

## Executive Summary

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The Collier County Watershed Management Plan (CCWMP) has been developed using an integrated water resources approach to balance water needs of both the human and natural system environments in the County's watersheds and estuaries. One of the key features of this approach is that it takes advantage of opportunities for restoring the natural ability of the landscape to benefit the human environment and protect the water quality, water quantity, and natural systems in the County.

### Directive

The CCWMP was prepared to address protection of the County's estuarine and wetland systems, consistent with Florida Statute (Subsection 163.3177(5)(d)). Applicable Elements of the Collier County's Growth Management Plan (GMP) addressed by the CCWMP include Conservation and Coastal Management and Drainage. The development of WMPs is specifically called out under Goal 2 of the Conservation and Coastal Management Element, Protection of surface and estuarine water resources.

### Background and Purpose

Under pre-development conditions, surface waters flowed through wetlands in Collier County into the Rookery Bay and Ten Thousand Island estuaries. Extensive canal construction began in south Florida in the 1940s and the Golden Gate Canal network was constructed in the 1960s. Drainage canals and urbanization altered regional surface and groundwater flow patterns, lowered groundwater levels, increased freshwater discharges to estuaries, and drained wetlands. Associated urbanization and coastal development displaced native habitats, increased surface water discharges, reduced aquifer recharge, and increased pollutant loads to estuaries. As a result, what was historically a regional watershed, has become multiple, artificially created watersheds and restoring regional function via a County-wide watershed management approach is critical to restoring historical functions that allow the

County to manage the resources for both human and natural water needs.

This CCWMP presents an evaluation of these issues with respect to pre-development conditions, performance measures by which to evaluate proposed management actions, and recommendations for water management actions that will improve the volume and timing of flows to the estuaries, reduce pollutant loads, increase groundwater recharge, and restore natural systems, to the extent possible, in the County. Recommendations were developed to:

- Restore historical water quantity and estuarine discharges
- Improve water quality within the watersheds and estuaries
- Address flood control and water supply issues

### Study Area

The CCWMP was developed to address conditions in both the watersheds and estuaries (Figure ES-1). The study area includes: three high priority watersheds: Cocohatchee-Corkscrew, Golden Gate, and Rookery Bay. The eastern watersheds, Faka Union, Okaloacoochee / State Road (SR) 29, and Fakahatchee watersheds, were evaluated as a single unit due to the less intensive land development and restoration activities currently underway in these watersheds. The estuaries in the study area are Wiggins Pass, Naples Bay, Rookery Bay, and the Ten Thousand Islands estuaries.

### Approach

Relevant data were compiled from numerous sources, including agencies, Florida STORET data base, literature, and other reports. Two primary tools were used to model and compare pre-development with current conditions in the study area. The Natural Systems Model (NSM) was originally developed by the South Florida Water Management District (SFWMD 1989) to simulate the pre-development conditions in the Everglades.

The NSM was revised for the Big Cypress Basin model (SFWMD 2007) and used in this study. Existing conditions were modeled using the Collier County MIKE SHE/MIKE11 Existing Conditions Model (ECM). The ECM is an integrated surface and groundwater model

Differences between pre- and post-development conditions were applied to develop performance measures for assessing watershed and estuary conditions and providing a measure of improvement, or “lift,” anticipated as a result of implementing proposed management actions. Performance measures were developed for surface waters in natural systems, freshwater discharges to estuaries, pollutant loads, and groundwater availability.

A series of potential capital improvement projects was identified, screened, and ranked to develop a list of recommended projects for addressing water resource issues in the County. Rankings are based on the anticipated improvements, or “lift,” in the system due to proposed projects. A benefit/cost analysis was also completed, for which benefit=lift and cost=construction cost. Priority project are recommended and described for each watershed. Non-structural (policy) actions were also evaluated to support water management objectives.

