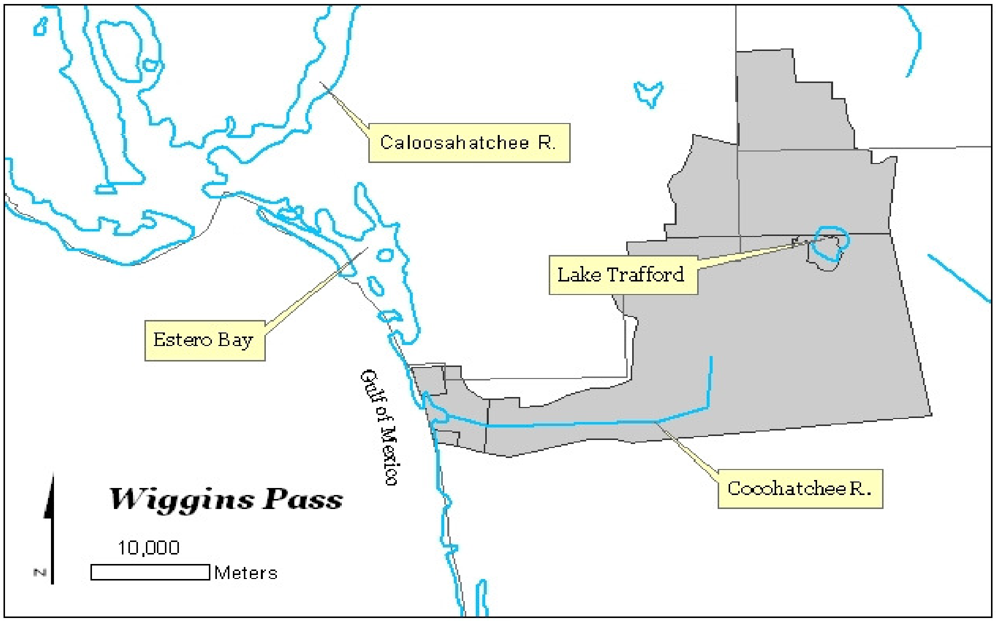
For some of the tributaries to the estuaries, a minimum freshwater flow has been adopted by either the Southwest Florida Water Management District or the South Florida Water Management District using the best available science to establish a minimum flow for preventing harm to the tributary or its downstream estuary. A minimum flow has been established for the Peace River and for the Caloosahatchee.

The following table lists each estuary and a summary of the hydrologic conditions. The methodology to determining whether the watershed's current hydrologic condition would be classified as "Good", "Average", or "Poor" is described in Chapter IV of this report. The information used to support the determination for each individual estuary is referenced in Appendix E.

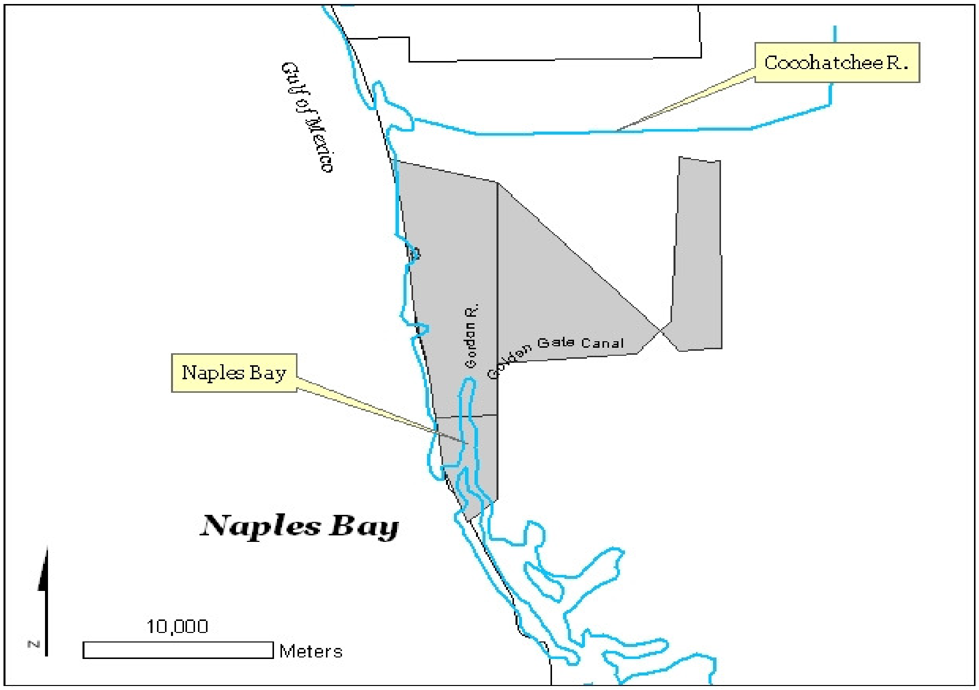
Estuary	Summary of Hydrologic Conditions
Charlotte Harbor	Poor
Pine Island Sound	Fair
Caloosahatchee	Poor
Estero Bay	Poor
Wiggins Pass	Fair
Naples Bay	Poor
Rookery Bay	Good
Ten Thousand Islands	Fair

G.3 FDEP WBID Boundary Maps

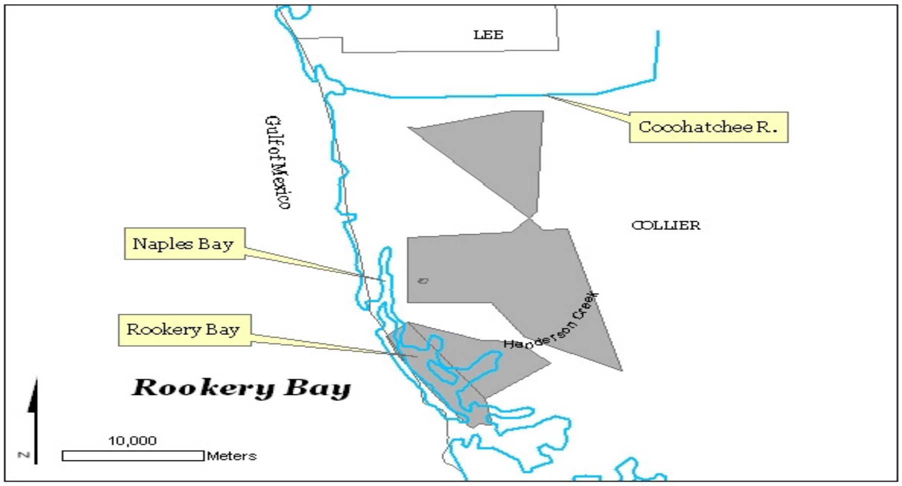
G.3.1 Wiggins Pass



G.3.2 Naples Bay



G.3.3 Rookery Bay



G.3.4 Ten Thousand Islands

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