Collier County

Watershed Management Plan

October 22, 2010

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Project Objectives

- Develop watershed management plans that will help protect estuaries and wetland systems to
  - Restore historical water quantity and estuarine discharges
  - Improve water quality within the watersheds and estuaries
  - Address flood control and water supply issues
- Project will be completed in December 2010.

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Project Specific Tasks

- Update the BCB hydrologic/hydraulic computer model
- Evaluate watershed and estuarine existing conditions
  - Water quantity
  - Water quality
  - Natural resources
- Define performance measures
- Evaluate alternatives and identify recommended improvement projects
- Prepare Watershed Management Plans

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Project Team Organization

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Principal-in-charge

QA/QC

Project Manager – Moris Cabezas, Ph.D., P.E. – PBS&J

Watershed Modeling	Water Resource Evaluation	Natural Systems Evaluation
Tim Hazlett, Ph.D. - DHI	Dave Tomasko, Ph.D. – PBS&J	Ed Cronyn – PBS&J
Preston Manning – DHI	Peter deGolian – PBS&J	Dave Tomasko, Ph.D. – PBS&J
Peter deGolian – PBS&J	Eric Fontenot, P.E. - DHI	

Other Support Services

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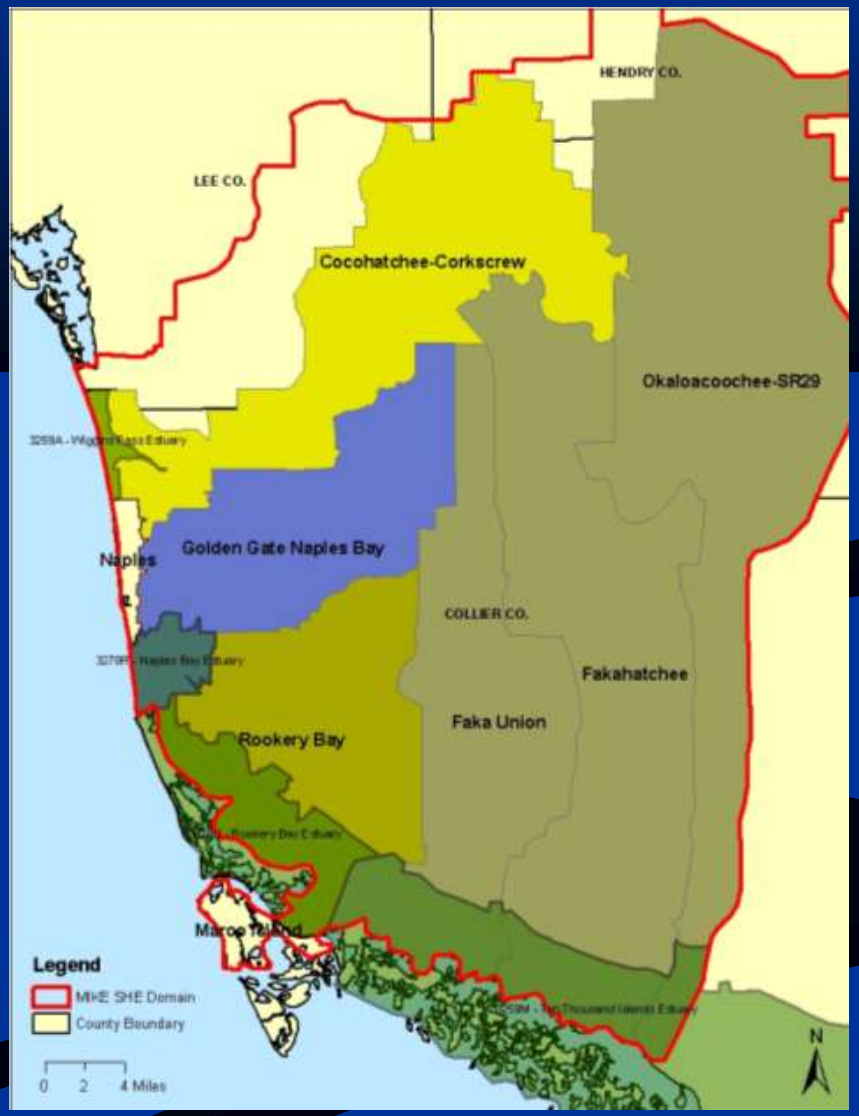
Watersheds

- Top Priority Watersheds
  - Cocohatchee Corkscrew
  - Golden Gate
  - Rookery Bay
- Additional Watersheds
  - Faka Union
  - Fakahatchee
  - Okaloacoochee SR 29
- Estuaries



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Water Body IDs (WBIDs)

- FDEP Run 40
- Coastal WBIDs clipped to match model extent
- WBID 3259M subdivided by watershed

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Existing Conditions

- Water Quantity Analysis
  - Existing conditions model update
  - Assessment of watershed H&H conditions and discharge to estuaries
- Water Quality Analysis
  - Stream impairment
  - Estuarine water quality
- Natural Systems Evaluation
  - Functional watershed assessment
  - Coastal habitats assessment
- Next Steps

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Water Quantity Analysis

- Objective
  - Assess the deficit or surplus of freshwater discharges to each estuarine system from the contributing watersheds

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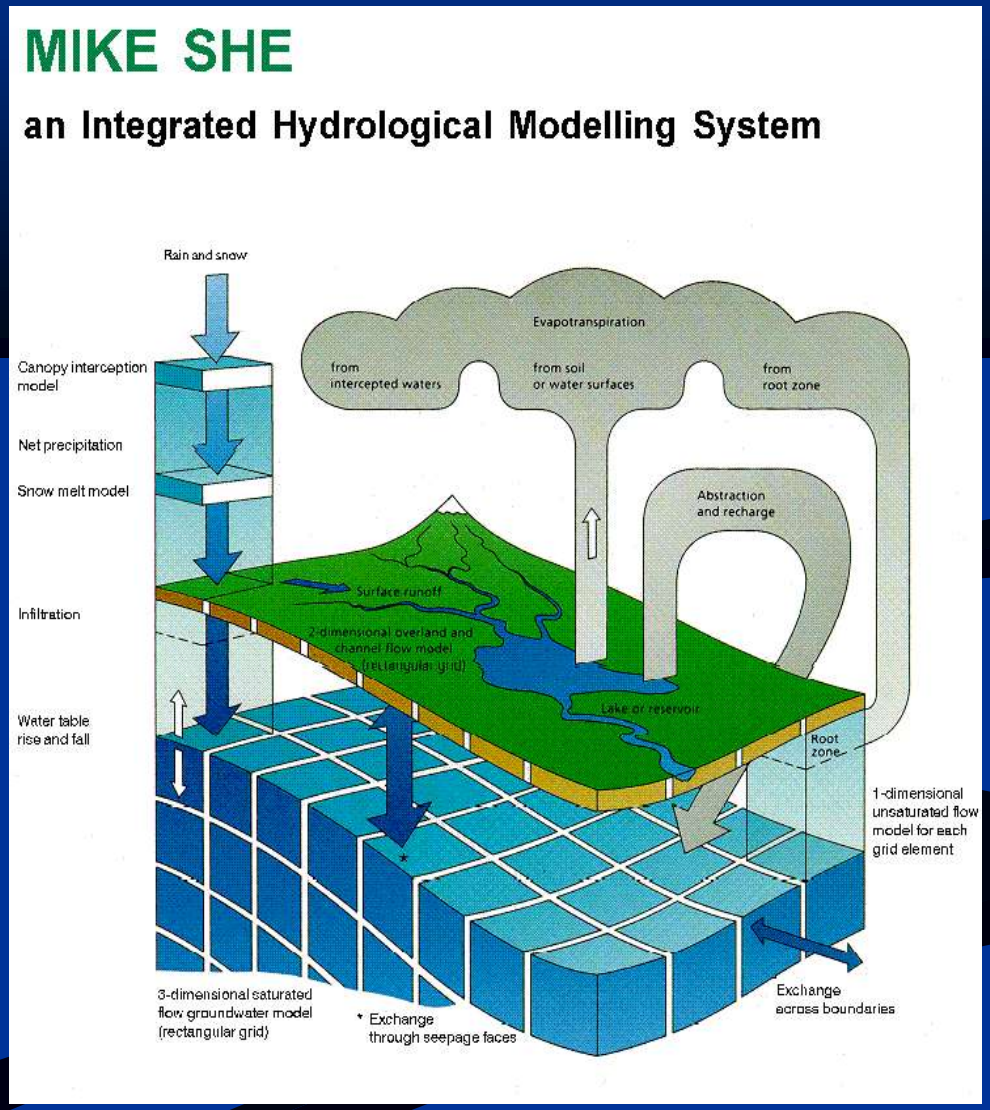
Existing Conditions Model

- Integrated surface water and groundwater model
- Simulation period is 2002 – 2007



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Computer Model Grid

- Consistent with previous Big Cypress Basin models
- Model area is 1400 square miles
- Grid size is 1500 feet

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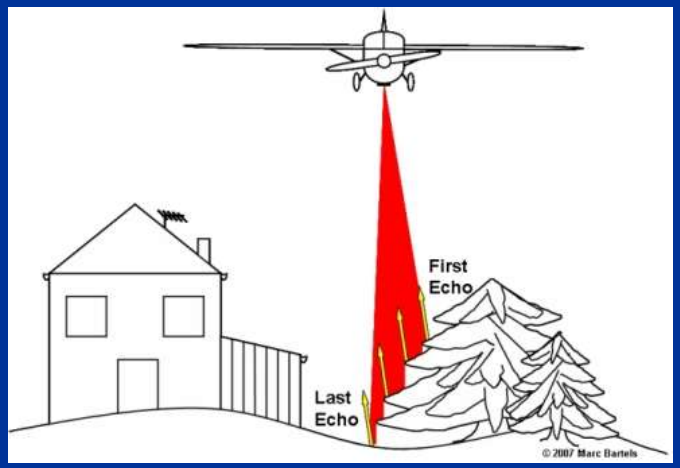
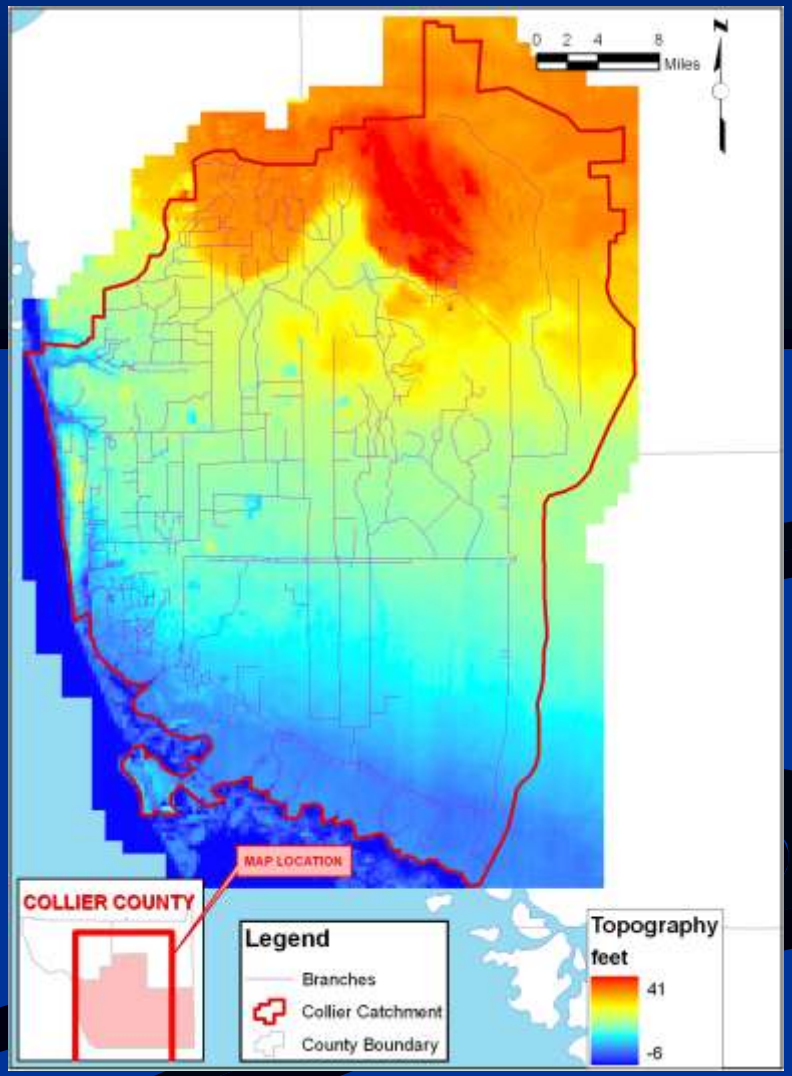
Topography

- LiDAR generated
- 5-ft digital elevation model (DEM)
- Elevation averaged over grid cell





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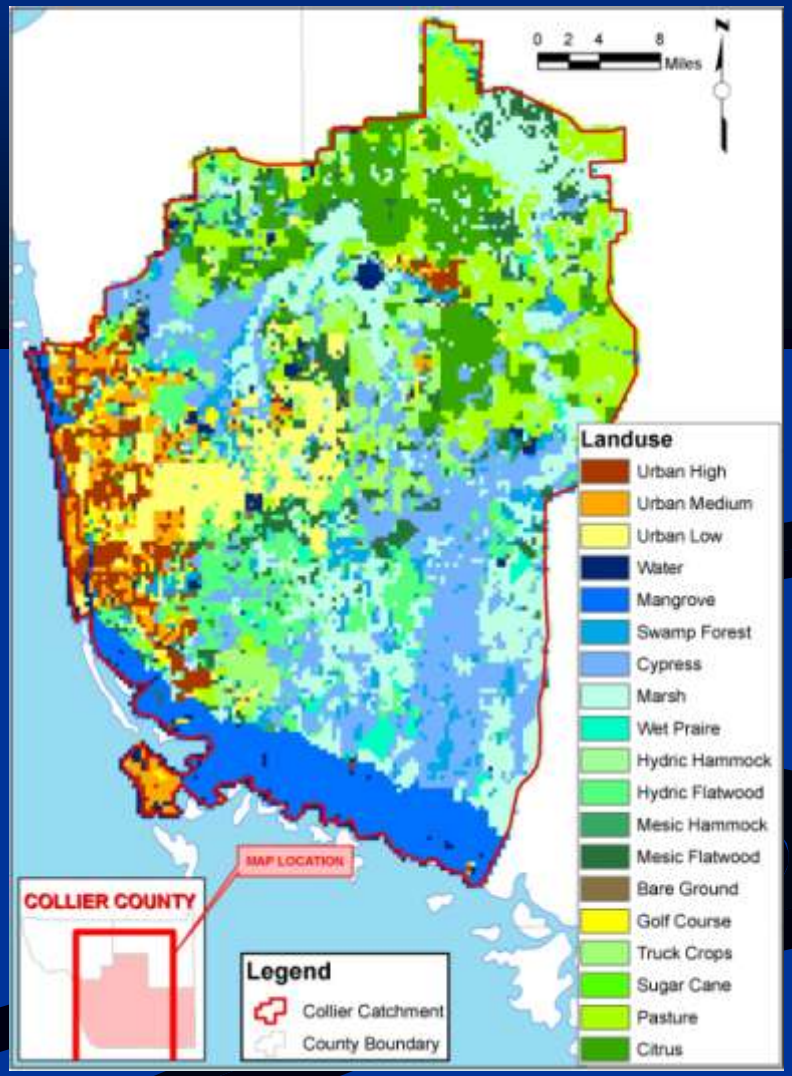
Land Use

- Land use categories developed from FLUCCS classifications
- Hydrologic parameters are assigned based on land use categories



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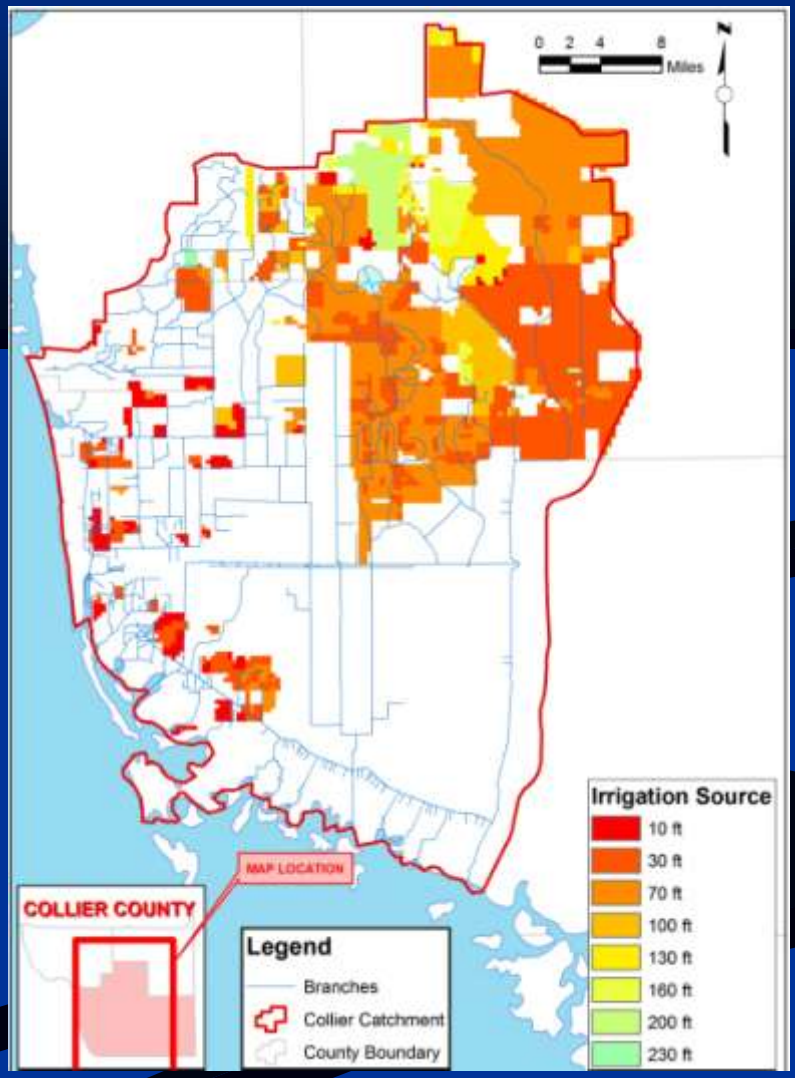
Irrigation

- Irrigation volume is determined by soil moisture
- Application rate and source defined by water use permits
- Precipitation (not mapped) 15 min radar returns



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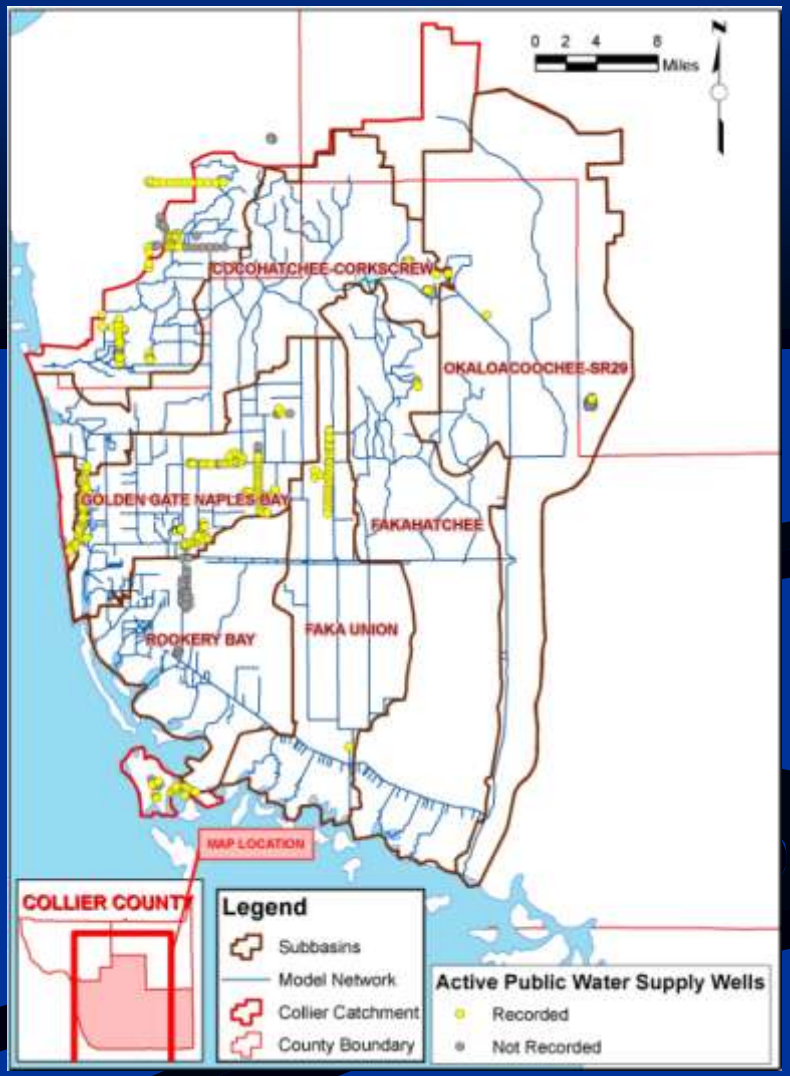
Water Supply Wells