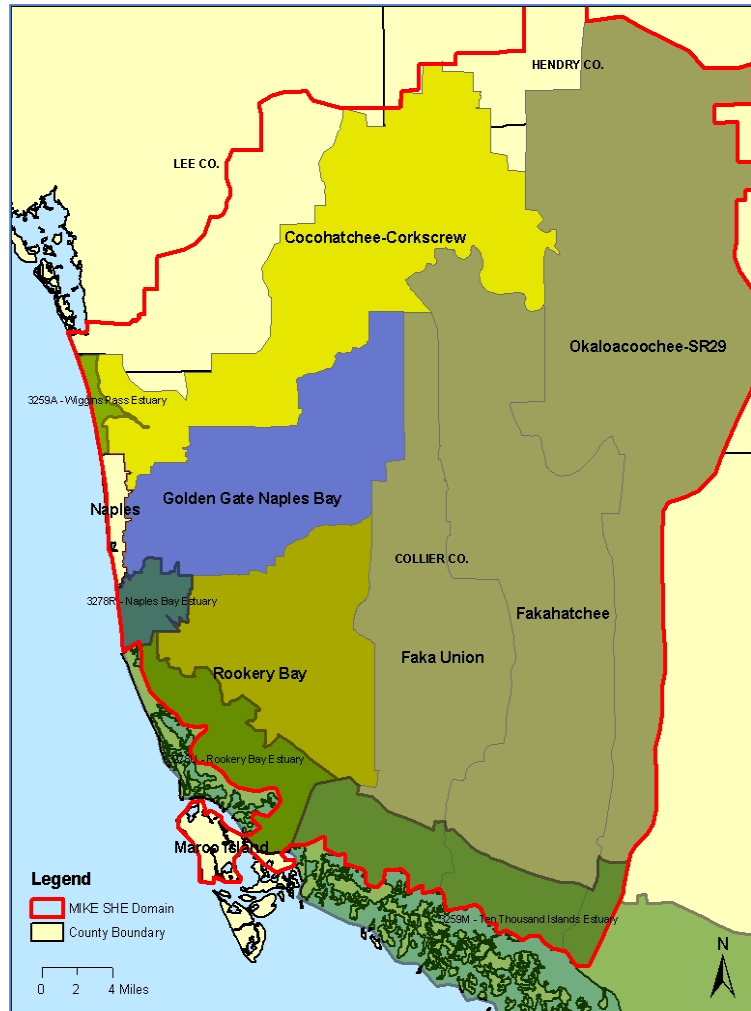


Figure ES-1. Collier County Watersheds and Estuaries

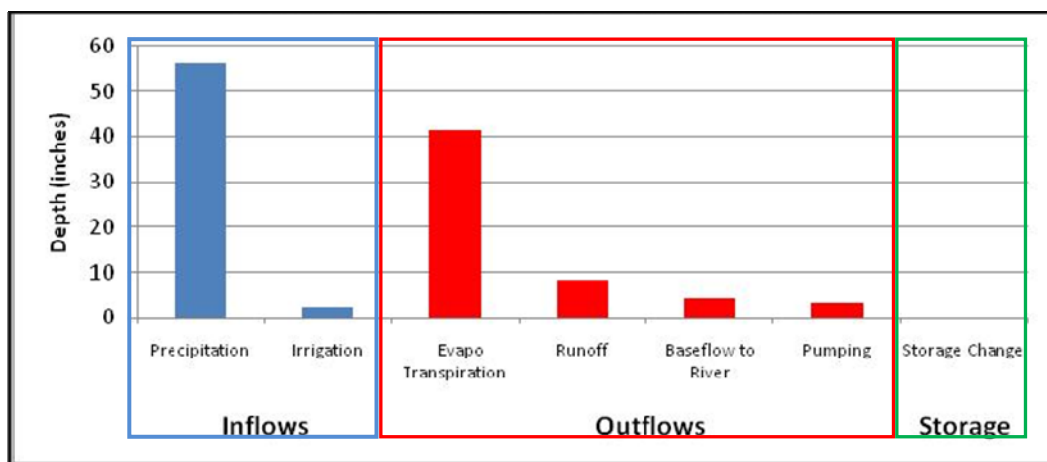


Figure ES-2. Surface Water Budget for Collier County

## Results: Element 1, Existing Conditions – Watersheds

The canals have increased the freshwater discharges to the Naples Bay estuary by as much as 10 times compared with pre-development conditions and altered the timing and volume of flows to the other estuaries. Development and altered surface water flows have led to a dramatic decline in natural wetland systems in the County, including nearly 70 percent of the wetlands in the Golden Gate – Naples Bay watershed.

**Watershed surface water quantity.** Stormwater runoff volumes are strongly influenced by precipitation, therefore, small changes in rainfall can result in large runoff changes. Base flow contributions increase with canal density, therefore managing canal stages in response to groundwater levels can help manage freshwater discharges to estuaries. No net loss or gain in watershed storage was documented for the simulation period examined. Annual storage losses in the dry season correspond with high base flow contributions and withdrawals from the surficial and lower Tamiami aquifers for potable and irrigation water supply.

Lowering the water surface in the canal network prior to large storm events can provide storage in the canal network and mitigate flood risks. Base flow and runoff in the Naples-Golden Gate watershed is larger when compared with the others.

**Instream water quality.** Water quality in Collier County watersheds was evaluated with respect to Total Maximum Daily Load (TMDL) conditions per the Florida Department of Environmental Protection (FDEP) verified list of impaired waters. Multiple impairments were documented. Each of the 6 watersheds have identified dissolved oxygen impairments, possibly due to anthropogenic pollutant loads, surface water runoff from forested wetland landscapes, and groundwater contributions. Two watersheds had fecal coliform impairments and 1 was impaired for nutrients.

**Watershed pollutant loads.** Areas with larger pollutant loads corresponded to areas without

Best Management Practices (BMPs). Nutrient loads were higher in older urban and agricultural areas and may be due to fertilizer applications. Higher biological oxygen demand and metals loads corresponded with low/medium residential areas and urban areas, respectively.

**Watershed hydrogeology (groundwater budget).** The groundwater system in Collier County is a regional reservoir and varies in response to seasonal changes. Current wet season recharge in each aquifer corresponds to the current dry season withdrawals in the 4 aquifers examined (water table, lower Tamiami, sandstone, and mid-Hawthorne aquifers). The pattern of drawdown was similar among the water table, lower Tamiami, and sandstone aquifers (Figure ES-3). The mid-Hawthorne is relatively isolated from these three and exhibits a somewhat different pattern due to limited withdrawals.

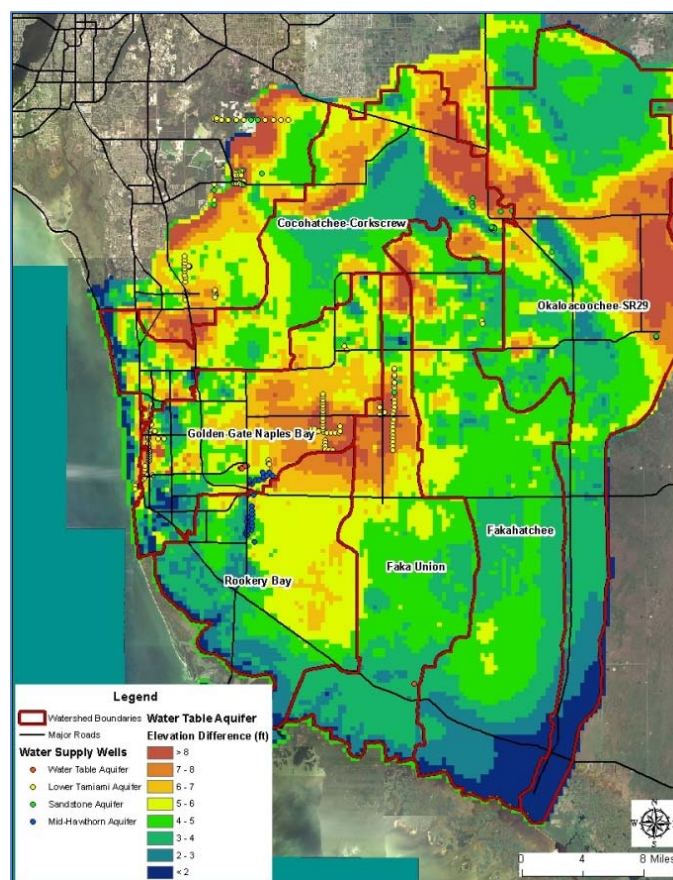


Figure ES-3. Water Table Aquifer Average Annual Groundwater Fluctuation



Structural operations changes in the Golden Gate Canal may provide opportunities to reduce groundwater losses and increase water availability. Reducing groundwater withdrawals for agricultural irrigation will increase the water available for potable supply and habitat protection.

**Water uses.** Changes in groundwater levels due to withdrawals were examined with respect to minimum aquifer levels established by the SFWMD. Predicted declines were more than 5 feet in many areas of the County and in all 4 of the aquifers under a scenario of a 10 percent increase in groundwater withdrawals (Figure ES-4). Predicted impacts were greater under prolonged dry season conditions.

