Collier County

# Watershed Management Plan

November 16, 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 April 2011.

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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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# Agenda

- Study Area and H&H Model Description
- Discussion of Individual Watersheds Existing Conditions and Issues
  - Water Quantity
  - Water Quality
  - Natural Resources/Functional Assessment
- Initial Identification of Potential Projects
- Performance Measures
- Regulatory Review

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# Watersheds

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


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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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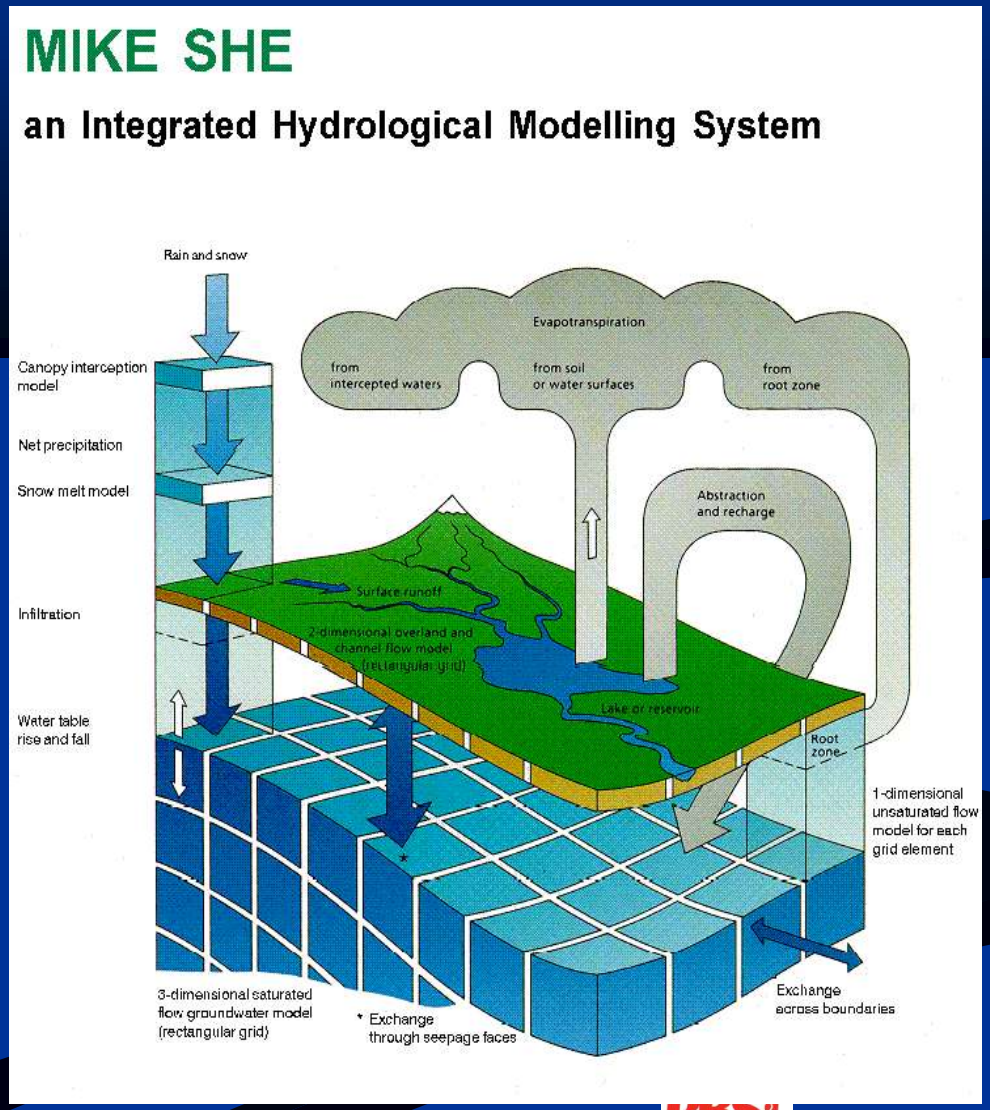
# Existing Conditions Model

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

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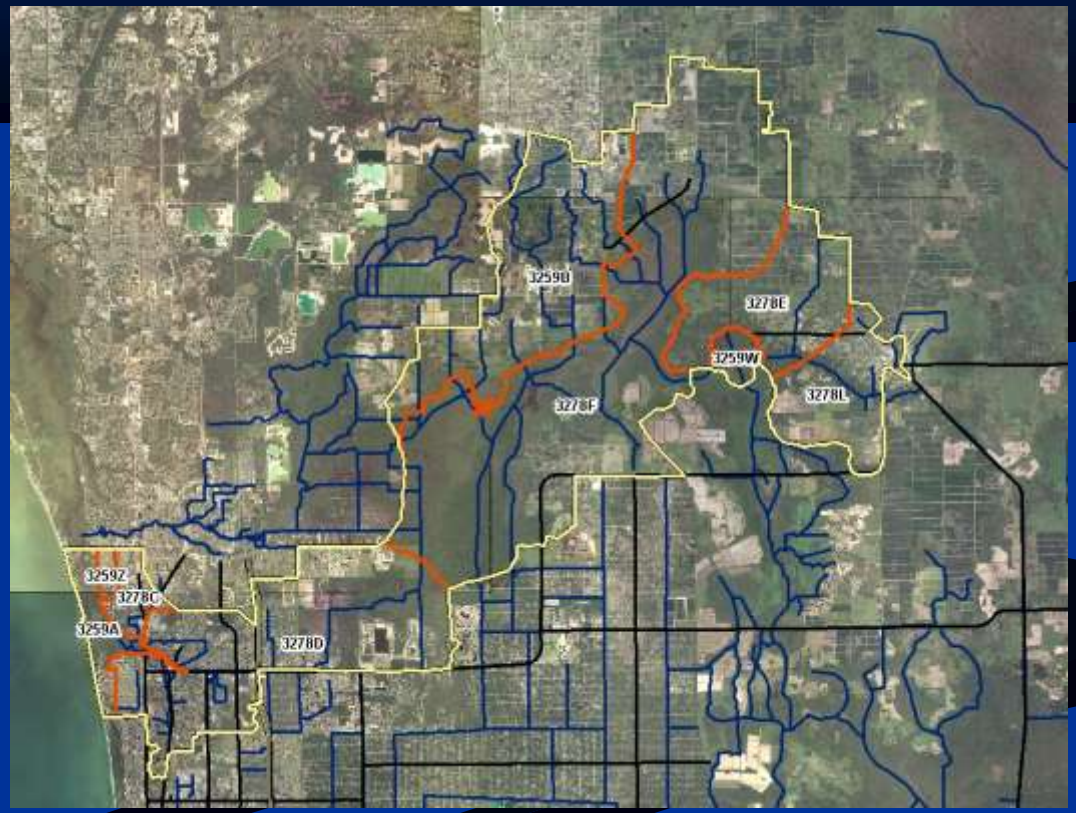
# Cocohatchee Corkscrew Watershed

- Area : ~200 sq. miles
- FDEP subdivided into 9 "WBIDs"
- Development centered in Immokalee and near I-75 at Immokalee Rd.
- Primarily wetlands in the central portion of the basin

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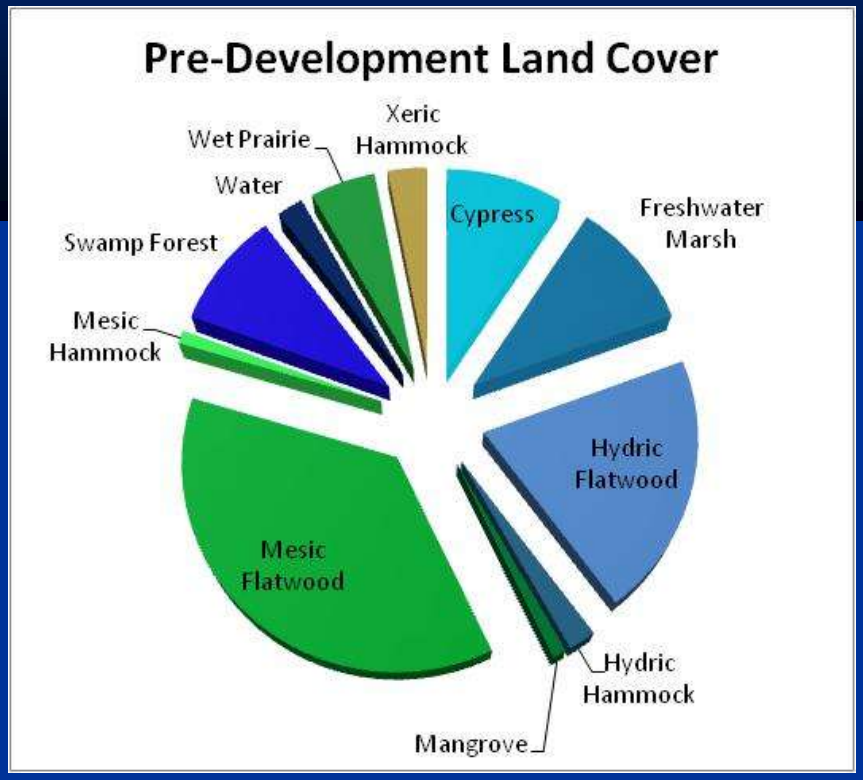
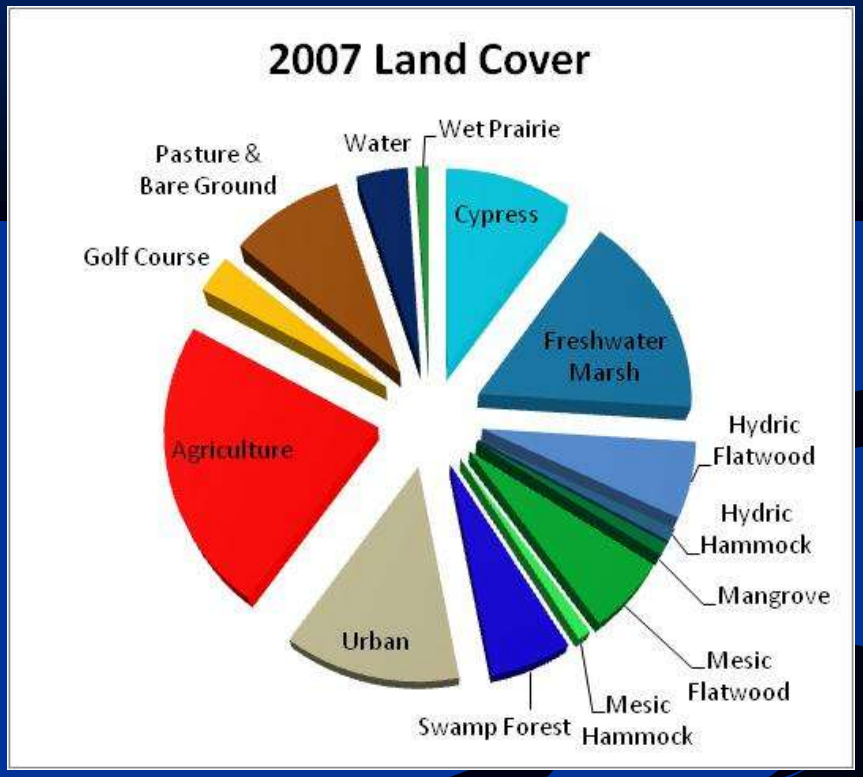
# Cocohatchee Corkscrew Watershed Land Use Comparison

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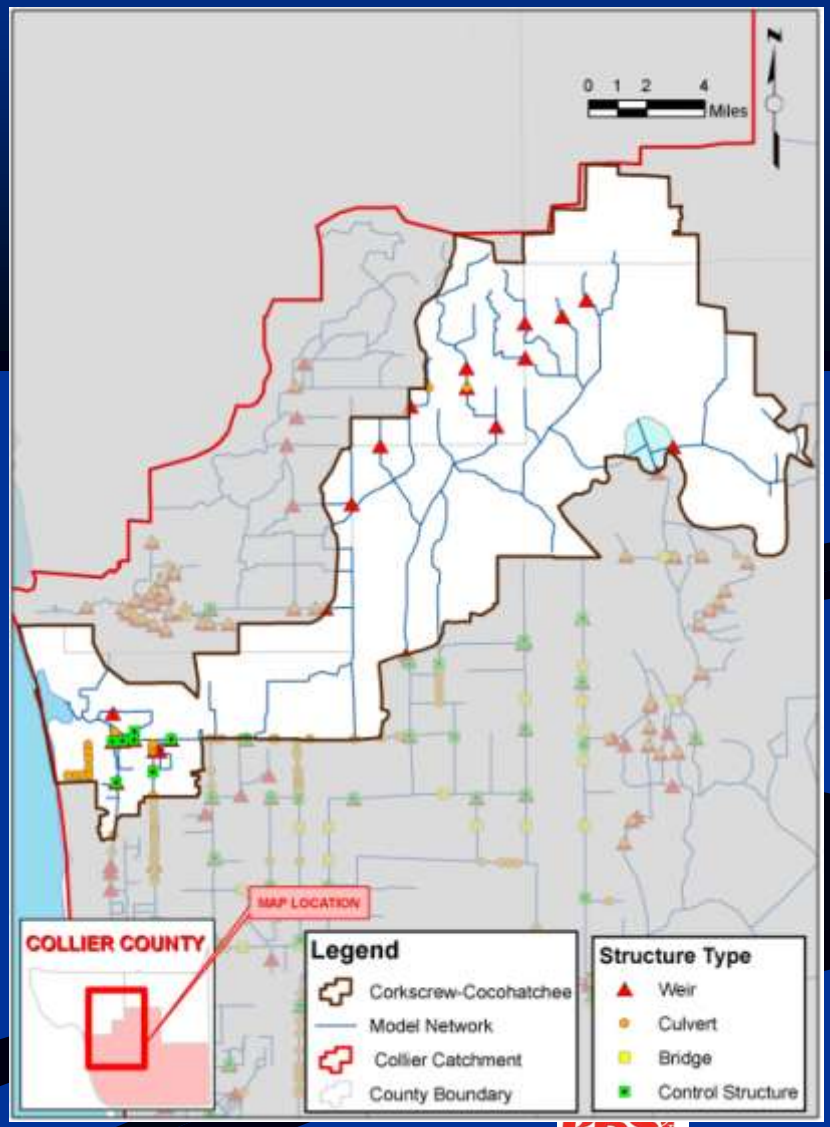
# Cocohatchee Corkscrew Watershed

- Primary drainage is Cocohatchee Canal
- Wet season water transfers with Golden Gate, Fakahatchee, and Imperial River watersheds

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# Control Structures Operation

- Cocohatchee Canal Structure 1

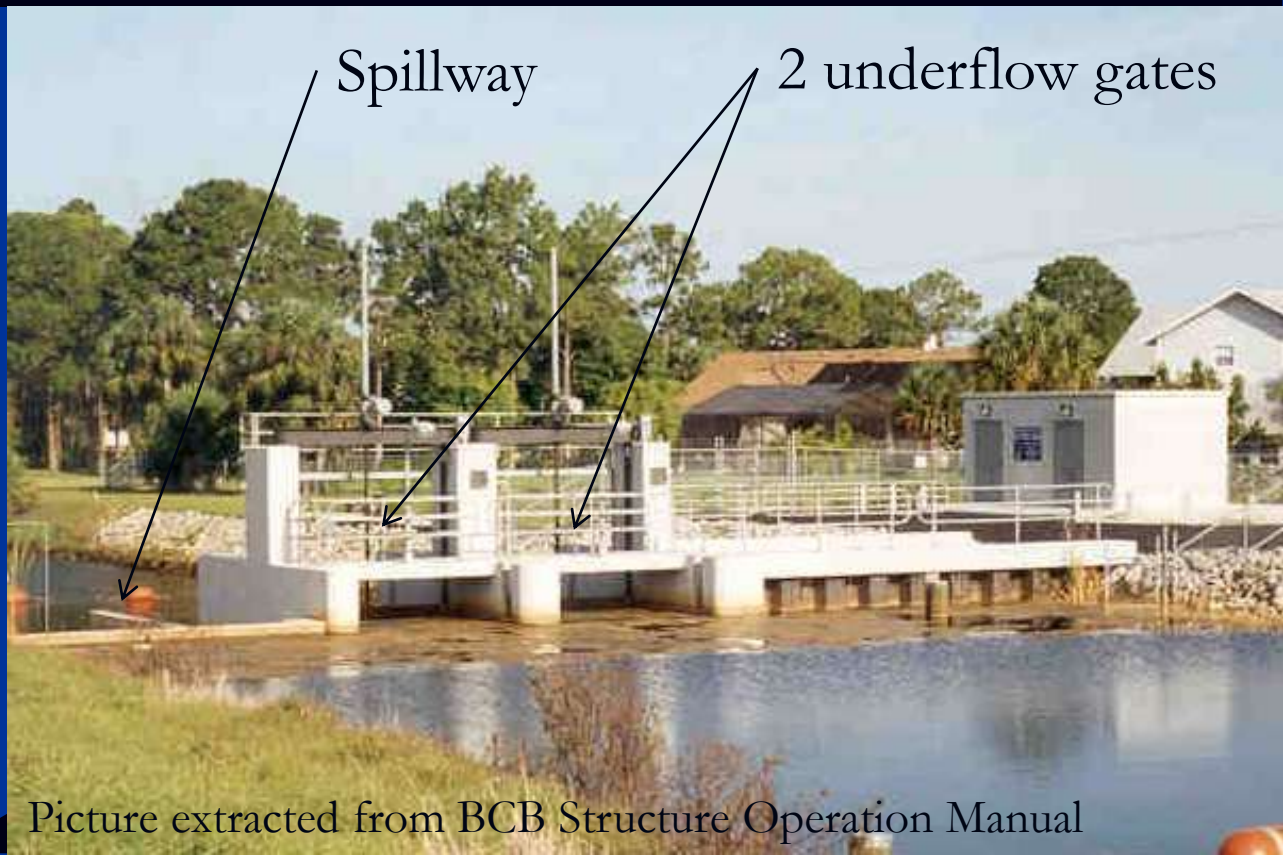
Rules:

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

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

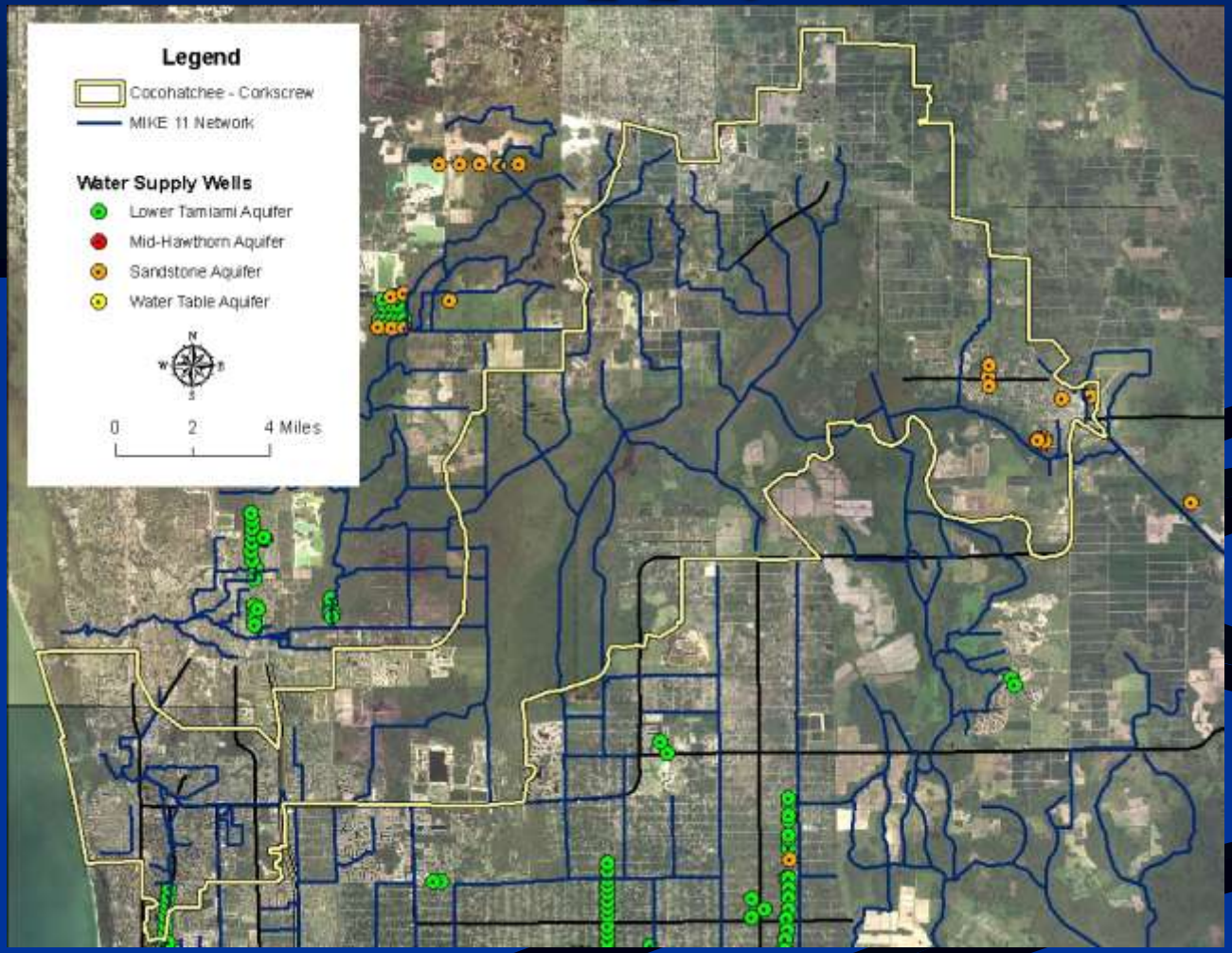
**Wet season-** Head water elevation desired at ≈ 4.3 feet NAVD.

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




Picture extracted from BCB Structure Operation Manual

# Cocohatchee Corkscrew Watershed Water Supply Wells

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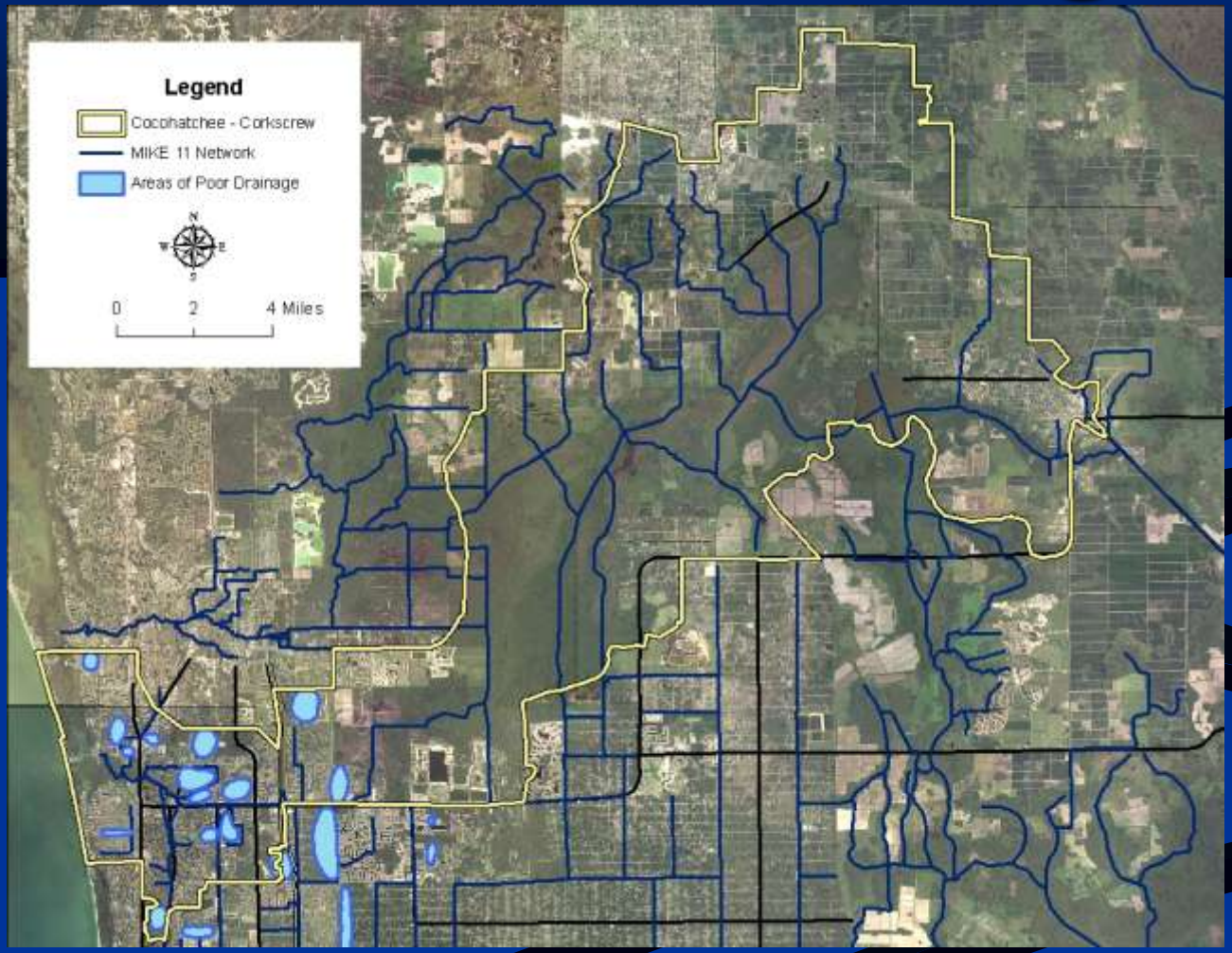
# Cocohatchee Corkscrew Watershed Areas of Poor Drainage

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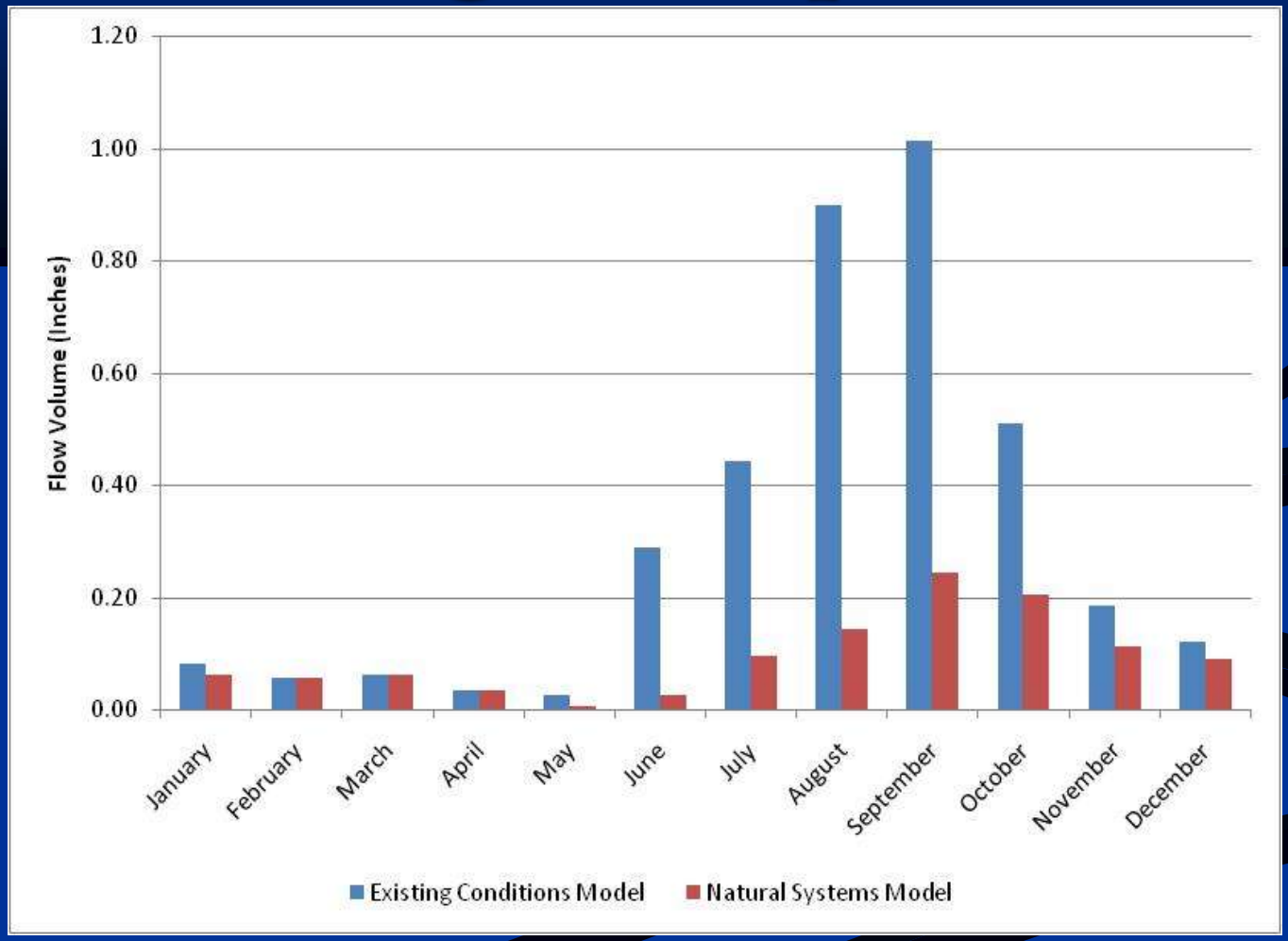
# Cocohatchee Corkscrew Watershed Discharge Comparison