- Primary users
  - City of Naples
  - Collier County
  - Marco Island
- Timing and volume is determined by withdrawal information provided by SFWMD



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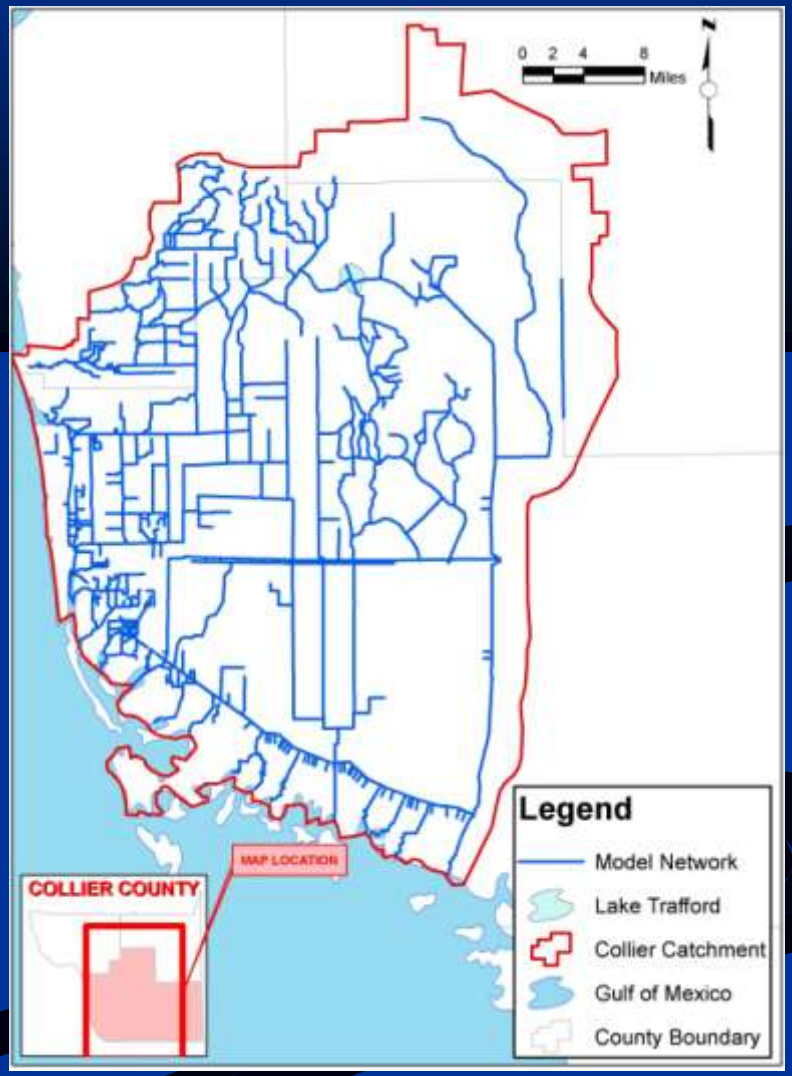
Canal and Stream Network

- 825 miles of rivers, streams and canals
- Primary drainage network managed by BCB
- Collier County secondary canals
- Imperial River drainage



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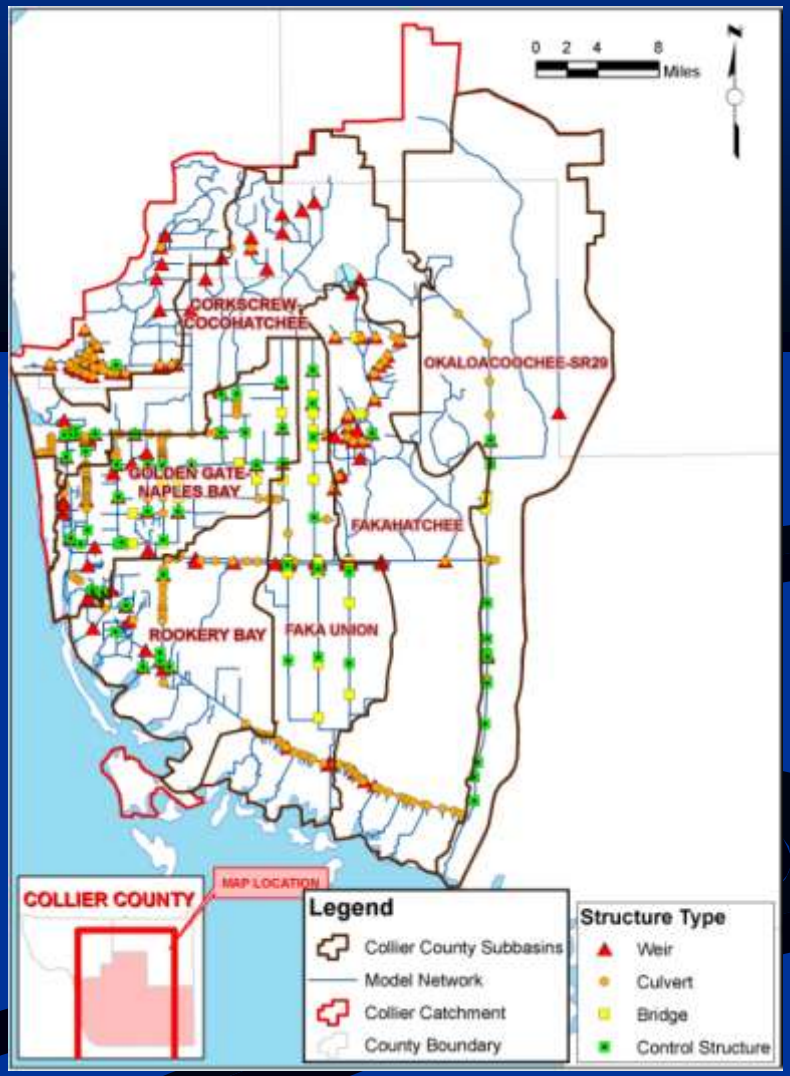
Control Structures

- Flow and water levels are controlled to maintain desired in-stream conditions
- Structures include weirs, culverts, bridges and gates



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Control Structures Operations

- Cocohatchee Canal Structure 1

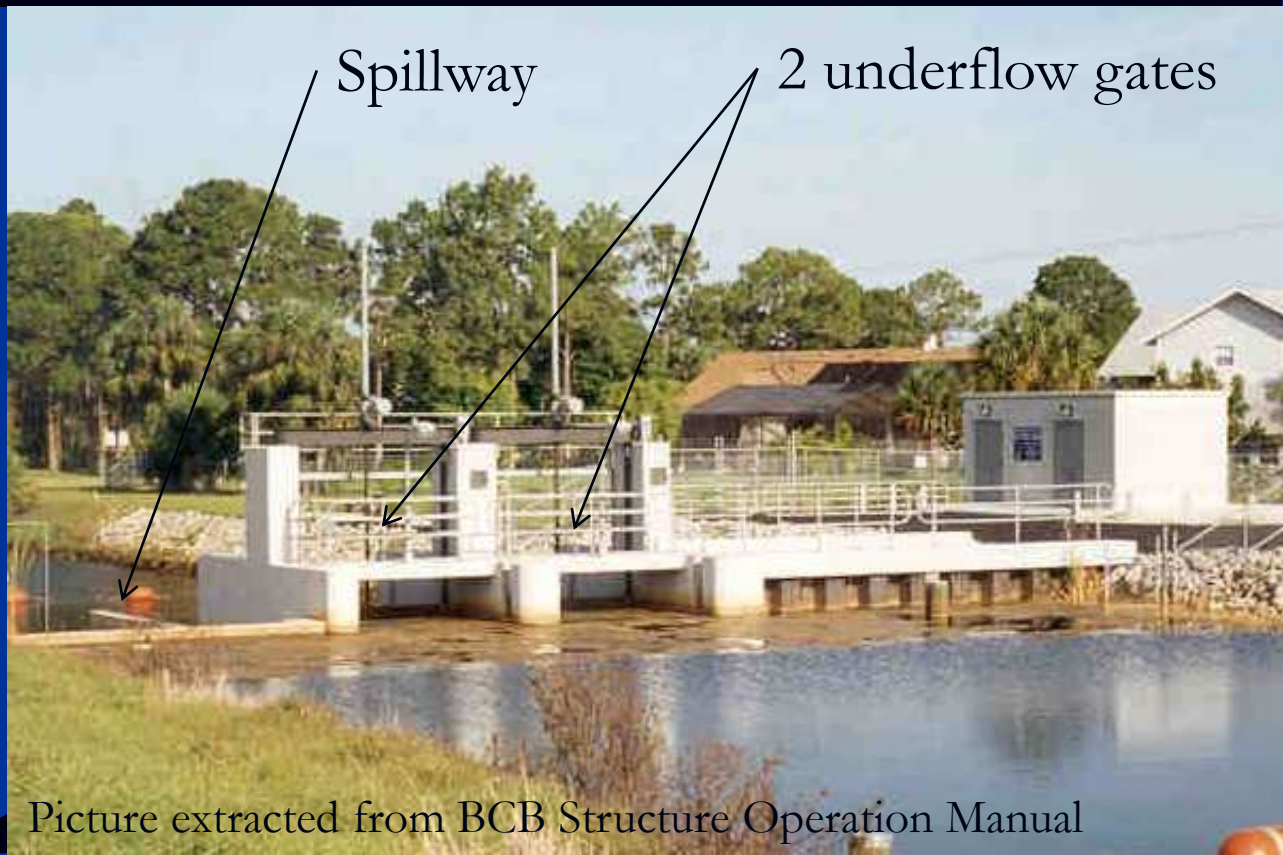
Rules:

Dry season- Head water elevation desired at ≈ 4.8 feet NAVD.

Above 5.5 feet, gates open.
Below 4.0 feet, gates close.

Wet season- Head water elevation desired at ≈ 4.3 feet NAVD.

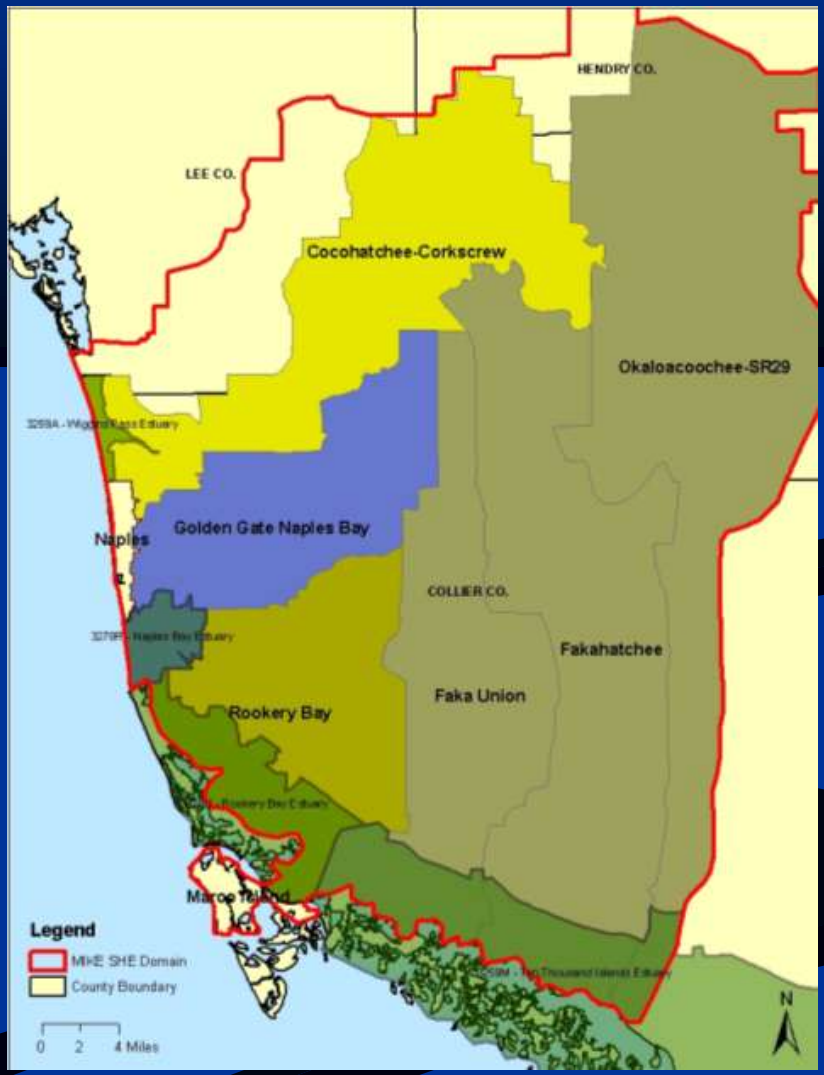
Above 5.5 feet, gates open.
Below 2.8 feet, gates close.



Picture extracted from BCB Structure Operation Manual

Surface Water Budget

- Prepared for each watershed
- Budget Components
  - Precipitation/ET
  - Infiltration
  - Surface Runoff
- Prepared for water year and wet and dry seasons



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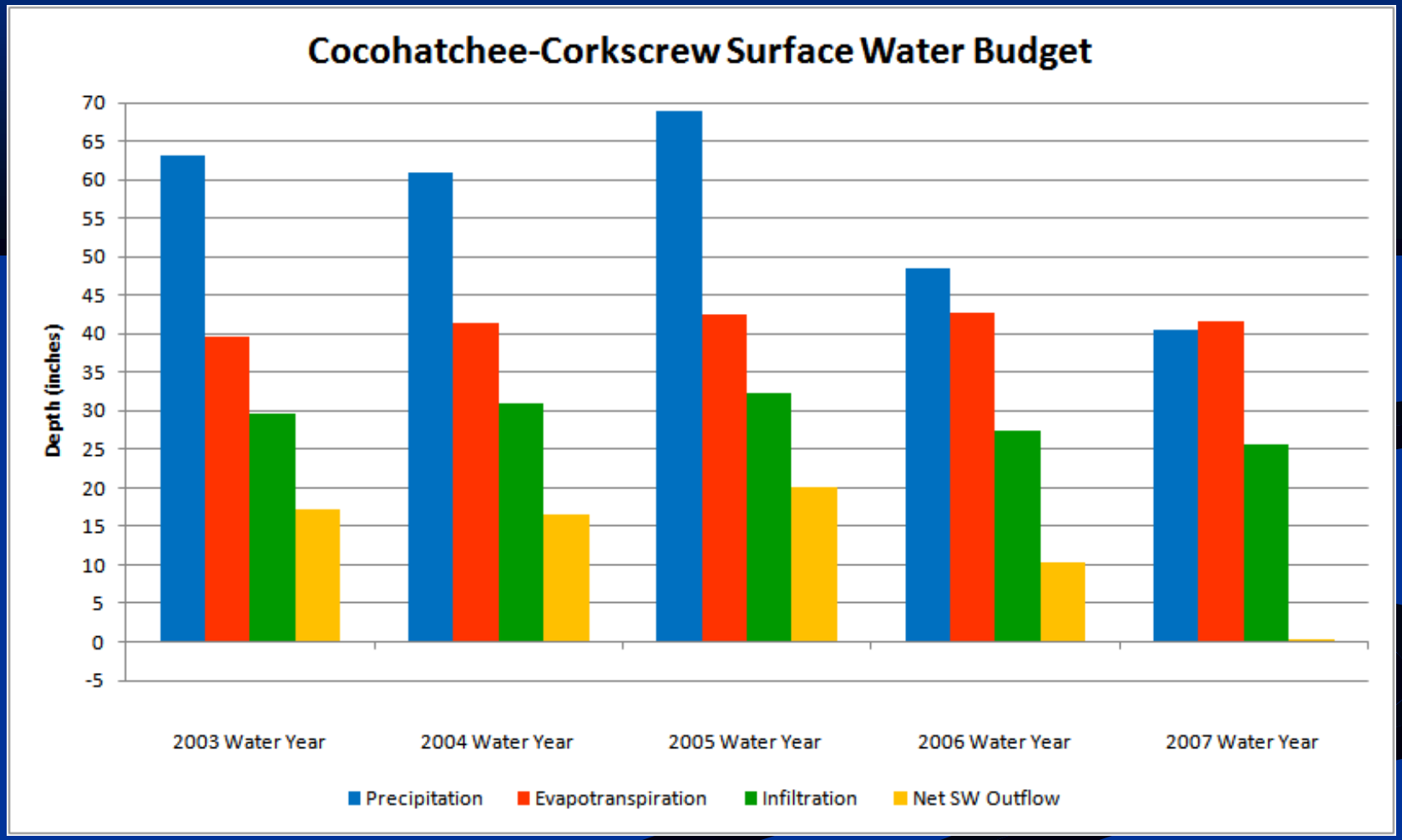
Surface Water Budget



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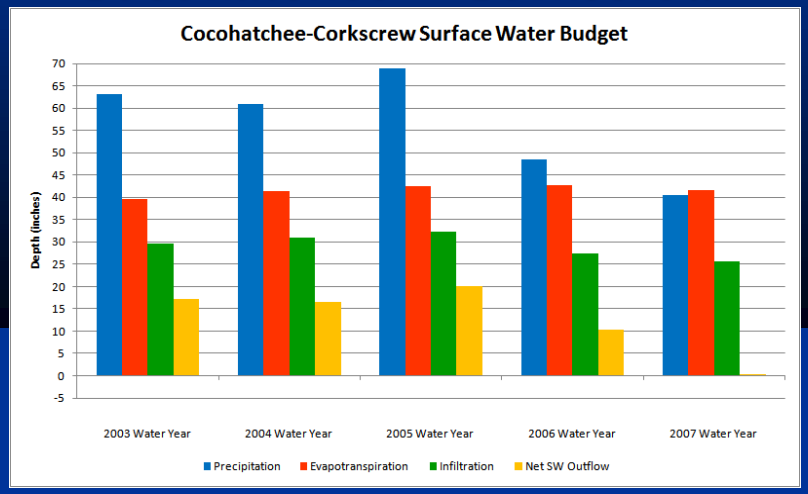
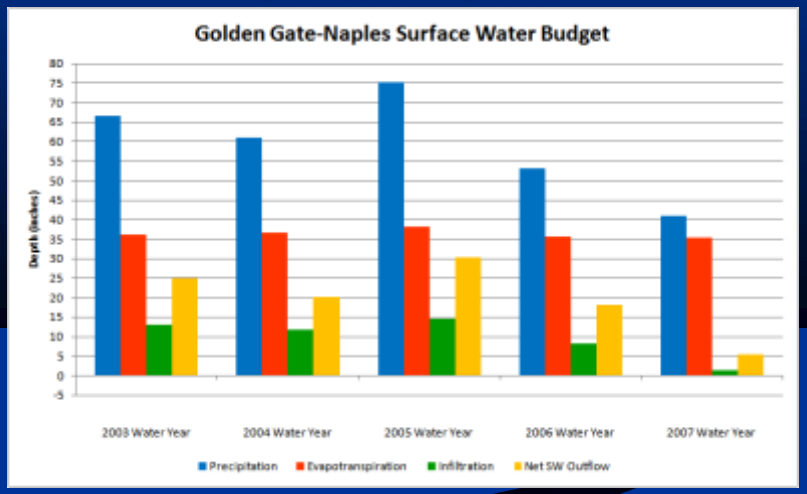
Surface Water Budget