#### **Groundwater quality and pollutant loads.**

Dissolved oxygen concentrations in groundwater are less than 1.5 mg/L in most of the county and are likely a source of the dissolved oxygen impairments in the canals. Total nitrogen in most of the county and phosphorus concentrations in the north county and coastal areas exceed corresponding surface water criteria and may be a source of the nutrient impairment to Rookery Bay. Iron, but not copper, in surface waters, may be attributable to groundwater sources. No correlation was found between septic tank density and nutrient concentrations in the watersheds.

**Natural systems.** A landscape-level functional assessment method (modified from Florida's Unified Mitigation Assessment Method) was used to assess, and assign value to, existing natural systems conditions in the watersheds in Collier County. In general, the combined Faka Union, Okaloacoochee/ SR29, and Fakahatchee watersheds exhibited the highest functional value (the least change from pre-development) when compared with the other watersheds. Measured functional value was less in the Rookery Bay and Cochatchee-Corkscrew watersheds, and least in the Golden Gate-Naples watershed. Landscape suitability index (LSI), vegetation, and hydrology scores provide performance measures

for evaluating potential improvement projects. The functional assessment analysis also provides a means of identifying ecologically valuable lands, such that comparisons can be made with areas currently included in the County's or the SFWMD's preserved lands and supportive agricultural lands programs. Ecologically valuable and supportive lands (ES-5) were identified in the watersheds via consideration of LSI and vegetation scores. Hydrology scores (Figure ES-6) were not included in the identification of ecologically valuable lands, due to focus on natural and passive land use management rather than identification of hydrological restoration projects. However, hydrologic restoration may provide the greatest opportunity for measurable improvements.

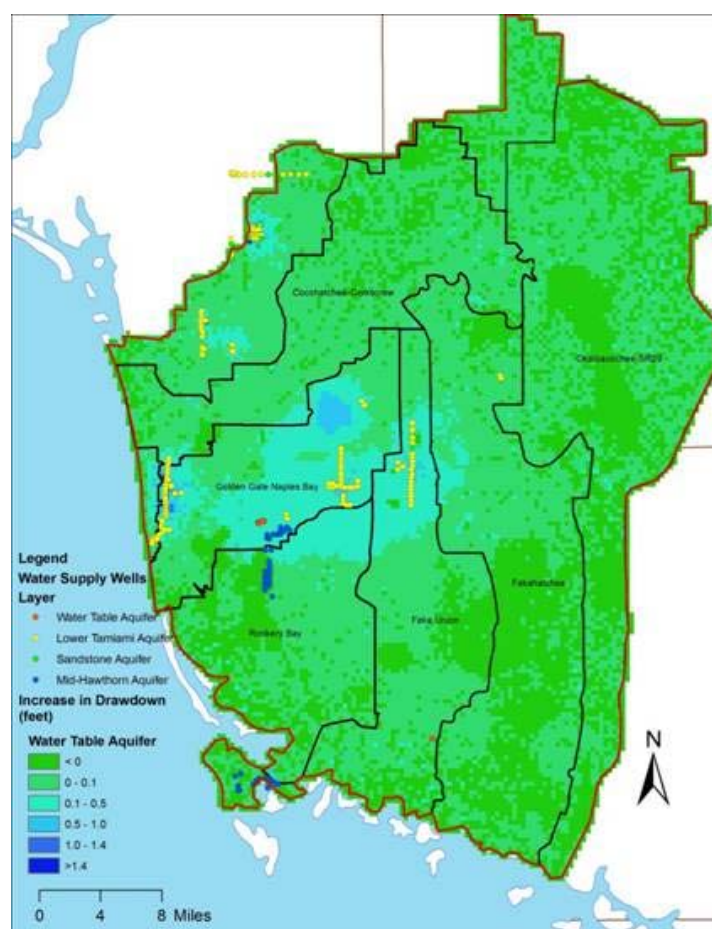


Figure ES-4. Water Table Aquifer (Prolonged Dry Season) Drawdown with 10 percent Increase in Withdrawals