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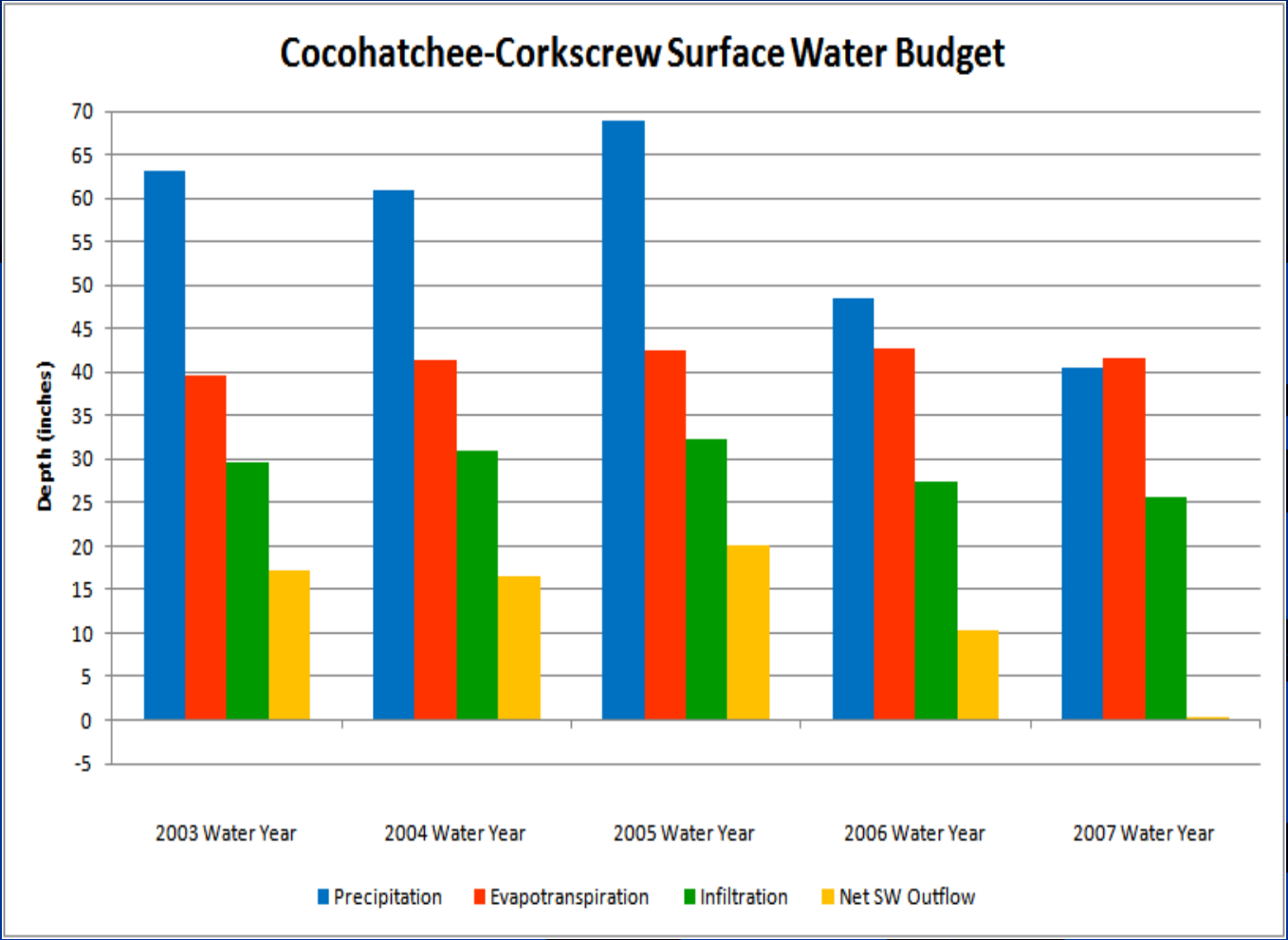
# Cocohatchee Corkscrew Watershed Surface Water Budget

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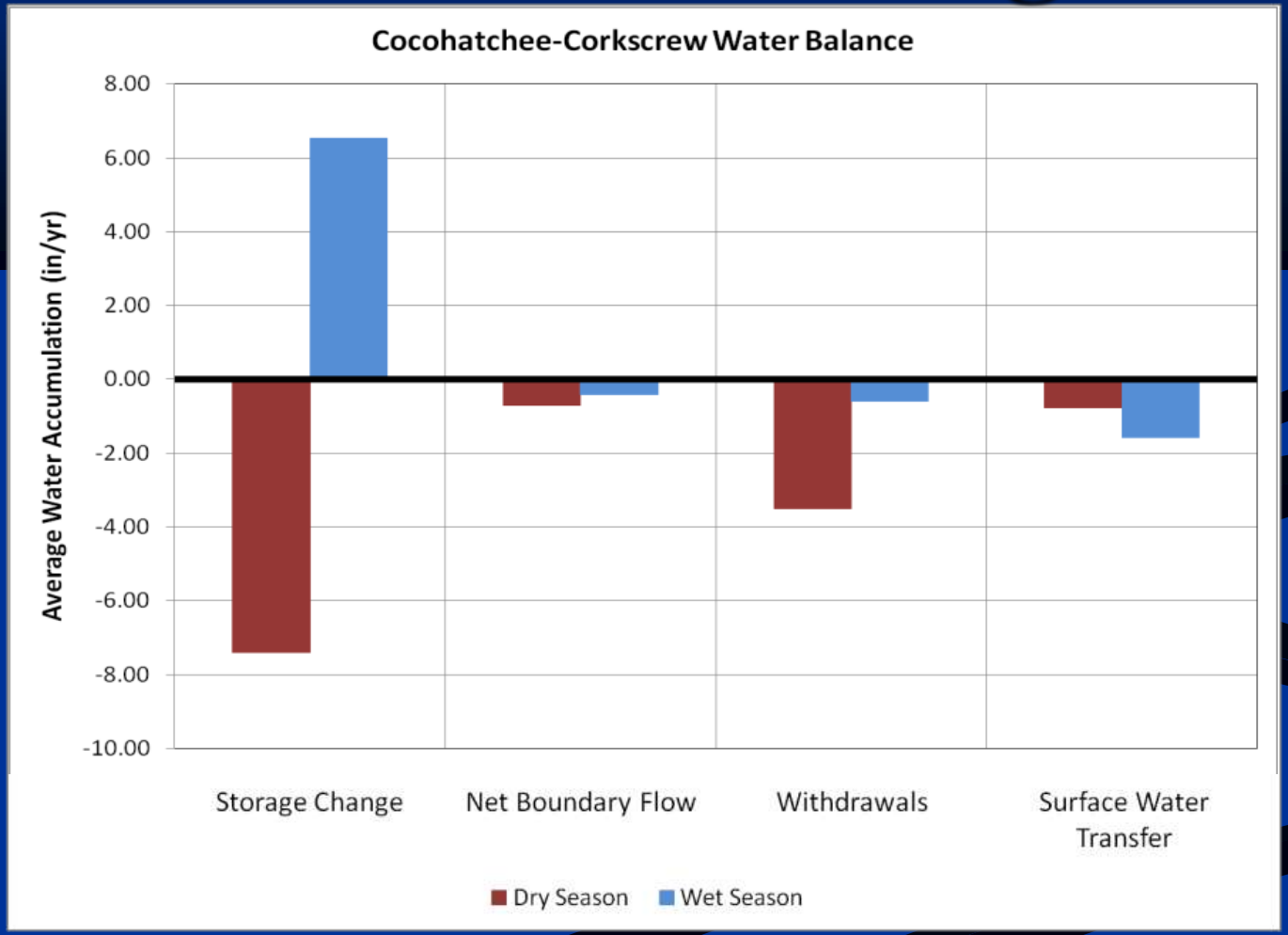
# Cocohatchee Corkscrew Groundwater Budget

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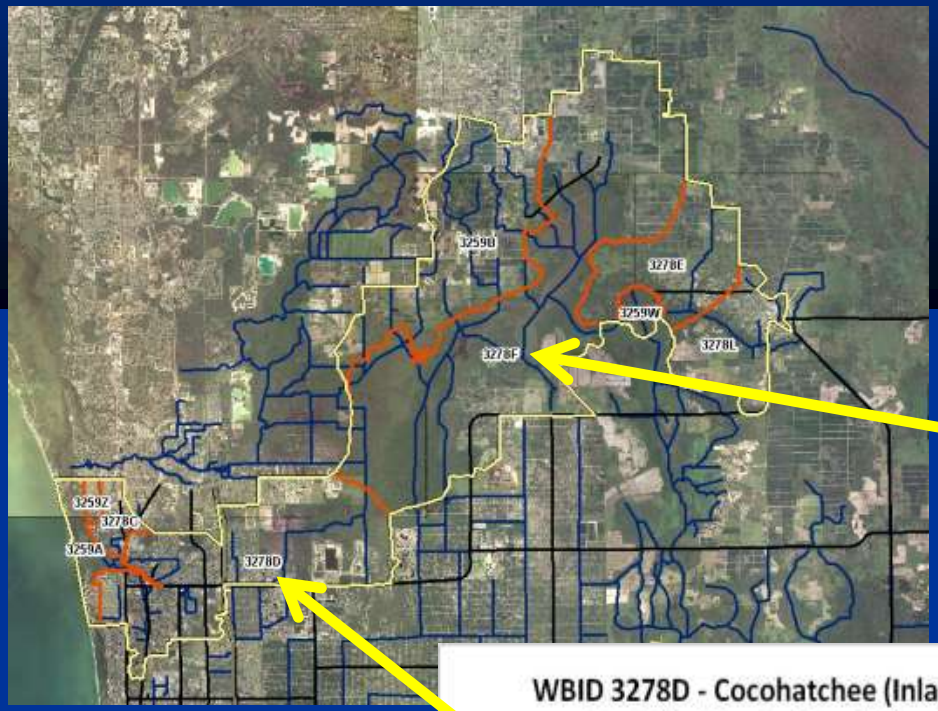
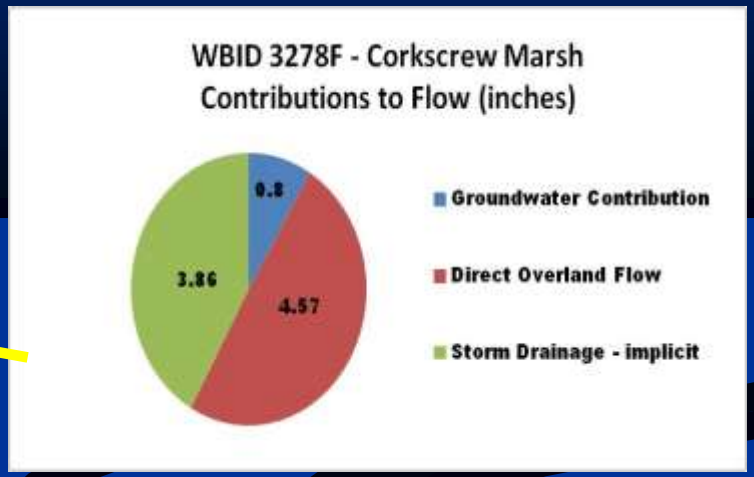
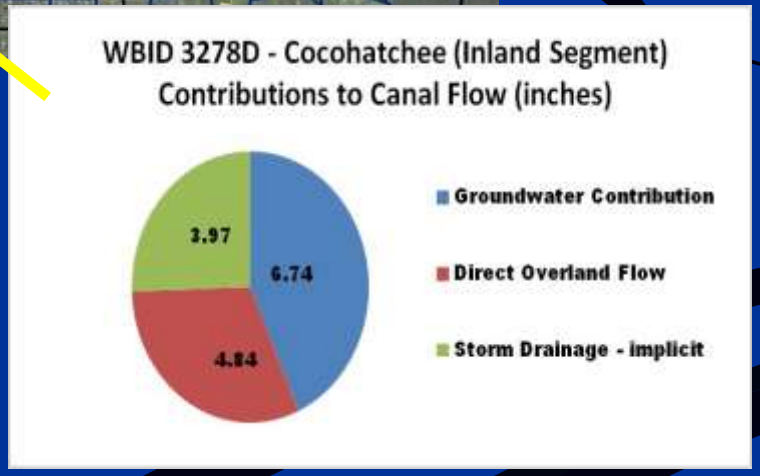
# Cocohatchee Corkscrew WBID Contributions to Canal

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# Cocohatchee Corkscrew Summary of Water Quantity Issues

- Watershed area has not changed significantly
  - Land Use has changed significantly (50% urban/ag)
- Hydrology of remaining wetlands has changed
  - Shorter hydro-period and less water stored
- Greater discharge to the estuary
  - Approximately two inches (2”) in the wet season
- High groundwater contribution to canals
  - Approximately 6.5” to the Cocohatchee Canal WBID

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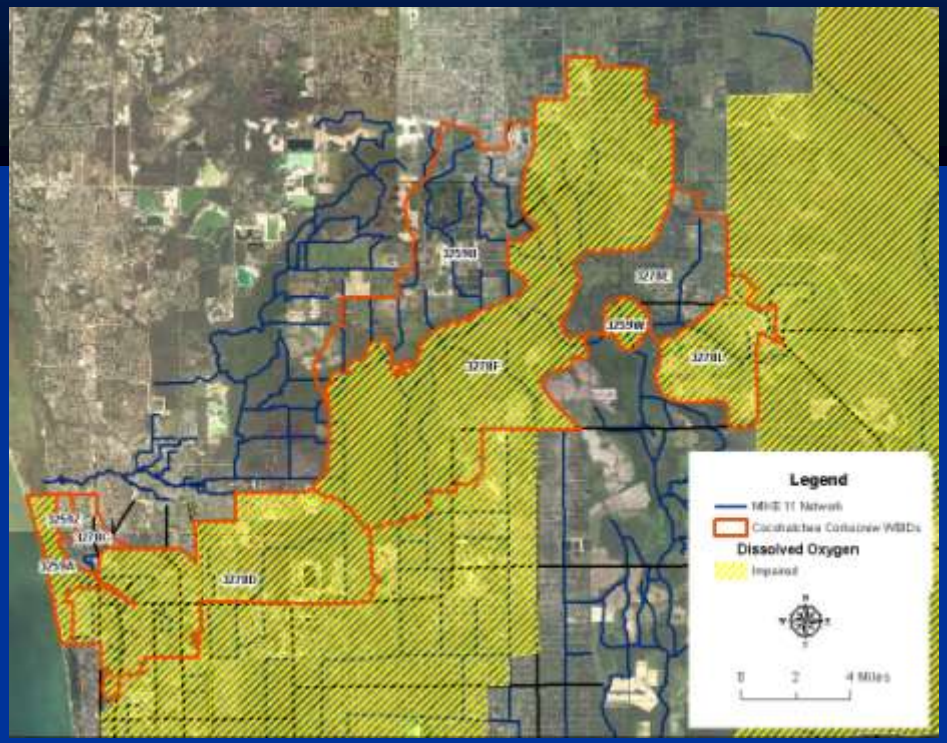
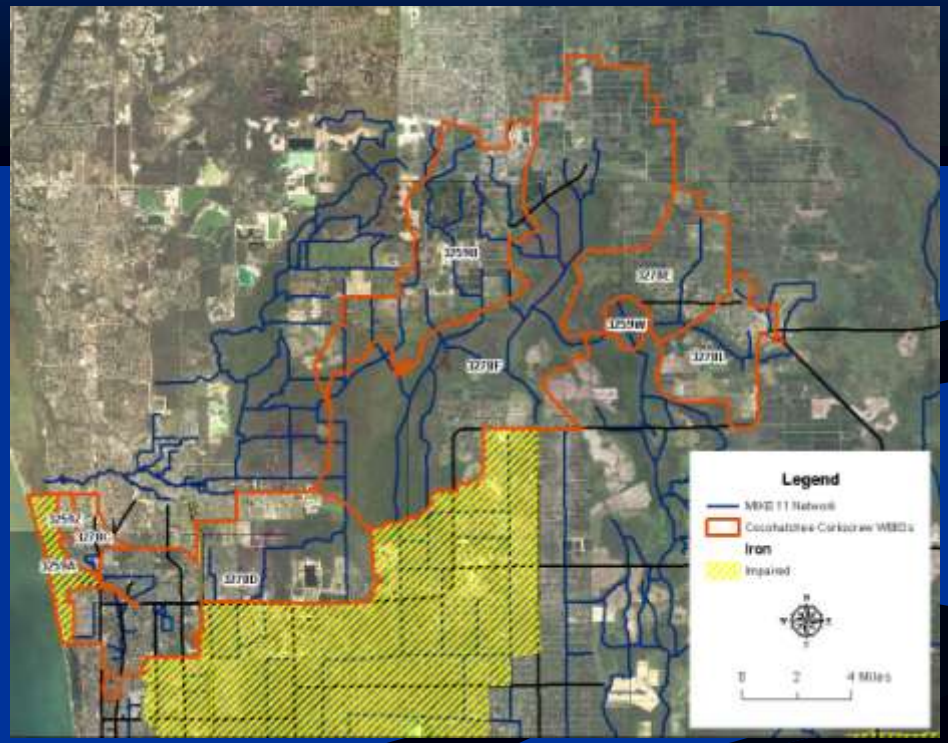
# Cocohatchee Corkscrew FDEP Identified Impairments

## Dissolved Oxygen




## Iron

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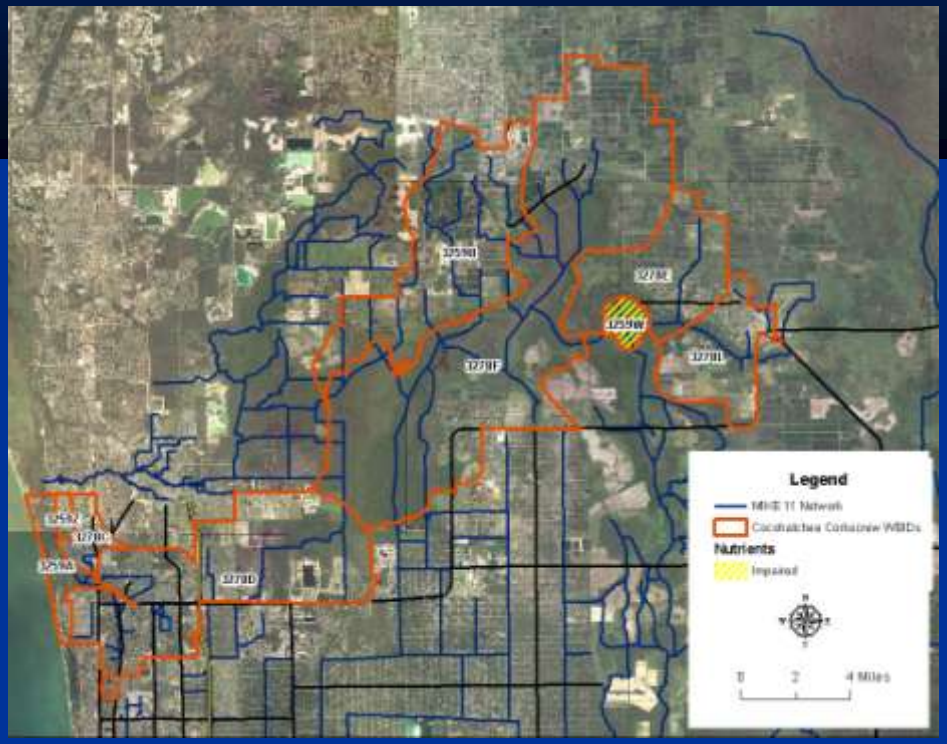
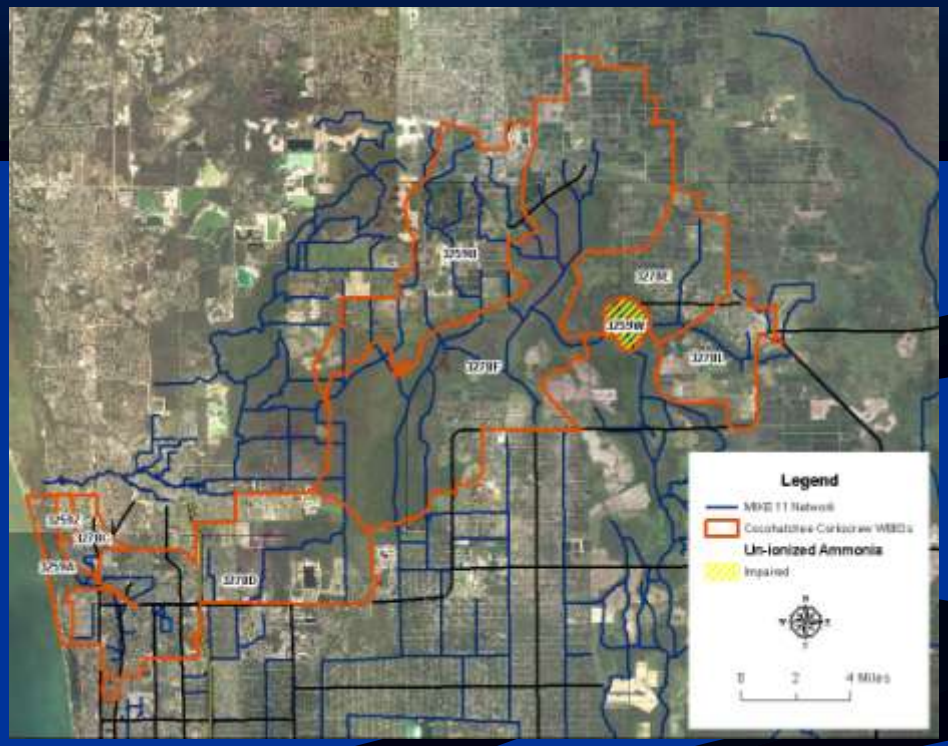
# Cocohatchee Corkscrew FDEP Identified Impairments

## Nutrients (Chlorophyll a)




## Un-ionized Ammonia

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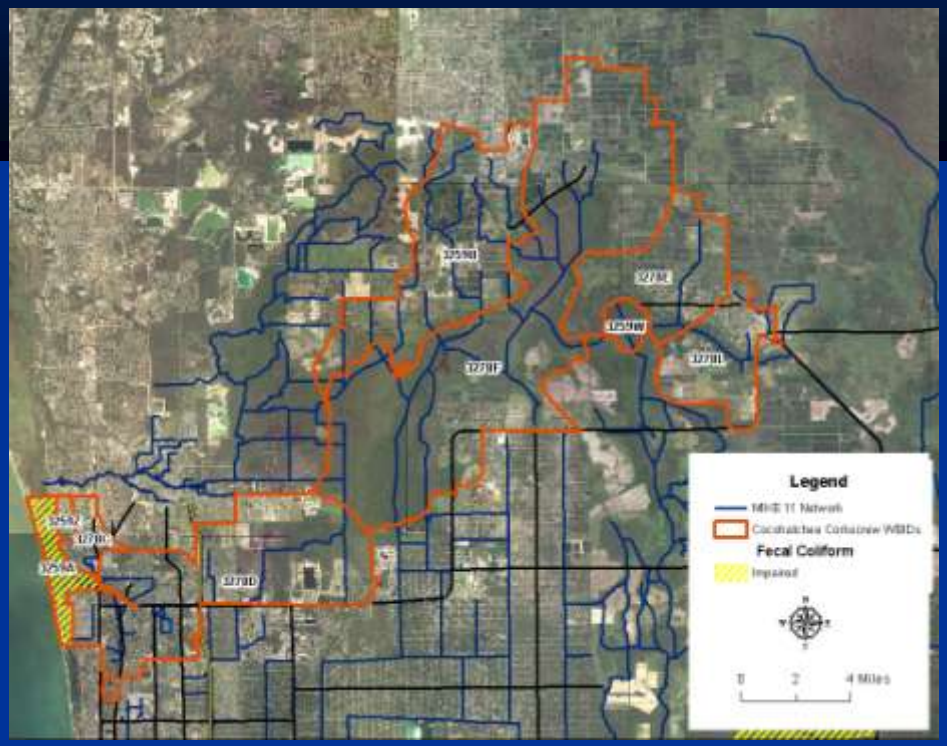
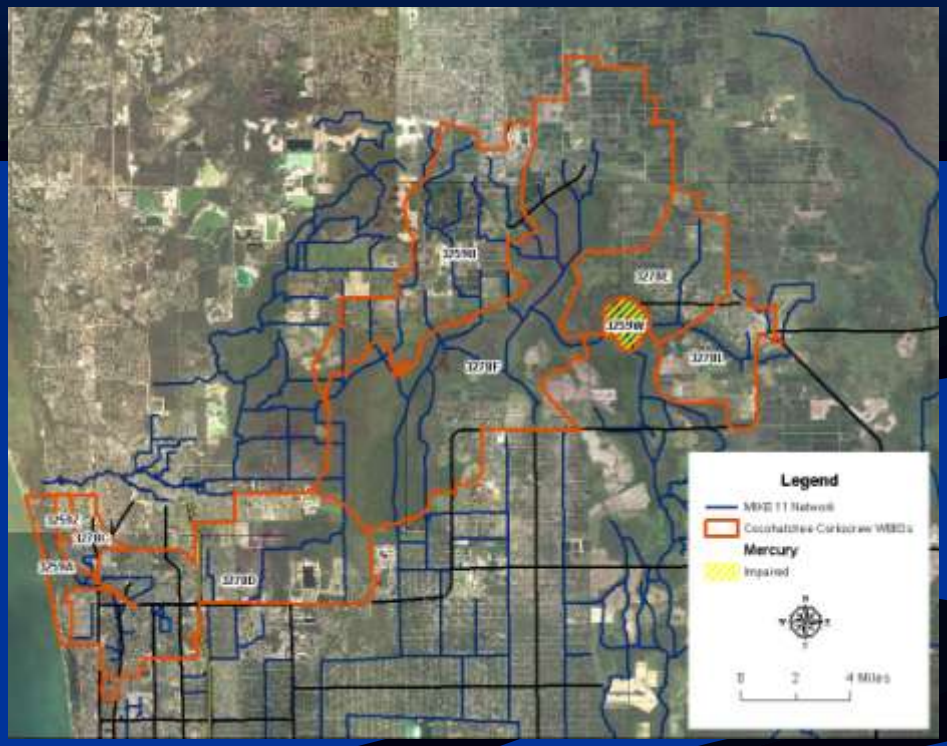
# Cocohatchee Corkscrew FDEP Identified Impairments

## Fecal Coliform




## Mercury

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# Cocohatchee Corkscrew Summary of Water Quality Issues

- Lake Trafford is impaired for five parameters
  - Impairments based on data collected prior to dredging project
- Wiggins Pass Estuary is identified as impaired for three parameters
- Five WBIDs impaired for Dissolved Oxygen
  - Is the cause nutrient concentrations, groundwater inflow, wetland discharges, or all of the above?