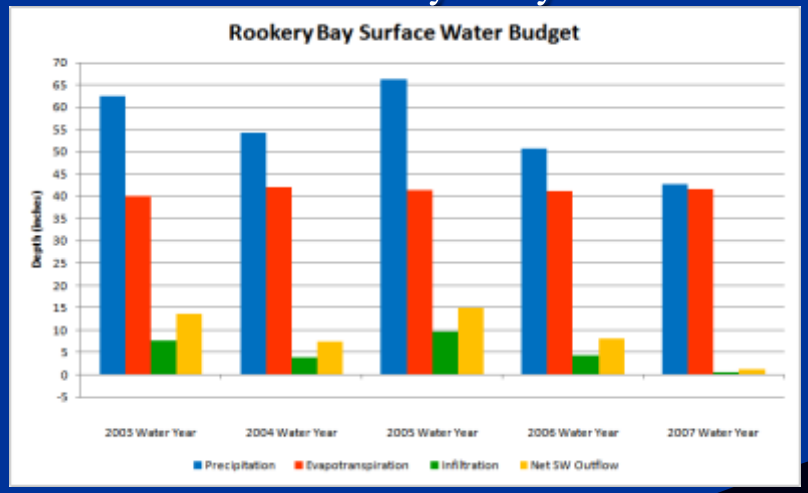
Cocohatchee – Corkscrew



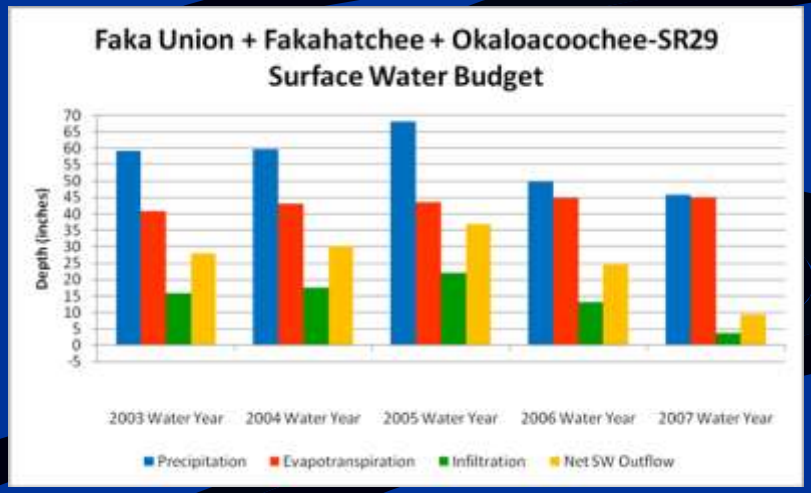
Golden Gate



Rookery Bay



Additional Basins



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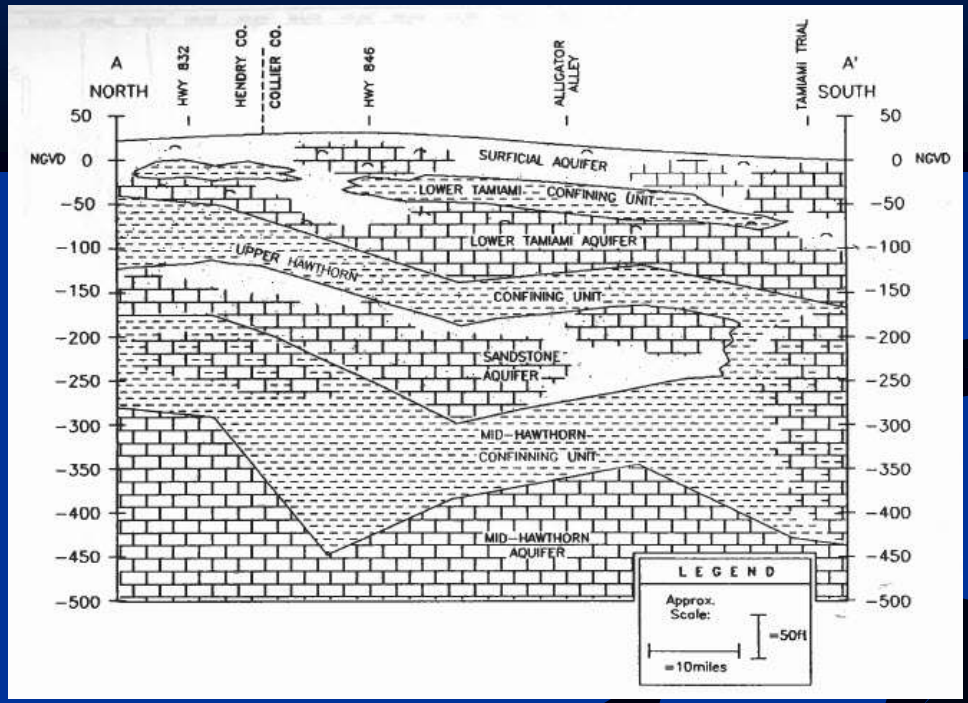
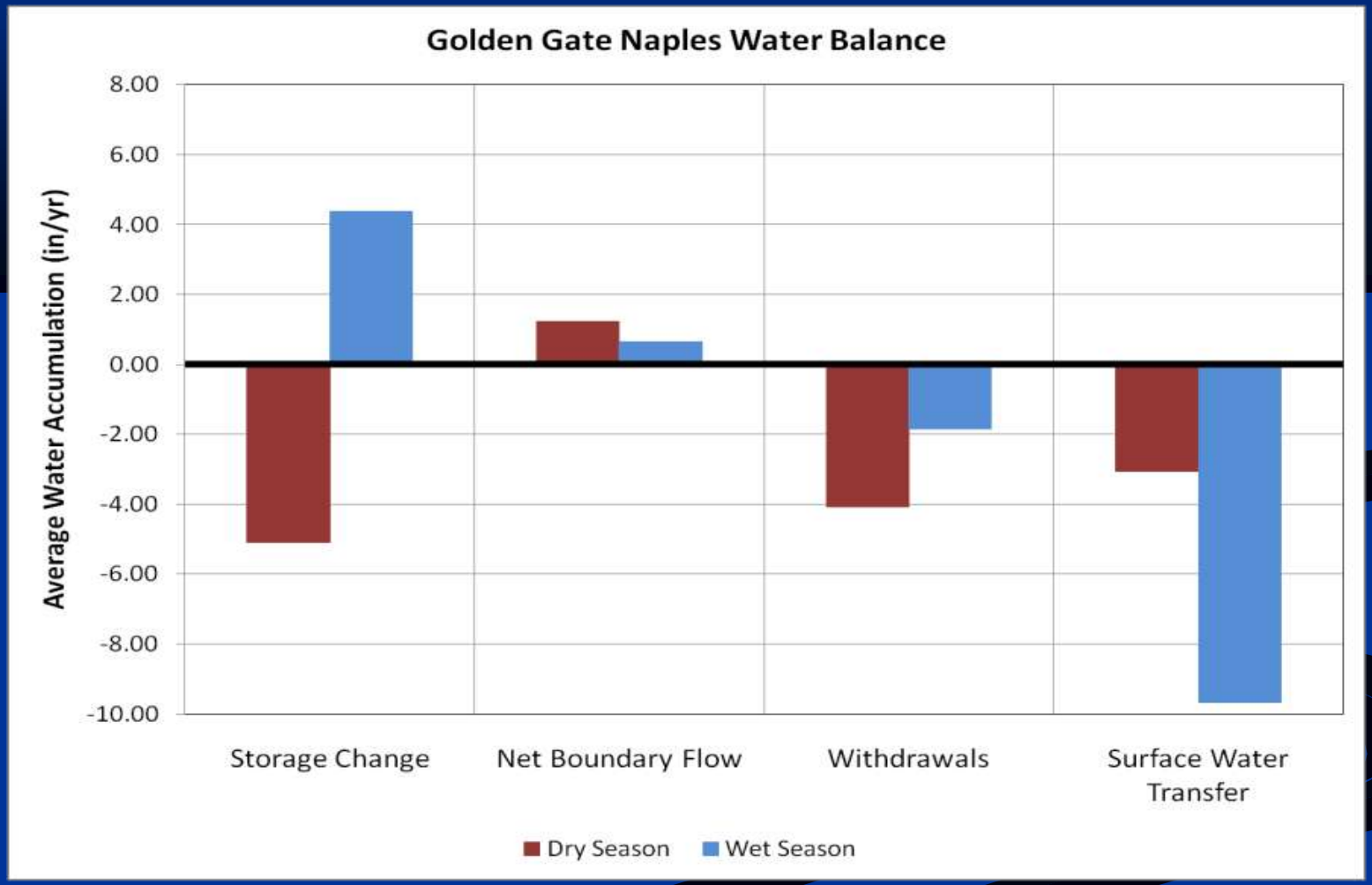
Groundwater Budget

- Budget Components
  - Flows across watershed boundaries
  - Withdrawals
  - Change in storage
  - Surface water interaction
- Average for wet and dry seasons

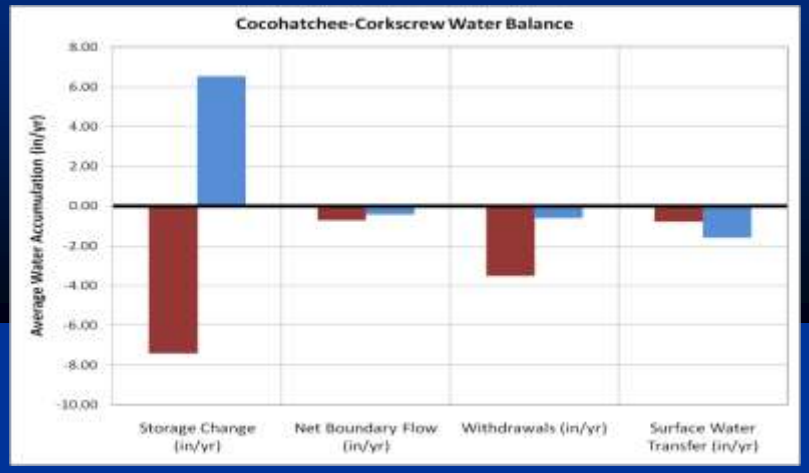


Groundwater Budget

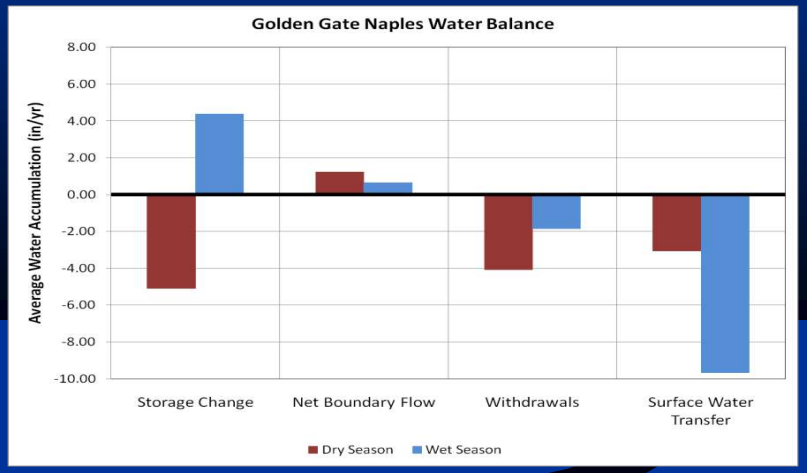


Groundwater Budget

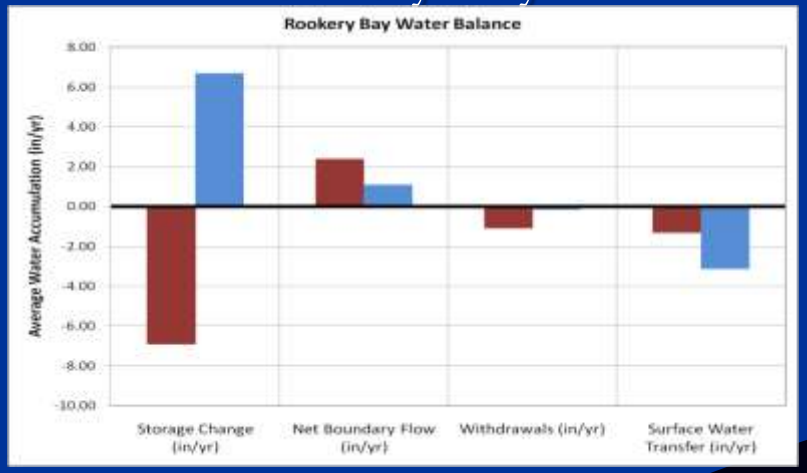
Cocohatchee – Corkscrew



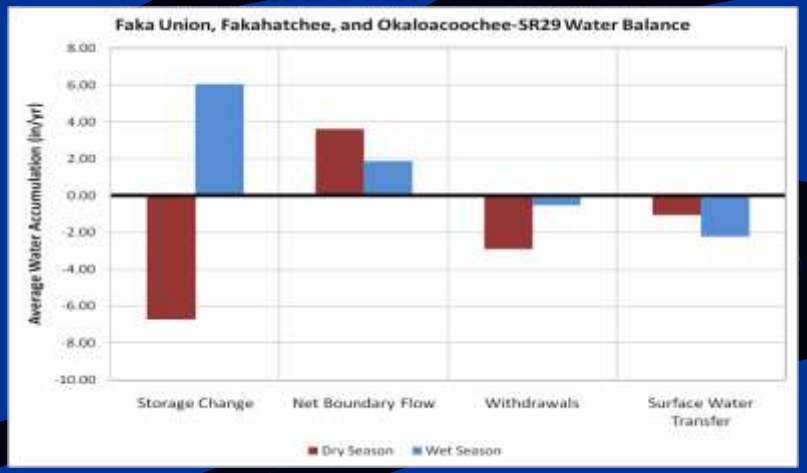
Golden Gate



Rookery Bay



Additional Basins



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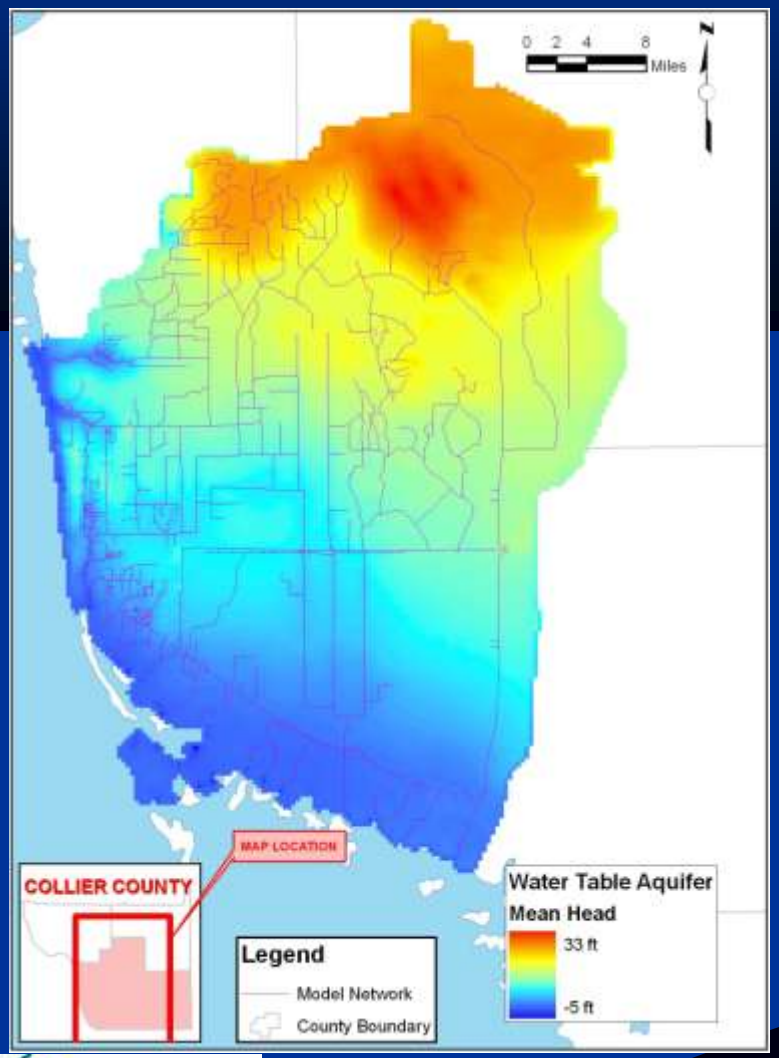
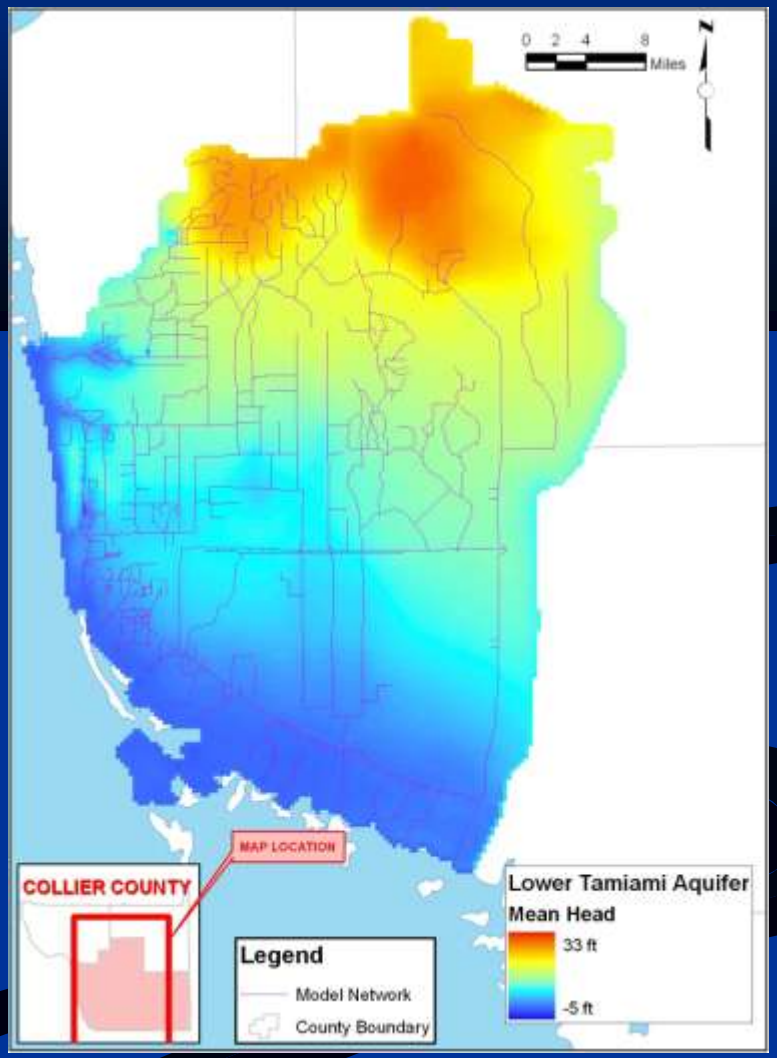
Surficial and Lower Tamiami Aquifers Head Elevation