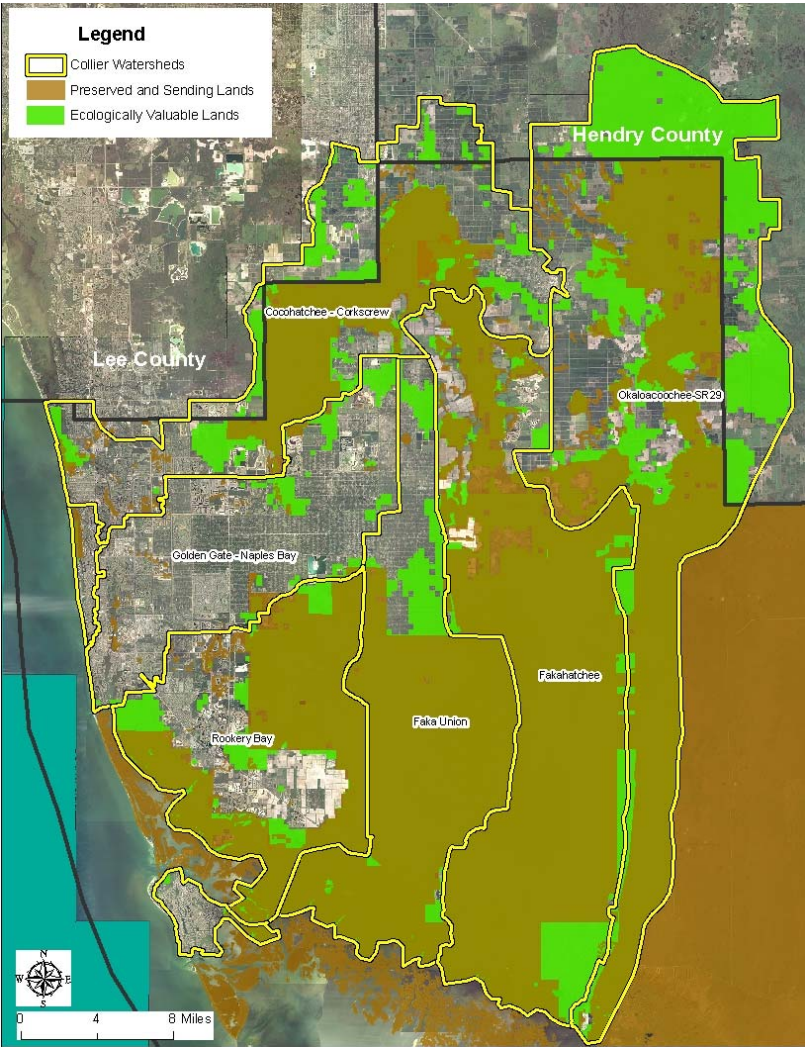


Figure ES-5. Ecologically valuable and supportive lands

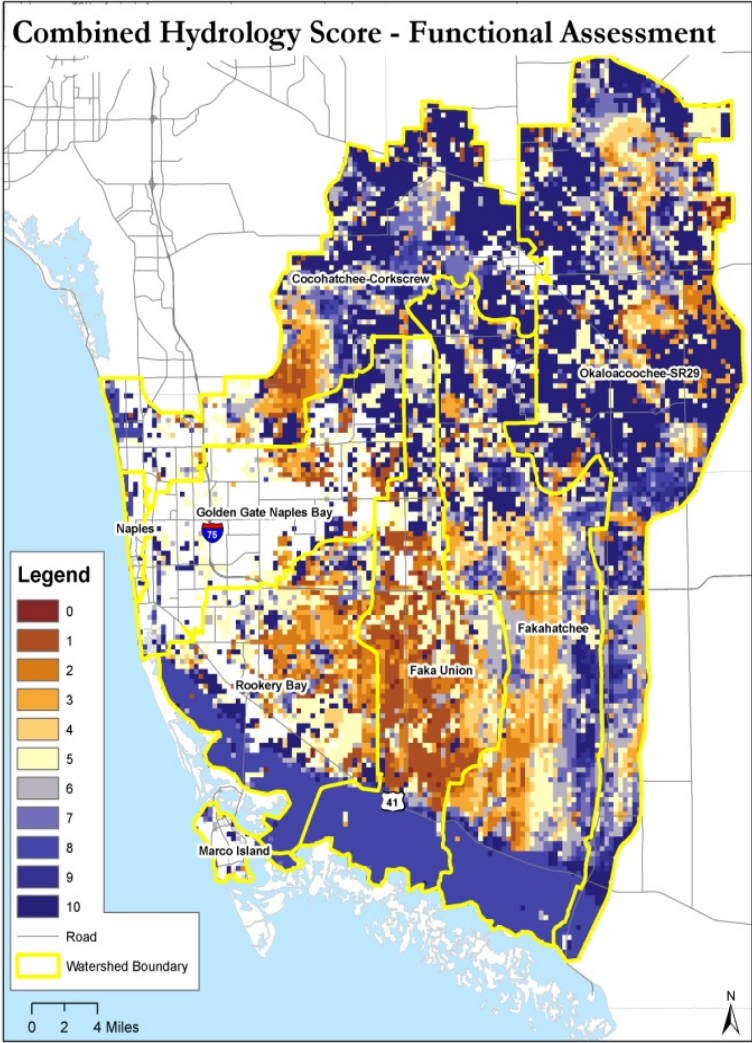


Figure ES-6. Hydrology assessment (pre-development vs. existing conditions)



## Results: Element 2, Existing Conditions – Estuaries

**Volume and timing of freshwater flows.** Excess wet season runoff under existing conditions (ECM), compared with pre-development (NSM) conditions is the primary issue in the Wiggins Pass, Naples Bay, and Ten Thousand Islands estuaries (Figure ES-7). For the Rookery Bay Estuary, the primary issue appears to be the timing of flow to the estuary and is due to excess water during the wet season and too little water during the dry season (Figure ES-8). Salinity model results (green bars) are consistent with differences measured by comparing pre- and post- development conditions.

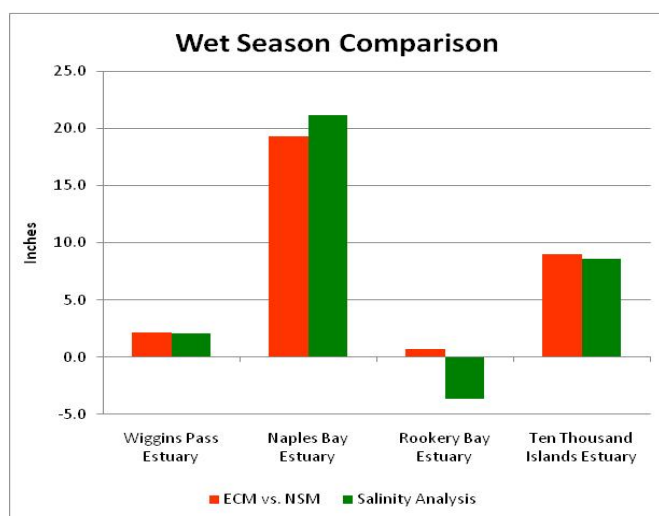


Figure ES-7. Wet season runoff (inches) in Collier County estuaries

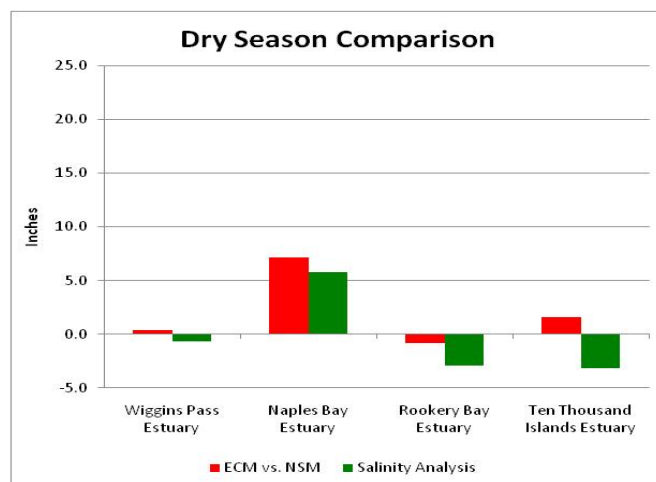


Figure ES-8. Dry season runoff (inches) in Collier County estuaries

**Water quality of discharge.** Collier County estuaries are typically impaired (with respect to state water quality criteria) for dissolved oxygen and fecal coliform bacteria. Rookery Bay is also impaired for nutrients.

Concentrations of dissolved oxygen and fecal coliform bacteria in the discharges to the estuaries also exceed water quality criteria. Consequently, the watershed conditions are likely impacting the receiving estuaries. While causes of low dissolved oxygen are often attributed to nutrients, groundwater influence, and water color, the causes in these estuaries are not clear and would require further study. Fecal coliform bacteria may not be an appropriate indicator for pathogenic diseases in the sub-tropical climate and further source identification efforts are warranted.

Other parameters of impairment concern are iron and copper. Iron appears to result from the groundwater discharges throughout the canal network, although other sources are possible. High copper concentrations may be the result of anthropogenic impacts such as the use of copper sulfate as an algacide to prevent algae growth in ponds or leaching from boardwalks and pilings that are constructed from pressure-treated lumber.