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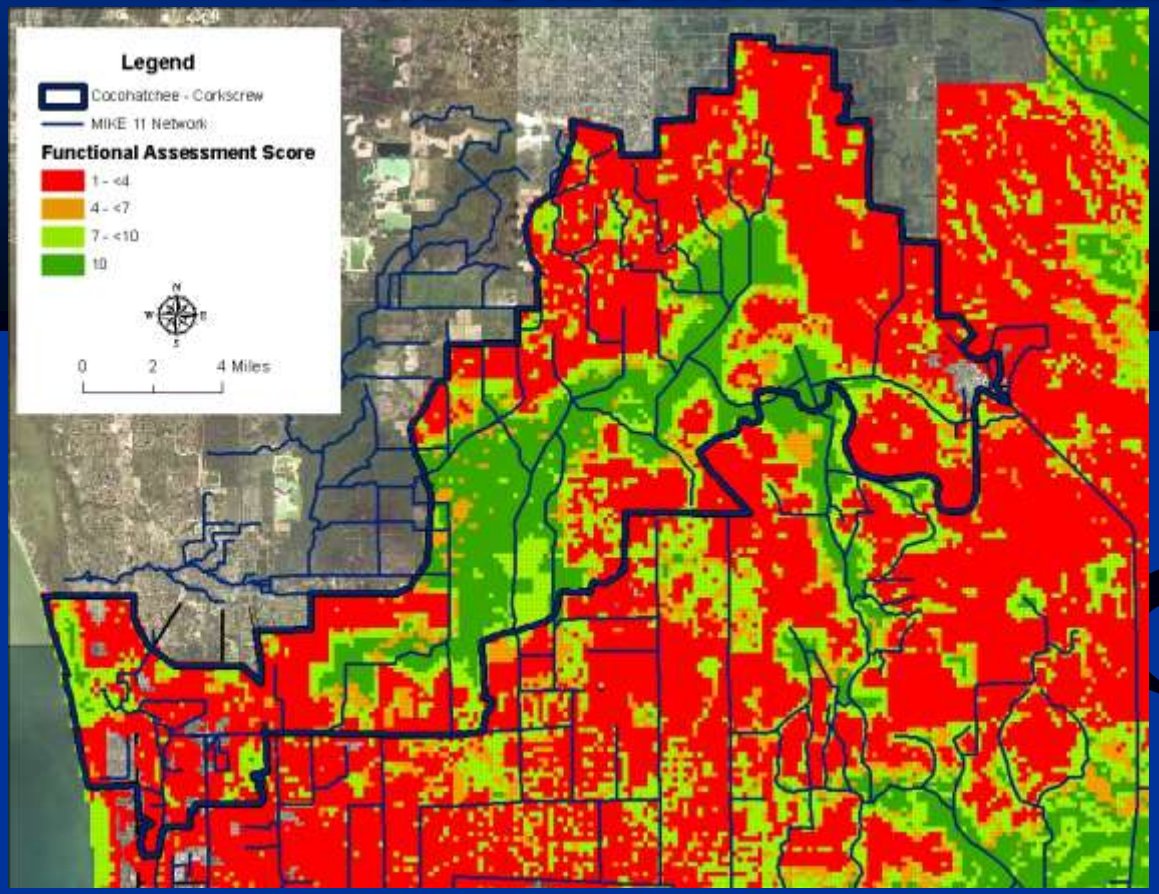
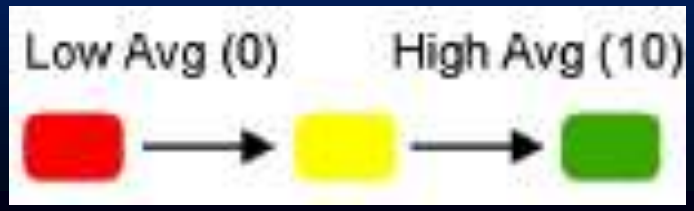
# Cocohatchee Corkscrew Watershed Functional Assessment Score




Based on Vegetation, hydrology, and location

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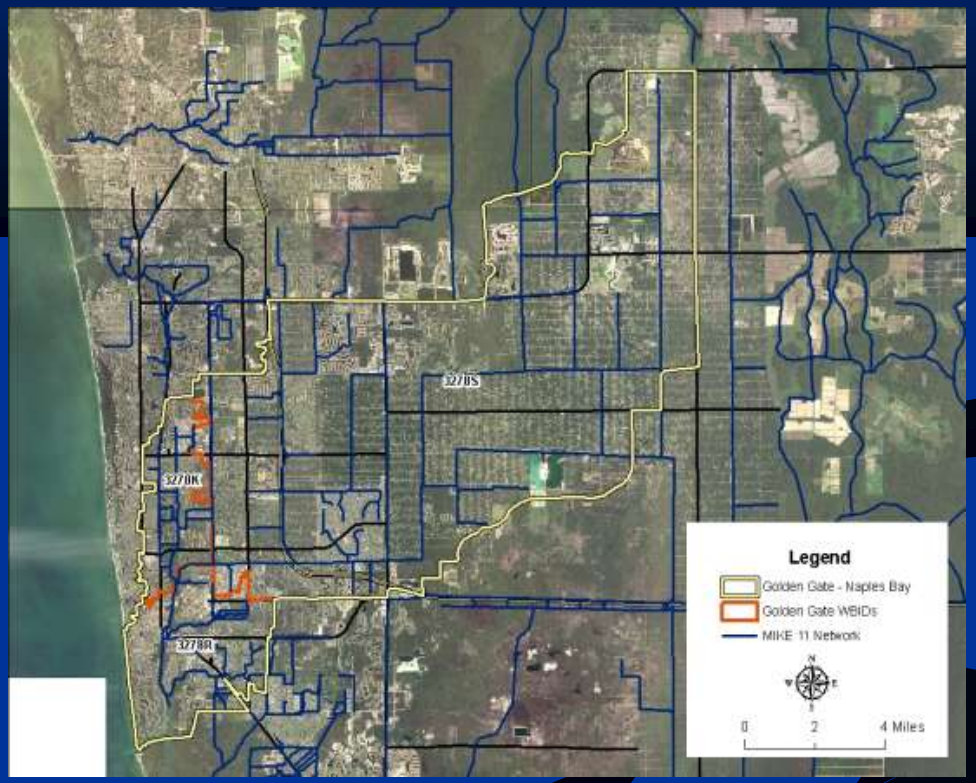
# Golden Gate – Naples Bay Watershed

- Area : ~135 sq. miles
- Mainly Urban Land Uses
- Most lots platted in 1960's; wetland connectivity was lost
- FDEP subdivided into 3 "WBIDs"

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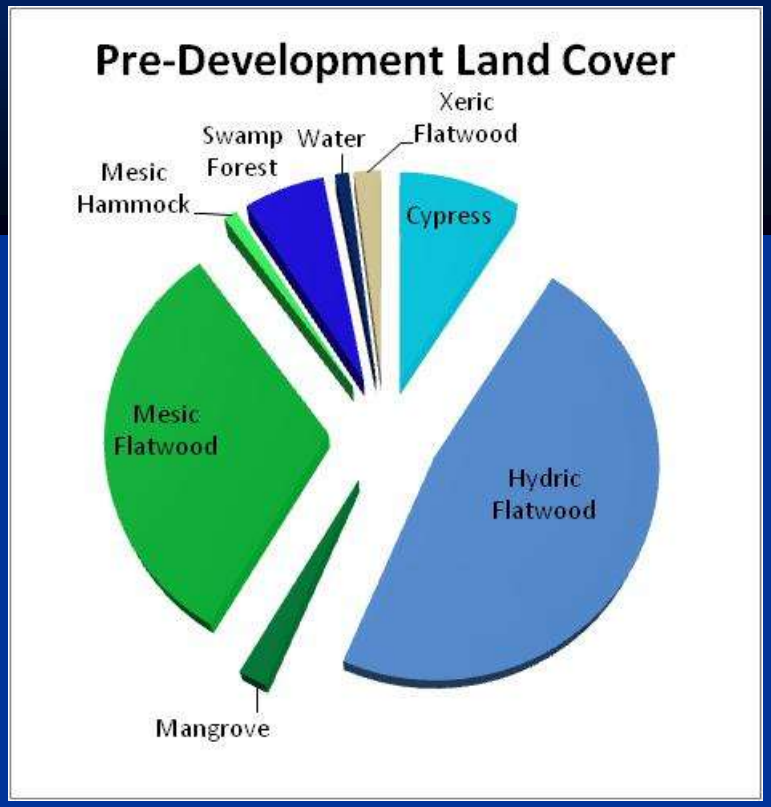
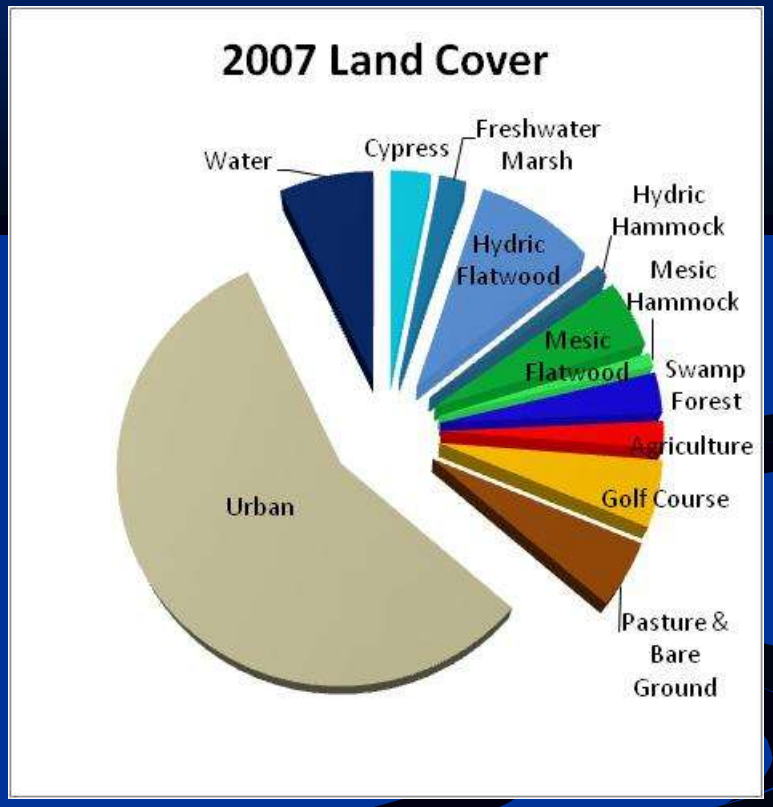
# Golden Gate – Naples Bay Land Use Comparison

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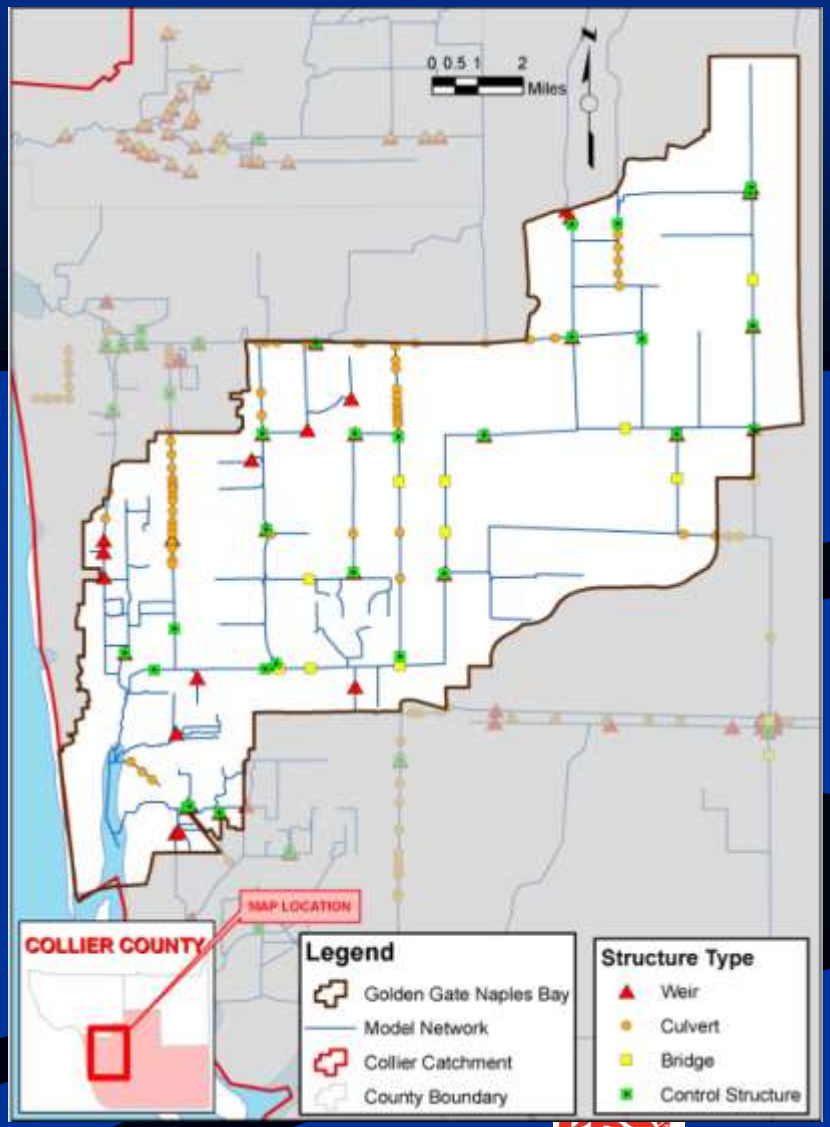
# Golden Gate – Naples Bay

- Primary drainage is Golden Gate Main Canal that discharges to Naples Bay
- Drainage pattern changed due to development
- Watershed almost 3X larger than pre-development

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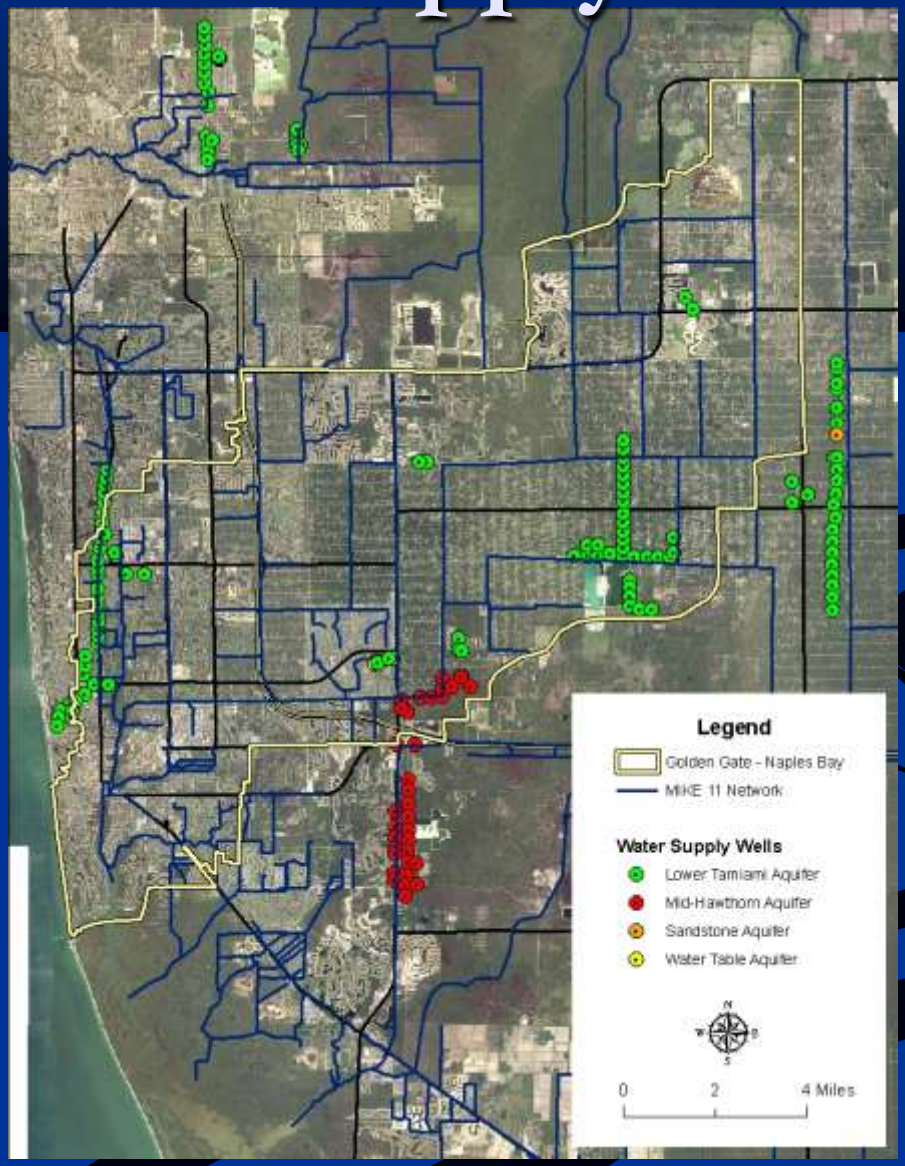
# Golden Gate – Naples Bay Water Supply Wells

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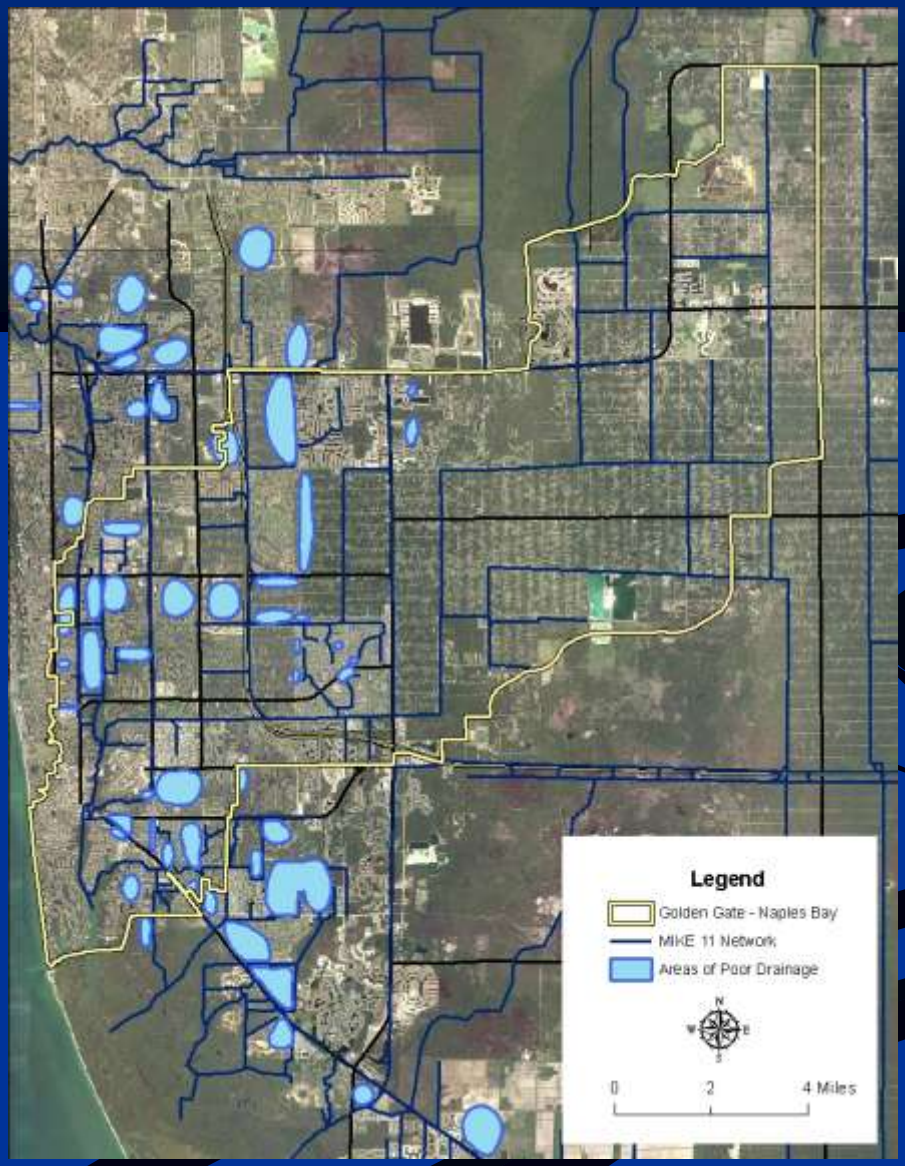
# Golden Gate – Naples Bay Areas of Poor Drainage

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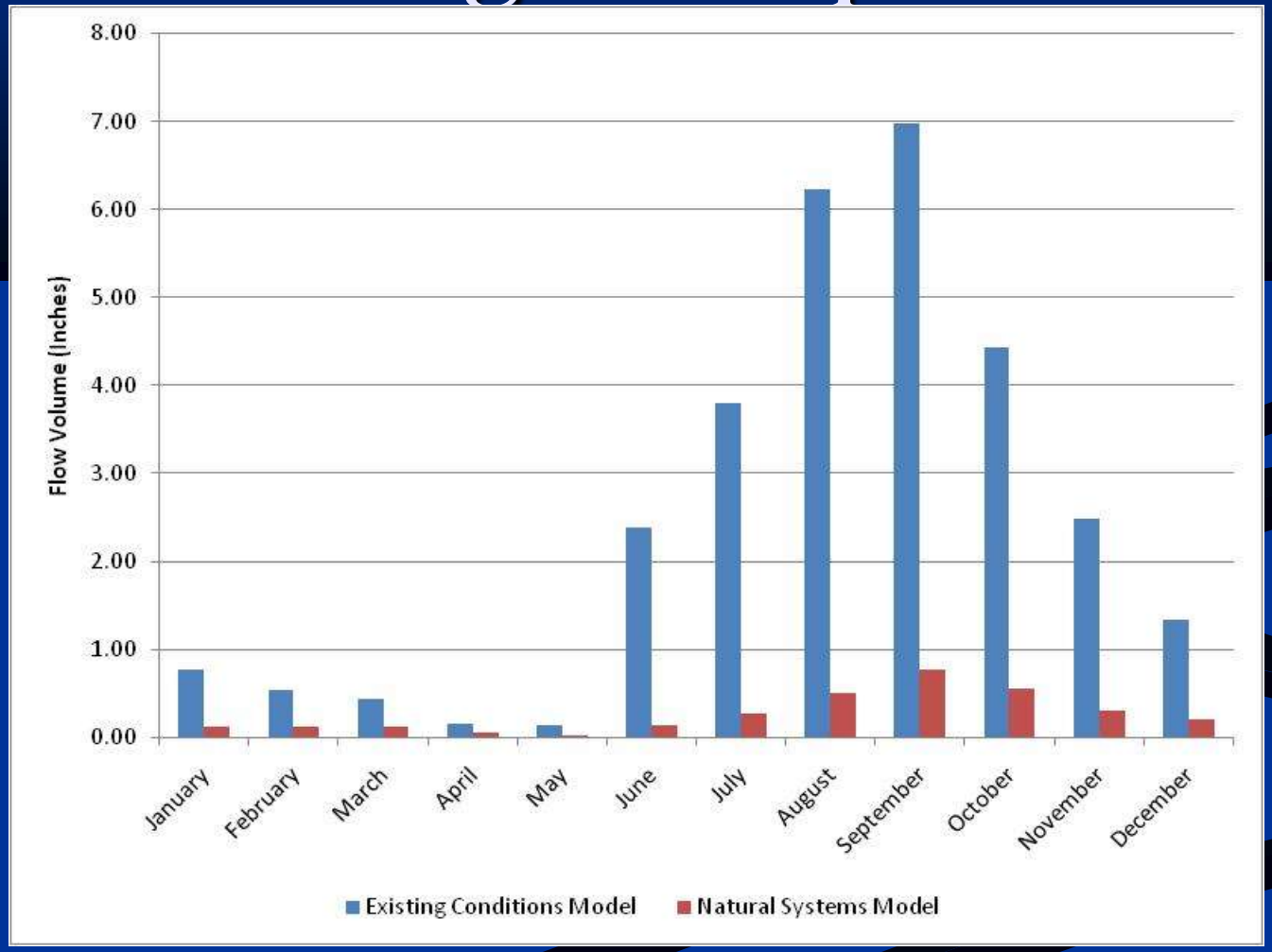
# Golden Gate – Naples Bay Discharge Comparison

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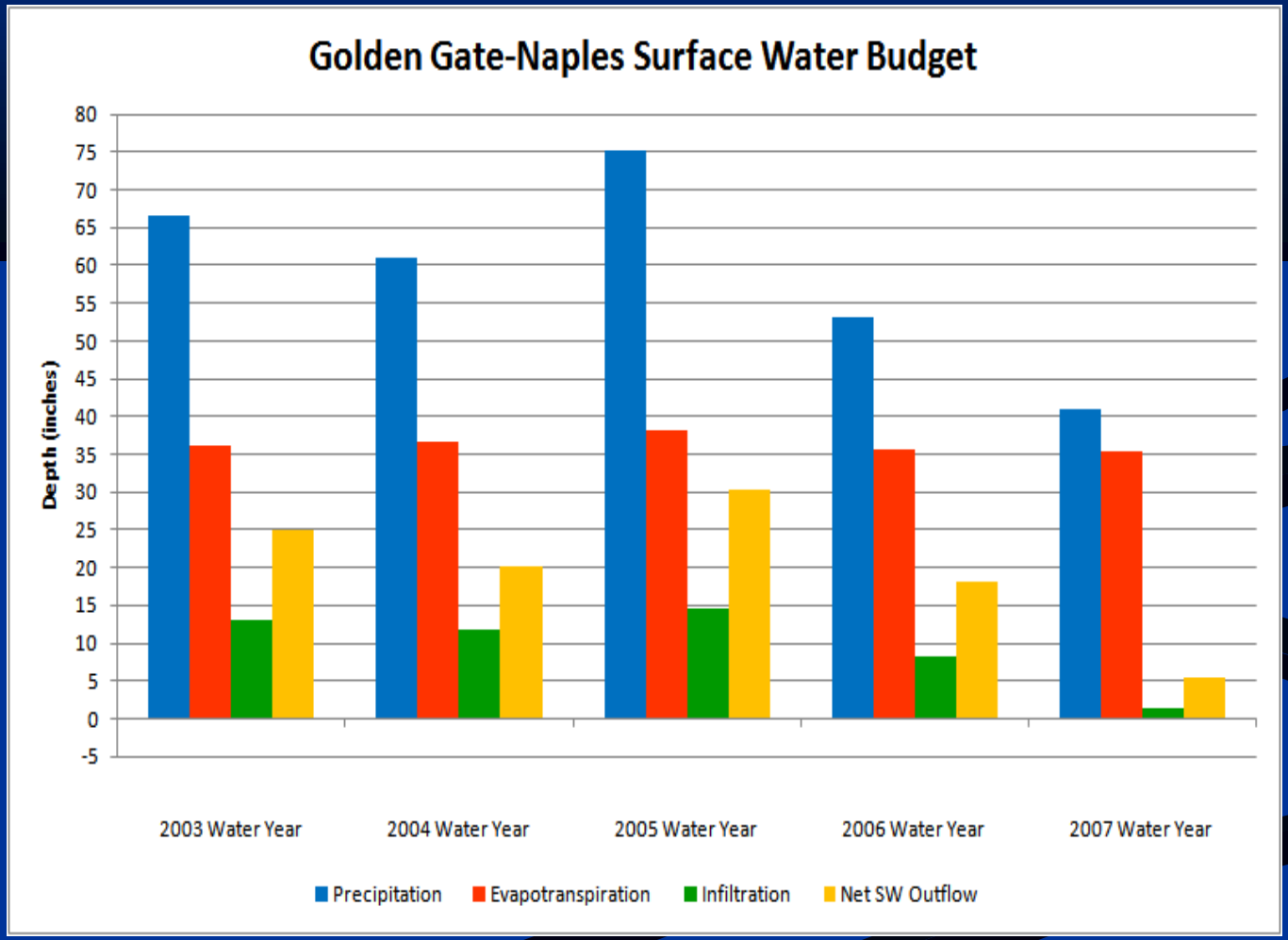
# Golden Gate – Naples bay Surface Water Budget

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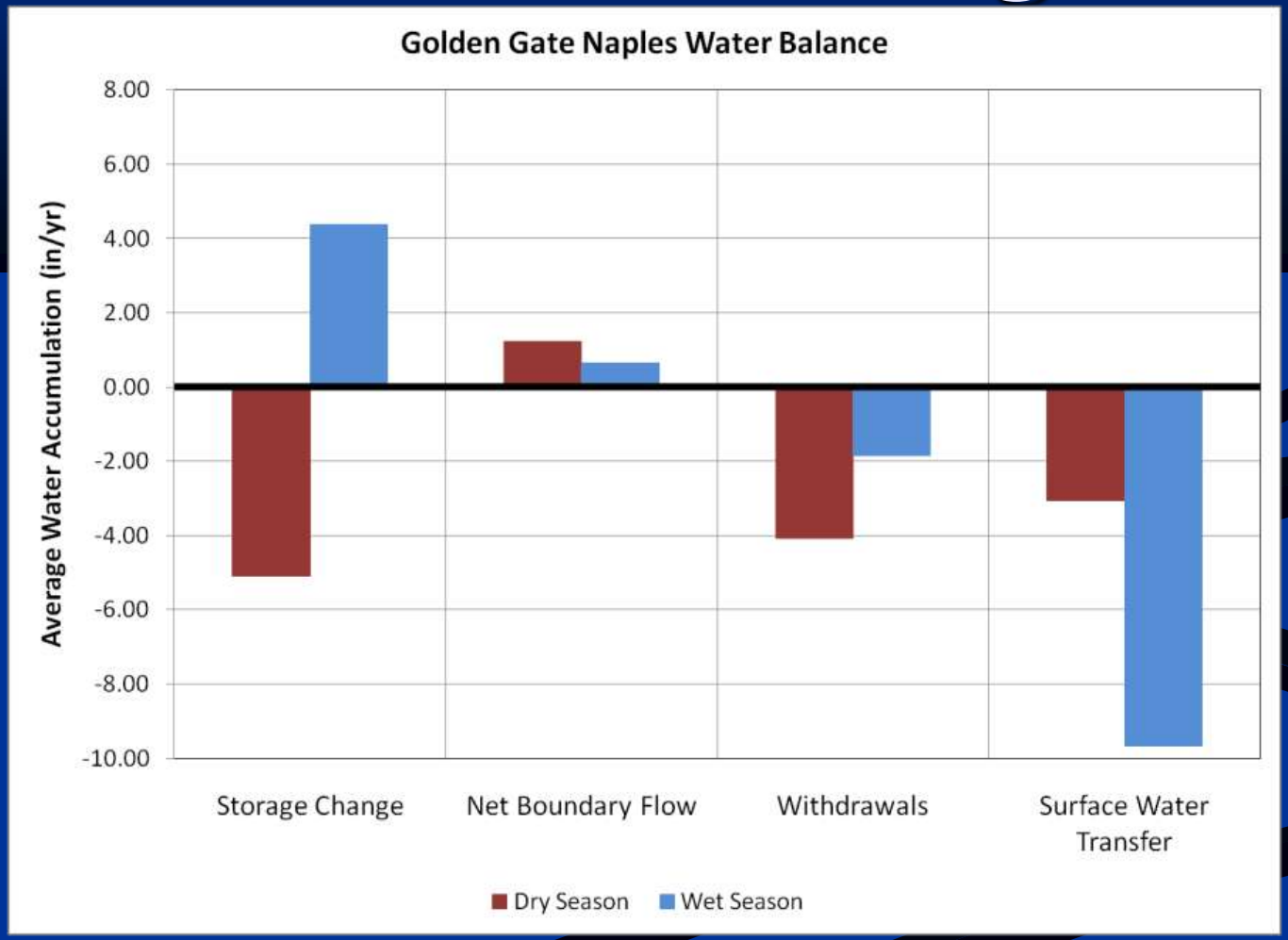
# Golden Gate – Naples Bay Groundwater Budget

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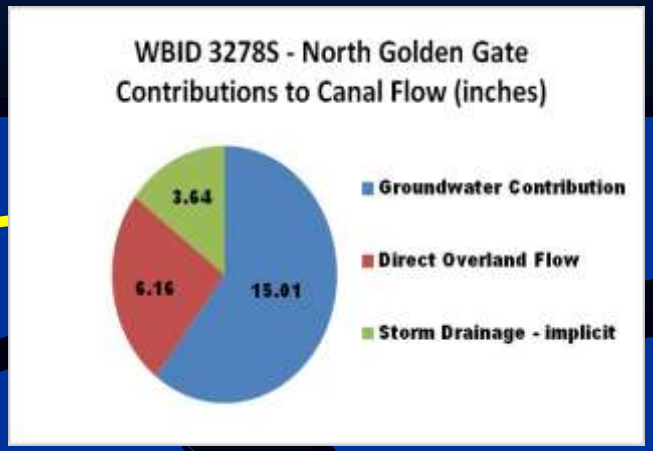
# Golden Gate – Naples Bay WBID Contributions to Canal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# Golden Gate – Naples Bay Summary of Water Quantity Issues

- Watershed area has tripled due to construction of drainage canal
- Hydrology of remaining wetlands has changed
  - Shorter hydro-period and less water stored
  - Wetland connectivity has been broken
- Greater discharge to the estuary
  - Approximately 19" in the wet season
- High groundwater contribution to canals
  - Approximately 15" to the canal network