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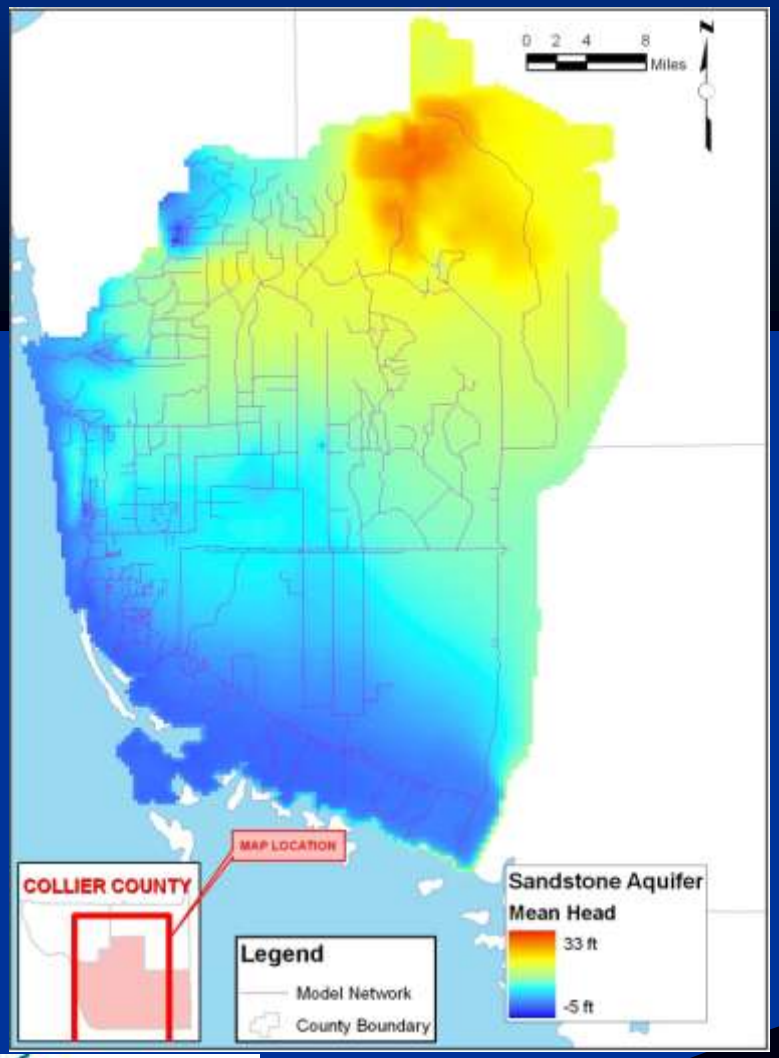
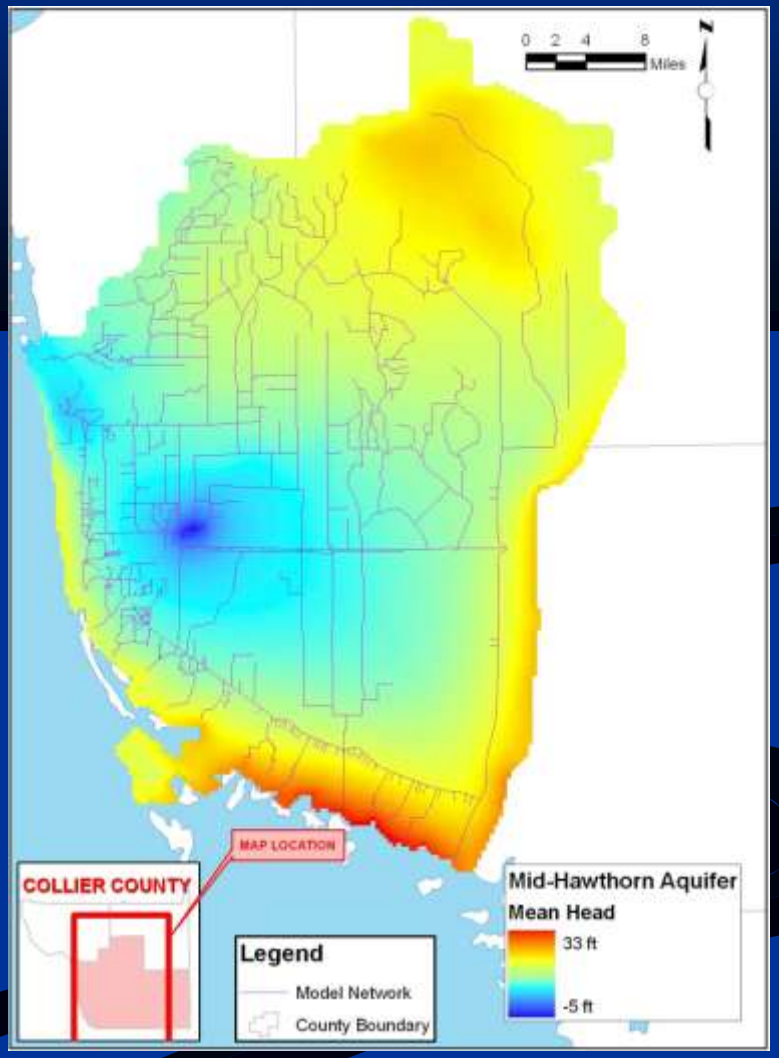
Sandstone and Mid-Hawthorn Aquifers Head Elevation





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Comparison of Estuarine Flow Calculation Methods

- Objective is to define the flow deficit or surplus for each estuary
- ECM versus NSM
  - Existing Conditions Model Results
  - Pre-development (Natural Systems) Model Results
- Salinity Based Flow Analysis

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Natural Systems Model

- Pre-development condition
- Developed for the SWFFS
- Simulation period is 1978 – 1986
- Recognized limitations due to topography and other issues

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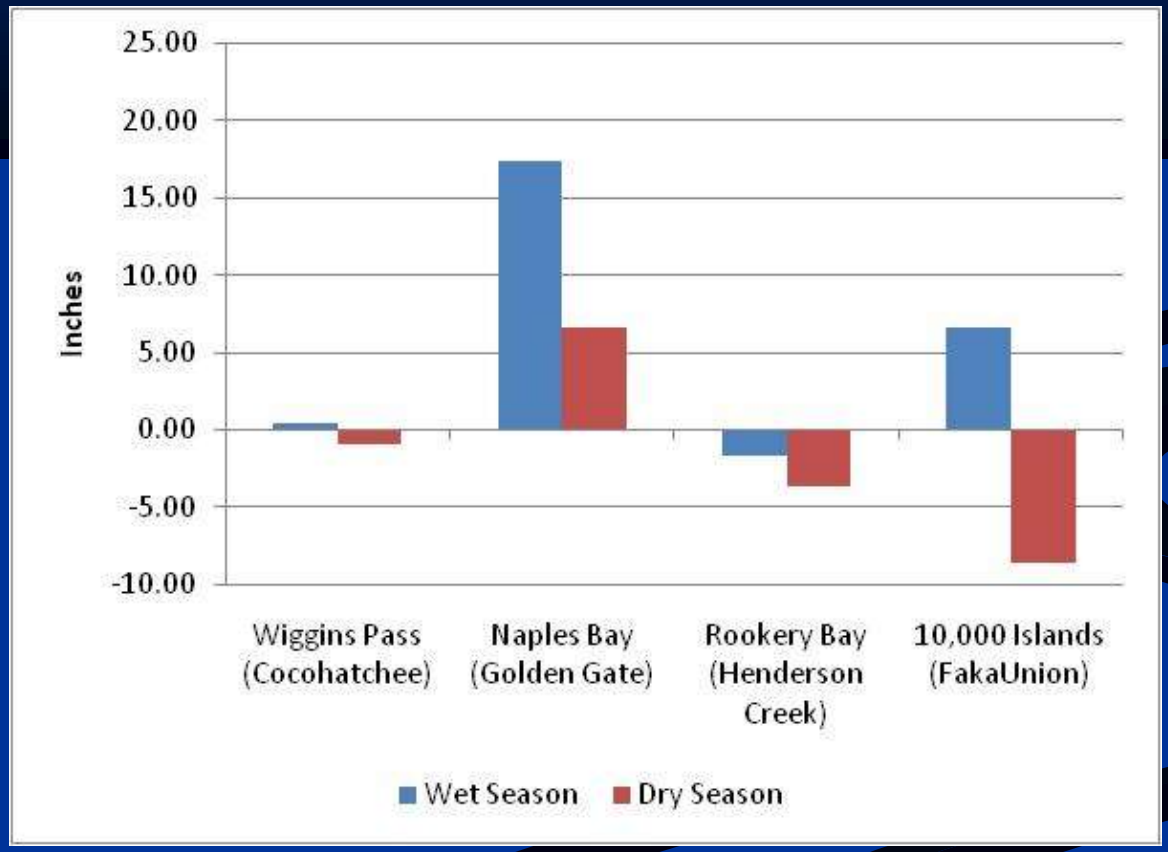
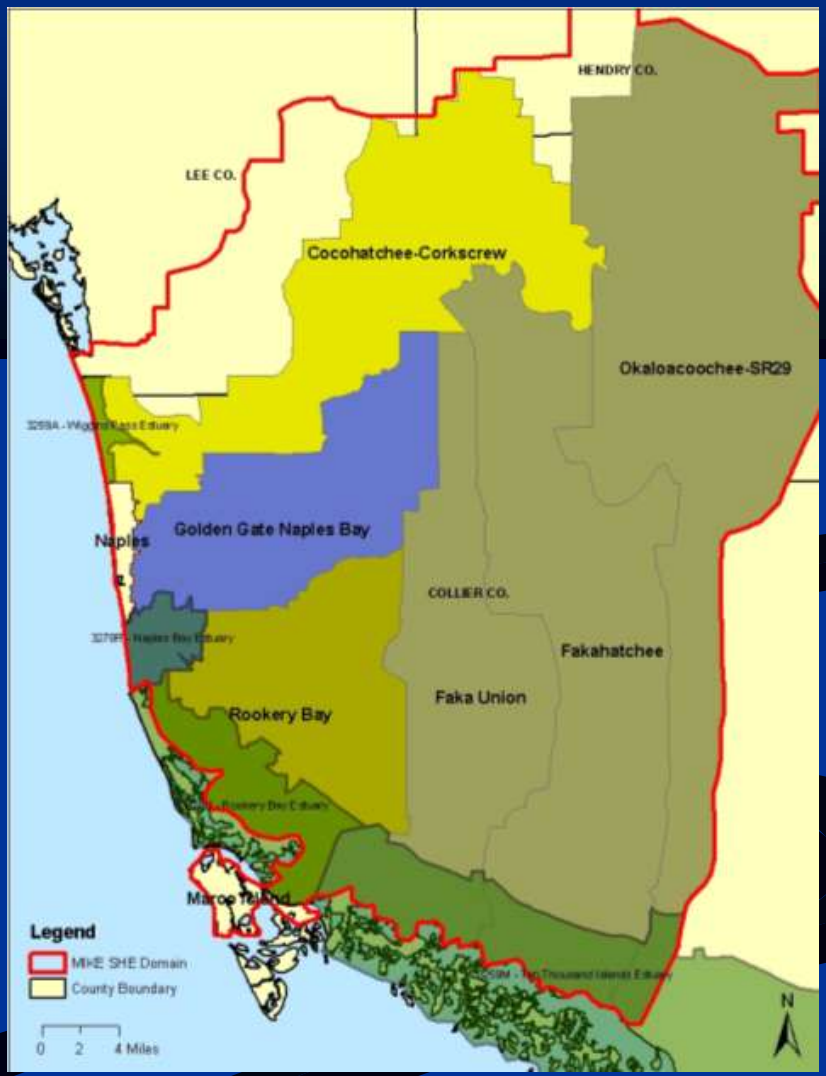
Existing Conditions Model vs Natural Systems Model

- Calculated deficit/surplus (inches)



Salinity Based Flow Analysis

- Salinity at a reference station used to determine flow deficit or surplus at the watershed outfall into the estuary



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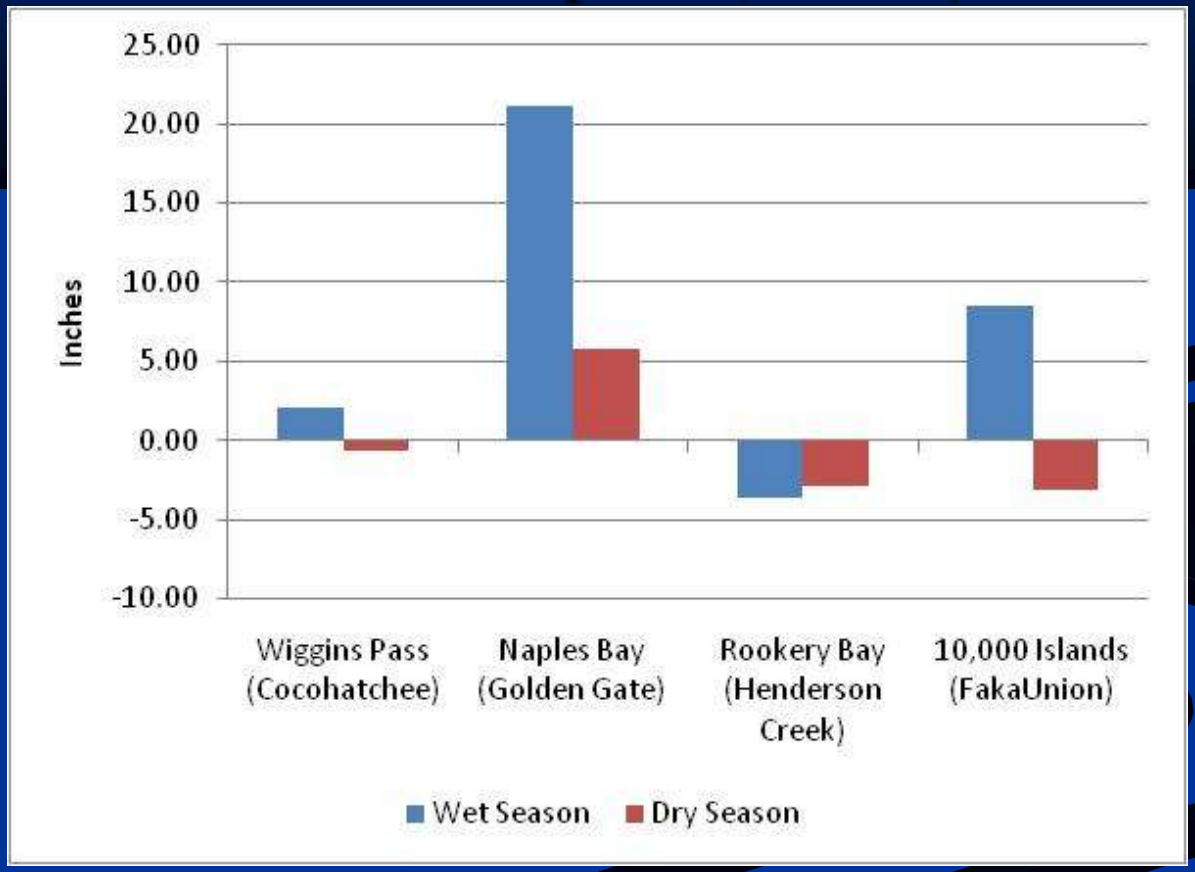
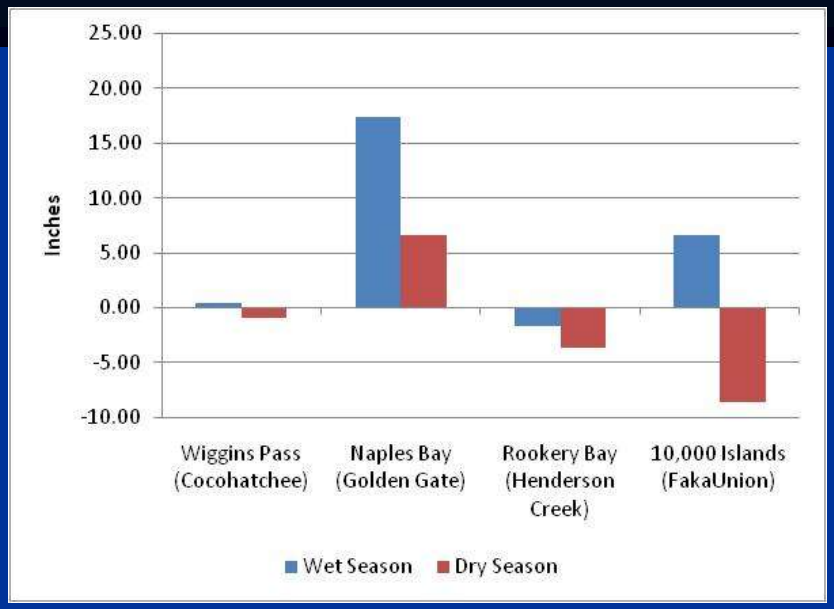
Salinity:Flow Analysis

- Calculated deficit/surplus (inches)

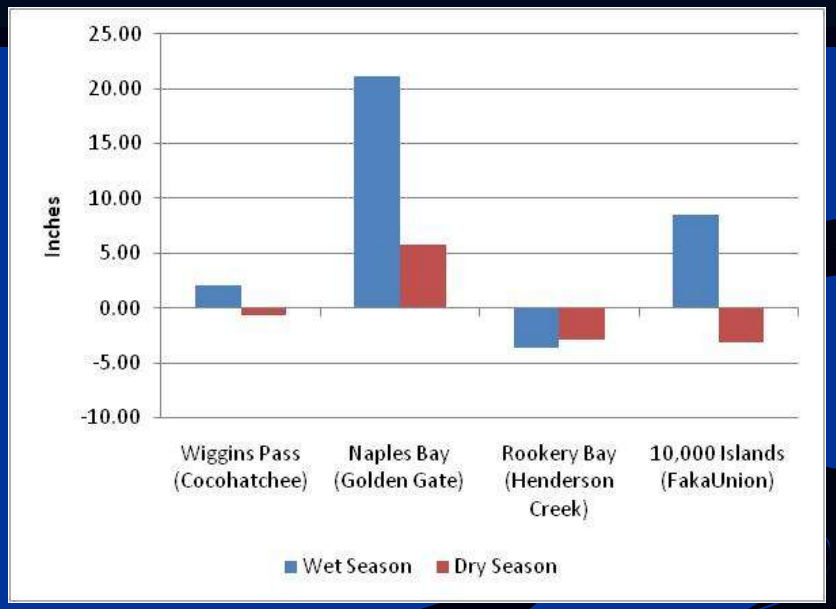


Comparison of Alternative Discharge Calculation Methods

Calculated deficit/surplus ECM vs NSM



Calculated deficit/surplus Salinity:Flow Relationship



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Water Quantity General Conclusions

- Comparison of flow surplus/deficit calculation methods validates the use of models to define performance measures and evaluate alternatives
- Limitations of the calculation methods must be well understood and documented prior to development of the performance measures

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Water Quality

- WBIDs, TMDL Process
- Watersheds, Impairments, DO, Nutrients
- Estuaries

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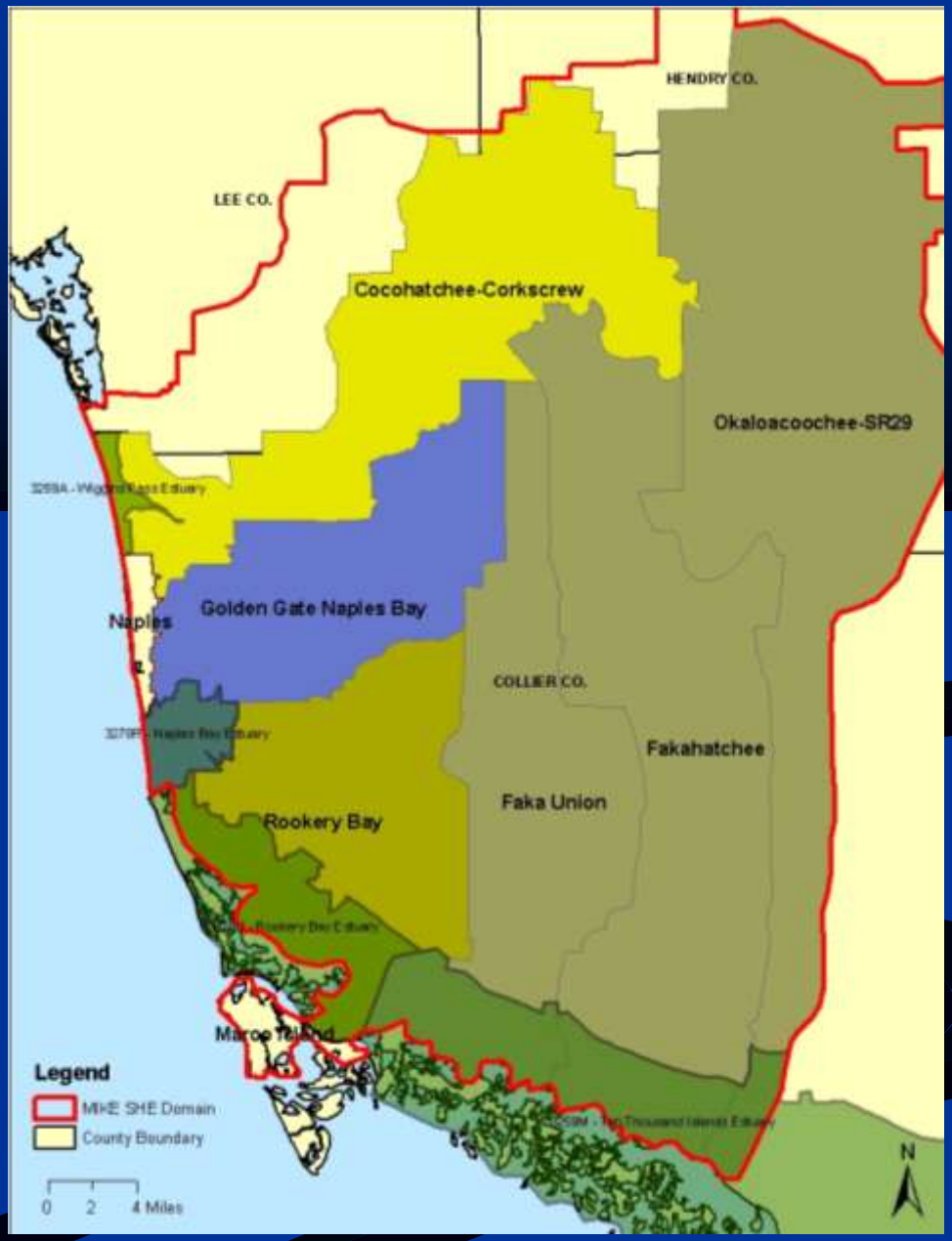
Efforts focused on six main watersheds, and the estuaries influenced by them