**Quality of receiving waters.** Water quality impairments identified as part of the Florida Department of Environmental Protection (FDEP) total maximum daily load (TMDL) program were confirmed with a single exception: the Rookery Bay impairment for chlorophyll-a was not confirmed and should be addressed with FDEP. The Wiggins Bay, Naples Bay, and Rookery Bay estuaries were found to be impaired for dissolved oxygen and fecal coliforms. Wiggins Bay was also found to be impaired for iron, and Naples Bay was found to be impaired for iron and copper. The Ten thousand Islands estuary is not listed as, and was not found to be, impaired for any water quality parameter. Collier County should consider working with the Florida Department of Environmental Protection (FDEP) to determine the sources

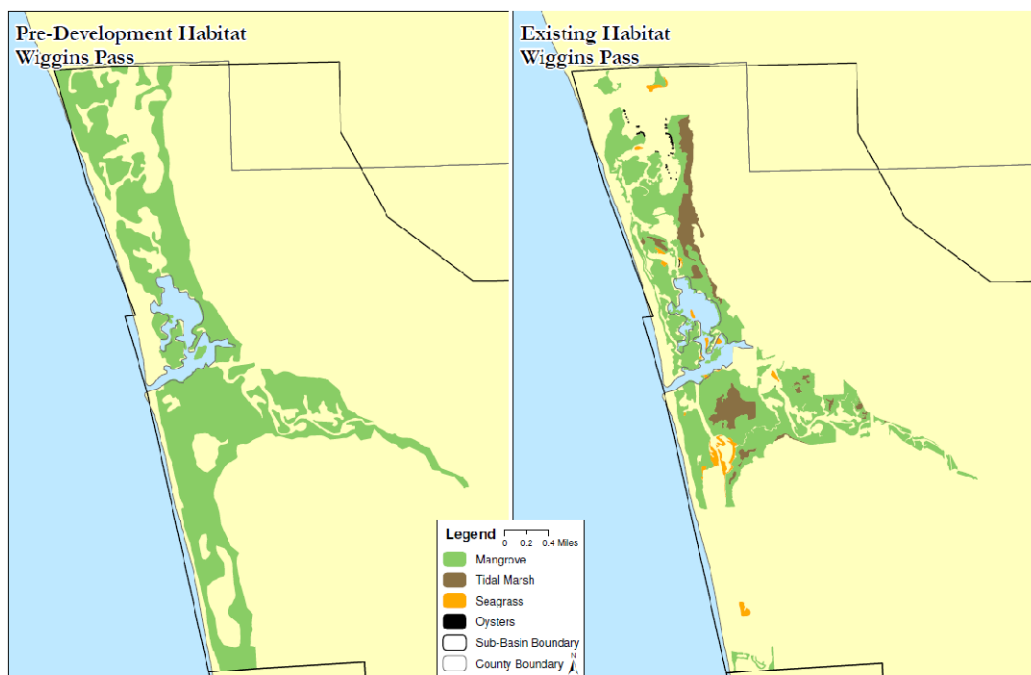


Figure ES-9. Wiggins Pass Habitat

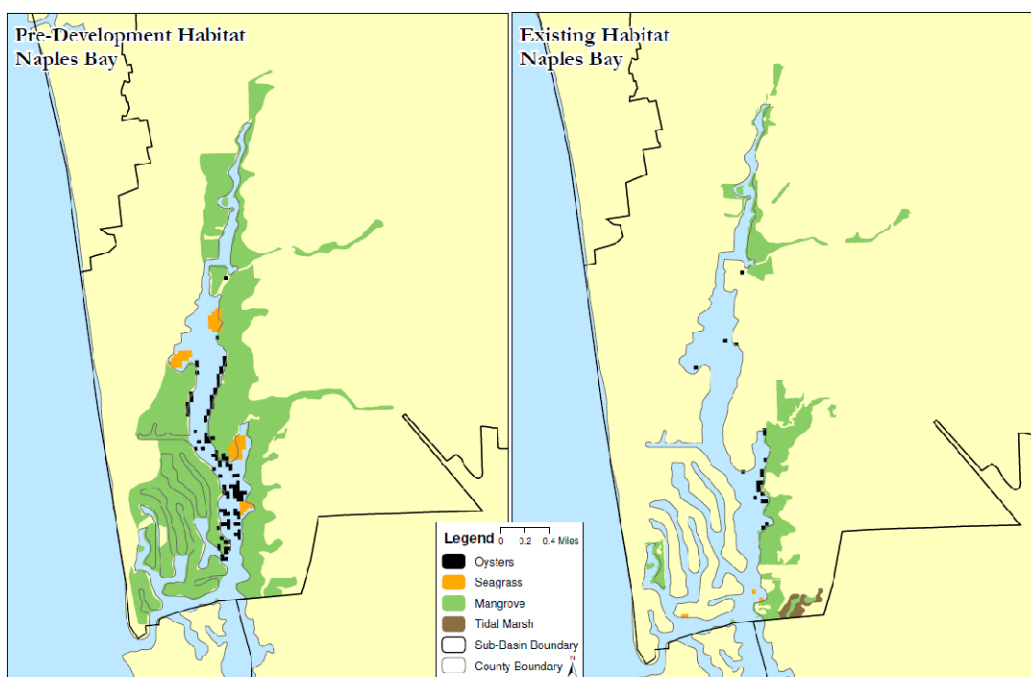


Figure ES-10. Naples Bay Habitat

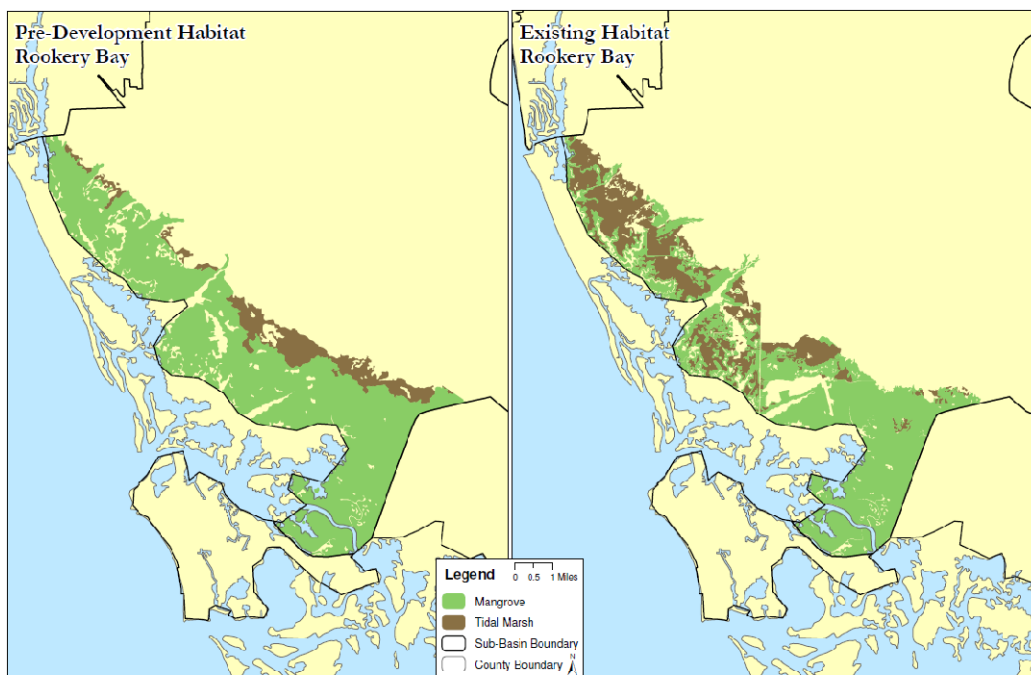


Figure ES-11. Rookery Bay Habitat

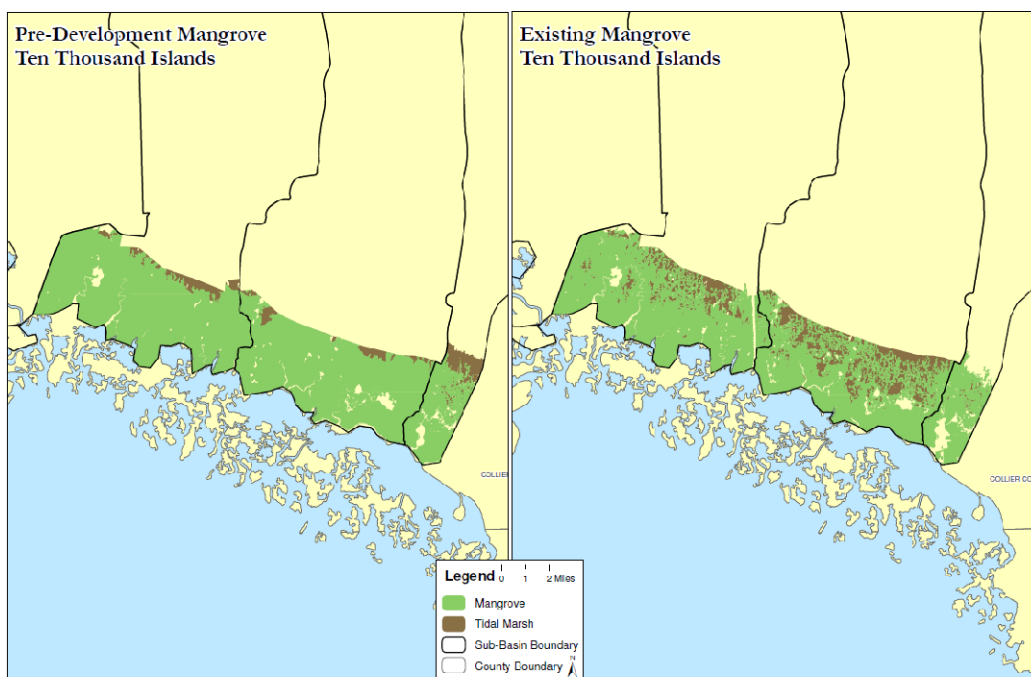


Figure ES-12. Ten Thousand Islands Mangrove



for the identified impairments in Wiggins, Naples, and Rookery Bay estuaries.

**Coastal habitats.** The reduction in areal extents of oyster bars, seagrass beds, mangrove forests and salt marshes in the estuaries is attributable to direct physical loss associated with coastal development. Habitat loss in Wiggins Pass and Naples Bay estuaries (Figures ES-10 and ES-11) is substantially greater when compared with the Ten Thousand Islands and Rookery Bay estuaries (Figures E-12 and E13), due to greater urbanization in Wiggins Pass and Naples Bay estuaries. In the Wiggins Pass estuary, the combined acreage of salt marsh and mangroves has declined by 29 percent over pre-development conditions. Acres of salt marsh and mangrove have declined by approximately 76 percent in Naples Bay. In contrast, the less-impacted estuaries of Rookery Bay and the Ten Thousand Islands have experienced salt marsh and mangrove declines of 12 and 5 percent, respectively.

### Results: Element 3, Performance Measures

Performance measures were developed as a baseline against which to measure the improvement, or “lift” due to implementation of a proposed project. Performance measures were developed with respect to seasonal water levels for natural systems, for freshwater discharges to estuaries, pollutant loads, and groundwater aquifers.