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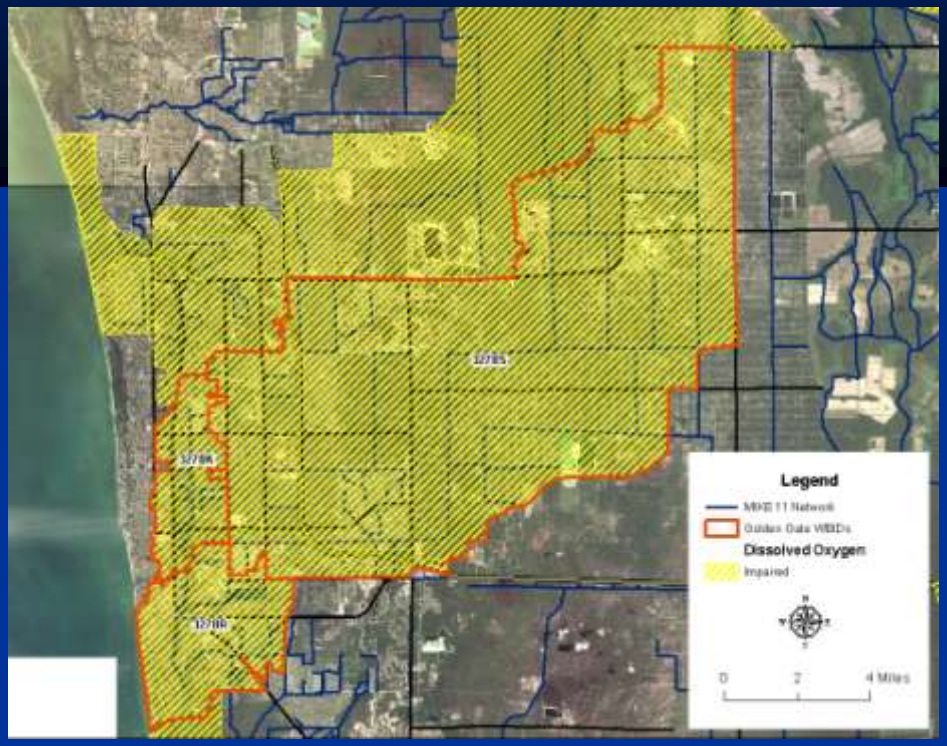
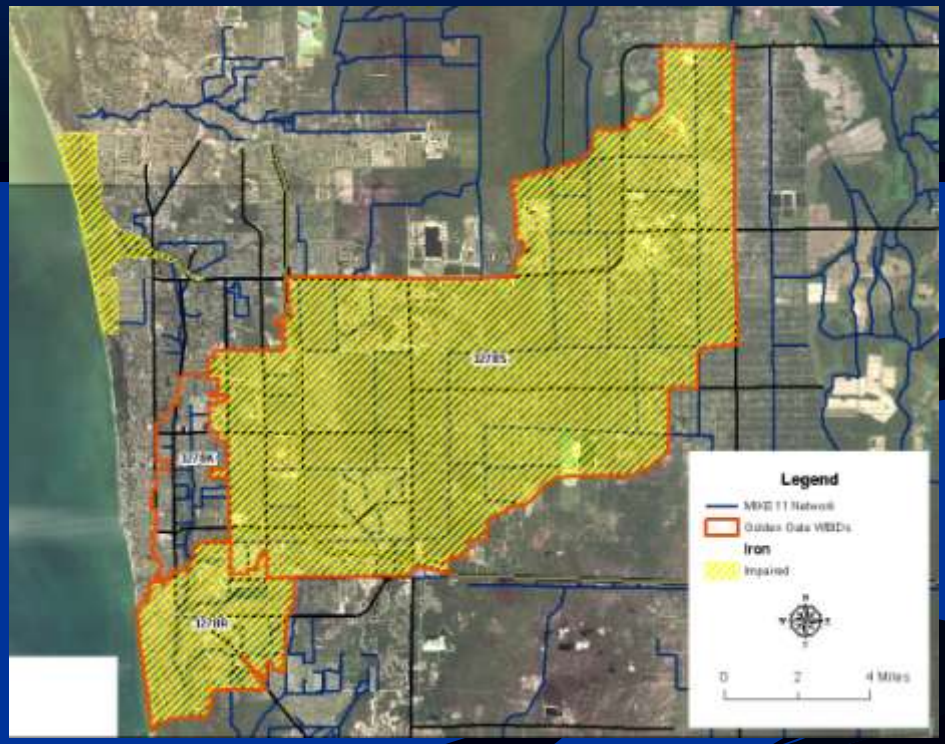
# Golden Gate – Naples Bay FDEP Identified Impairments

## Dissolved Oxygen




## Iron

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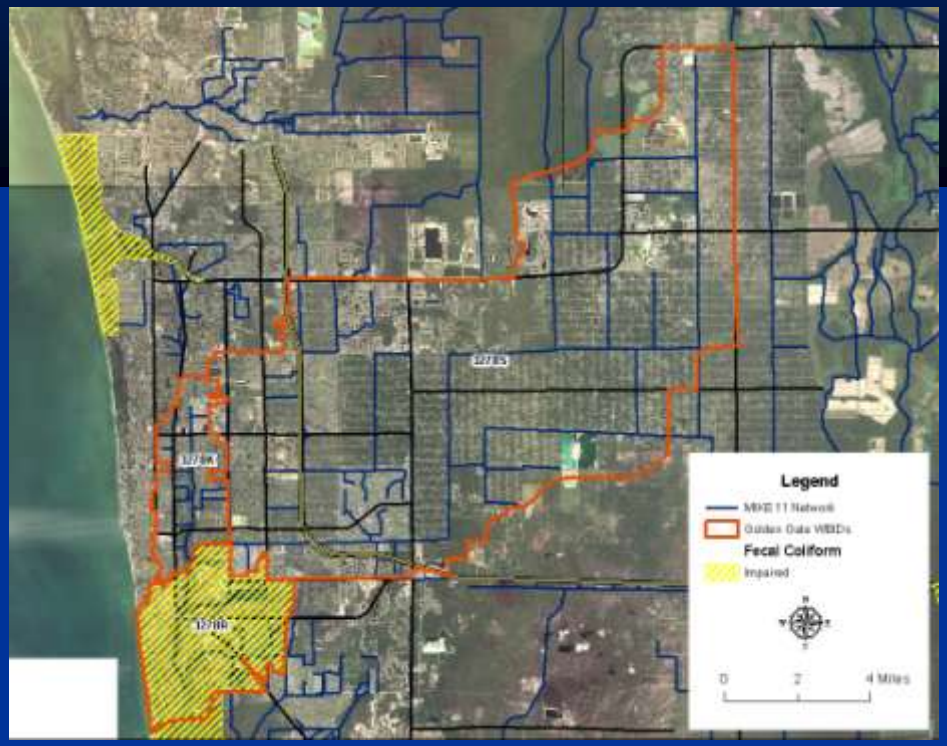
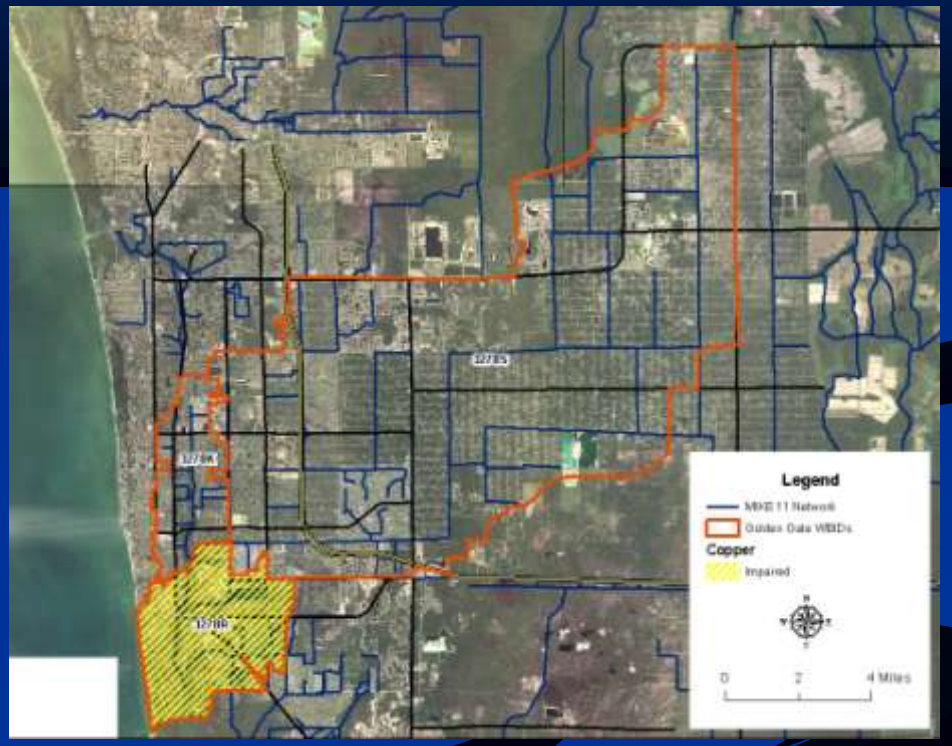
# Golden Gate – Naples Bay FDEP Identified Impairments

## Fecal Coliform




## Copper

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# Golden Gate – Naples Bay Summary of Water Quality Issues

- All WBIDs identified as impaired for DO
- Cause of DO impairment not well defined
- Naples Bay WBID is impaired for three (3) parameters
  - Are D.O. and Iron impairments associated with groundwater flow to canals?
- Naples Bay WBID also identified as impaired for copper
  - May be related to use of copper sulfate

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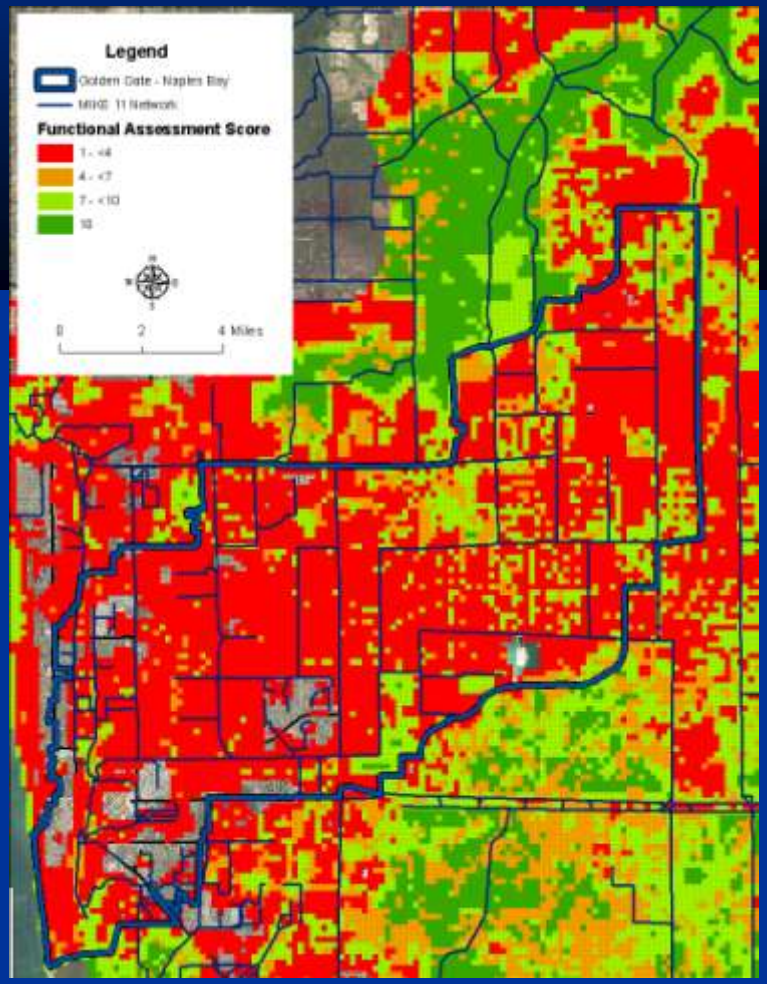
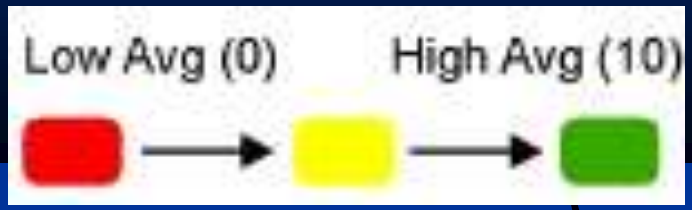
# Golden Gate – Naples Bay Watershed Functional Assessment




Based on Vegetation, hydrology, and location

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# Golden Gate – Naples Bay Other Issues

- Residential lot owners are able to dredge or fill up to 4,000 square feet of wetlands; plus additional clearing up to 6,000 square feet
- Canal system has limited capacity; full build out could overwhelm the system

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# Rookery Bay Watershed

- Area : ~145 sq. miles
- FDEP subdivided into 3 "WBIDs"
- Includes natural areas, agricultural lands, and urban development
- Mostly urbanized west of Collier Boulevard


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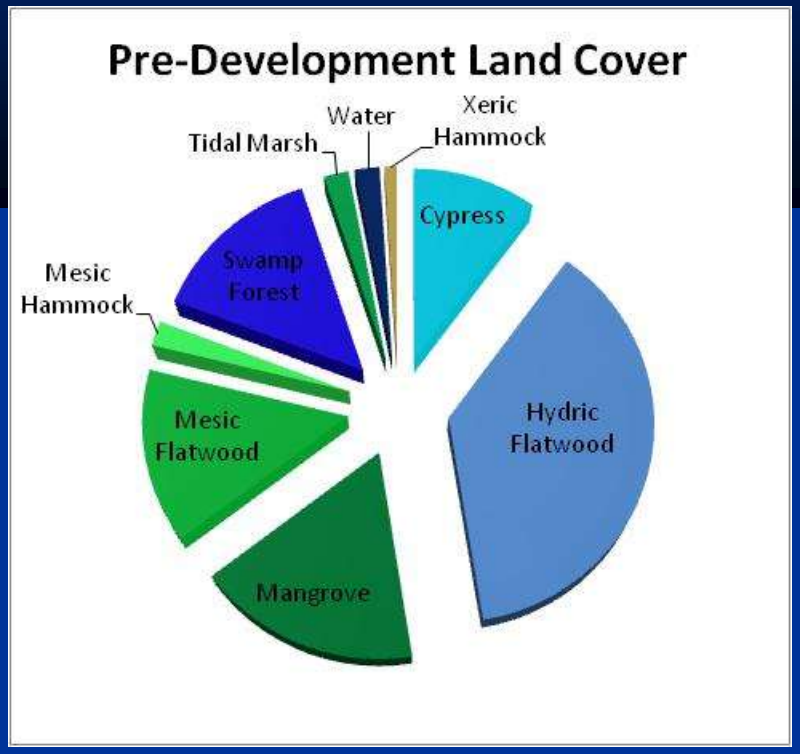
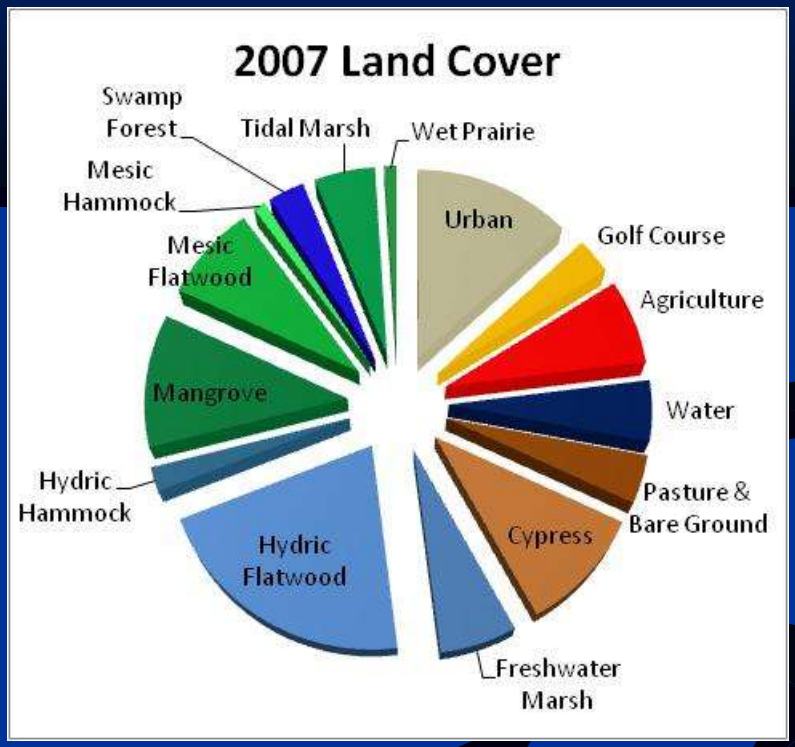
# Rookery Bay Watershed Land Use Comparison

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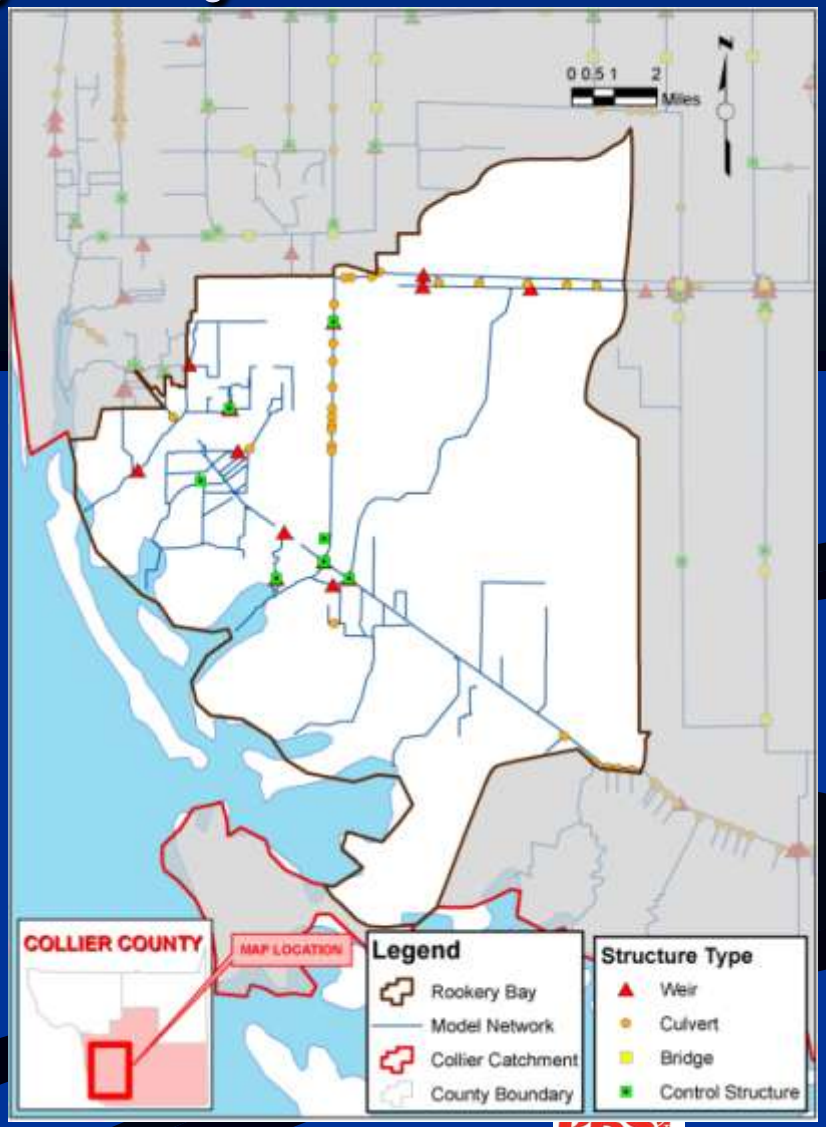
# Rookery Bay

- Almost 100 sq. miles smaller than pre-development
- Overland flow and channel flow

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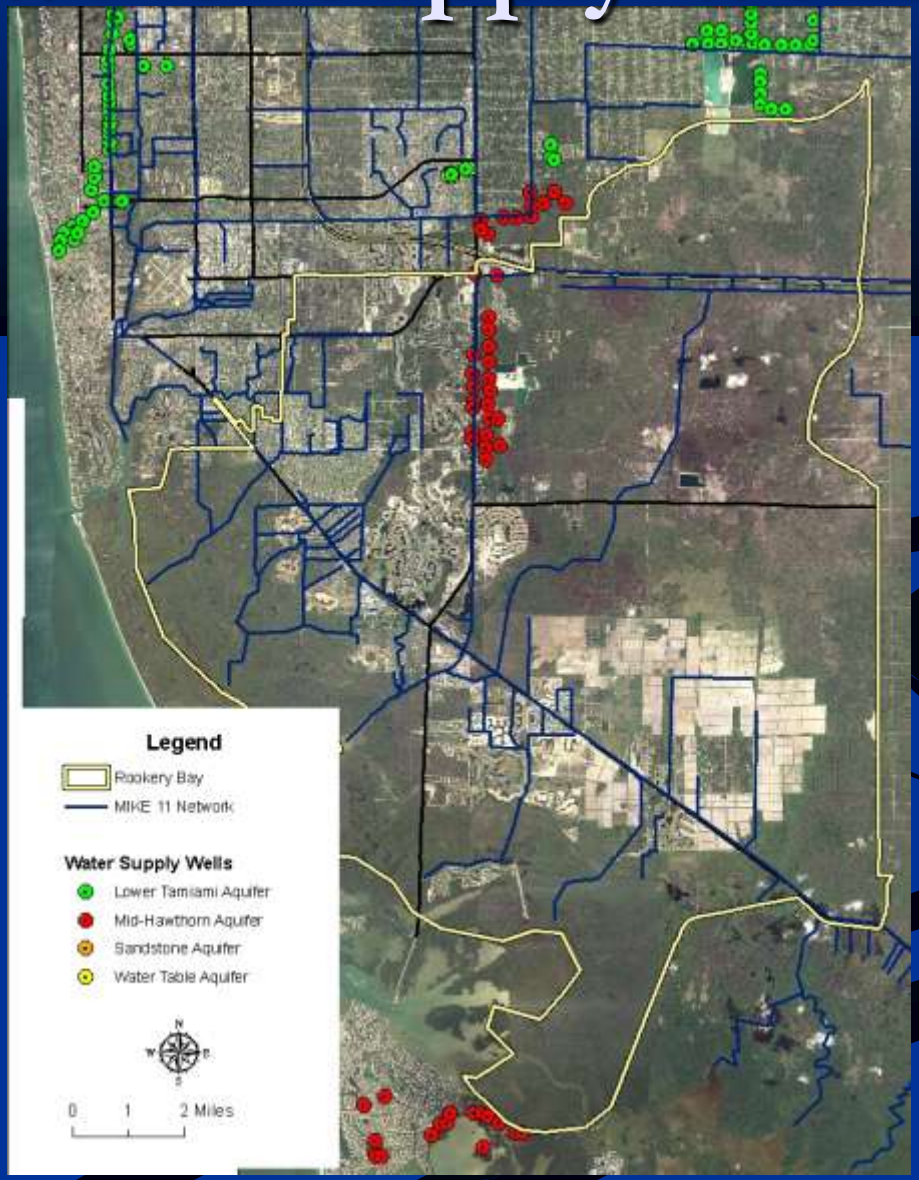
# Rookery Bay Watershed Water Supply Wells

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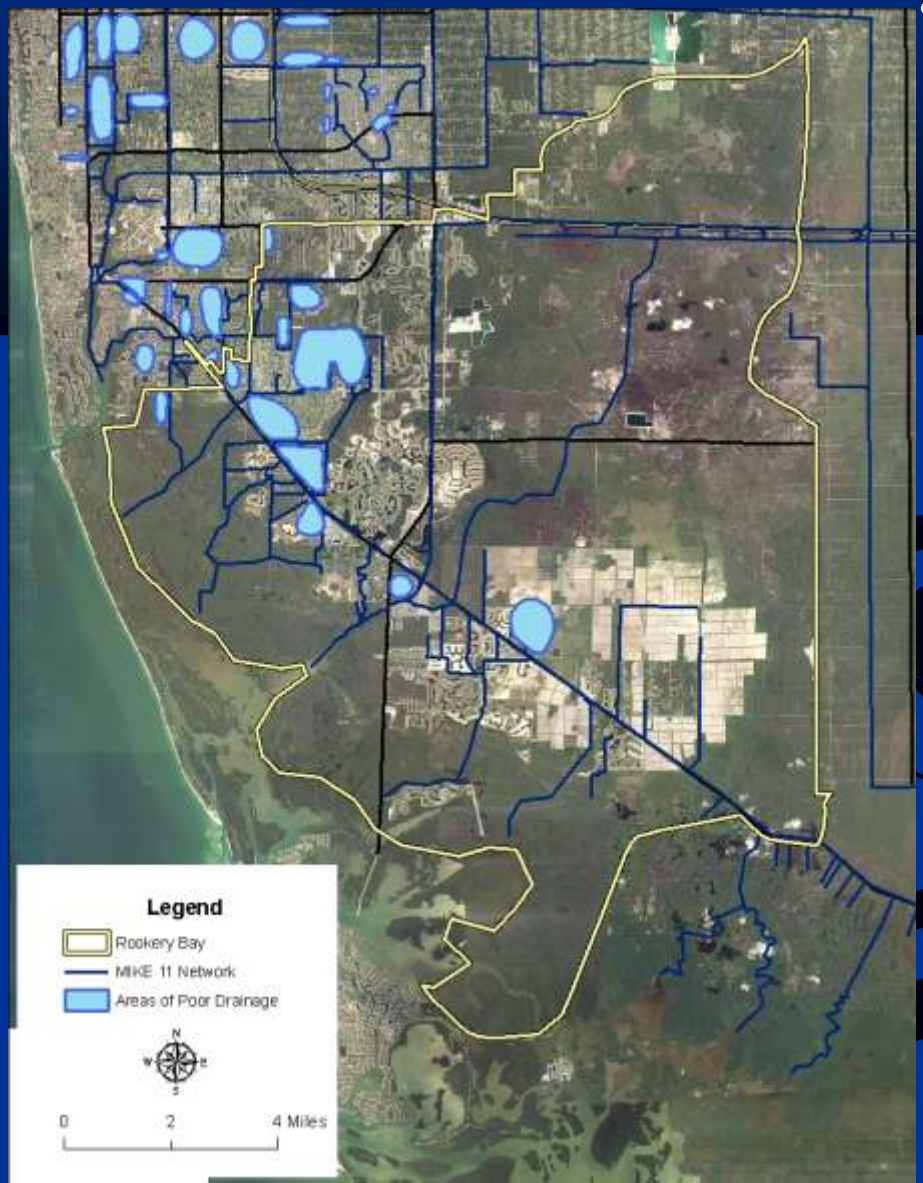
# Rookery Bay Watershed
# Areas of Poor Drainage

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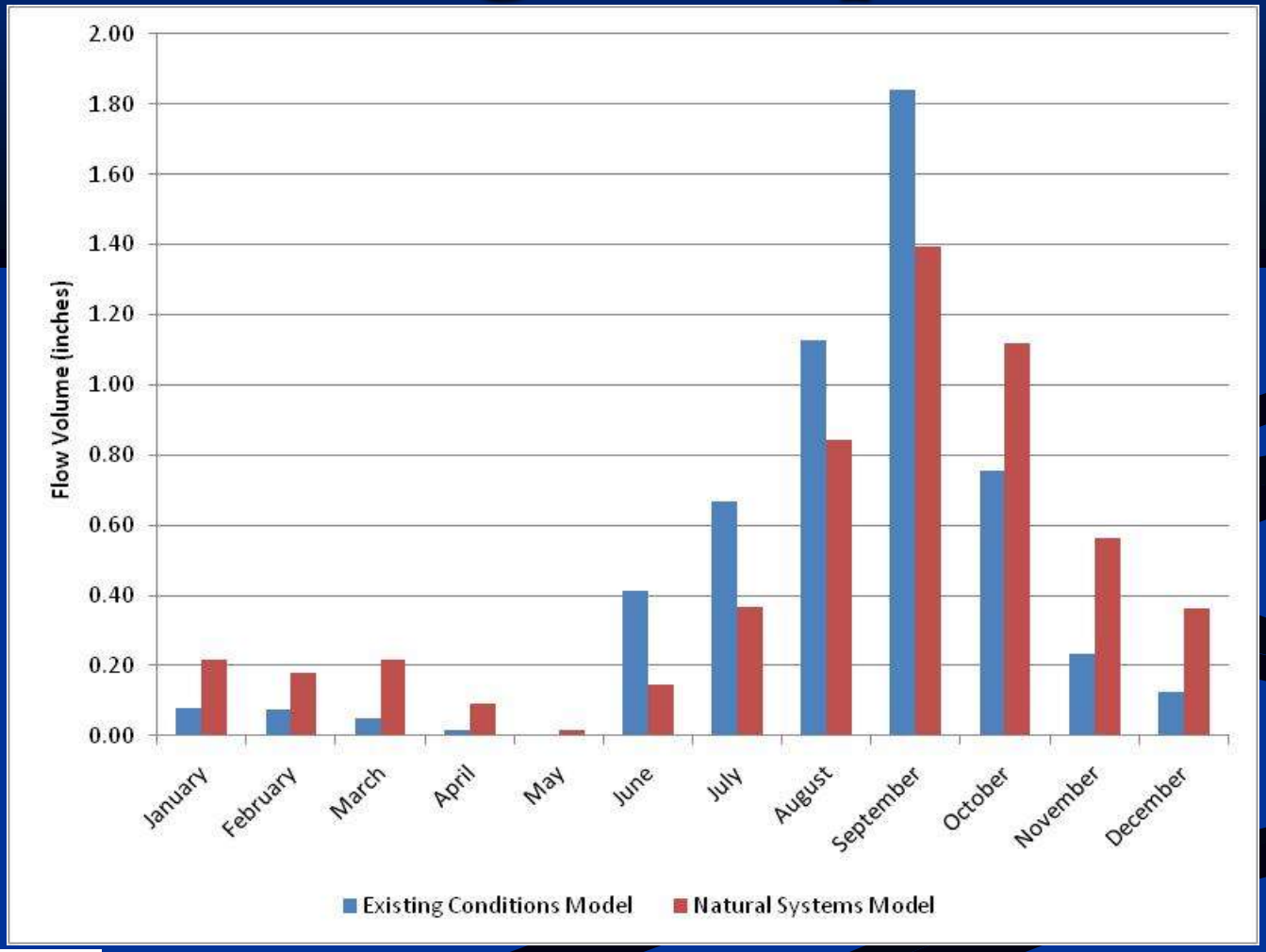
# Rookery Bay Watershed Discharge Comparison