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TMDL process

- FDEP-led process with 5 basic phases
  - Assess the quality of surface waters--are they meeting water quality standards?
  - Determine which waters are impaired--which ones are not meeting water quality standards
  - Establish and adopt, by rule, a TMDL for each impaired water for the pollutants of concern
  - Develop a Basin Management Action Plan (BMAP)
  - Implement the strategies and actions in the BMAP

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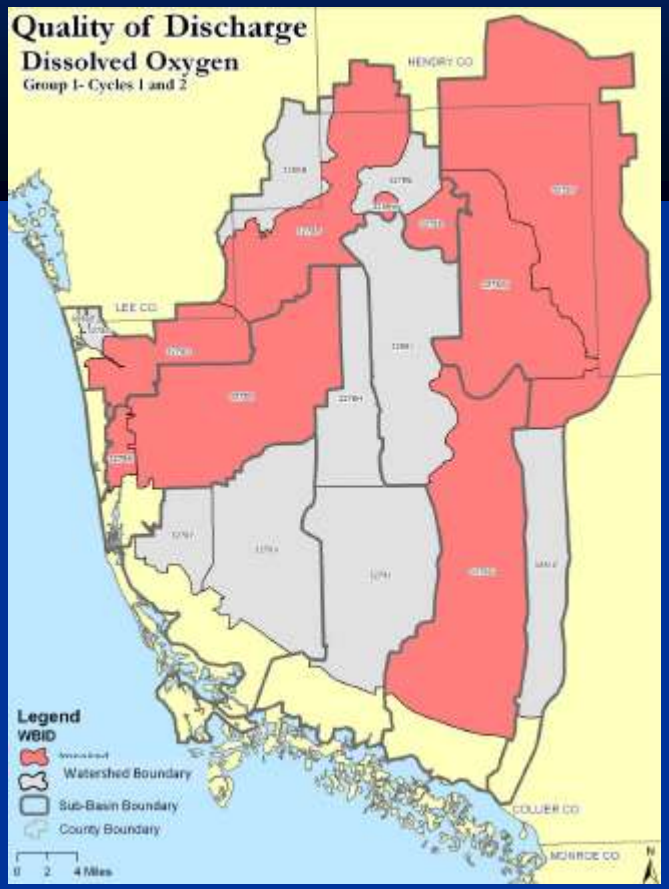
Within the watersheds themselves, 15 WBID-impairment combinations

WBID#	WBID Name	Impaired Parameter	Watershed
3259W	Lake Trafford	Dissolved Oxygen	Cocohatchee-Corkscrew
3259W	Lake Trafford	Mercury	Cocohatchee-Corkscrew
3259W	Lake Trafford	Nutrients	Cocohatchee-Corkscrew
3259W	Lake Trafford	Un-ionized Ammonia	Cocohatchee-Corkscrew
3278D	Cocohatchee Inland	Dissolved Oxygen	Cocohatchee-Corkscrew
3278F	Corkscrew Marsh	Dissolved Oxygen	Cocohatchee-Corkscrew
3278L	Immokalee Basin	Dissolved Oxygen	Cocohatchee-Corkscrew
3278K	Gordon River Extension	Dissolved Oxygen	Golden Gate - Naples Bay
3278S	North Golden Gate	Dissolved Oxygen	Golden Gate - Naples Bay
3278S	North Golden Gate	Iron	Golden Gate - Naples Bay
3278G	Fakahatchee Strand	Dissolved Oxygen	Fakahatchee
3278G	Fakahatchee Strand	Fecal Coliform	Fakahatchee
3261C	Barron River Canal	Iron	Okaloacochee-SR29
3278T	Okaloacoochee	Dissolved Oxygen	Okaloacochee-SR29
3278W	Silver Strand	Dissolved Oxygen	Okaloacochee-SR29

Watersheds
Spatial extent of impairments

Dissolved Oxygen



Nutrients (Chl-a)

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Watersheds
Spatial extent of impairments

Fecal Coliform Bacteria

Un-ionized Ammonia

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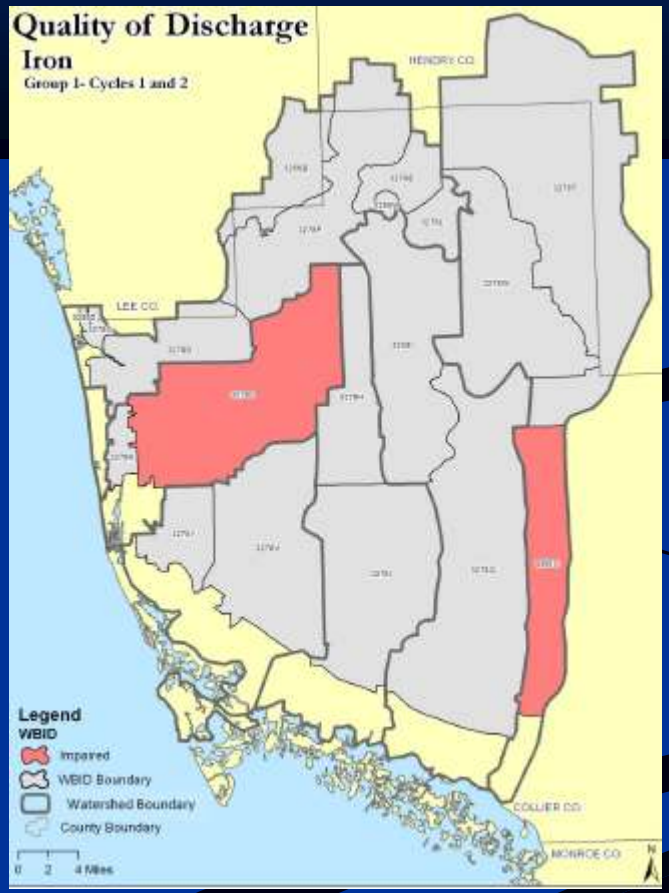
Watersheds
Spatial extent of impairments

Iron



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General findings - watersheds

- Lake Trafford had most impairments
  - DO, nutrients (Chl-a), un-ionized ammonia
- North Golden Gate and Fakahatchee Strand were second highest impairments
- Most common impairment was for dissolved oxygen (DO)
  - 9 of 15 impairments were for low DO
- Iron was second most common impairment
  - North Golden Gate and Barron River Canal

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Impairments listed by FDEP also assessed for the estuarine receiving water bodies

WBID#	WBID Name	Receiving Water
3259A	Cocohatchee River	Wiggins Pass
3278R	Naples Bay (Coastal Segment)	Naples Bay
3278U	Rookery Bay (Coastal Segment)	Rookery Bay
3259M	Ten Thousand Islands	Ten Thousand Islands

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Estuaries
Spatial extent of impairments

Dissolved Oxygen

Nutrients (Chl-a)

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Estuaries
Spatial extent of impairments

Fecal Coliform Bacteria

Estuaries
Spatial extent of impairments

Iron

Copper

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General findings - estuaries

- Naples Bay had most impairments
  - DO, fecal coliform bacteria, iron, copper
- Rookery Bay had second highest impairments
  - DO, nutrients (Chl-a), fecal coliform bacteria
- Most common impairments were DO and fecal coliform bacteria
- Iron as second most common impairment
  - Naples Bay and Wiggins Pass

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Issues for Collier County

- Are standards appropriate?
  - Does existing DO standard make sense in SW Florida?
  - Class II standards for bacteria in marine waters
- Are locations sampled representative of system being assessed?
- Are portions of Collier County truly problematic, or is DO standard too high?

Appropriateness of standards Dissolved Oxygen

- Florida's Surface Water Quality Standard (Rule 62-302, F.A.C.) states that, for Class III freshwater –
  - *Shall not be less than 5.0 (mg/L). Normal daily and seasonal fluctuations above these levels shall be maintained.*
- For Class II and III marine water -
  - *Shall not average less than 5.0 in a 24-hour period and shall never be less than 4.0. Normal daily and seasonal fluctuations above these levels shall be maintained.*
- Problems
  - DO often fails standard in "reference" locations
  - DO shows strong evidence of influence from wetlands, rather than human-induced

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Among more developed watersheds, Fakahatchee Strand (83% forested) had the lowest DO average and minimums

WBID	WBID Name	Average (mg/L)	Median (mg/L)	Minimum (mg/L)	Maximum (mg/L)
3278G	Fakahatchee Strand	4.1	3.7	0.2	12.8
3278H	Faka-Union (North Segment)	5.3	5.2	1.6	12.8
3278I	Faka-Union (South Segment)	6.2	6.4	1.2	12.9
3278V	Rookery Bay (Inland East Segment)	6.2	6.4	2.1	11.4

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Appropriateness of standards Fecal Coliform Bacteria

- Freshwater and marine standard of 200 # / 100 ml
  - Typical screening level for recreation and bodily contact
- Marine standard for Class II of 43 # / 100 ml
  - Standard for shellfish harvesting
- Bacteria of genus *Klebsiella* can be natural soil organisms, but can also test positive as "fecal coliform bacteria"
- Additional source identification efforts warranted

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Are sample locations appropriate – example from Rookery Bay. What happened in 2006?

Year	Sample Size	Chlorophyll a (µg/l)	
		Corrected	Uncorrected
1999	4		4.6
2000	4		5.8
2001	4		5.4
2002	4		5.7
2003	4		4.9
2004	4		5.0
2005	4		7.3
2006	4	14.0	

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2006 –sampling, not ambient within the bay. Station location matters.

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Are portions of Collier County truly problematic, from a nutrient perspective?

- Nutrient enrichment could explain impairments for DO (widespread)
  - But DO levels lowest in watersheds with greatest amount of wetlands
  - And estuaries have more dynamic natures than standard
- Nutrient enrichment could explain impairments in "nutrients" (actually Chl-a)
  - Rookery Bay impaired as per FDEP, not by PBS&J method
  - Naples Bay of concern, as per PBS&J

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Developing Nutrient Criteria

- No state standards for nutrients
  - FDEP proposed, but not adopted
  - EPA's Numeric Nutrient Criteria – estuarine downstream protective values (DPV) withdrawn for further analysis
- Default FDEP approach is to develop screening levels per waterbody type as 70th percentile value state-wide
- Alternative approach – use TN and TP targets from Gordon River TMDL
  - Based on DO due to nutrients (not necessarily the case)
  - Gordon River reference sites also fail standard
  - Developed as 75th percentile of Everglades reference sites

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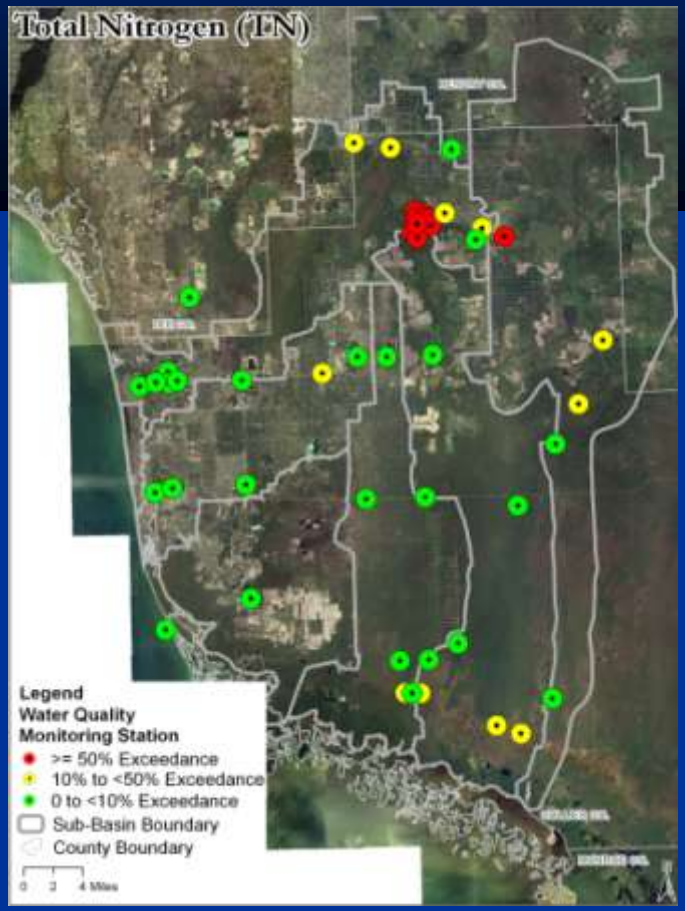
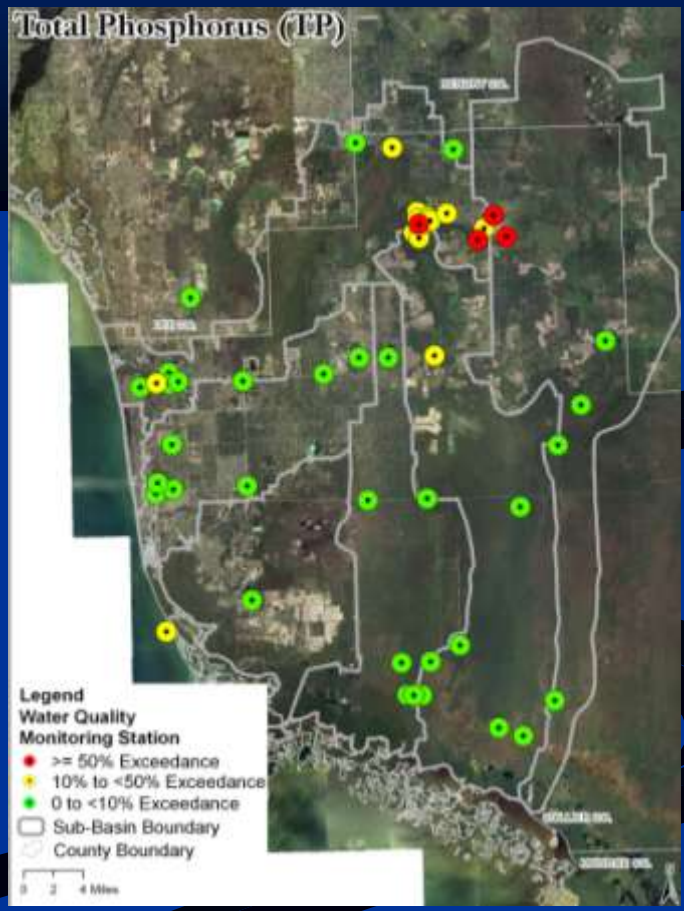
Frequency of exceeding 70th percentile values statewide for lakes and/or stream within watershed

TN of 1.6 mg / L



TP of 0.22 mg / L



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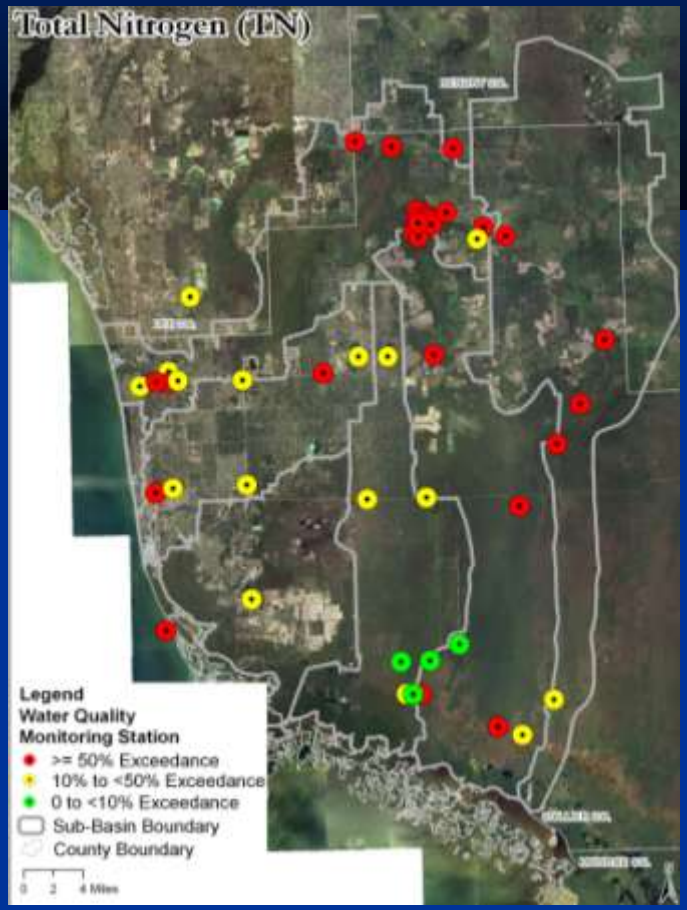
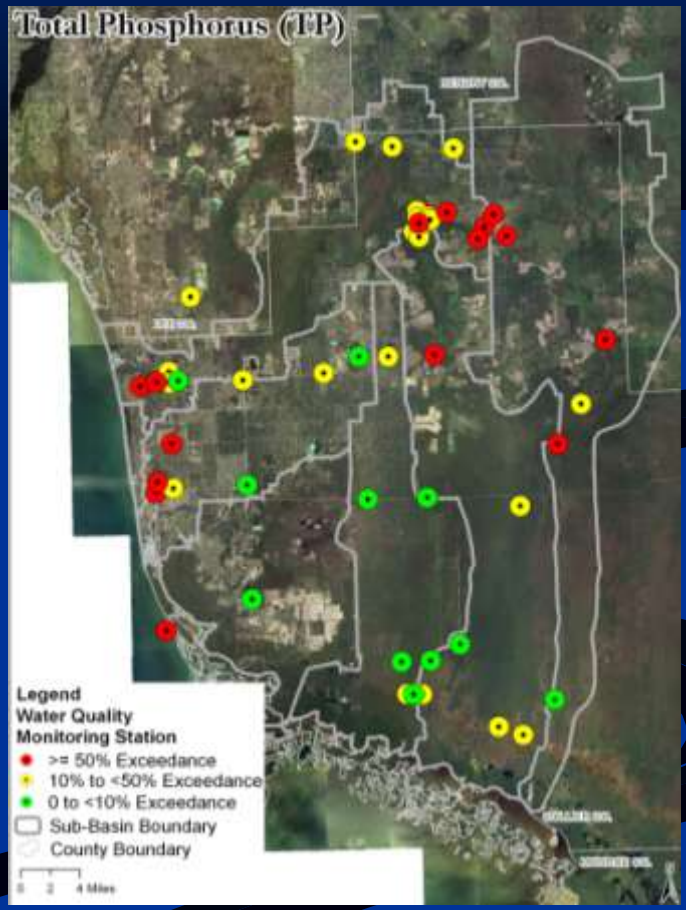
Frequency of exceeding 75th percentile values for Gordon River TMDL reference sites for streams

TN of 0.74 mg / L



TP of 0.04 mg / L



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Nutrient issues within Collier County

- Lake Trafford obviously impaired
  - But also improving water quality with dredging project
- For most of Collier County "impairment" for nutrients really means Chl-a higher than standards
  - Rookery Bay "impairment" likely due to 2006 sample sites
- Based on TN and TP screening using 70th percentile values statewide, nutrients not much of a concern in Collier County
- Based on TN and TP screening using 75th percentile values from Gordon River TMDL reference sites, nutrients elevated throughout much of County
  - But nutrient thresholds based on DO "impairment" caused by nutrients

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Water Quality
General Conclusions

- Dissolved oxygen
  - Lots of impairments, most likely due to inappropriate standard
  - Value to creating locally-relevant standard
- Fecal coliform bacteria
  - Class III standards in freshwater
  - Class II standards in marine waters - shellfish harvesting
- Appropriate to have source identification efforts

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Water Quality
General Conclusions

- Nutrients (chlorophyll-a)
  - Impairment in Rookery Bay likely not realistic
    - Nutrient levels not very high in watershed
  - Level of concern over nutrients depends on screening criteria used
    - State-wide approach – not much of a problem
    - Reference sites in Everglades approach – more of a problem
- Various metals
  - Copper could be herbicide use
  - Iron likely from groundwater

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Natural Systems

- Methodology
- Functional assessment of watersheds
- Coastal habitats assessment

Functional Assessment

- Comparison of existing conditions to Pre-Development Vegetation Map (PDVM; Duever 2004)
- Uniform Mitigation Assessment Method (UMAM; FAC 62-345) as template
  - Modified for landscape level assessment
- Optimal condition defined
  - Vegetation
  - Hydrology
  - Landscape Suitability Index (landscape position)