**Natural systems.** Functional assessment scores, or performance measures, are presented below (Table ES-1) for the watersheds in Collier County. Higher scores indicate greater similarity to pre-development conditions. Average scores are lower in the Golden Gate-Naples Bay watershed due to extensive canals systems and development and indicate that hydrologic restoration may provide the greatest opportunity for measurable improvement in functional value in Collier County.

**Freshwater discharge to estuaries.** Performance measures (scores) are based on comparisons of timing and volume of discharges to estuaries for modeled pre- (NSM) and post- (ECM) development conditions. Average monthly

Table ES-1. Average Functional Values (Performance Scores) for Non-Urban Lands, by Watershed

Watershed	Non-Urban Acres	Vegetation Score	Hydrology Score	LSI Score
Cocohatchee-Corkscrew	111,250	7	7	8
Golden Gate-Naples	36,627	5	6	6
Rookery Bay	83,105	8	6	9
Faka Union/ Okaloacoochee SR 29/ Fakahatchee	431,414	9	6	9

discharge volumes from the NSM and ECM models were used to define the baseline distribution and total volume of flow from each watershed. Higher scores indicate greater similarity to pre-development conditions. The Golden Gate – Naples Bay watershed had the lowest annual score of 1.6 and is indicative of the year round flow surplus into Naples Bay. The scores for the Rookery Bay indicate dry season freshwater deficits, likely due to the reduced watershed caused by construction of the Golden Gate Canal. The wet season surplus is likely due to stormwater runoff from the Lely area and from the agricultural lands in the southeastern watershed.

Table ES-2. Discharge to Estuary Performance Scores

Watershed	Annual Score	Dry Season Score	Wet Season Score
Golden Gate-Naples Bay	1.6	1.9	1.0
Cocohatchee-Corkscrew	5.4	6.9	2.5
Rookery Bay	4.3	3.1	6.8
Faka Union, Okaloacoochee / SR 29, and Fakahatchee	5.6	7.4	2.0

Scores for the Cocohatchee-Corkscrew, and eastern watersheds suggest that the operational controls used to manage dry season flows are reasonably effective at matching pre-development flow conditions. This contributes to the higher scores during the dry season. Low wet season

scores in all watersheds point to the effect of development on the natural drainage system.