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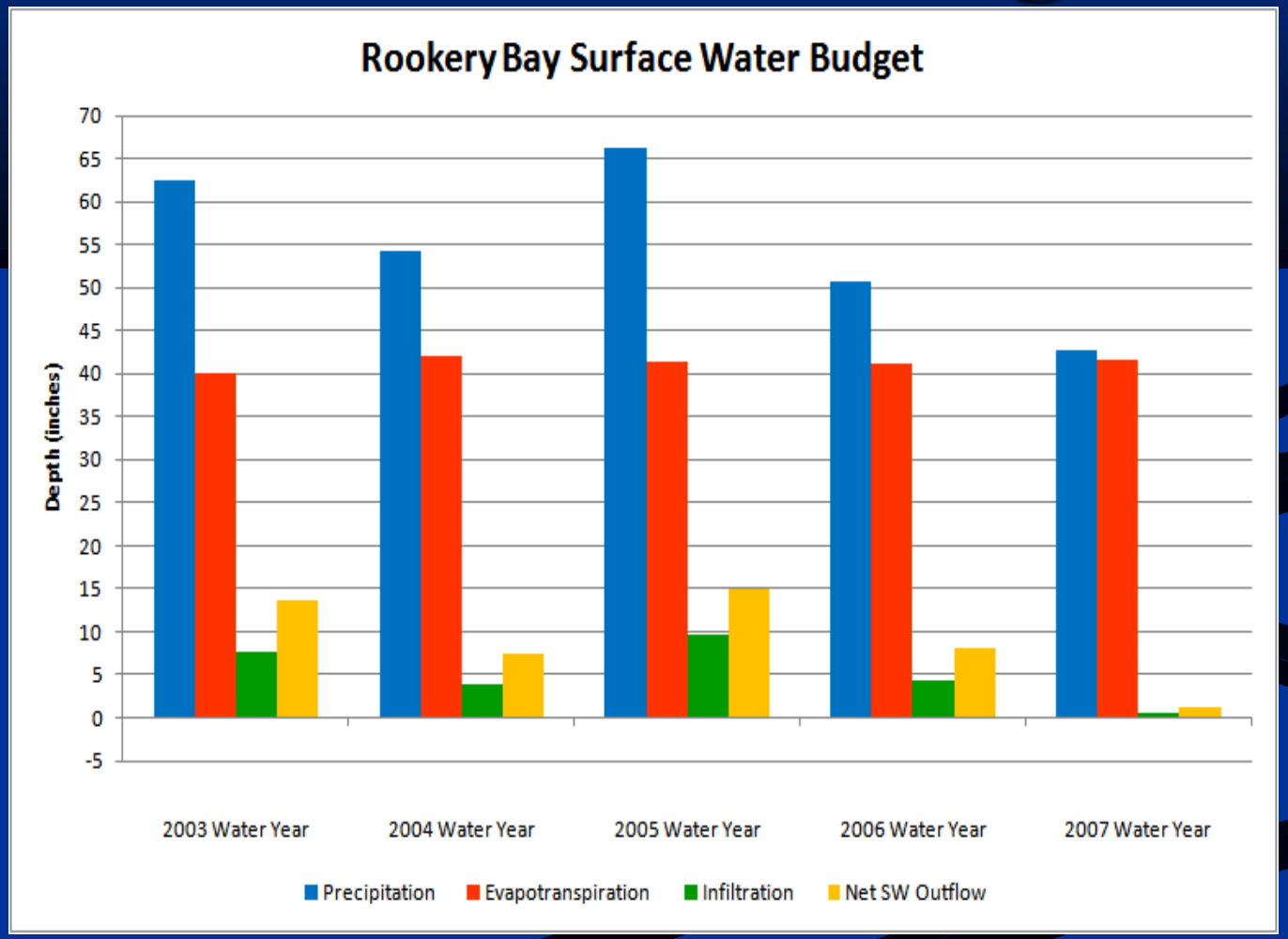
# Rookery Bay Watershed Surface Water Budget

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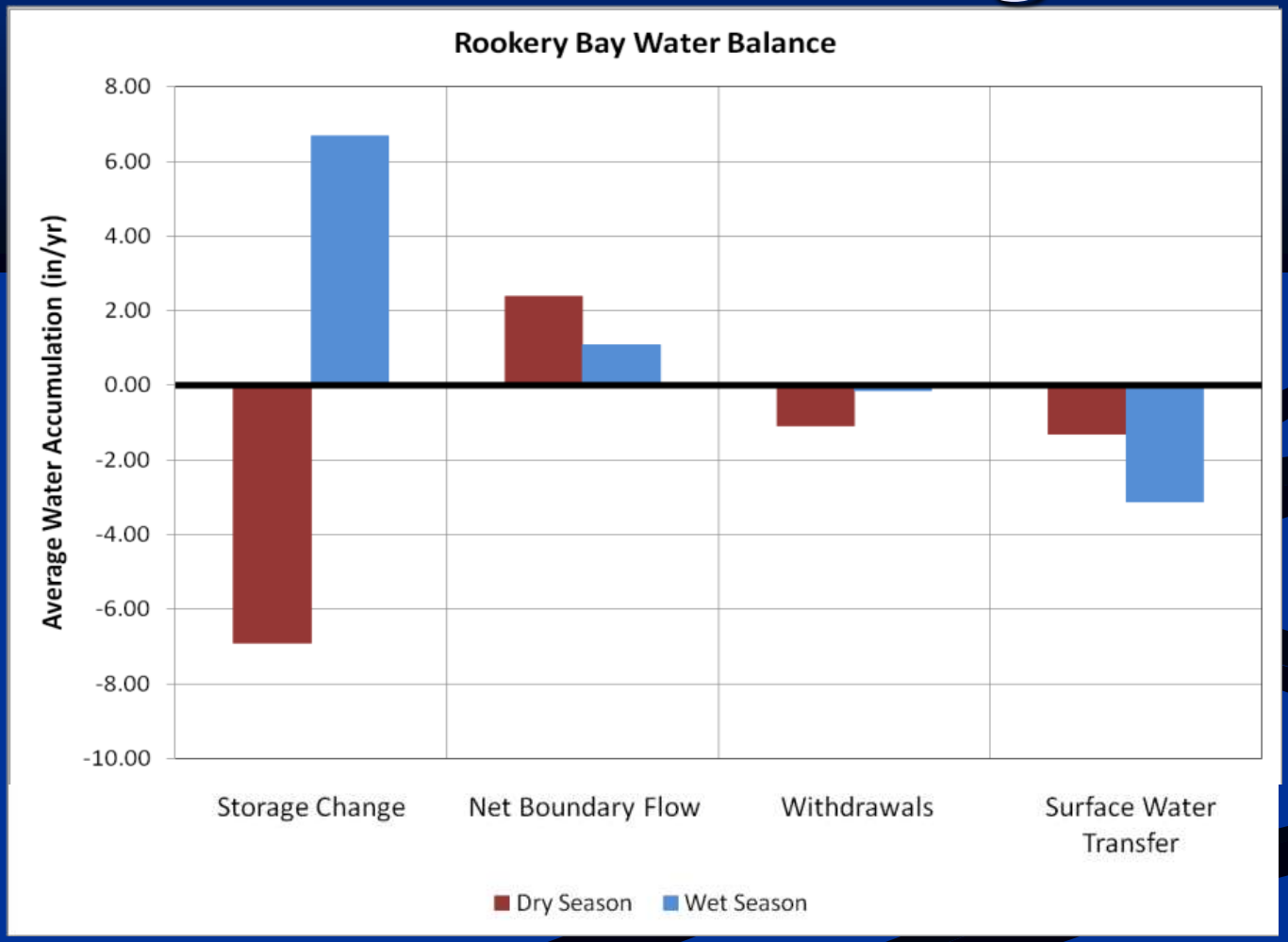
# Rookery Bay Watershed Groundwater Budget

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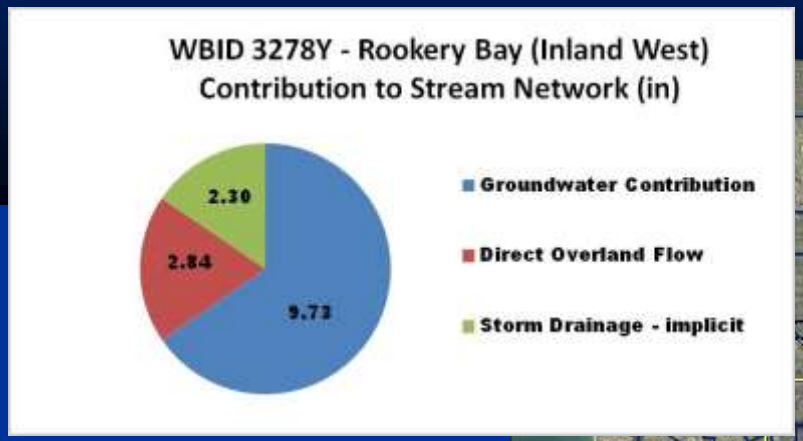
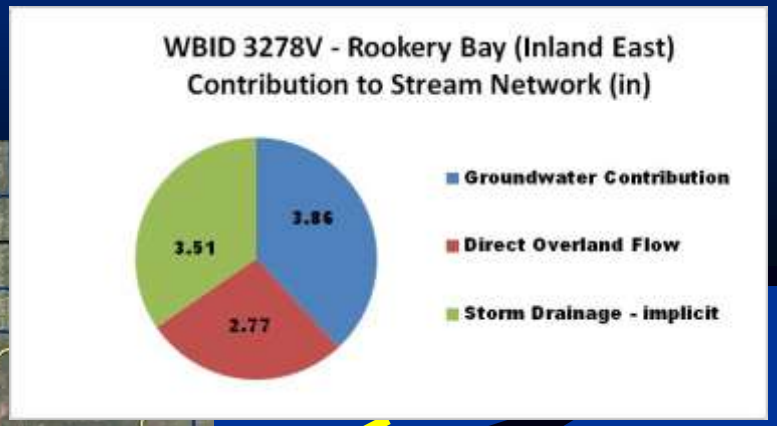
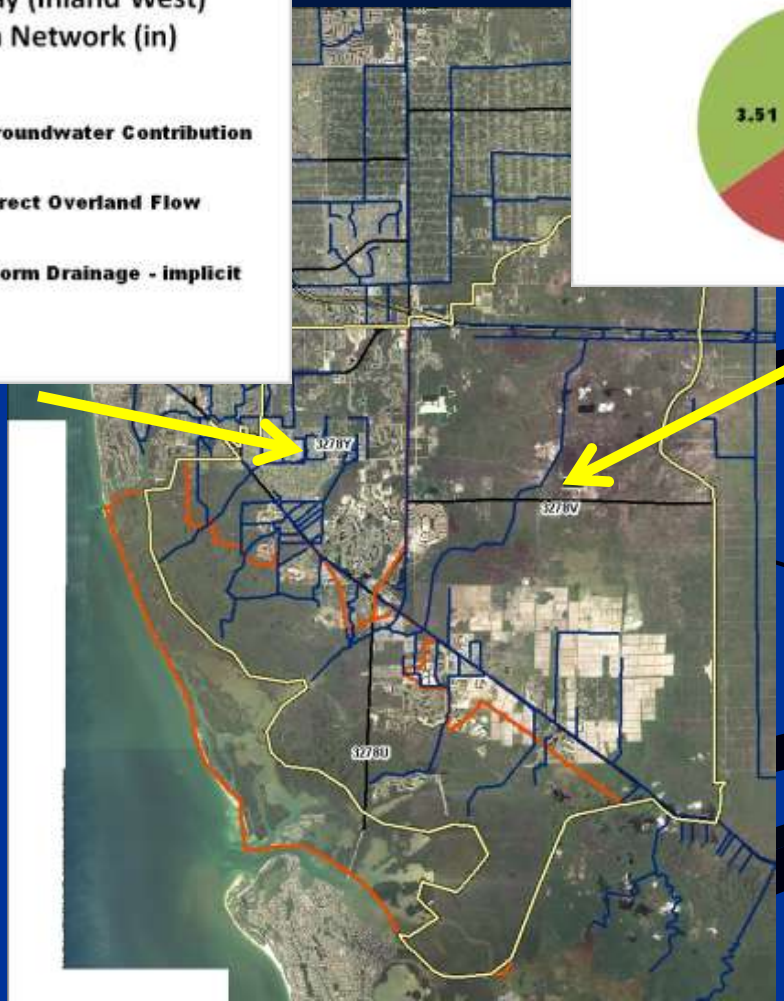
# Rookery Bay Watershed
# WBID Contributions to Canal

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# Rookery Bay Watershed Summary of Water Quantity Issues

- Watershed area has decreased by about 100 sq.mi. due to construction of canals.
- Hydrology of remaining wetlands has changed
  - Shorter hydro-period and less water stored
- Pattern of discharge to the estuary has changed
  - Dry season deficit and wet season surplus

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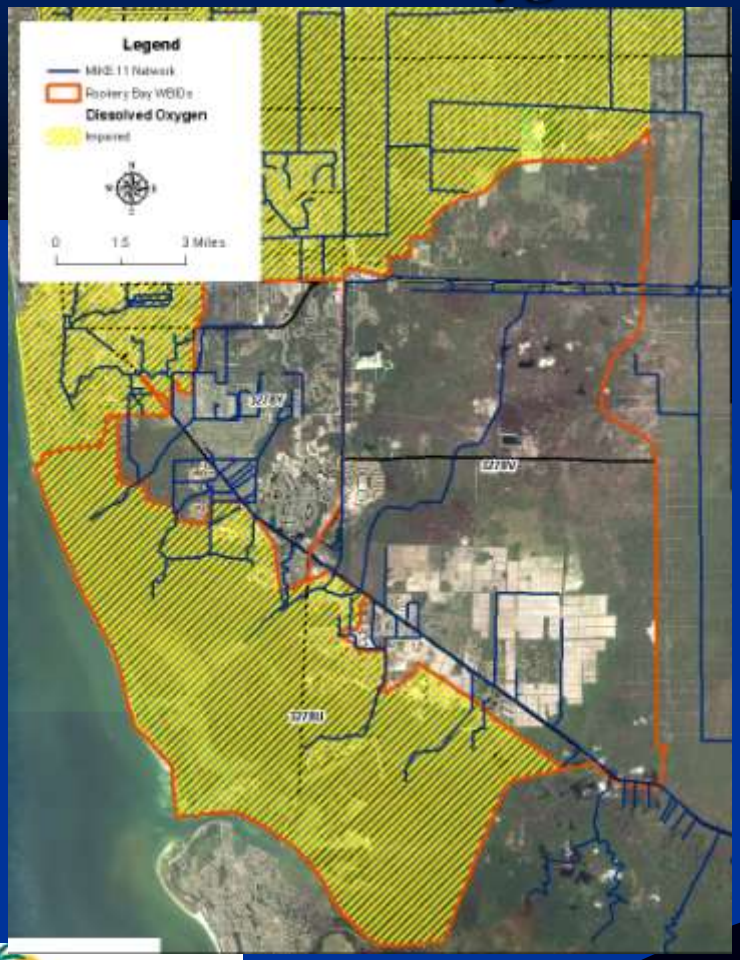
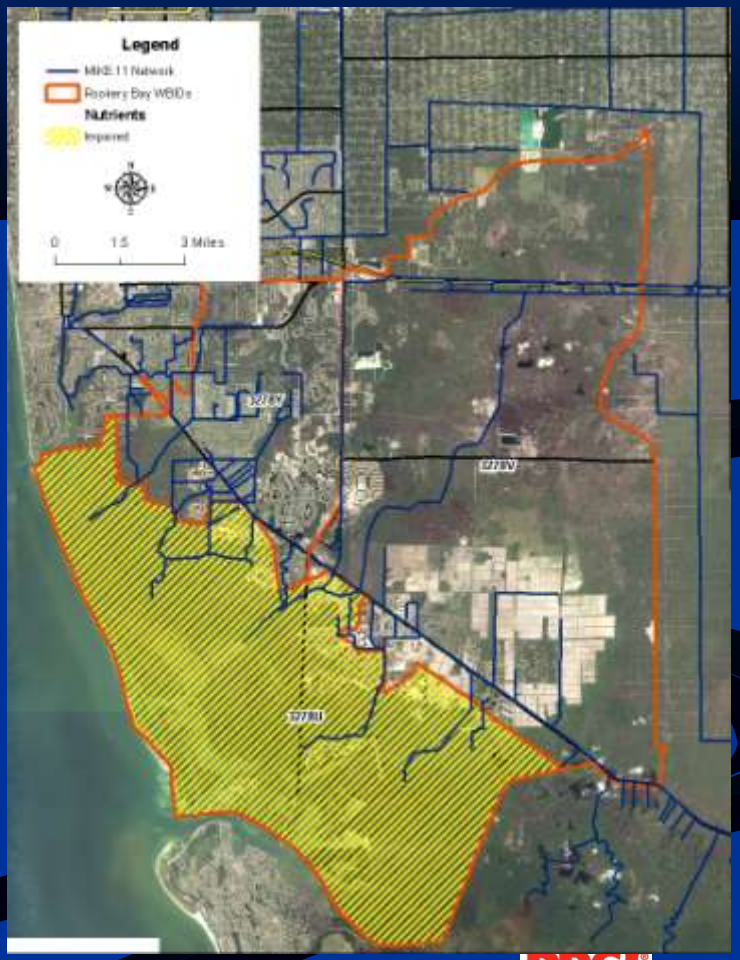
# Rookery Bay Watershed
# FDEP Identified Impairments

## Dissolved Oxygen




## Nutrients

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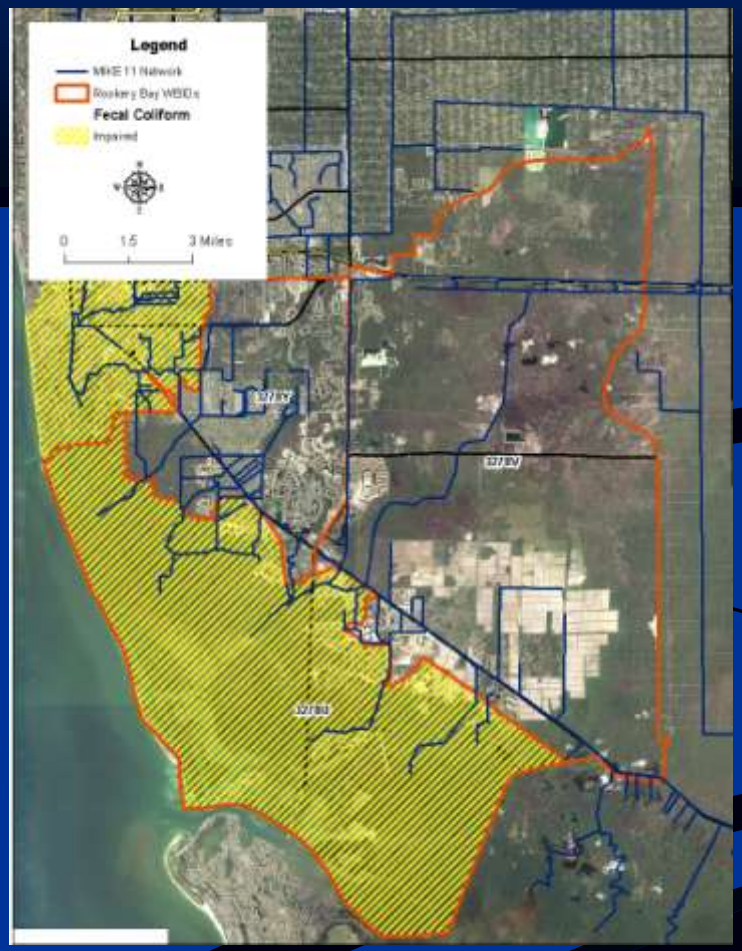
# Rookery Bay Watershed
# FDEP Identified Impairments

## Fecal Coliform

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# Rookery Bay Watershed Summary of Water Quality Issues

- Rookery Bay Estuary is only WBID identified as impaired
  - Nutrient impairment may be related to change in sampling location. Results should be verified.

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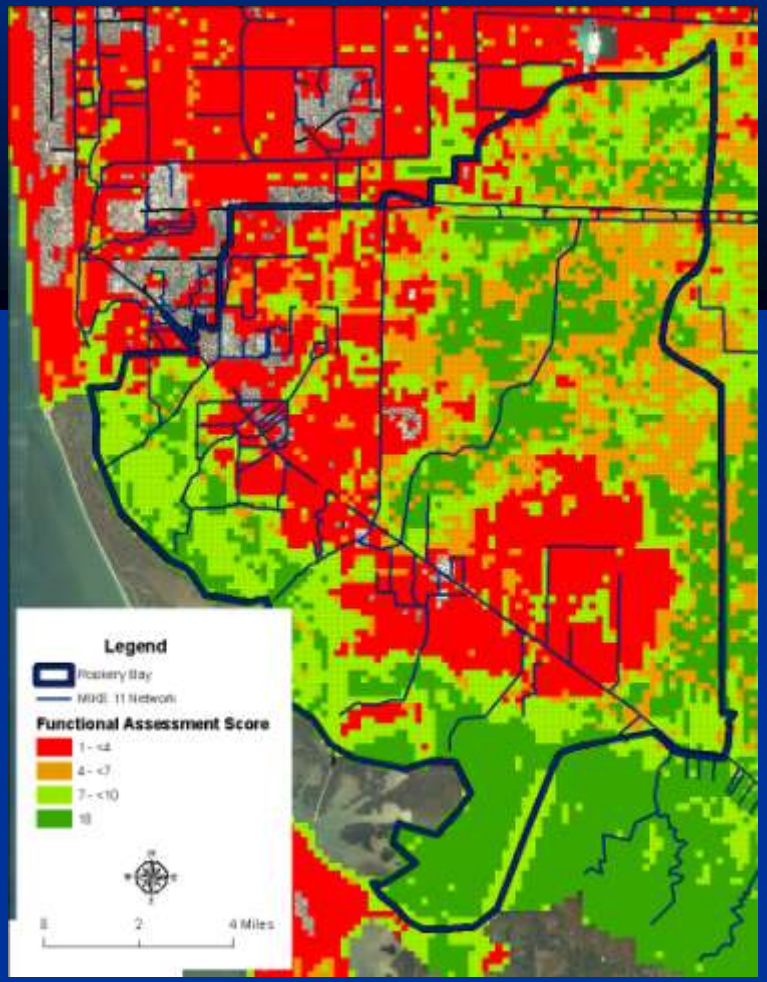
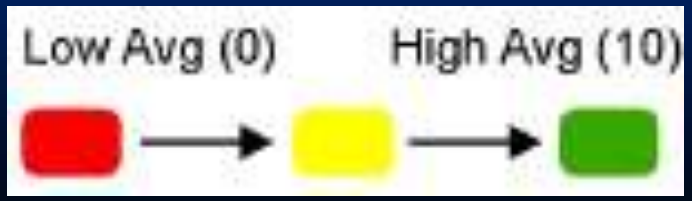
# Rookery Bay Watershed Functional Assessment




Based on Vegetation, hydrology, and location

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# Faka Union, Fakahatchee, and Okaloacoochee – SR29 Watersheds

- The three watersheds encompass 770 sq.mi.
- Three watersheds divided into 8 "WBIDs"
- Faka Union is most modified:
  - Miller Canal
  - Faka Union Canal
  - Merritt Canal


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# Faka Union, Fakahatchee, and Okaloacoochee – SR29 Watersheds

- Fakahatchee watershed is often used as a reference station and remains mostly natural
  - Agriculture in headwaters
- Okalocoochee partially developed
  - Ave Maria
  - Agricultural lands
  - SR 29 Canal to south


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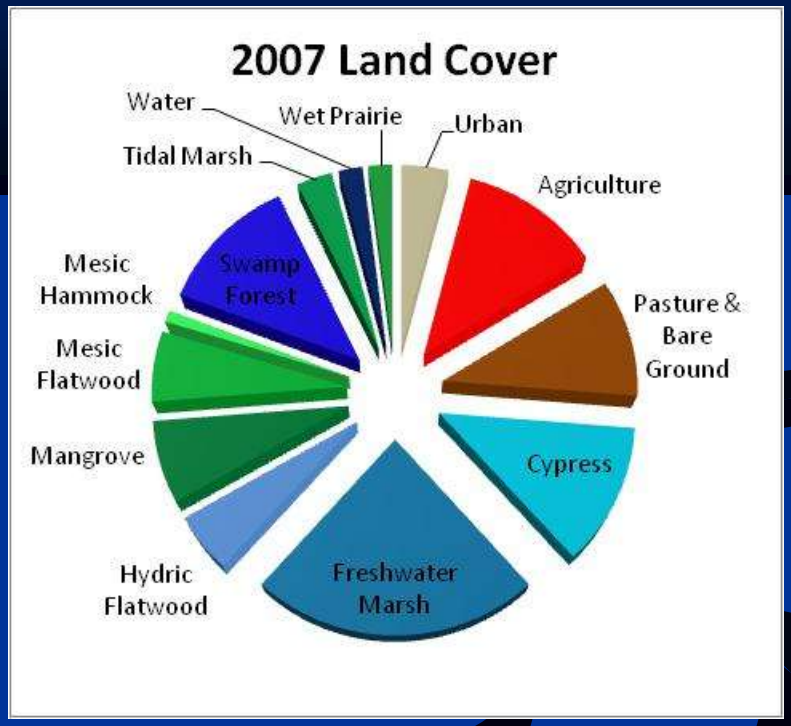
# Eastern Watersheds Land Use Comparison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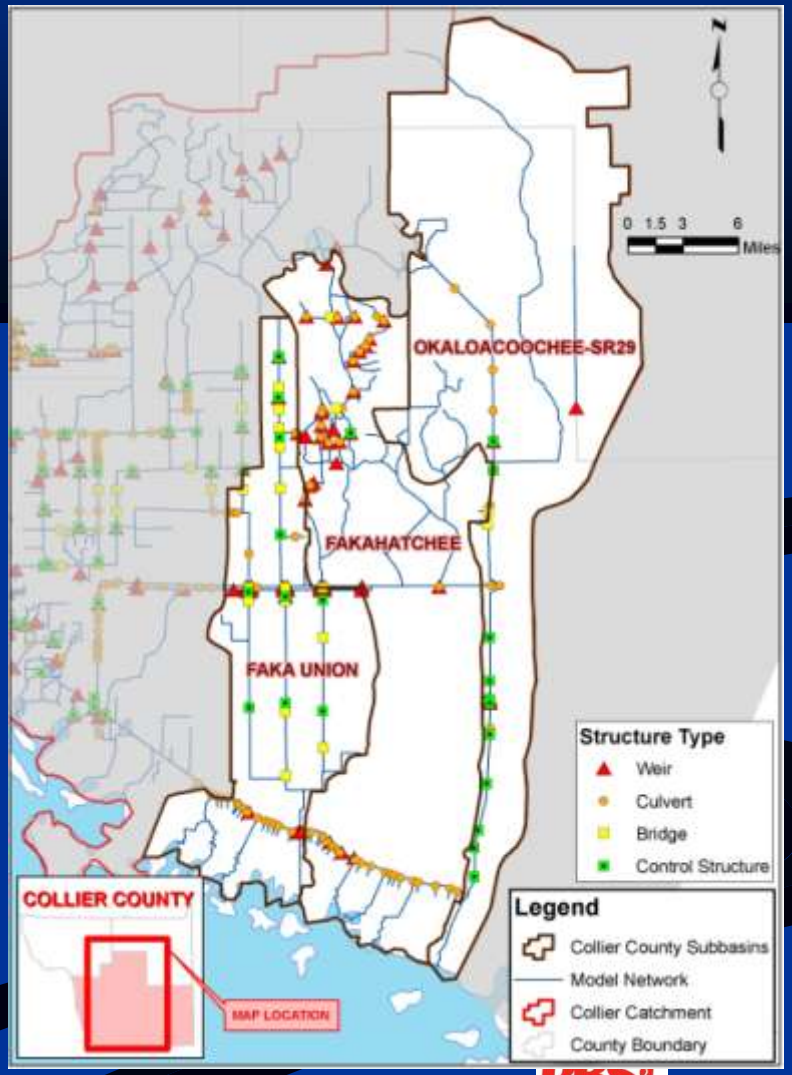
# Faka Union, Fakahatchee, and Okaloacoochee – SR29 Watersheds

- Primary drainage features:
  - Miller Canal
  - Faka Union Canal
  - Merritt Canal
  - SR 29 Canal
- Area of the Faka Union watershed has increased by ~35 sq.mi.