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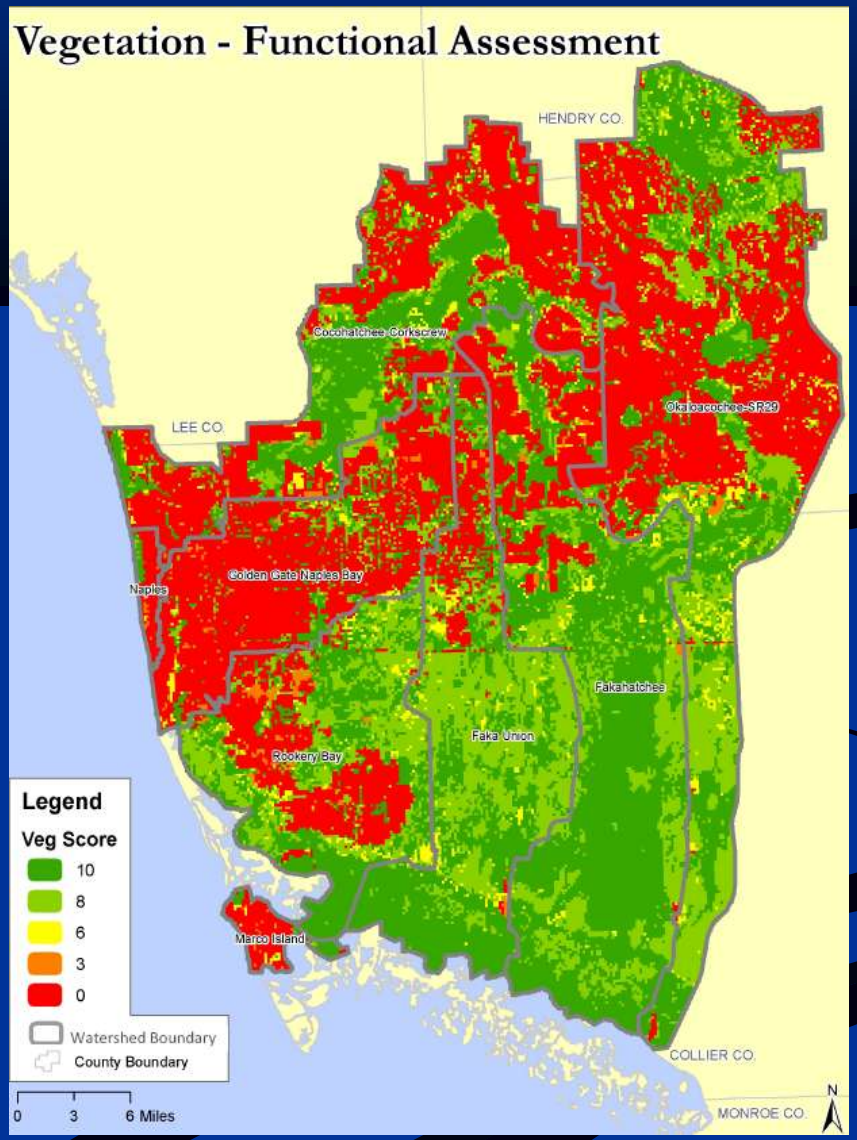
Vegetation Score

- Concept – assumption that pre-development vegetation community provides optimal functional value
- For watershed-level application
  - 2007 FLUCCS compared to PDVM
  - Polygons with no difference (regardless of original type of community) assigned score of 10
  - Polygons with different strata but same ecosystem type (i.e., freshwater forested wetland to freshwater herbaceous wetland) assigned score of 8
  - Shift from mesic to hydric communities (or vice versa) scored as 8
  - Shift of both vegetation and ecosystem type (i.e., freshwater forested wetland to forested native upland) scored as 6
  - Shift to artificial water body scored as 3
  - Shift to developed land use scored as 0

Vegetation Index - Spatial Display of Values



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Hydrology Score

- Concept – locations with similar water depths and hydroperiods over time provide optimal functional value
- Use of vegetation as indicator of changes in levels and/or hydroperiods
  - Rerun with model results?
- For watershed-level application
  - 2007 FLUCCS compared to PDVM
  - Use of hydrologic regime table
  - Polygons with communities suggesting difference scored as percent change in hydroperiod (regardless of direction of change)
  - Polygons with development and/or newly formed water given max change score

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Hydrology Factors

SW Florida Plant Communities	Hydroperiod (months)	Seasonal Water Level (inches)	
		Wet	Dry (1,10)*
Xeric Flatwood Xeric Hammock	0	≤-24	-60, -90
Mesic Flatwood Mesic Hammock	≤1	≤2	-46, -76
Hydric Flatwood Hydric Hammock	1 - 2	2 - 6	-30, -60
Wet Prairie Dwarf Cypress	2 - 6	6 - 12	-24, -54
Freshwater Marsh	6 - 10	12 - 24	-6, -46
Cypress	6 - 8	12 - 18	-16, -46
Swamp Forest	8 - 10	18 - 24	-6, -36
Open Water	>10	≥24	< 24, -6
Tidal Marsh Mangrove Beach	Tidal	Tidal	Tidal
* 1 = average year low water			
10 = 1 in 10 year drought			July 2002

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Landscape Position

- Landscape Suitability Index (LSI)
  - Concept – if good hydrology and vegetation, but what if in the median of an interstate?
  - Developed by Center for Wetlands (UF)
  - For watershed-level application
    - 2007 FLUCCS into 750 x 750 foot cells
    - LSI for each cell calculated based on LSI values from adjacent cells
    - LSI for a watershed or WBID calculated and percentage of cells with various scores calculated

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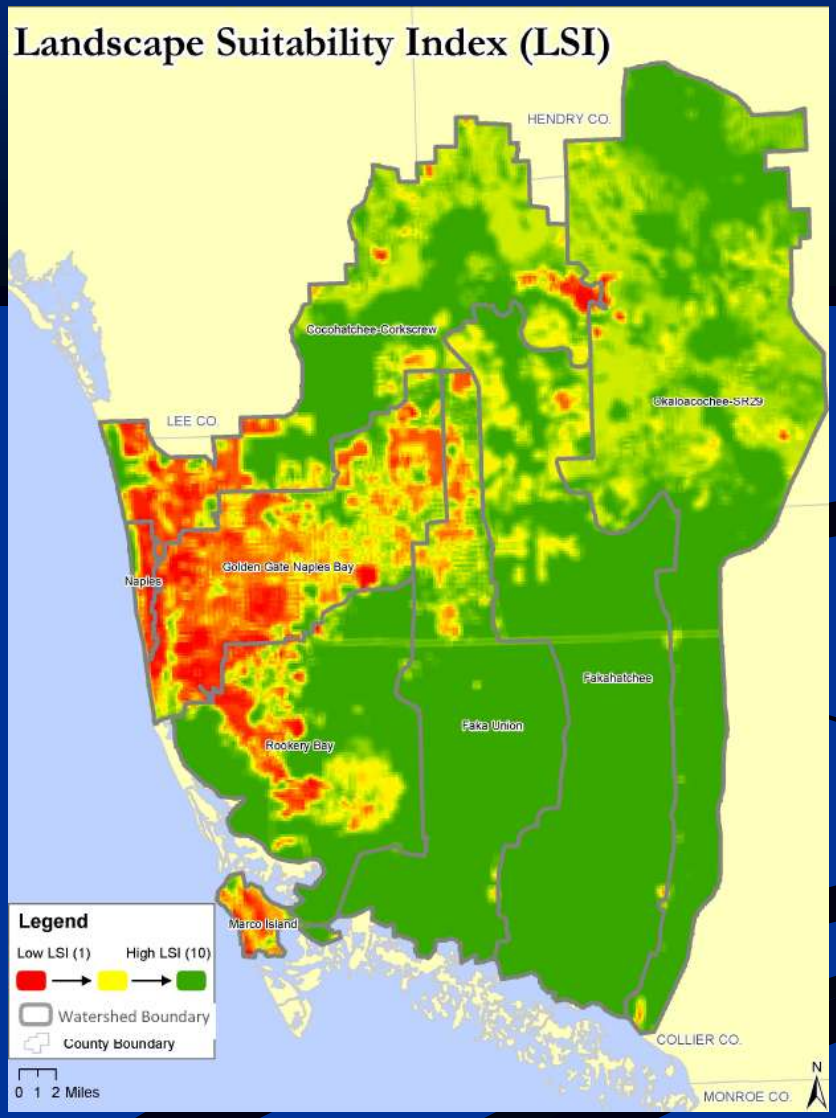
LSI Coefficients

Land Use/Land Cover	LSI Coefficients
Natural System	10.00
Natural Open water	10.00
Pine Plantation	9.36
Recreational / Open Space (Low-intensity)	9.08
Woodland Pasture (with livestock)	8.87
Pasture (without livestock)	8.03
Low Intensity Pasture (with livestock)	7.32
Citrus	7.02
High Intensity Pasture (with livestock)	6.96
Row crops	6.07
Single Family Residential (Low-density)	3.57
Recreational / Open Space (High-intensity)	3.42
High Intensity Agriculture (Dairy farm)	3.33
Single Family Residential (Med-density)	2.81
Single Family Residential (High-density)	2.72
Mobile Home (Medium density)	2.56
Highway (2 lane)	2.43
Low Intensity Commercial	2.22
Institutional	2.14
Highway (4 lane)	1.91
Mobile Home (High density)	1.90
Industrial	1.87
Multi-family Residential (Low rise)	1.49
High Intensity Commercial	0.91
Multi-family Residential (High rise)	0.90
Central Business District (Average 2 stories)	0.64
Central Business District (Average 4 stories)	0.00

LSI Spatial Display of Values



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Results on a watershed level

Avg Functn	Cocohatchee-Corkscrew		Golden Gate Naples Bay		Rookery Bay		Faka Union, Fakahatchee, OK-29	
	Acres	% of Watershed	Acres	% of W'shed	Acres	% of W'shed	Acres	% of Watershed
0 - < 1	3,603	3%	9,155	10%	2,492	3%	258	0%
1 - < 4	67,549	50%	60,253	66%	25,762	26%	136,389	27%
4 - < 7	11,054	8%	7,012	8%	18,427	19%	41,090	8%
7 - < 10	27,027	20%	14,282	16%	27,686	28%	162,151	32%
10	25,129	19%	465	1%	24,367	25%	162,771	32%
Total Ac	134,362		91,167		98,735		502,660	

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Coastal Habitats Assessment

- Mangrove, salt marsh, seagrass, oysters assessed
- GIS based comparison of all available and mappable data layers
- Issues
  - Not all areas with maps
  - Not all areas with maps were mapped at same time
  - Not all ecosystem types can be mapped with traditional GIS-based approaches
    - Seagrasses
    - Oysters (dead or alive)
  - Mangroves and salt marsh separated and combined

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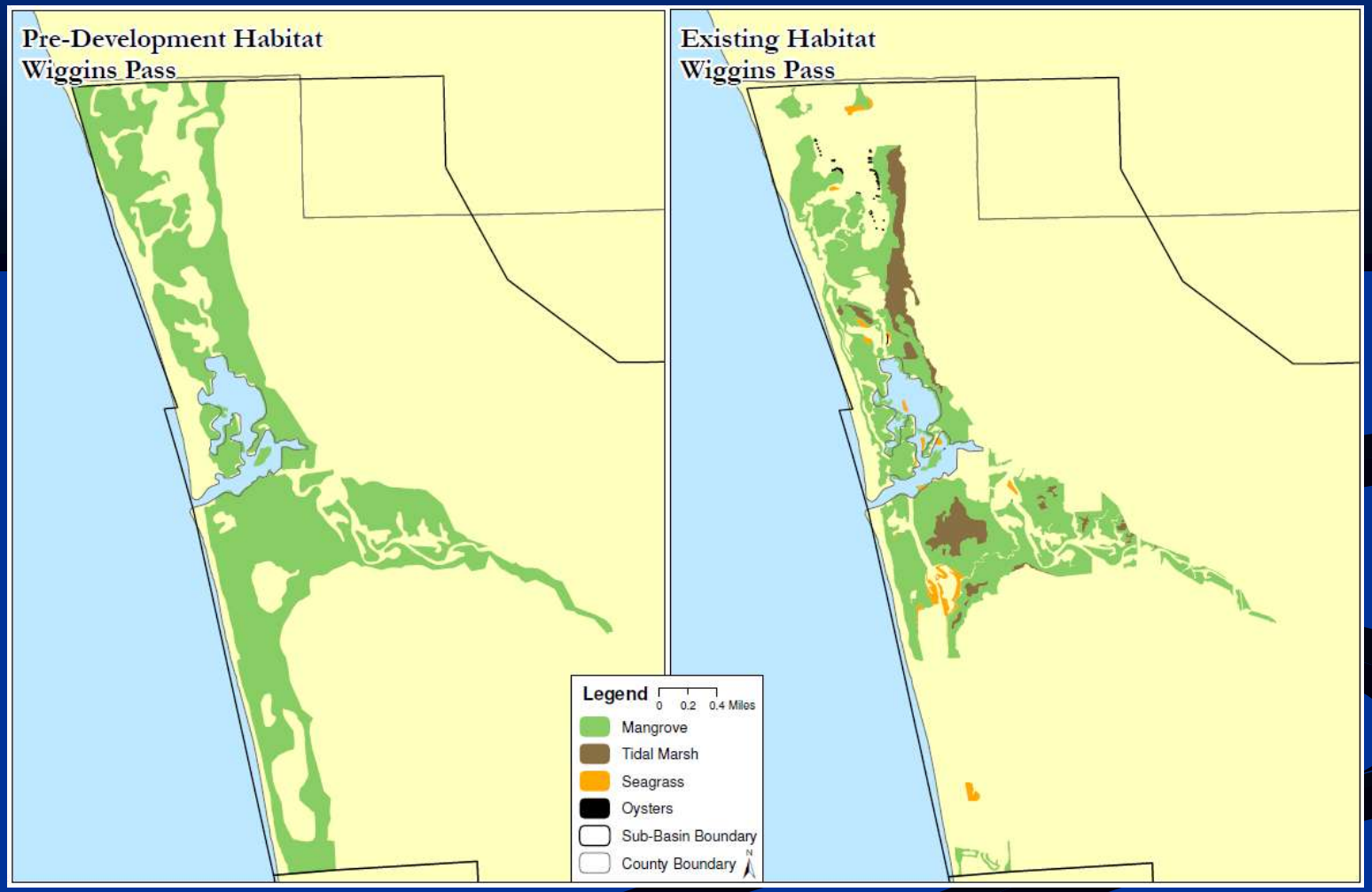
Wiggins Pass



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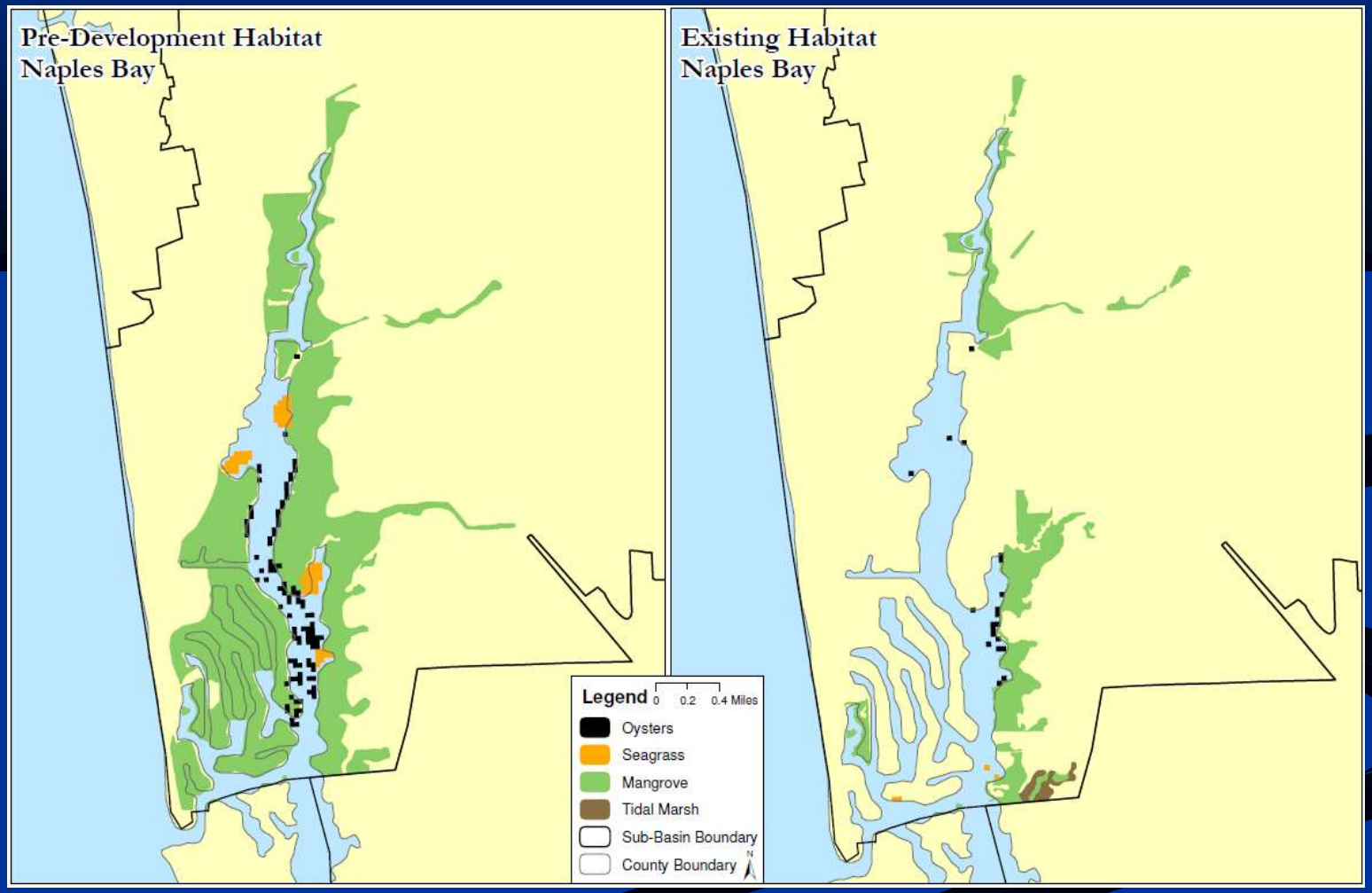
Wiggins Pass

Wiggins Pass	Pre-Development	Current	Acres Lost	Percent Loss
Oyster (1999)	No Data	5		
Seagrass (2006)	No Data	39		
Tidal Marsh (Pre-Dev vs. 2007)	0	183	477	29
Mangrove (Pre-Dev vs. 2007)	1,660	999		