**Surface water pollutant loads.** Pollutant load performance measures (scores) for watersheds were based on data for the individual basins (as designated by FDEP water body identification numbers, or WBIDs) that make up each watershed. Scores were calculated as a function of pollutant loads relative to medium density residential reference loads (in contrast to NSM vs. ECM model results). Current scores indicate that the WBIDs of most concern are in the Cocohatchee – Corkscrew and the Golden Gate – Naples Bay watersheds, particularly the coastal segment of Naples Bay and the Gordon River Extension. The Golden Gate – Naples Bay watershed received the lowest average scores for the other pollutants because of the presence of areas of urban development with no treatment. Lake Trafford WBID had a score of zero because the WBID includes only the lake itself.

**Surface waters.** As described previously the eastern watersheds exhibited the highest functional value, i.e. performance measure, therefore the least change from pre-development conditions, when compared with the other watersheds. In the estuaries, functional value was less in the Rookery Bay and Cocohatchee-Corkscrew watersheds, and least in the Golden Gate-Naples watershed (see table below).

**Aquifer recharge/yield.** Weighted average performance scores for each WBID in each watershed are based on the average dry season water levels with respect to differences between existing (ECM) and pre-development (NSM) conditions. Low performance scores were typically associated with wellfield locations, agricultural irrigation concentrations, and canals. Scores are mapped for the water table aquifer in Figure ES-13: high scores (10) indicate high performance or relatively little change in dry season condition when compared with the NSM. Low scores (1) indicate areas where water demand to meet agricultural and potable water supply needs

reduce the performance scores relative to historic groundwater levels against which they are measured. Areas that score poorly tend to correspond to wellfield locations.

**Flood risk.** Design storm simulations were used to evaluate flood inundation and the Level of Service (LOS) for roads in Collier County. Roads in the county are identified as either evacuation routes or other surface streets. Most evacuation routes meet 25-year/72-hour storm event criteria, while most surface streets fail. There is no effective means available to rank (assign priority) projects to address flooding. Therefore:

1. The first priority for the County is to further evaluate evacuation route segments identified under the proposed LOS analysis to ensure the route can remain open for large storm events.

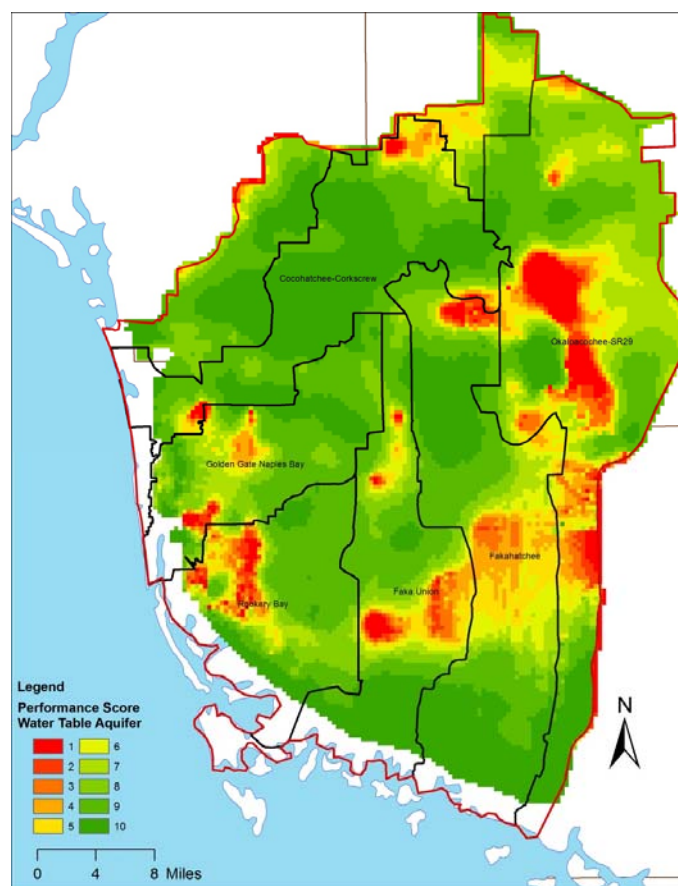


Figure ES-13. Performance scores for surficial aquifer

2. The second priority is further evaluation of existing arterial, collector, and neighborhood roads that, based on proposed LOS for the 10-year design storm, meet the 10-year LOS and may also meet the LOS criteria for the 25- and 100-year storm events.

### Results: Element 4, Analysis of Alternatives and Recommendations

Structural and non-structural projects were identified as potential solutions to existing and anticipated water resource and natural systems issues in Collier County based on analyses completed as part of this study, as well as previously completed studies.

#### Non-structural (policy) recommendations.

Non-structural recommendations offer long-term regulatory benefits critical to a sustainable watershed management plan. Benefits due to non-structural (policy) recommendations are anticipated to substantially improve watershed conditions in Collier County.

Non-structural planning controls include land use ordinances, development regulations, mitigation banking, and other incentives for improving watershed conditions (benefits). Non-structural BMPs for watershed management focus on preserving and protecting natural features of the landscape to manage stormwater at its source. Evaluation of these BMPs includes an analysis of the applicable regulatory framework. Recommended non-structural initiatives address issues that range from land development guidelines to water quality monitoring and are listed below.

- Low Impact Development Program
- Stormwater Retrofit Program
- Fee-Based Stormwater Utility
- Allowable Maximum Site Discharges
- Flood Protection Levels of Service Criteria
- Volume Control for Large Storm Events
- Golden Gate Estates Transfer of Development Rights Program
- Golden Gate Estates Watershed Mitigation Program

- Modified Operations of Water Control Structures
- Water Quality Monitoring
- Additional Watershed Protection Programs



**Structural improvement recommendations.** In contrast with non-structural recommendations, structural (engineered) improvements offer short term improvements. They are not a long term solution and the lift associated with these projects ranged from only 10 to 15 percent.

After an initial screening of more than 150 projects, 27 potential structural improvement projects were evaluated with respect to permitting, constructability, environmental benefits, and costs in the Collier County watersheds. Permitting constraints reduced the number of projects for further evaluation to 18.