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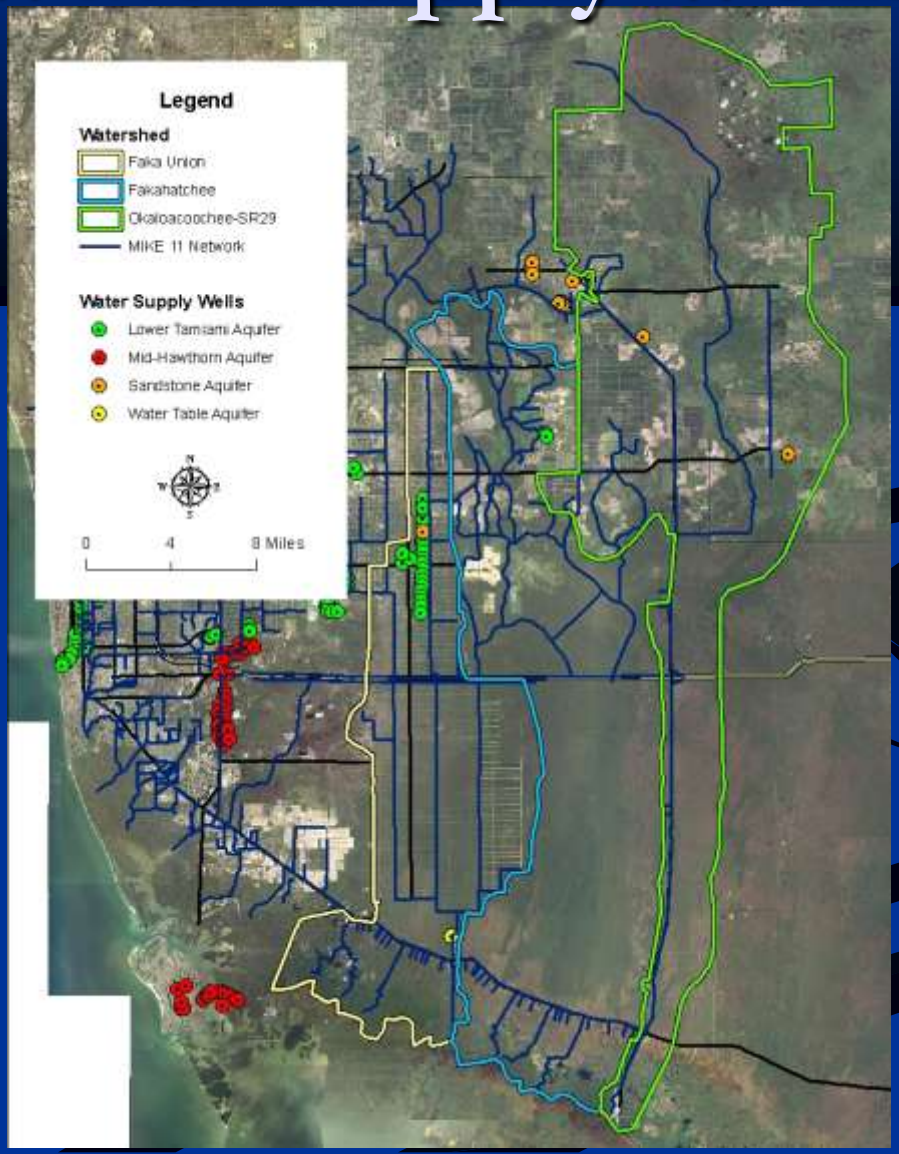
# Eastern Watersheds Water Supply Wells

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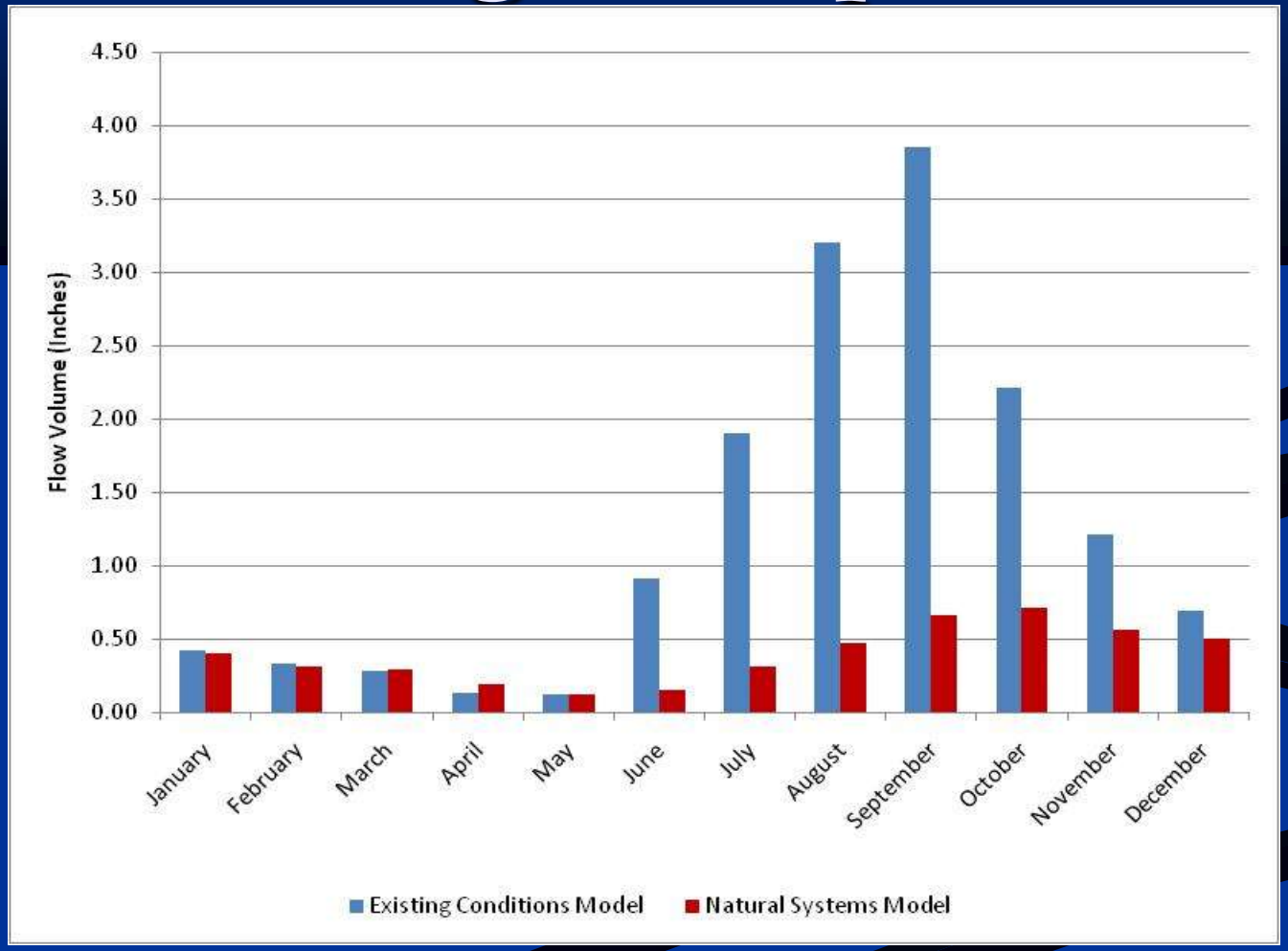
# Eastern Watersheds Discharge Comparison

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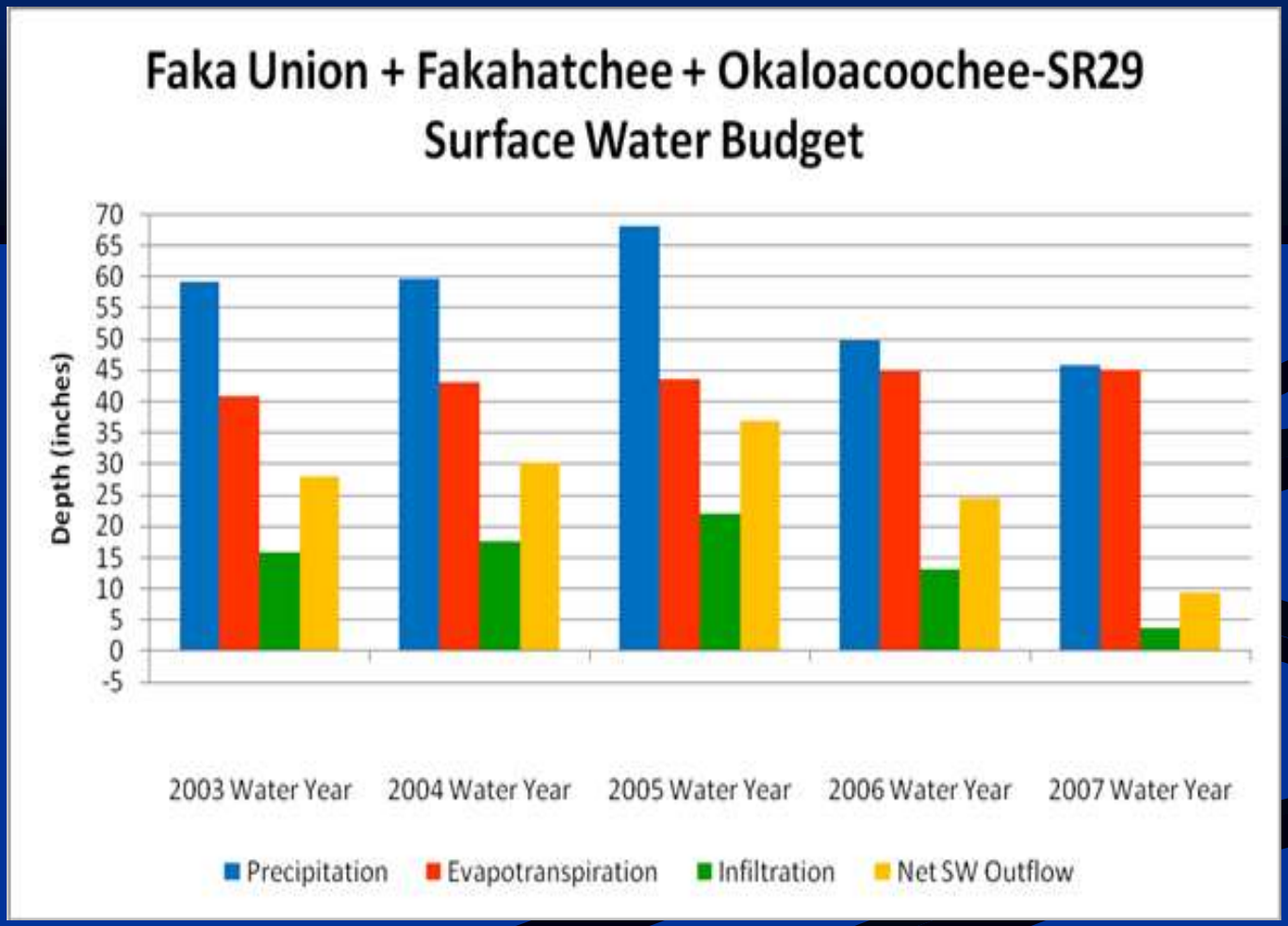
# Eastern Watersheds Surface Water Budget

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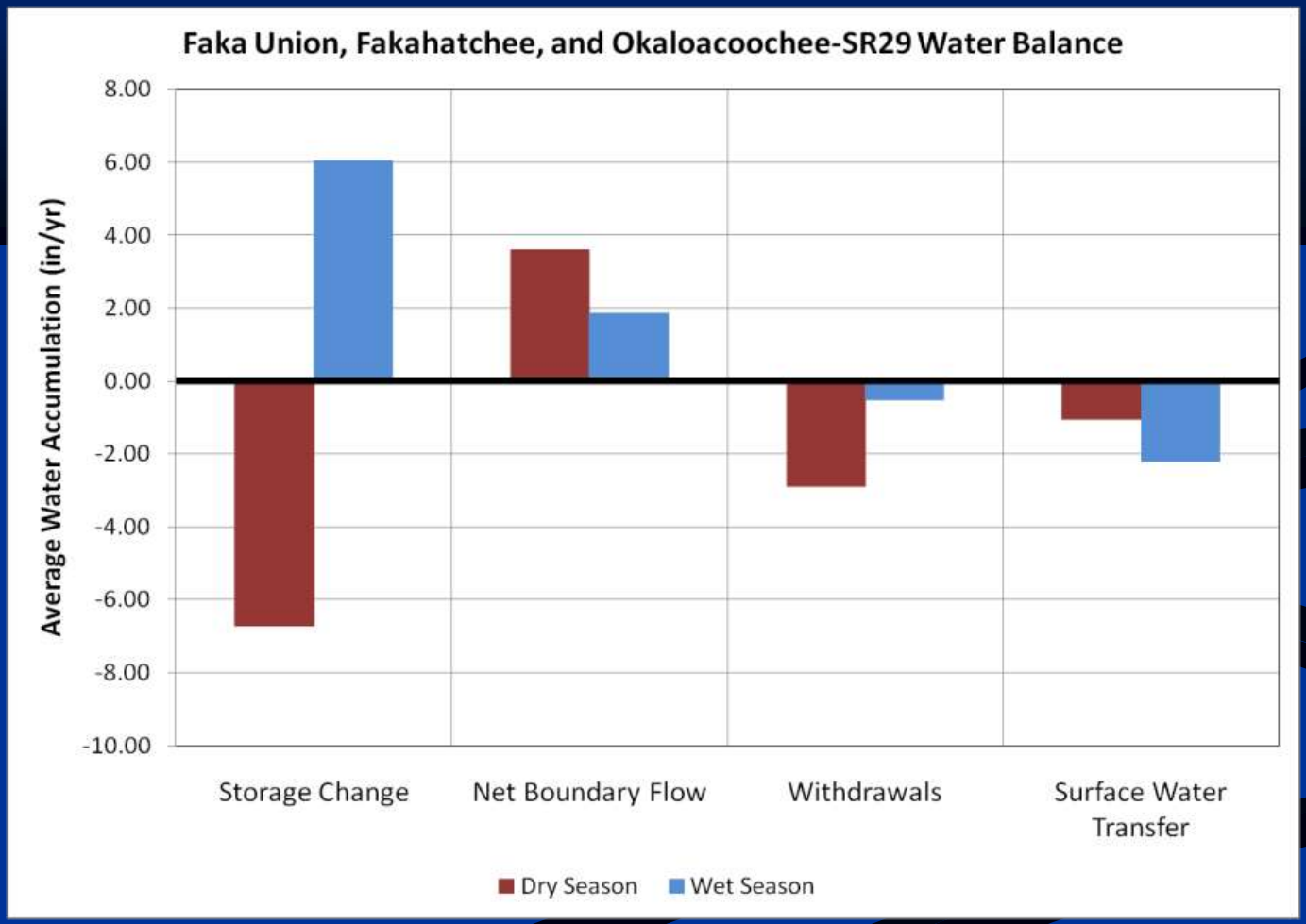
# Eastern Watersheds Groundwater Budget

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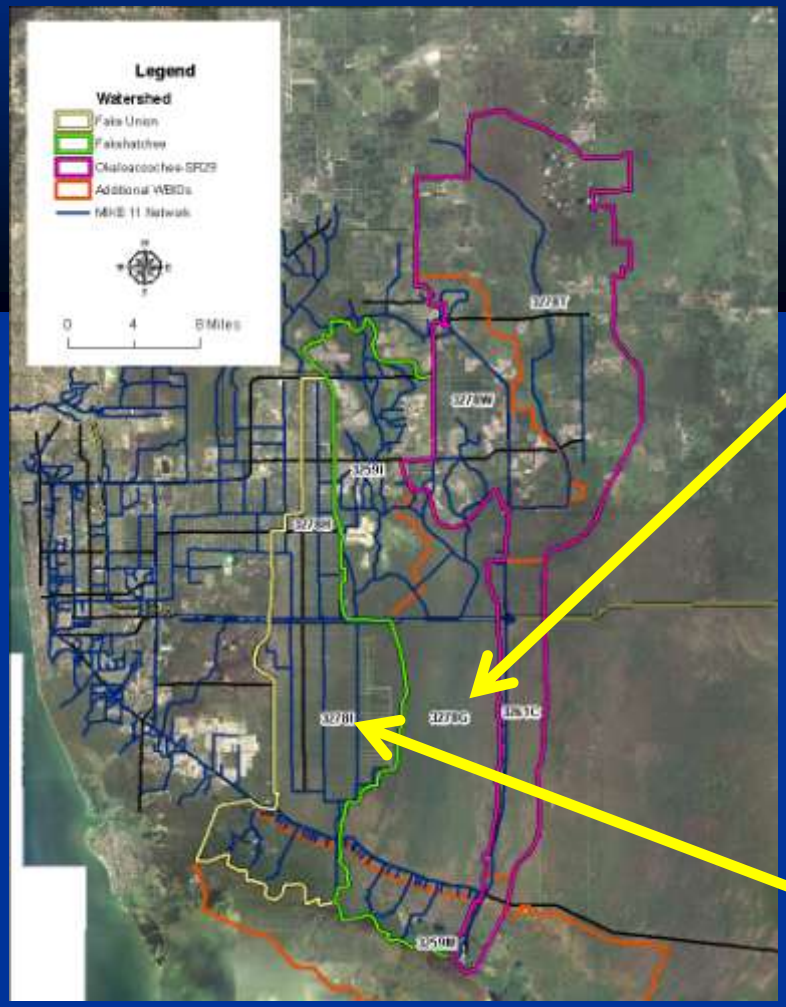
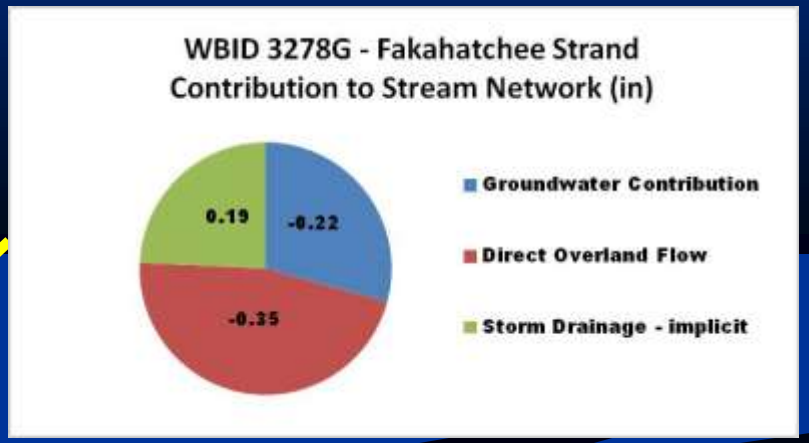
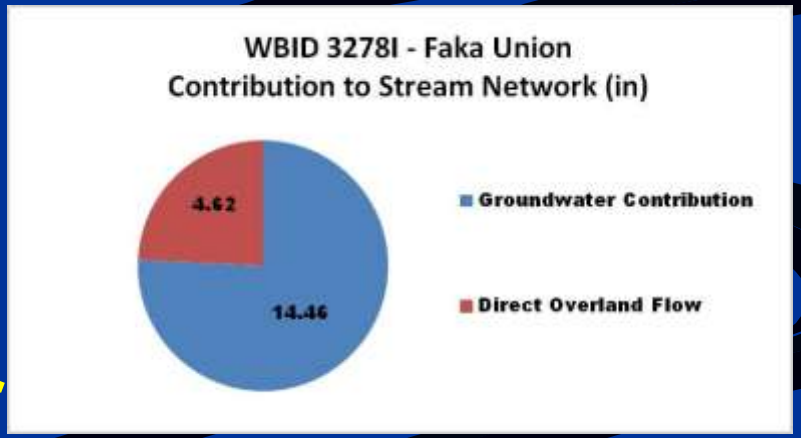
# Eastern Watersheds
# WBID Contributions to Canal

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# Eastern Watershed
# Summary of Water Quantity Issues

- Watershed area is increased in headwaters of Faka Union watershed
  - Dredging of canals in GGE changed hydrology
- Hydrology of remaining wetlands has changed
  - Shorter hydro-period and less water stored
- Large increase in wet season flow to estuary
  - Approximately 9” increase during wet season
  - Existing dry season flows are very similar to NSM

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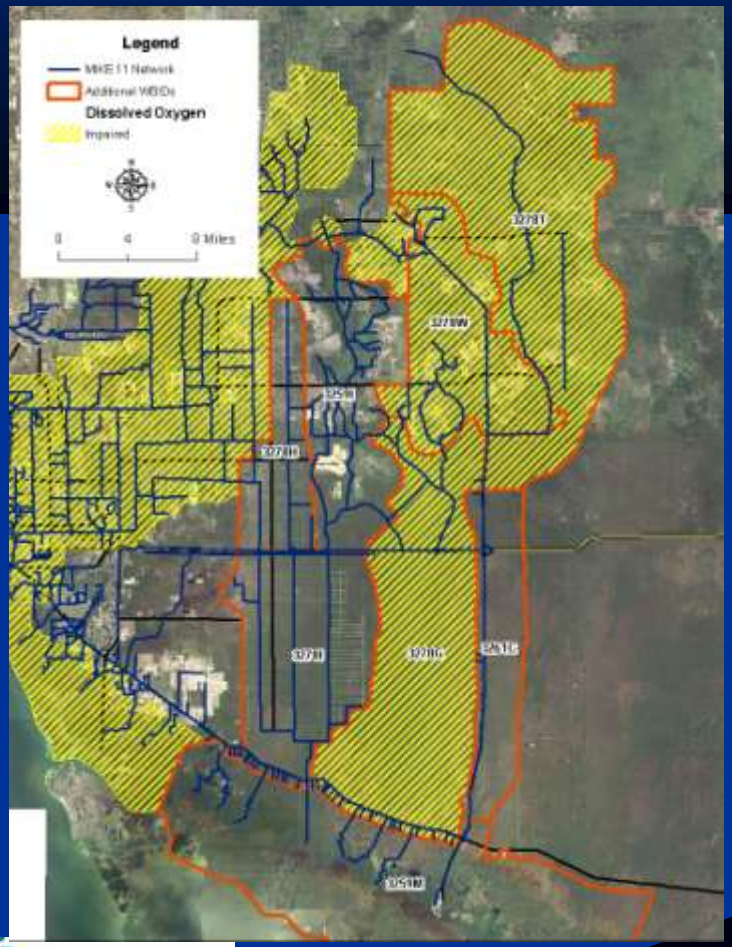
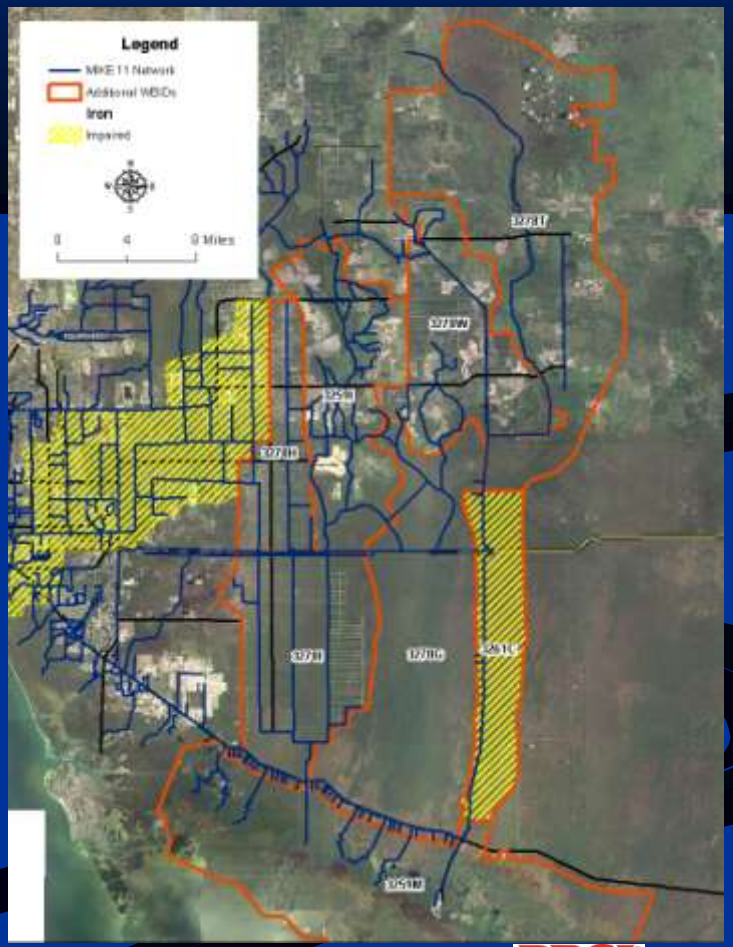
# Eastern Watersheds
# FDEP Identified Impairments

## Dissolved Oxygen




## Iron

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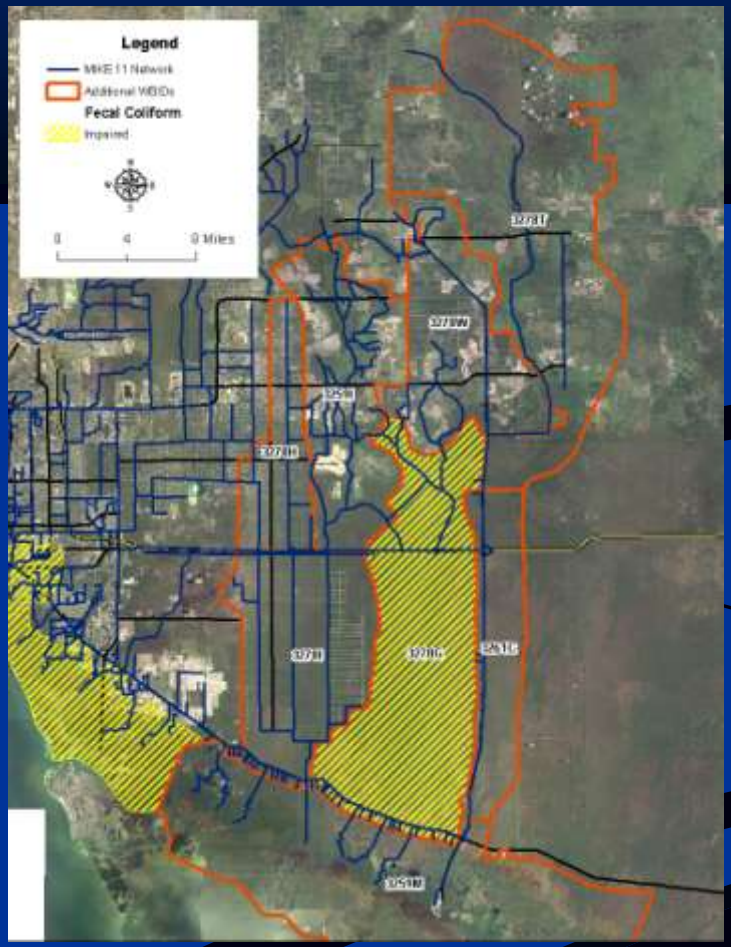
# Eastern Watersheds
# FDEP Identified Impairments

## Fecal Coliform

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# Eastern Watersheds Summary of Water Quality Issues

- Camp Keais Strand, Okaloacoochee Strand, and Fakahatchee Strand identified as impaired for Dissolved Oxygen
  - Fakahatchee Strand is considered a reference station
  - What is role of wetland activity on low D.O. level?
- SR29 Canal identified as impaired for Iron
  - Is there a groundwater contribution?

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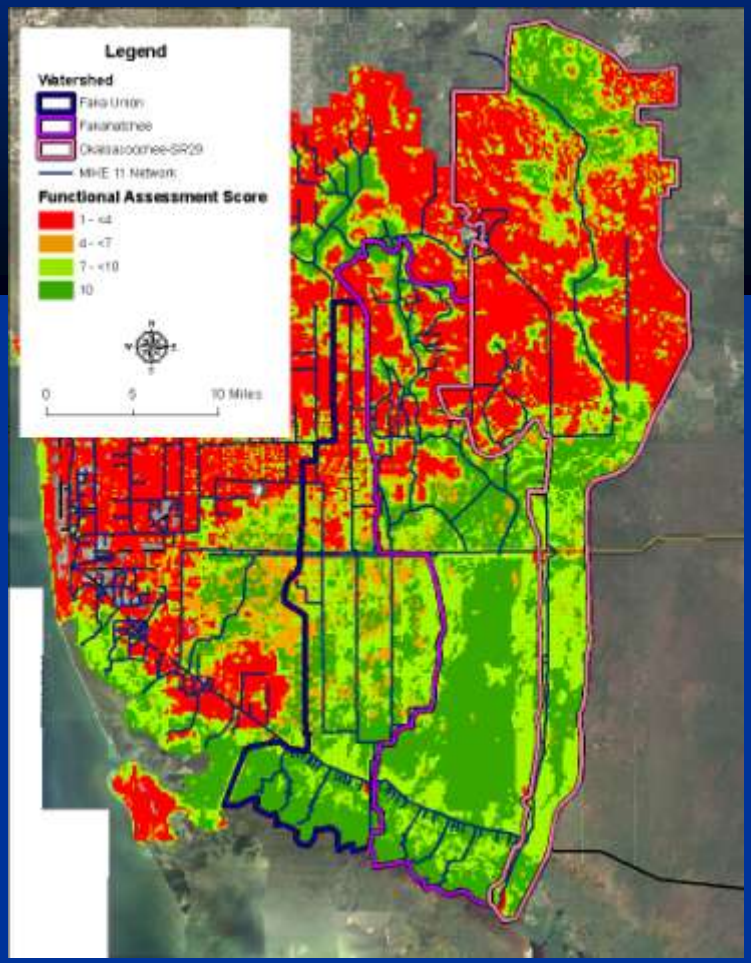
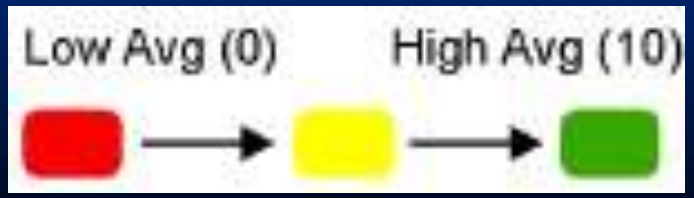
# EasternWatersheds Functional Assessment




Based on Vegetation, hydrology, and location

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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
    - Changes in hydrology
    - Future roadway improvements
    - 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 Master Plan
    - Northern Golden Gate Estates Flowway Restoration Plan (Horsepen Strand Restoration)
    - Lely Area Stormwater Improvement Project
    - Immokalee Stormwater Master Plan
    - Master Plan for Regional Irrigation Distribution System (RIDS)

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# Previously Proposed Projects