Naples Bay



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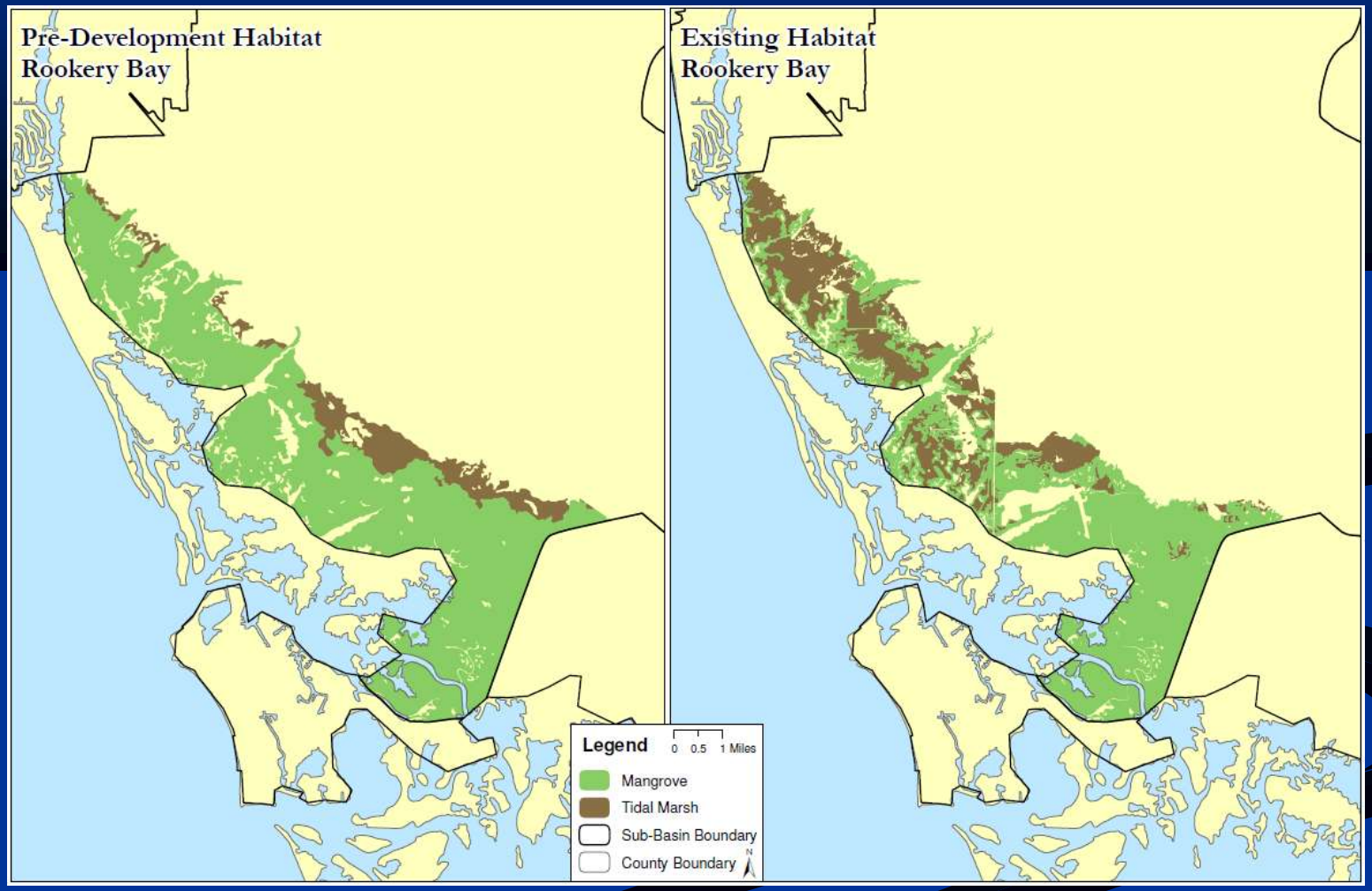
Naples Bay

Naples Bay	Pre-Development	Current	Acres Lost	Percent Loss
Seagrass (1953 vs. 2005)	51	2	48	95
Oyster (1953 vs. 2005)	68	12	55	82
Tidal Marsh (Pre-Dev vs. 2007)	0	20	1,182	76
Mangrove (Pre-Dev vs. 2007)	1,549	347		

Rookery Bay



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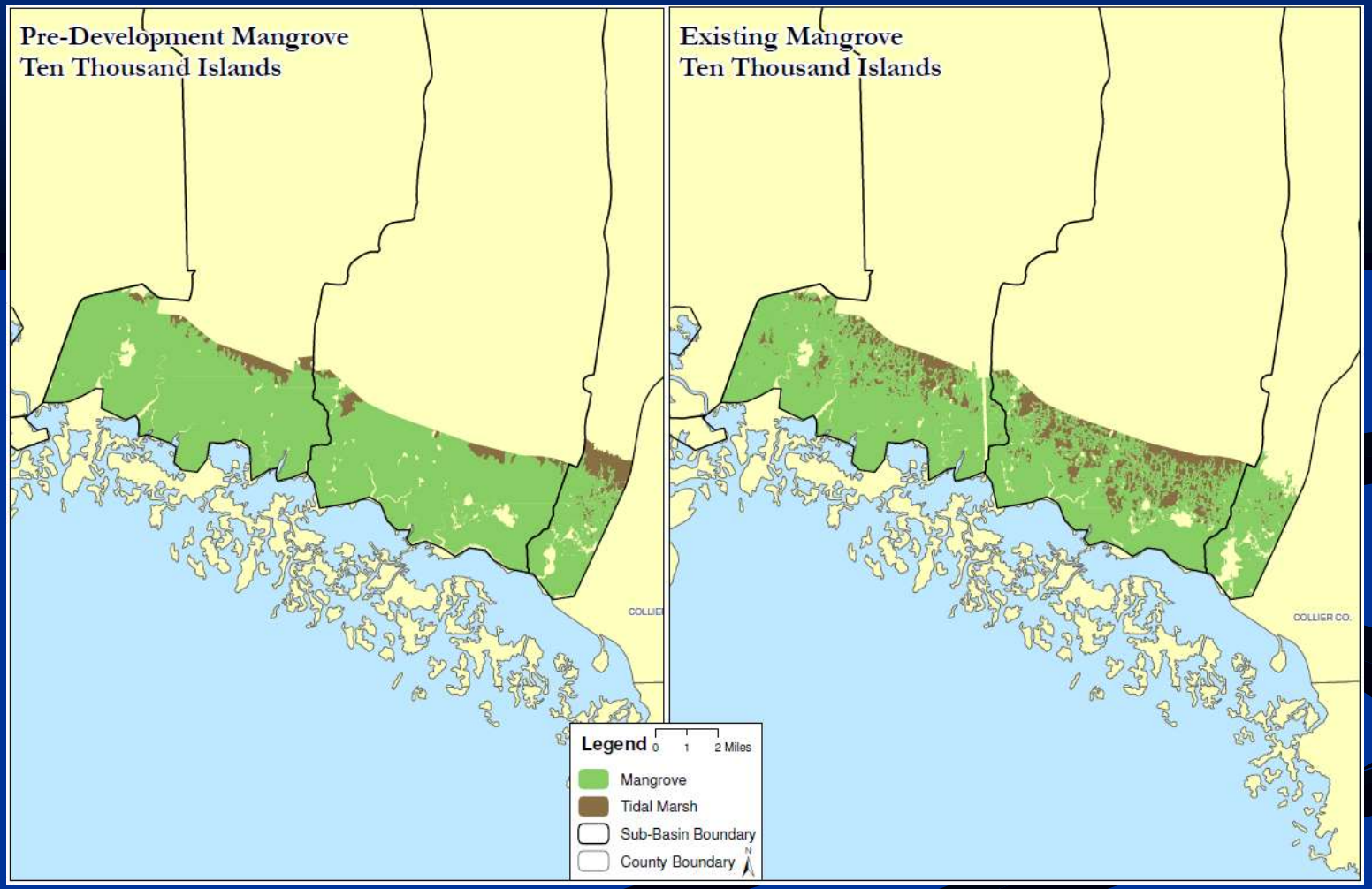
Rookery Bay

Rookery Bay	Pre-Development	Current	Acres Lost	Percent Loss
Tidal Marsh (Pre-Dev vs. 2007)	2,131	5,122	2,170	12
Mangrove (Pre-Dev vs. 2007)	15,735	10,575		

Ten Thousand Islands



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Ten Thousand Islands

Ten Thousand Islands	Pre-Development	Current	Acres Lost	Percent Loss
Tidal Marsh (Pre-Dev vs. 2007)	2,711	7,737	1,916	5
Mangrove (Pre-Dev vs. 2007)	37,694	30,753		

Coastal Habitats Assessment

- Gradient of habitat loss
  - Naples Bay – 76 to 95 % decline in habitats
  - Wiggins Pass – 29% loss (that can be documented)
  - Rookery Bay – 12 % loss
  - Ten Thousand Islands – 5% loss
- These are only for mappable communities
- Hydrologic alteration may mean dead oyster reefs, even if still mappable

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Existing Conditions
Major Conclusions

- Water quality can be a concern in portions of the most developed watersheds
- But, literature is quite clear…
- Most commonly cited concern with estuarine health is water quantity
  - Changes in amounts and timing of freshwater inflow
- Concerns with water quality shouldn't trump need to get hydrology corrected

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Performance Measure

- Definition
  - A metric used to assess the potential benefit/impact resulting from implementation of a specific program or project

Performance Measures

- Surface Water Systems
  - Freshwater Discharge to Estuaries
    - Compare with NSM estimate
  - Hydroperiod, Water Depth
    - Used to Evaluate Wetland Systems
  - Flood Protection
    - Potential effects on flood depth – evaluation at regional scale
  - Water Quality and Pollutant Loads
    - Tied back to TMDLs

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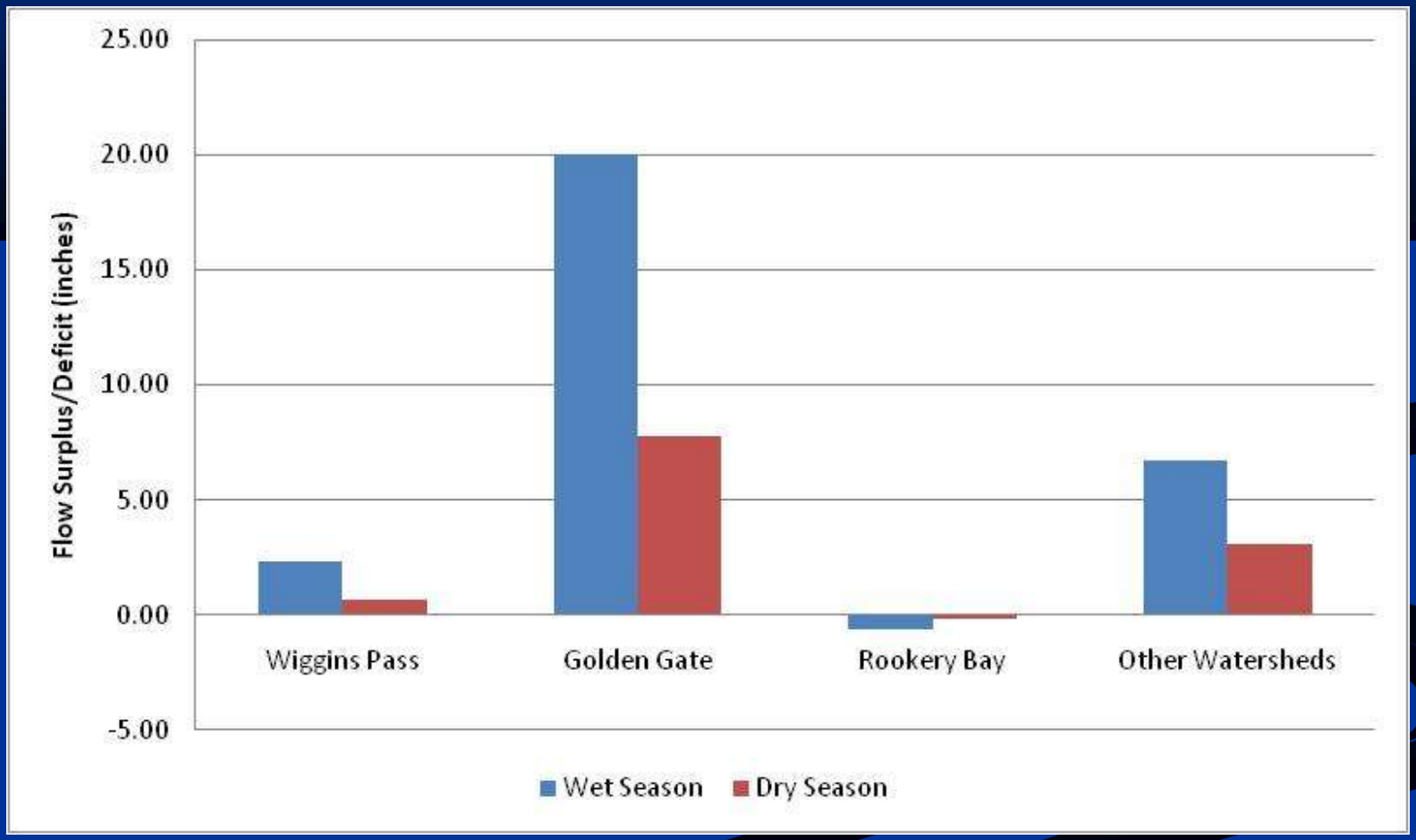
Performance Measures

- Groundwater Systems
  - Aquifer yields (volume of available water)
- Natural Systems
  - Vegetation
  - Hydrology
  - Landscape Suitability Index

Freshwater Discharge Surplus/Deficit to Estuaries



Pollutant Load

- Pollution loads quantified for total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), copper and iron.
- Performance measures based on anthropogenic loads as the target is to minimize or eliminate those loads
- Scores based on level of treatment ranging from 0 to 10
  - 0 = existing condition land use with no stormwater treatment (provides credit for current level of treatment)
  - 10 = load equivalent to achieving maximal (i.e., 85%) anthropogenic load reduction

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Flood Risk

- Benefit/impact will be evaluated only for urban areas
- Benefit/impact will be measured as change in flood depth per MIKE SHE model
- Optimum score (10): zero flood depth during the 100 year/3 day storm
- Low score (0): increased flood depth at identified critical locations

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Flood Risk Issues

- MIKE SHE results do not exactly match DFIRM map
- Potential problems
  - Different topographic data
  - Different modeling assumptions

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Aquifer Yield

- Projects will be evaluated based on change in potentiometric surface elevation for each aquifer
- Optimal score (10) for each aquifer: NSM head elevation
- Minimum score (0): top of confining unit for each aquifer

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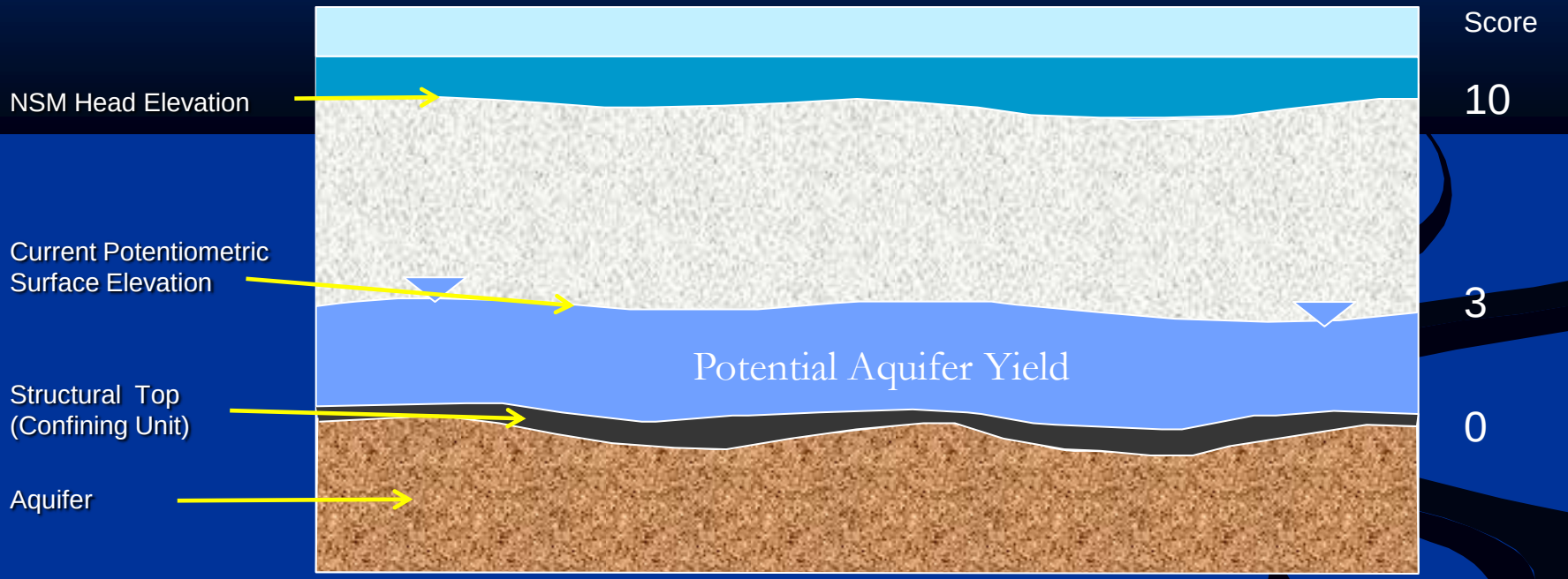
Groundwater Yield

- Benefit is measured as the change in potentiometric surface elevation



Natural Systems

- Potential projects will be evaluated in comparison to the Pre-development Vegetation Model (PDVM)
- Scoring is based on hydrology and landscape suitability index (LSI); i.e. (hydrology + LSI)/2
  - Hydrology scores based on percent below PDVM
    - Wet season depth and hydroperiod
  - LSI = Suitability based on characteristics of surrounding vegetation/land uses
- Scoring is based on SFWMD (hydrology) and UF (LSI) tables

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Hydrology

SW Florida Plant Communities	Hydroperiod (months)	Seasonal Water Level (inches)	
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Landscape Suitability Index (LSI)

Land Use/Land Cover	LSI Coefficients
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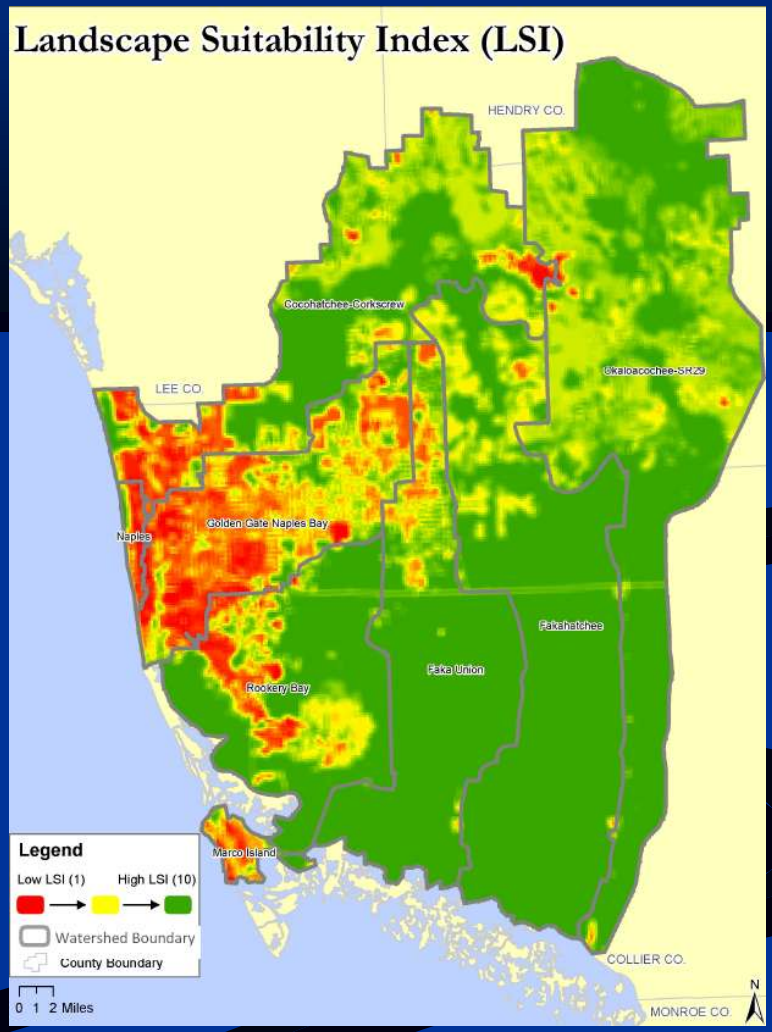

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Identification of Potential Projects

- Methodology
  - Identify previously considered projects or projects that are scheduled for implementation
  - Better define previously identified projects
  - Identify new project opportunities based on:
    - Estuary freshwater surplus/deficit
    - Current property ownership
    - Existing conservation easements
    - Location within Sending/Receiving areas

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Identification of Potential Projects

- Methodology
  - Previously considered projects or projects that are scheduled for implementation
    - Picayune Strand Restoration Project
    - Southwest Florida Feasibility Study
    - Belle Meade Area Stormwater Master Plan
    - Lely Area Stormwater Improvement Project
    - Immokolee Stormwater Master Plan
    - Master Plan for Regional Irrigation Distribution System (RIDS)

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Potential Projects by Watershed

- Cocohatchee – Corkscrew
- Golden Gate – Naples Bay
- Rookery Bay
- Other watersheds
  - Faka Union
  - Fakahatchee
  - Okaloacoochee Slough/SR29 Canal