The 18 projects were evaluated against corresponding performance measures developed for each of the 4 performance criteria (freshwater discharge, water quality, wetland hydrology/habitat, and groundwater recharge). Project benefits were measured by the “lift,” or the improvement in performance criteria anticipated as a result of the proposed project, as described earlier. Weighting factors were integrated into the selection process to address both individual watershed characteristics (e.g. watershed size) and the relative importance of the watershed issues (e.g. extent of development). Cost, equal to the construction cost of the project, was estimated and benefit/cost (B/C) ratios were developed. Performance scores normalized to a 0 to 10 scale and were averaged for each of the 4 criteria. Each



combined scores is the quotient of the average performance score divided by the cost. Combined, normalized project scores with respect to performance criteria, cost, and B/C ratio are listed in Table ES-3.

The final 10 projects, in order of B/C ratio, range in cost from \$96,000 to approximately \$7 million (Table ES-4). Priority projects, in order of preferred implementation, are briefly outlined below.

1. **Northern Golden Gate Estates Flow-way Restoration.** The project ranks second in B/C, but first in benefits. It has the most lift anticipated for each of the 4 performance criteria, but only minimal lift for the discharge to estuary criteria.
2. **North Belle Meade Spreader Swale project** provides lift with respect to each of the 4 performance criteria. The primary benefit is lift in discharge to estuary in the Golden Gate and Rookery Bay watersheds, based on an anticipated 10 percent reduction in flows to Naples Bay and increased flows to Rookery Bay. Moderate lift is expected for the other 3 performance measures.
3. **The Henderson Creek Diversion project** is considered the third most important project to implement. It ranks fourth in the B/C ratio and, similar to the North Belle Meade project, it provides lift to estuary discharge for the Golden Gate and Rookery Bay watersheds. It does not provide lift to the 3 other performance criteria.
4. **The Corkscrew Regional Ecosystem Watershed Restoration** has the greatest B/C ratio among the 10 projects. However, the anticipated lift in wetland hydrology is local and does not address some of the more important issues facing the county. Consequently, the project was assigned a lower priority for implementation despite the higher B/C ratio.

Table ES-3. Normalized Performance Scores and B/C Ratios for the Four Performance Criteria

Project Name	Discharge to Estuary	Water Quality	Wetland Hydrology/Habitat	Ground-water	Total Score	Estimated Cost (\$ million)	Benefit-to-Cost Ratio
Corkscrew Regional Ecosystem Watershed	0.00	0.00	2.01	0.00	2.01	0.10	20.95
North Golden Gate Estates Flowway Restoration	0.05	10.00	10.00	10.00	30.09	2.37	12.71
North Belle Meade Spreader Swale	8.60	2.58	2.70	2.76	25.24	7.03	3.59
Henderson Creek Diversion	10.00	0.00	0.00	0.00	20.00	5.71	3.50
South I-75 Canal Spreader Swale	0.13	1.04	7.81	1.38	10.49	3.13	3.35
Wolfe Road Wetland Treatment System	0.00	0.11	0.00	3.34	3.45	1.42	2.44
Upper Golden Gate Estates Canal Weir Constuction	0.00	0.00	0.00	0.67	0.67	0.55	1.21
Orange Tree Canal Control Structure Installation	0.00	0.00	0.00	0.67	0.67	0.55	1.21
Henderson Creek Off-Line Storage Reservoir	1.06	0.14	0.00	0.07	2.33	2.93	0.79
US HWY 41 Stormwater Treatment Area	0.00	0.03	0.12	0.00	0.15	0.54	0.28

Table ES-4. Cumulative Benefit (Performance Scores) and Cost of Project

Project Name	Cocohatchee-Corkscrew				Golden Gate - Naples Bay				Rookery Bay				Cumulative Cost (Millions of Dollars)
	Cumulative Lift				Cumulative Lift				Cumulative Lift				
	Discharge to Estuary	Water Quality	Hydrology	Groundwater	Discharge to Estuary	Water Quality	Hydrology	Groundwater	Discharge to Estuary	Water Quality	Hydrology	Groundwater	
<b>Corkscrew Regional Ecosystem Watershed</b>	0.000	0.000	0.031	0.000									\$0.096
<b>North Golden Gate Estates Flowway Restoration Project</b>					0.010	0.682	0.118	0.002					\$2.464
<b>North Belle Meade Spreader Swale<sup>(1)</sup></b>					0.900	0.682	0.118	0.002	1.250	0.435	0.036	0.200	\$9.490
<b>South I-75 Canal Spreader Swale</b>									1.289	0.523	0.088	0.250	\$12.621
<b>Henderson Creek Diversion<sup>(1)</sup></b>					1.345	0.682	0.118	0.002	2.124				\$18.329
<b>Wolfe Road Wetland Treatment System</b>					1.345	0.690	0.118	0.007					\$19.745
<b>Henderson Creek Off-Line Storage Reservoir</b>									2.282	0.547	0.088	0.255	\$22.674
<b>Upper Golden Gate Estates Canal Weir Constuction</b>					1.345	0.690	0.118	0.008					\$23.226
<b>Orange Tree Canal Control Structure Installation</b>					1.345	0.690	0.118	0.009					\$23.778
<b>US HWY 41 Stormwater Treatment Area</b>									2.282	0.553	0.089	0.255	\$24.322
<b>Total Benefit or Cost</b>	0.000	0.000	0.031	0.000	1.345	0.690	0.118	0.009	2.282	0.553	0.089	0.255	\$24.322

## Conclusions

Canal construction and urban development in Collier County have altered what were historically regional surface and groundwater patterns, resulting in multiple, artificially created watersheds that have reduced water quality, altered freshwater flows to estuaries, reduced groundwater recharge, and altered natural ecosystems.

The CCWMP provides an analysis of existing conditions in the County with respect to changes from pre-development conditions and provides County-wide recommendations to:

- Restore historical water quantity and estuarine discharges
- Improve water quality within the watersheds and estuaries
- Address flood control and water supply issues

NSM and ECM results were successfully used to evaluate changes and develop performance measures that were, in turn, used to quantify relative benefits anticipated from implementing

proposed structural projects. Several projects were recommended as part of the benefits and B/C analysis. Structural projects recommended, in order of preferred implementation are:

- Northern Golden Gate Estates Flow-way Restoration
- North Belle Meade Spreader Swale
- Henderson Creek Diversion
- Corkscrew Regional Ecosystem Watershed Restoration

Nonstructural, policy recommendations that have longer term, sustainable ecosystem benefits were also developed. These non-structural measures offer an alternative to structural measures and emphasize a more-integrated approach to managing water resources in Collier County. Recommendations include actions related to low impact development (LID) regulations, transferrable development rights, retrofit programs, better management and/or improvements of existing control structures, and monitoring.