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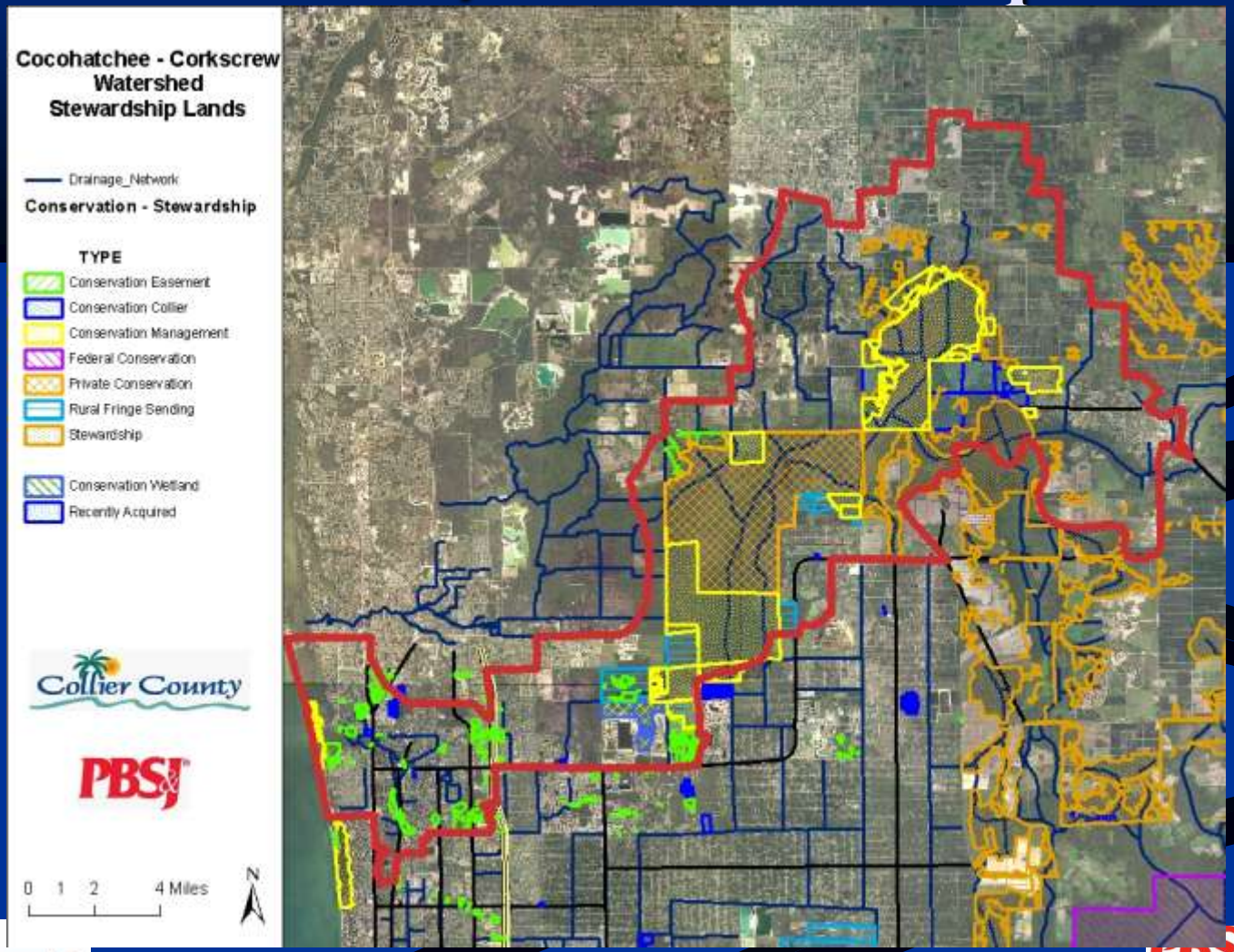
# Cocohatchee-Corkscrew Conservation/Stewardship Lands

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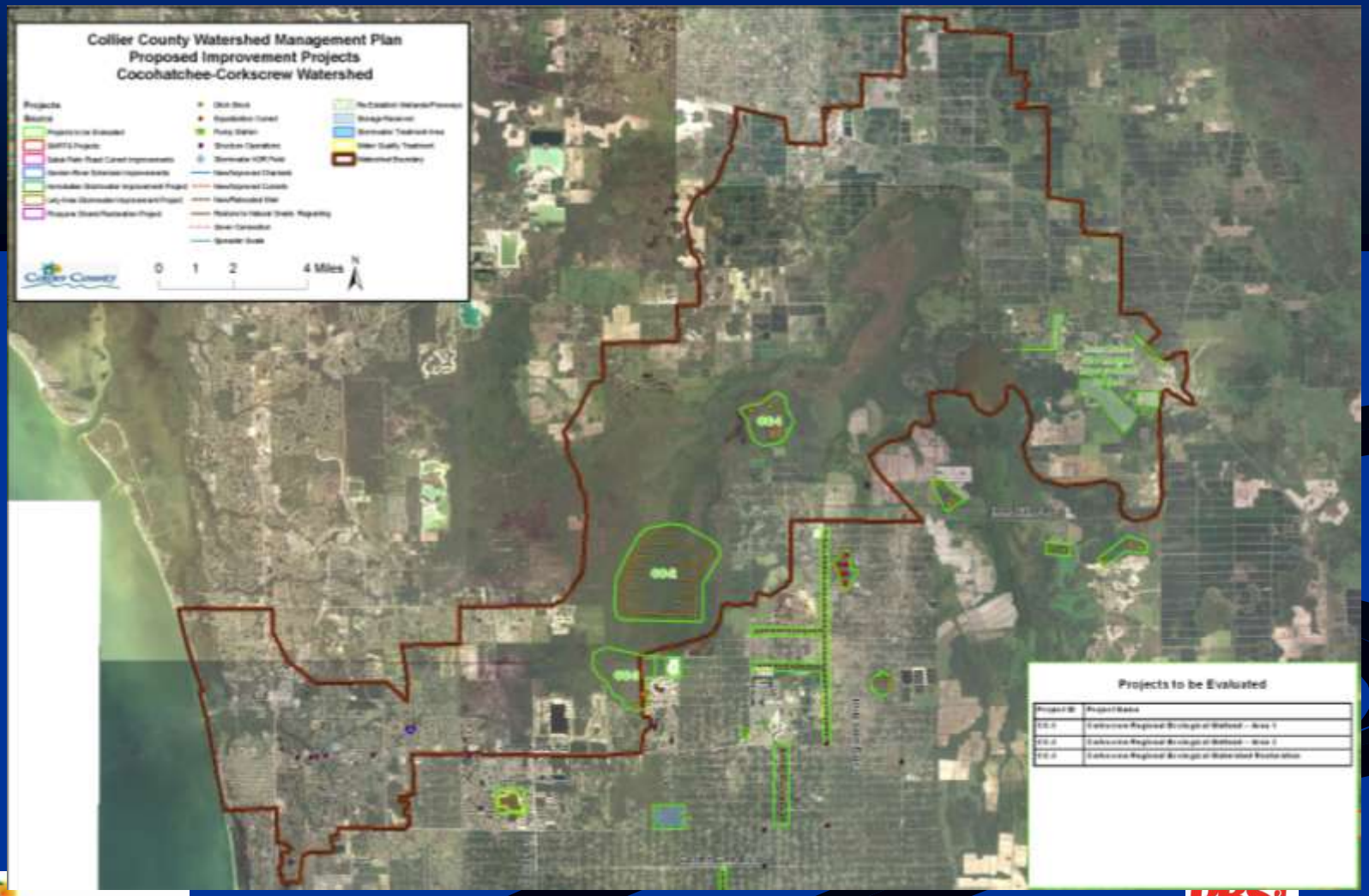
# Potential Projects: Cocohatchee-Corkscrew

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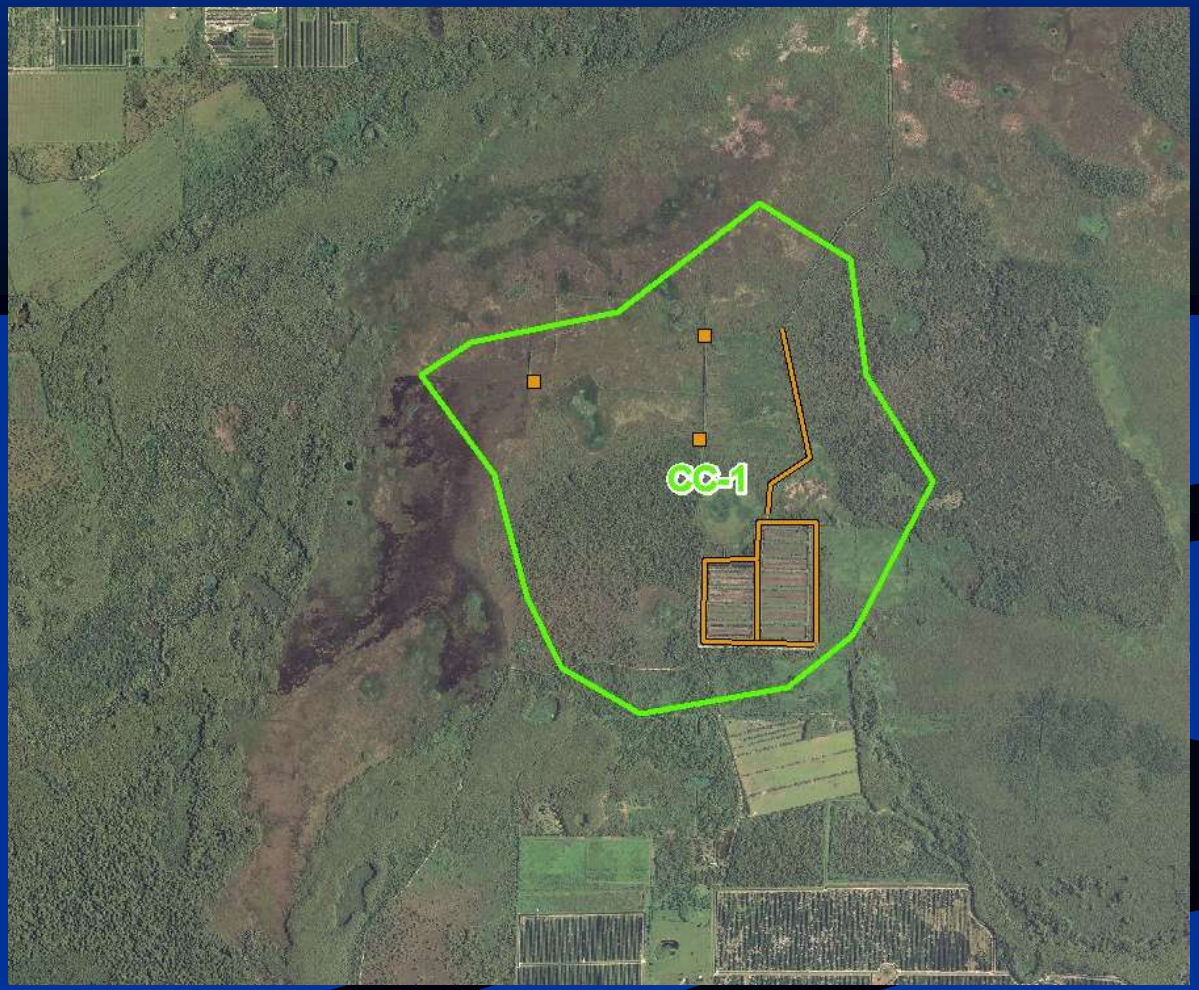
# Potential Projects: Cocohatchee-Corkscrew

- CC-1
  - Ditch blocks to force overland flow
  - Regrade area to remove berms

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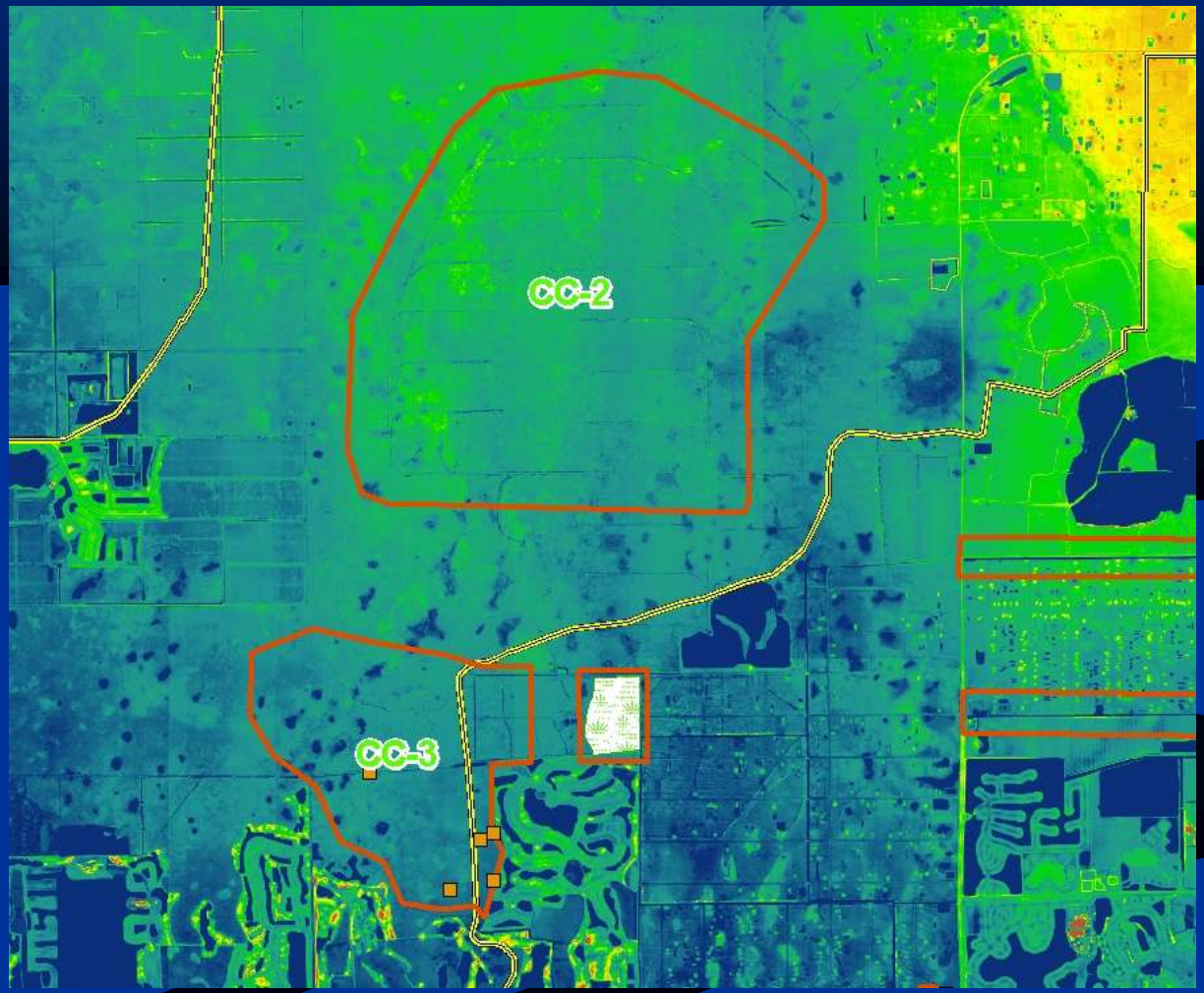
# Potential Projects: Cocohatchee-Corkscrew Watershed

- CC-2
  - Regrade to natural elevation
- CC-3
  - Ditch blocks to encourage overland flow

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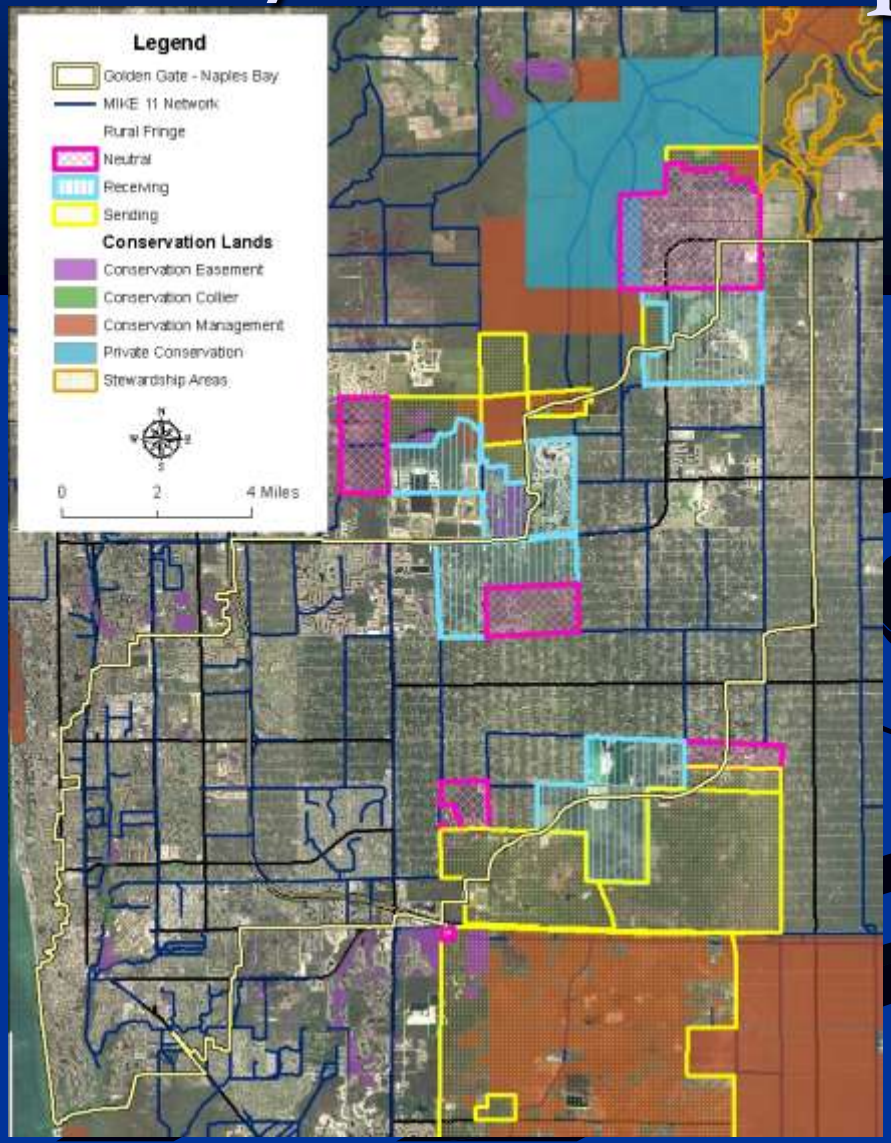
# Golden Gate – Naples Bay Conservation/Stewardship Lands

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# Potential Projects: Golden Gate – Naples Bay Watershed


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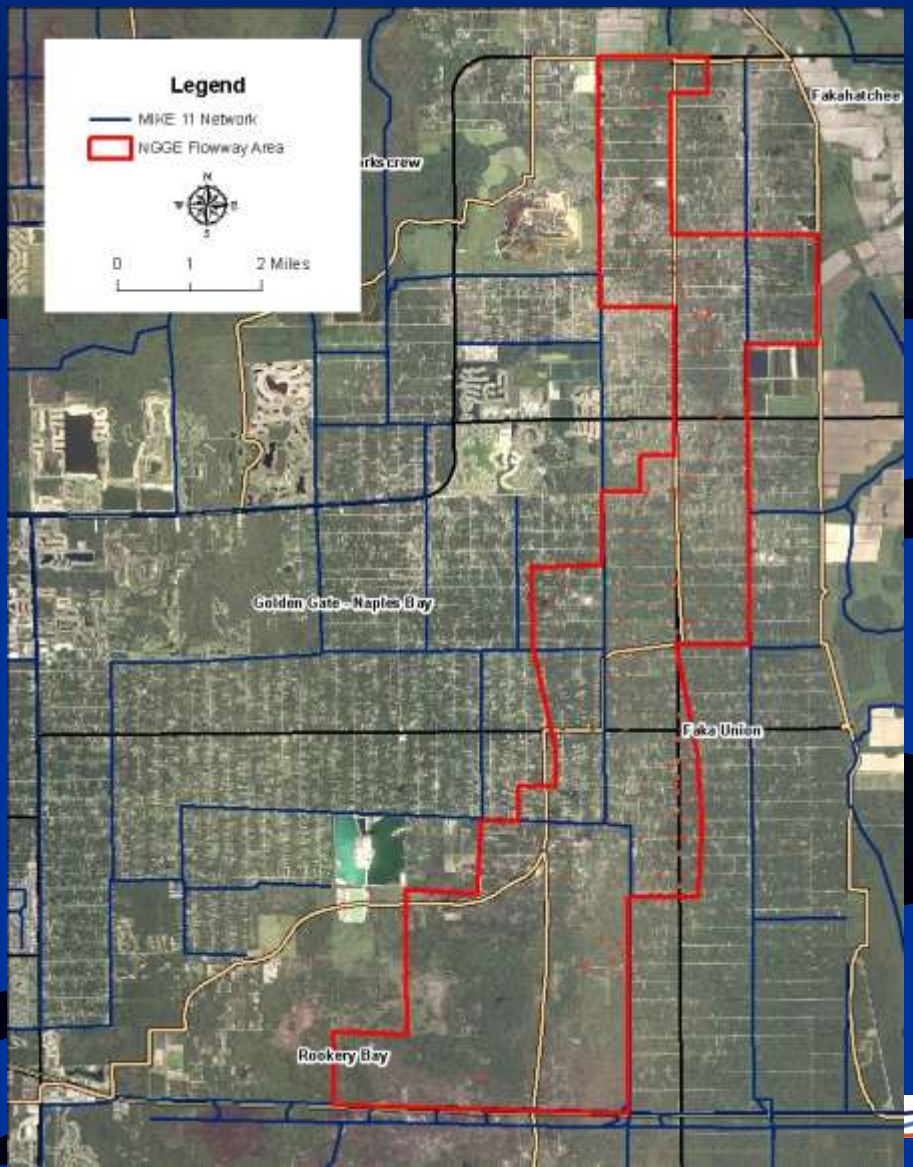
# Potential Projects: NGGE Flowway Restoration

- Goal is to restore wetland connectivity
- Currently defined area falls within three (3) watersheds
- Key issues
  - Interaction with primary canal network
  - Influence on septic systems

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# Potential Projects: Golden Gate – Naples Bay Watershed

- GG-1
  - New weirs to stage water in canals
- GG-2
  - Ditch blocks and equalization culverts to allow more storage
- GG-3
  - Ditch blocks to force overland flow


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# Potential Projects: Golden Gate – Naples Bay Watershed

- GG-4
  - Ditch blocks to force overland flow
- GG-5
  - Divert water for water treatment
- GG-6
  - Off-line stormwater reservoir
- GG-7
  - New weirs in canal


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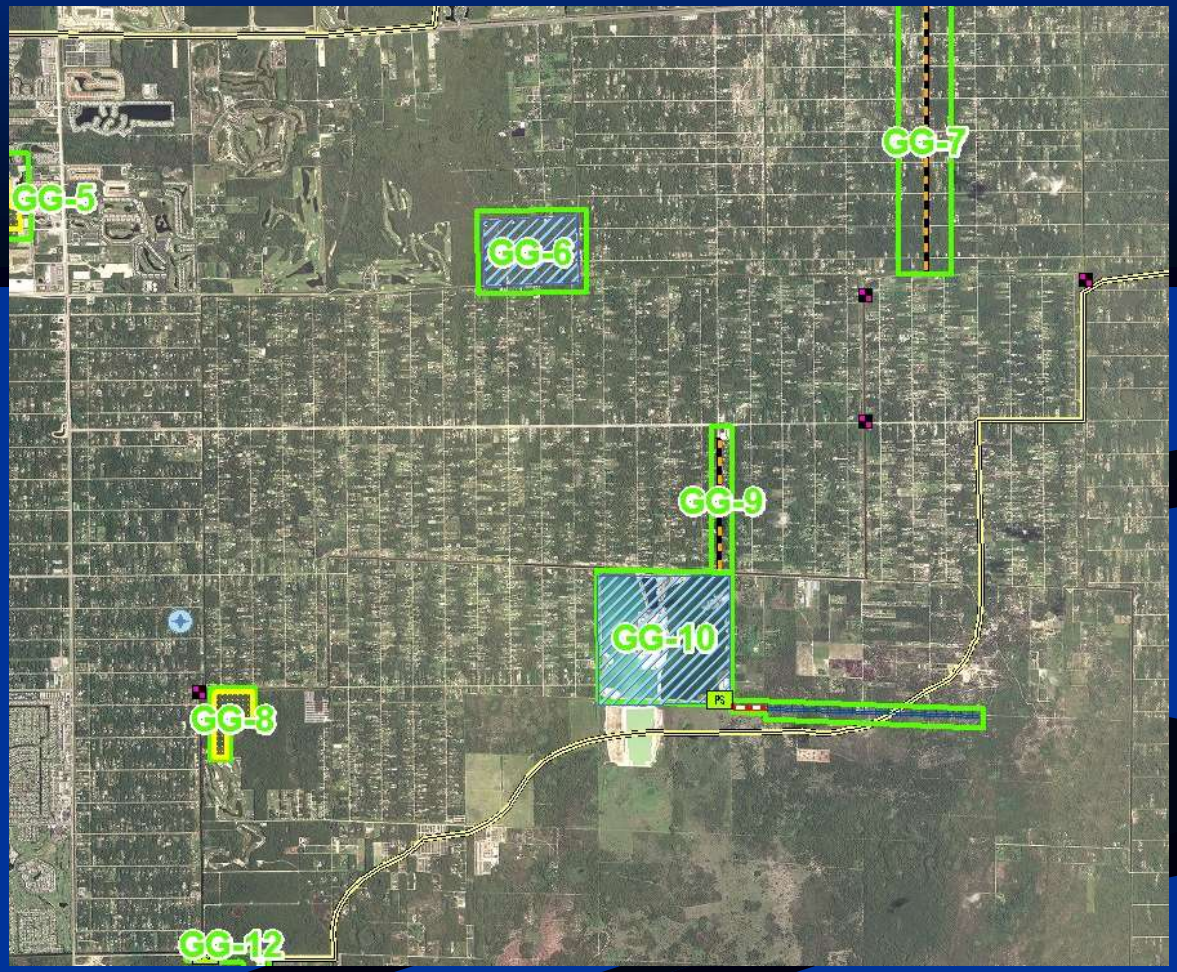
# Potential Projects: Golden Gate – Naples Bay Watershed

- GG-8
  - Wetland flow
- GG-9
  - New weirs to stage water
- GG-10
  - Off-line storage reservoir

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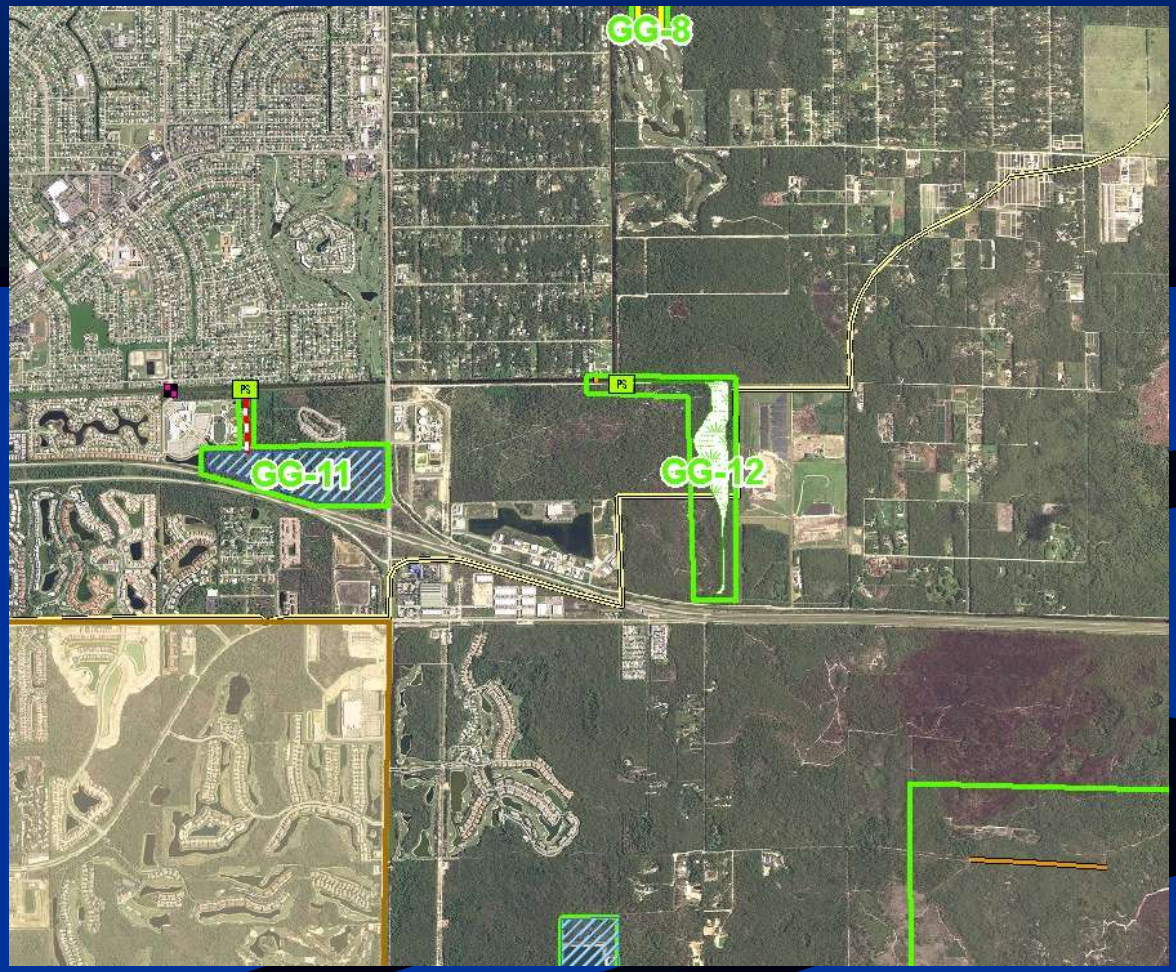
# Potential Projects: Golden Gate – Naples Bay Watershed

- GG-11
  - Off-line storage reservoir
- GG-12
  - Diversion to Rookery Bay watershed