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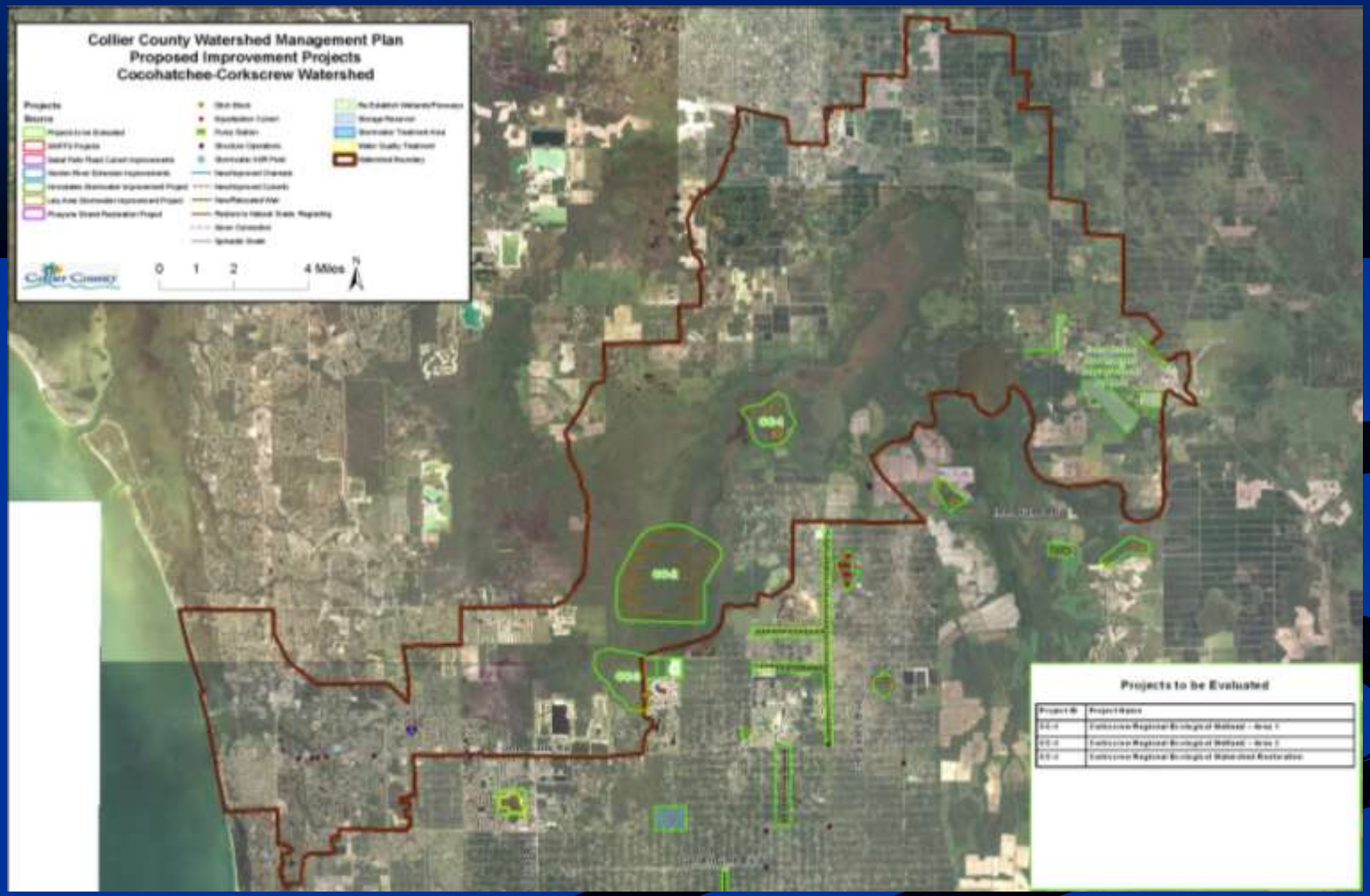
Potential Projects: Cocohatchee-Corkscrew



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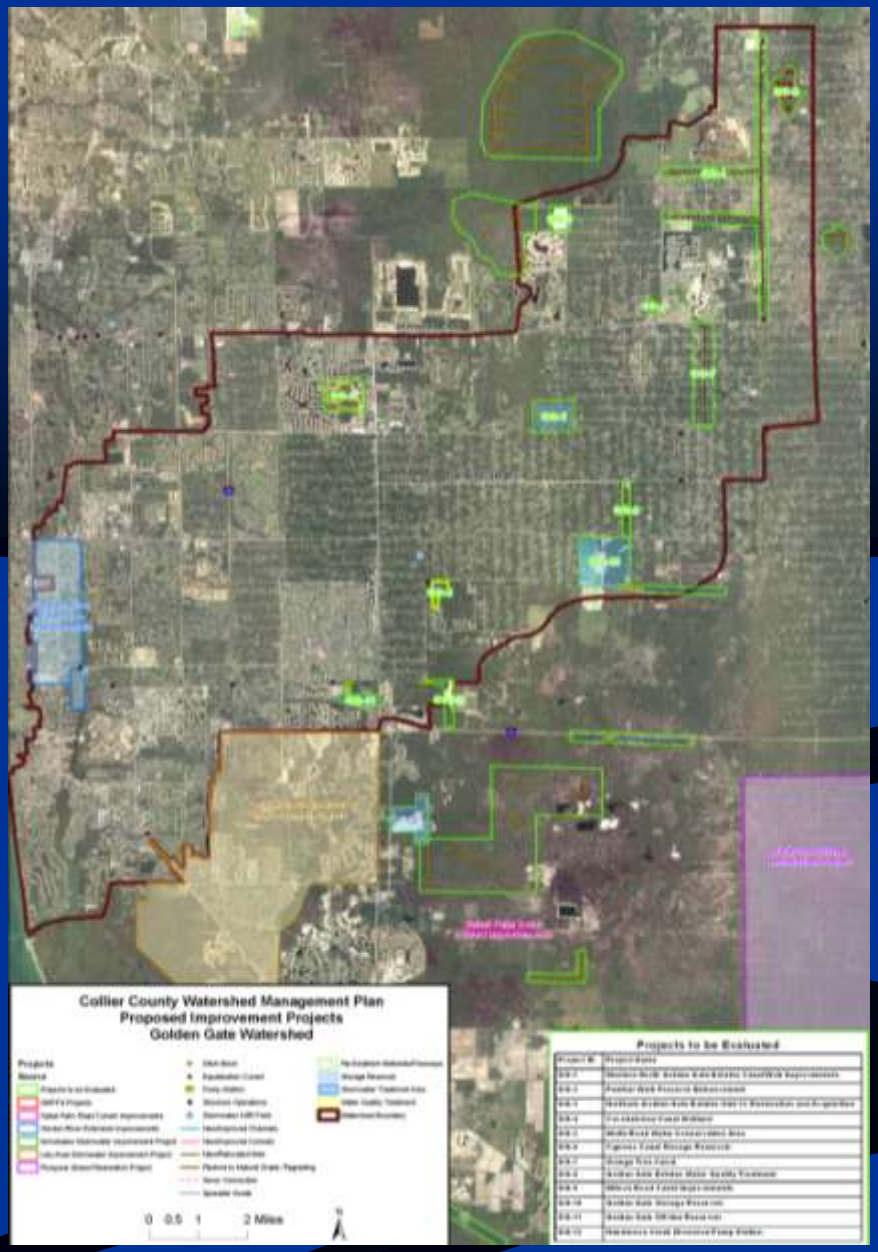
Potential Projects: Golden Gate – Naples Bay Watershed



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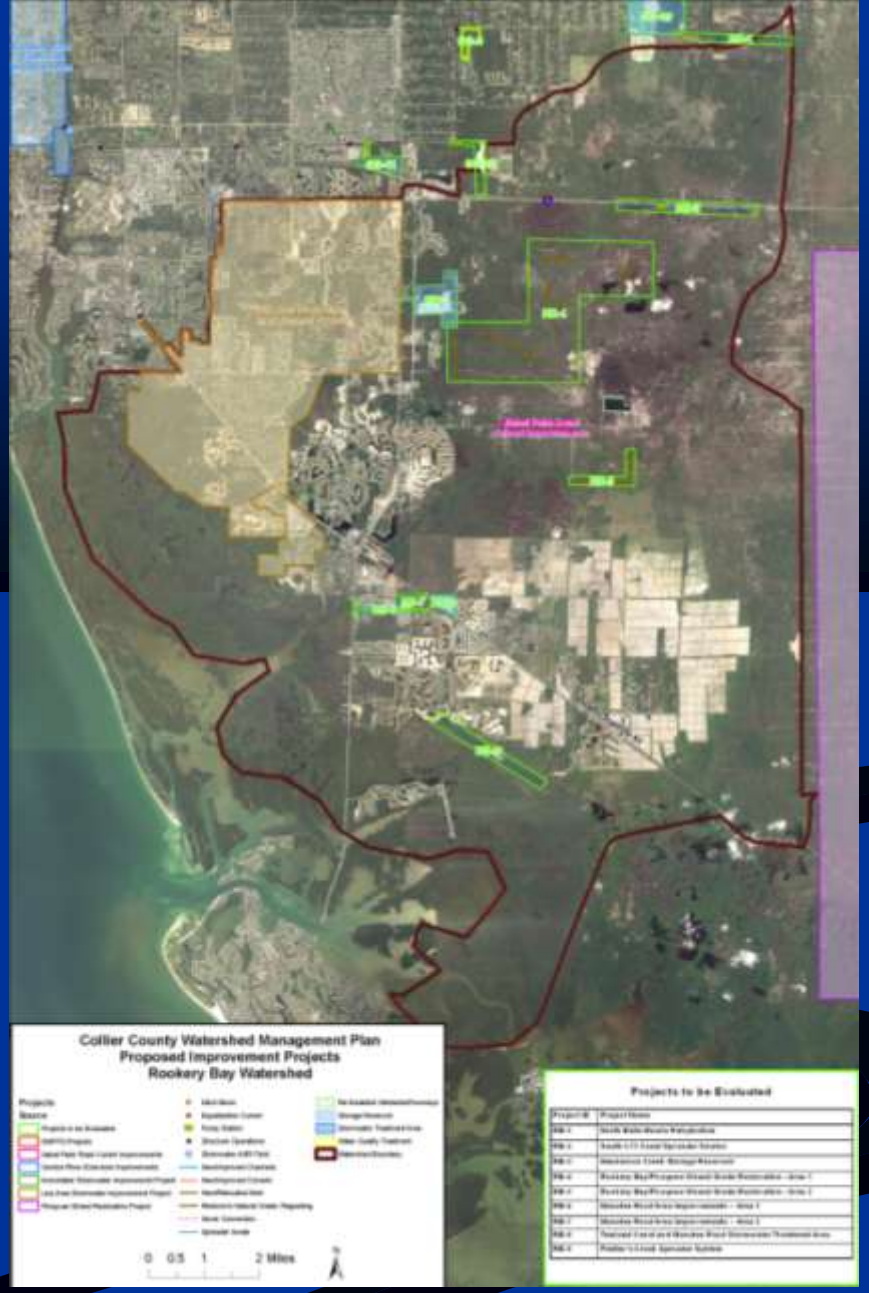
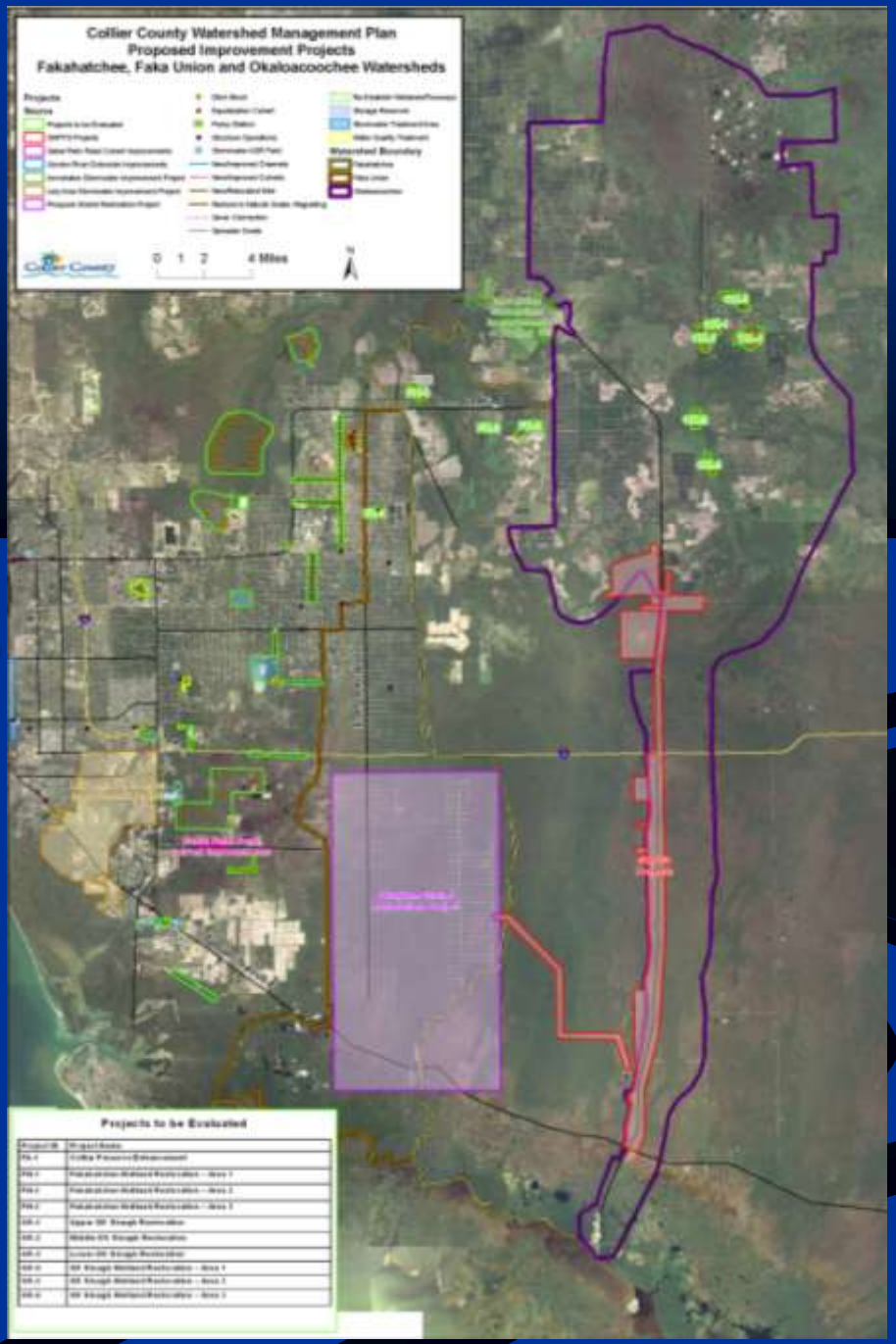
Potential Projects: Rookery Bay Watershed



Potential Projects: Other Watersheds



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County-wide Projects

- Structure operations
- Public facilities (schools and parks) retrofits
  - Pervious paving
  - Infiltration basins
  - Rain gardens
- Incentive programs for retrofit of private property
- Aquifer Storage and Recovery (stormwater)

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Golden Gate High School
Potential Retrofits

- Utilize islands as infiltration basins
- Install pervious pavement in low traffic areas
- Install rain gardens to capture roof runoff

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Presentation Topics

- Identification of Potential Projects
  - Methodology
  - Watershed specific projects
  - County-wide projects
- Regulatory and Policy Issues
  - Water Quality
  - Water Quantity
  - Land Development Code

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Regulatory Issues

- Background
- Objectives
- Low Impact Development

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Objective

- Help implement a Sustainable Stormwater Management Program
- The programs should aim to:
  - Promote more effective site planning to minimize anthropogenic impacts,
  - Promote preservation of the natural system
  - Help reduce development costs
  - Help reduce cost of future drainage system improvements

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Low Impact Development (LID)

- The program is based on the concept of LID
- LID promotes management of stormwater by:
  - Encouraging management of stormwater at the site
  - Minimize the extent of directly connected impervious areas.
  - Minimize site disturbance
  - Maintain or restore a site's natural hydrology
  - Maximize the site's assimilative capacity

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Current Stormwater Management Approach

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Regulatory Review Categories

- Water Quality
- Water Quantity
- Land Development
- Zoning

Water Quality Regulations Must Promote LID

- Main Issue: How to provide water quality credits for development
- Not feasible under current State regulations. Feasible under proposed new stormwater rules.
- Recommendation:
  - Modify Ordinance 90-10 requiring 150% of ERP treatment.
  - Develop incentives to retrofit private property

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Water Quantity and Flood Risk

- Issue: Current regulations for large storms focus on control of peak discharge for the 25-year/24-hour design event.
- Recommendation:
  - Require volume control for the 25-year/24-hour design event.
  - It allows control of peak, volume and timing of stormwater discharges

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Water Quantity and Flood Risk

- Issue: Most County watersheds do not meet current flood protection levels of service (FPLOS).
- Recommendation:
  - Modify FPLOS to set realistic goals.

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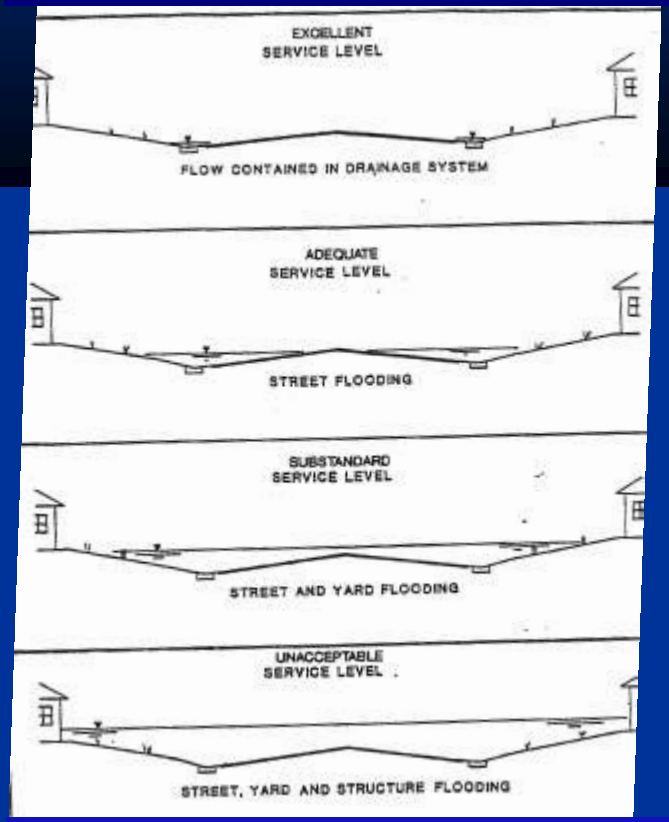
Water Quantity and Flood Risk

Current FPLOS



Proposed FPLOS

	Storm Return Period (years)		
Roadways	**10**	**25**	**100**
A. Evacuation Routes	None	None	None
B. Arterials	None	None	6 inches
C. Collectors	None	6 inches	9 inches
D. Neighborhood	6 inches	9 inches	12 inches
Open Space			
Flooding of open space is acceptable if it does not compromise public health and safety			

Land Development Regulations

- Recommendations:
  - Promote cluster development
  - Modify road width requirements based on actual ADT
  - Modify required lot set-backs (“zero lot lines”)

Zoning Regulations

- Current "large lot zoning" has limitations:
  - Increases cost of development - utilities
  - Increases road lengths, which increases pollution
  - Promotes use of septic tanks
- Zoning must support cluster development:
  - Zoning should not be based exclusively on population density, but also on extent of impervious cover.

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Summary

- There are opportunities to modify current regulations related to water quality, water quantity, land development, and zoning.
- The objective should be to implement a "sustainable stormwater management program".
- Encourage application of LID concepts and promote cluster development.

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What's Next

- Alternatives Analysis
- Preparation of Watershed Management Plans

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Alternatives Analysis

- Structural projects
  - Evaluate effect of current projects:
    - Picayune Strand
    - Golden Gate Diversion
    - LASIP
  - Consider projects identified in SWFFS, or Naples Bay SWIM plan, or Belle Meade Plan, etc.
  - Other potential projects

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Alternatives Analysis

- Non-structural projects
  - Policy related issues
    - Low Impact Development
    - Land Development Regulations
    - Etc.
  - Operation Strategies
  - Public Education Strategies
    - Rain Barrels
    - Runoff Gardens
    - Etc.

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Watershed Management Plans

- Separate Watershed Management Plans for each watershed.
  - Cocohatchee-Corkscrew
  - Golden Gate Naples Bay
  - Rookery Bay
  - Additional Watersheds
- Target date for submittal to Collier County is December 2010.

Long-Term Plan

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Wrap Up

- Comments via E-Mail

  machatcher@colliergov.net

- Formal position papers
  - Please mail to Mac Hatcher

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