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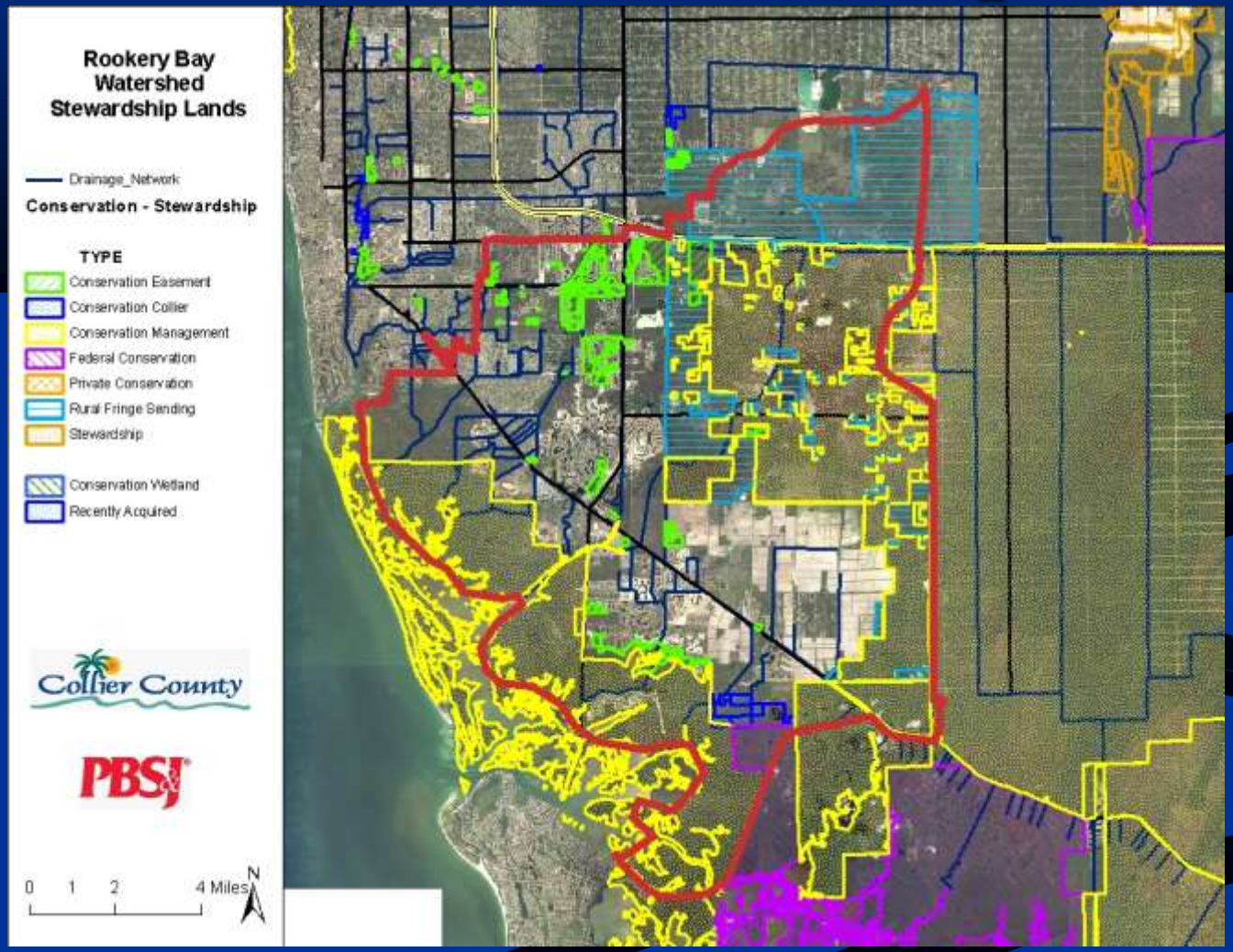
# Rookery Bay Watershed Conservation/Stewardship Lands

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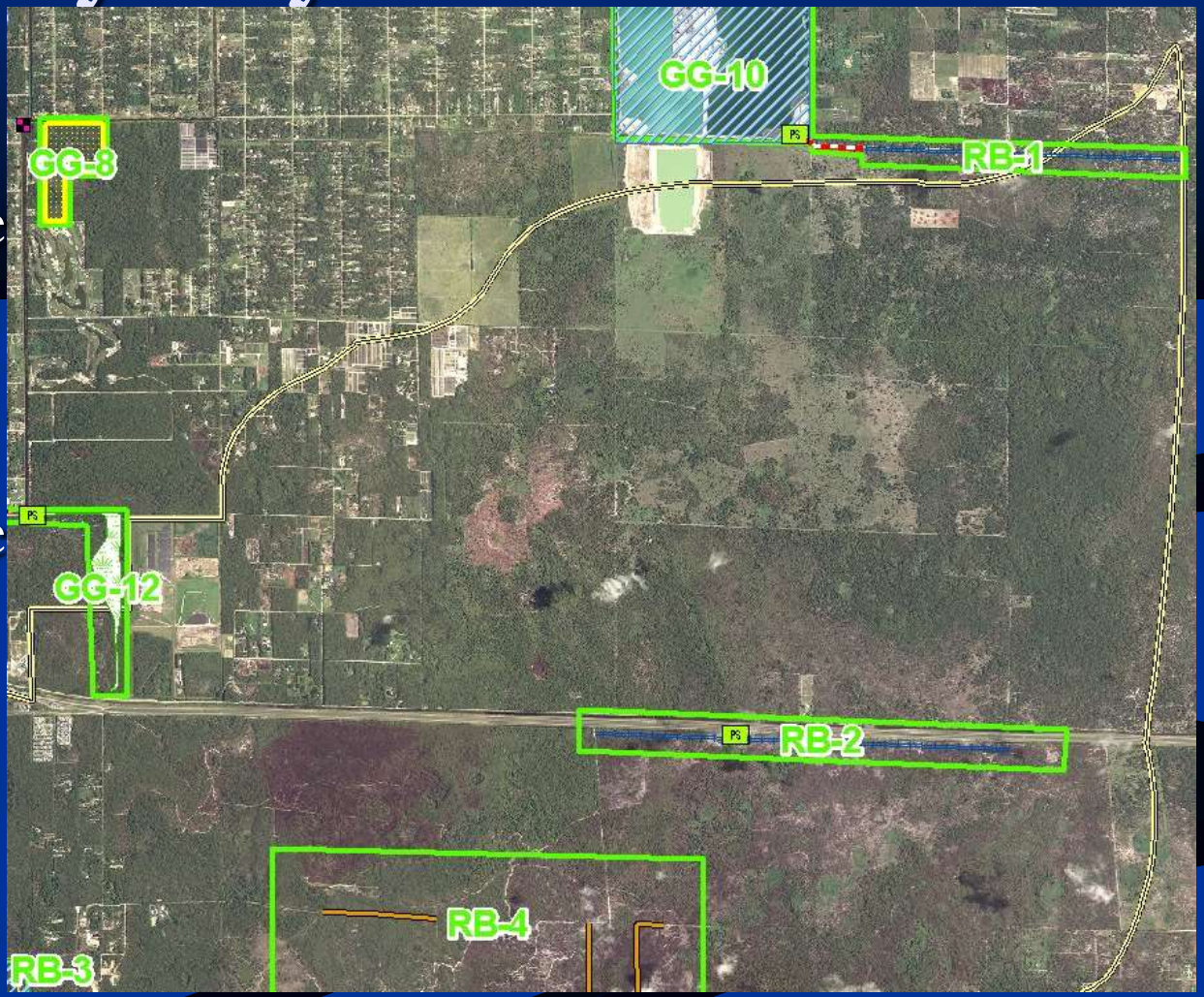
# Potential Projects: Rookery Bay Watershed

# Potential Projects
# Rookery Bay Watershed

- RB-1
  - Spreader swale in RFS lands
- RB-2
  - Spreader swale south of I-75

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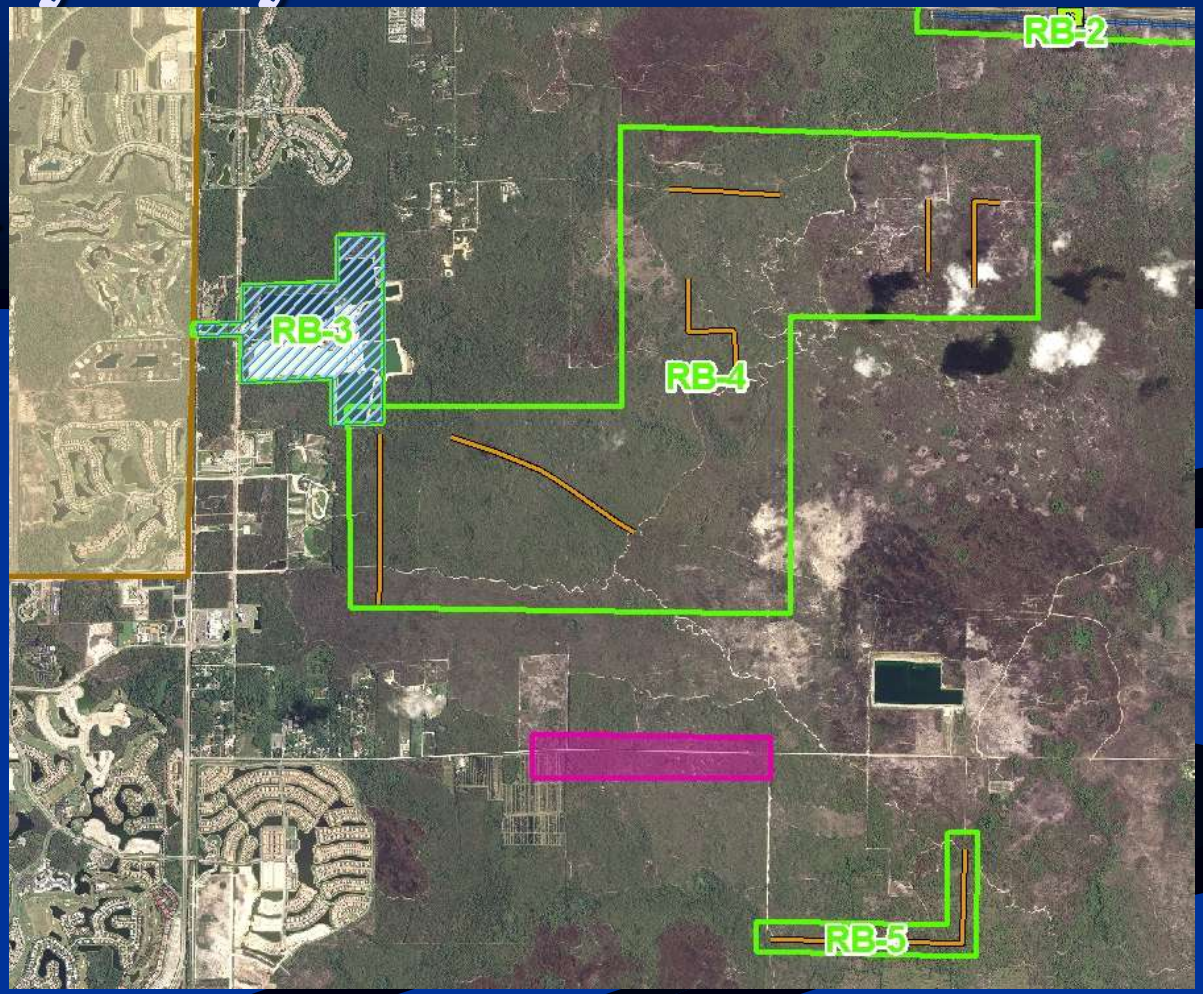
# Potential Projects
# Rookery Bay Watershed

- RB-3
  - Storage reservoir (SWFFS)
- RB-4 and RB-5
  - Regrading of roads and horse trails in PSSF

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# Potential Projects
# Rookery Bay Watershed

- RB-6 and RB-7
  - Drainage upgrades and spreader swale
- RB-8
  - Stormwater treatment area
- RB-9
  - Spreader swale


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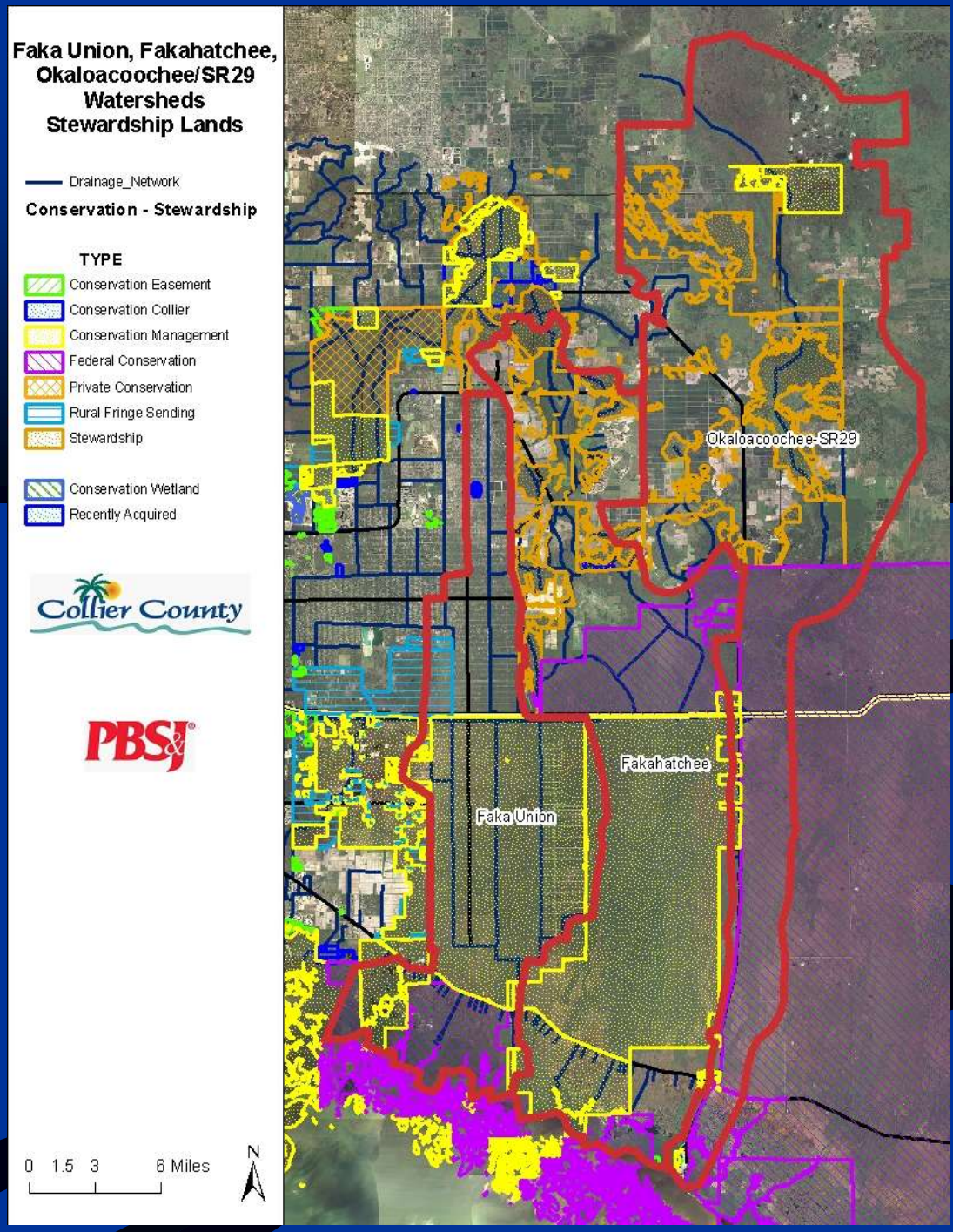
# Eastern Watersheds Conservation/ Stewardship Lands

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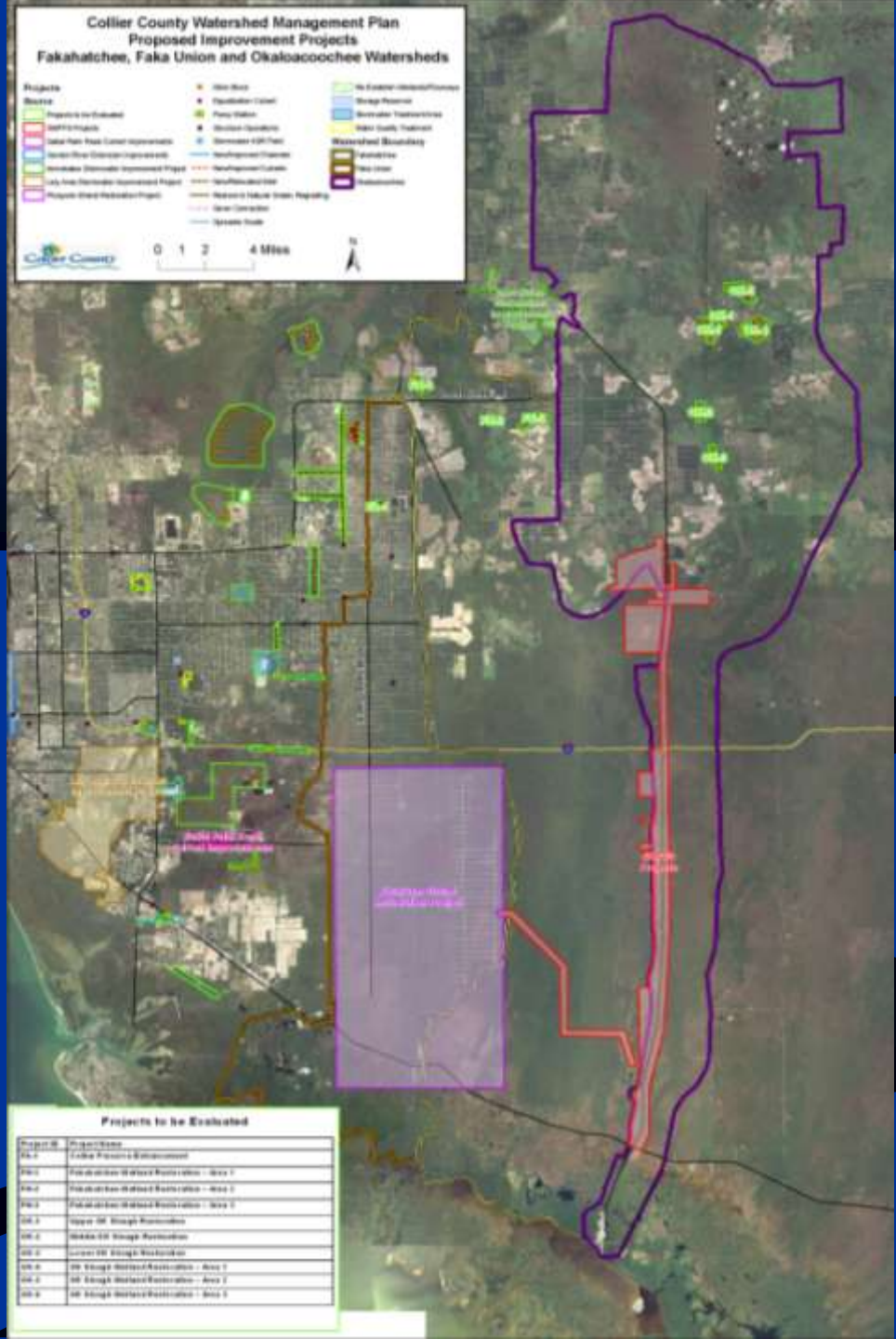
# Potential Projects: Eastern Watersheds



# Potential Projects Eastern Watersheds

- FA-1
  - Winchester Head in the Northern Golden Gate Estates Flowway Restoration Plan
  - Ditch blocks and equalization culverts for more storage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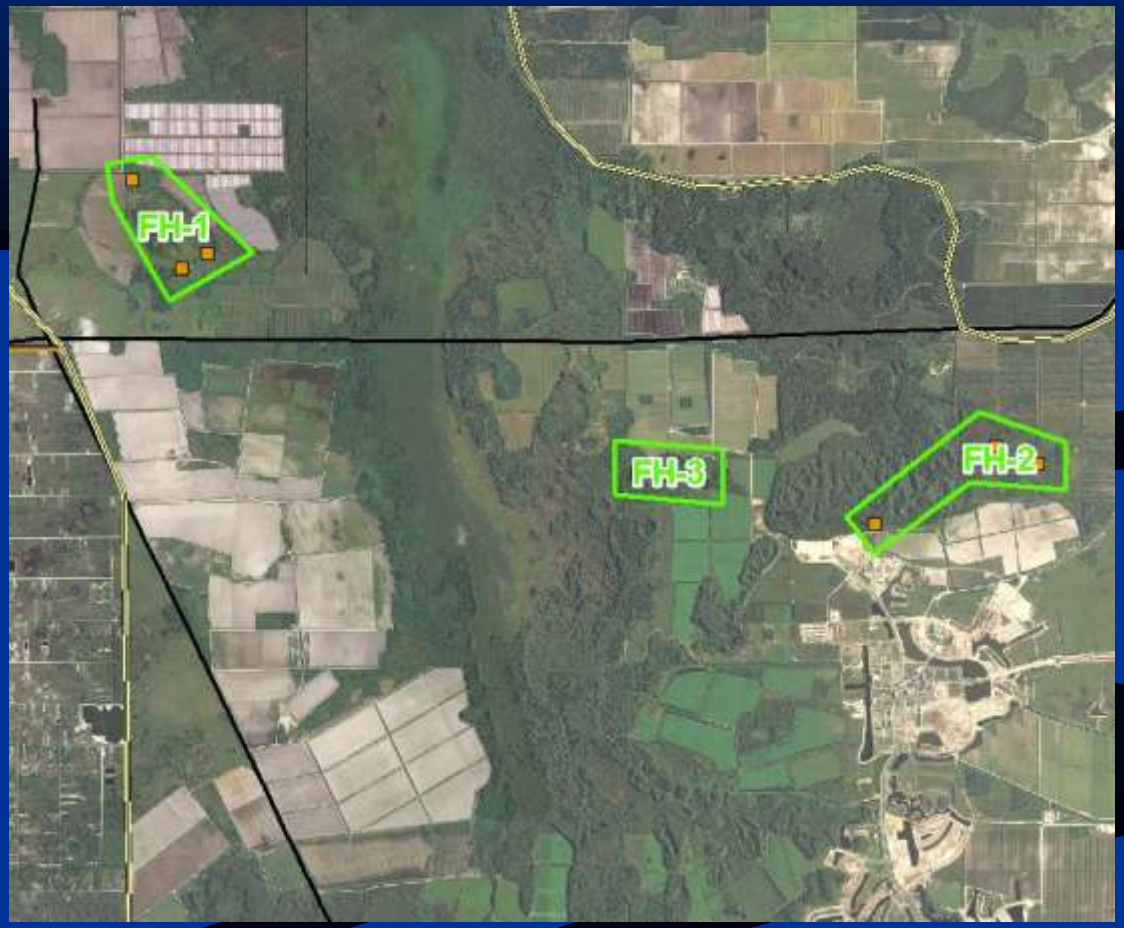
# Potential Projects Eastern Watersheds

- FH-1 to FH-3
  - Ditch blocks to reduce drainage of isolated wetlands

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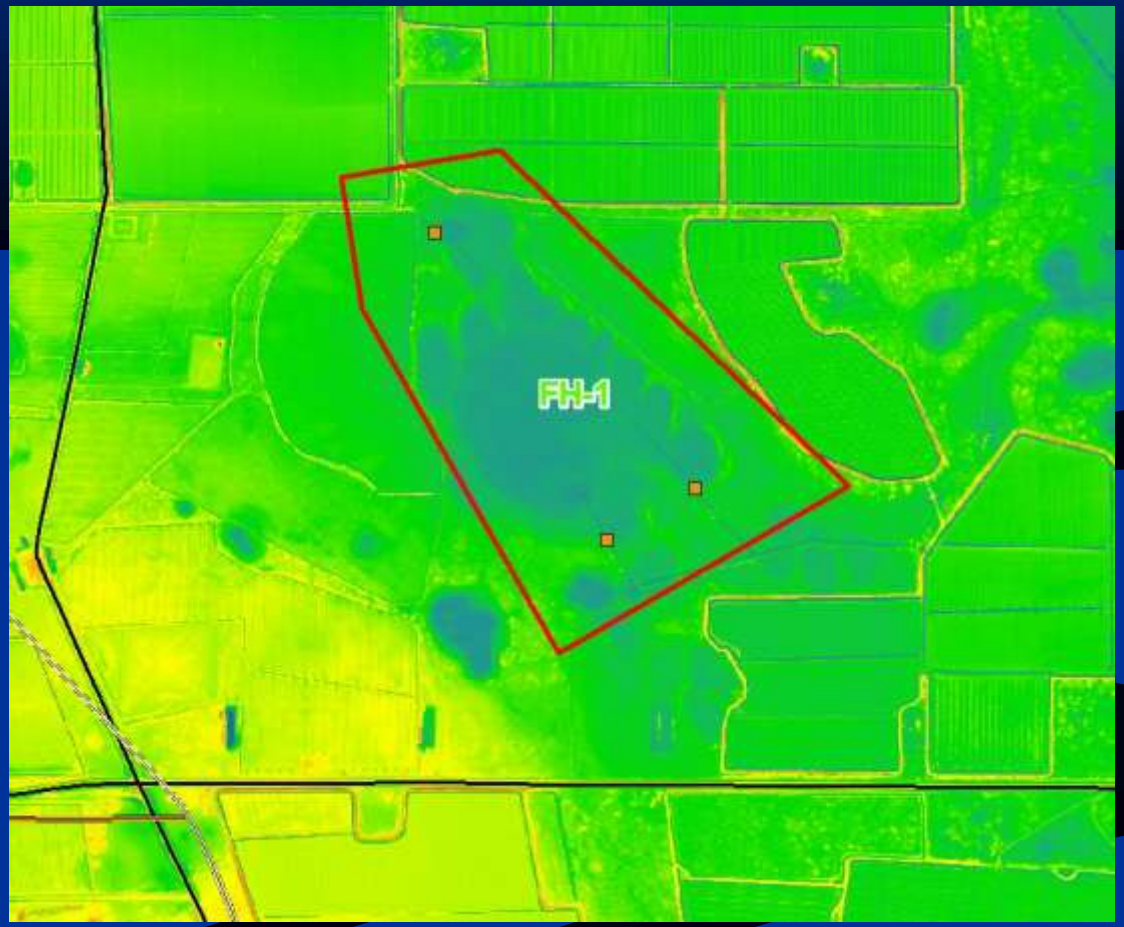
# Potential Projects Eastern Watersheds

- FH-1
  - Ditch blocks to reduce drainage of isolated wetlands

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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
- Agricultural Containment
- Aquifer Storage and Recovery (stormwater)

# Public Facilities
## 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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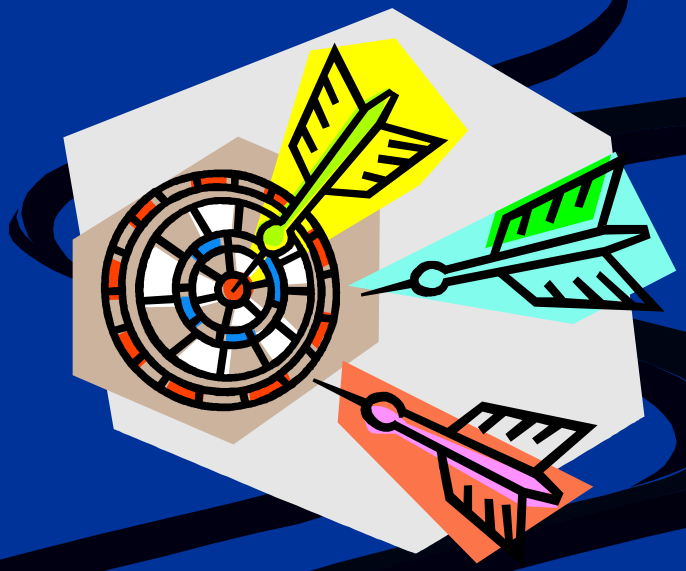
# Performance Measures

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



# Performance Measures

- Freshwater Discharge to Estuaries
- Pollutant Load
- Flood Risk
- Aquifer Recharge/Yield
- Natural Systems

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# Regulatory Issues

- Background
- Objectives
- Low Impact Development

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# Background

- State Water Policy, the TMDL Program, the Current ERP Process, and the Proposed Stormwater Rules
- Current Applicable Regulations from SFWMD and Collier County
- Regulatory Review Categories:
  - Water Quality
  - Water Quantity
  - Land Development
  - Zoning

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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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# Regulatory Review Categories

- Water Quality
- Water Quantity
- Land Development
- Zoning

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# Current Stormwater Management Approach

# Water Quality Regulations Promote Low Impact Development (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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# Low Impact Development (LID)

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# Water Quality Regulatory Issues

- 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 Quality Regulations Fertilizer Ordinances

- Main Issue: How best to manage application rates and timing of fertilizer?
- Ordinances have been implemented by Lee County, City of Naples and other municipalities
- Recommendation:
  - At a minimum, implement ordinance using FDEP recommended language
  - Consider options appropriate for Collier County

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# Fertilizer Ordinances

**FDEP Model Ordinance**

- Nitrogen and Phosphorus application prohibition period
- A minimum of ten (10) feet from water bodies
- Nitrogen, Phosphorus formulation restriction
- Deflector shields
- Avoid impervious areas
- Manage yard clippings
- Agricultural exemptions


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# Fertilizer Ordinances

**Additional Options**

- Mow-Free zone near water
- Landscaper certification
- Slow-Release formula
- Maximum application rates
- Seasonal ban on sale
- Public education


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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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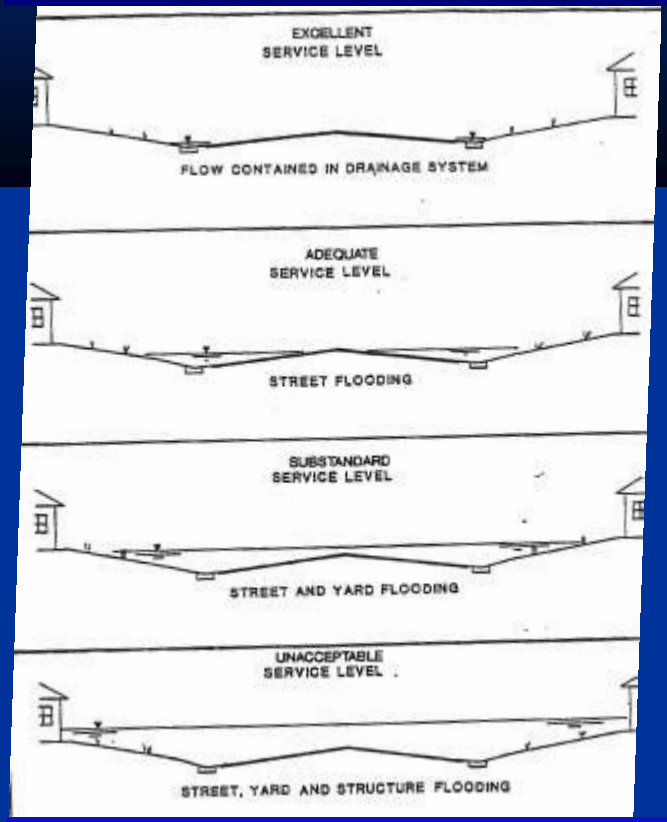
# Water Quantity and Flood Risk

## 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”)

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# Other Issues

- Modify zoning to address extent of impervious cover in addition to density
- Examine the TDR program and make recommendations

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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
- Examine zoning and TDR program

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# Wrap Up

- If you didn't sign in, please do so
  - Include your E-mail address and Phone Number
- Comments via E-Mail

  *machatcher@colliergov.net*
- Formal position papers
  - Please mail to Mac Hatcher

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