SOUTH FLORIDA WATER MANAGEMENT DISTRICT

# Big Cypress Basin
# Regional Water Supply Workshop

Clarence Tears
Big Cypress Basin Director
February 25, 2011

# Strategic Priorities for Water Supply

- Ensure sustainable water supplies that protect natural systems and meet all reasonable beneficial uses by
  - Improving water storage capacities
  - Strengthening the linkage between land use, water supply planning and consumptive use
  - Creating financial and other incentives for regional solutions
  - Updating regional models and analysis
  - Developing and implementing the LWCRWSP
  - Increasing water conservation education and outreach programs

# Overview of discussion

- Update on LWCWSP
- Update on water resources modeling
- Update on local comprehensive planning
- Update on climate change
- Discussion

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

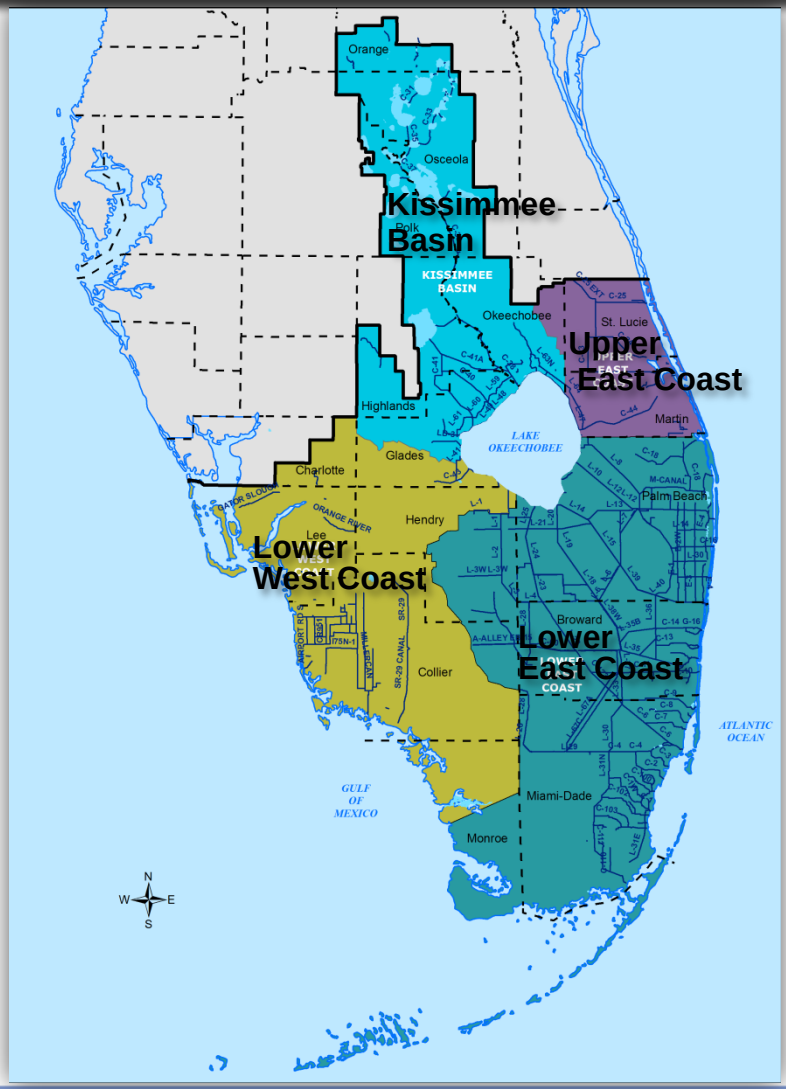
# Lower West Coast Water Supply Planning

**Mark Elsner, P.E., Director**
**Water Supply Development Division**

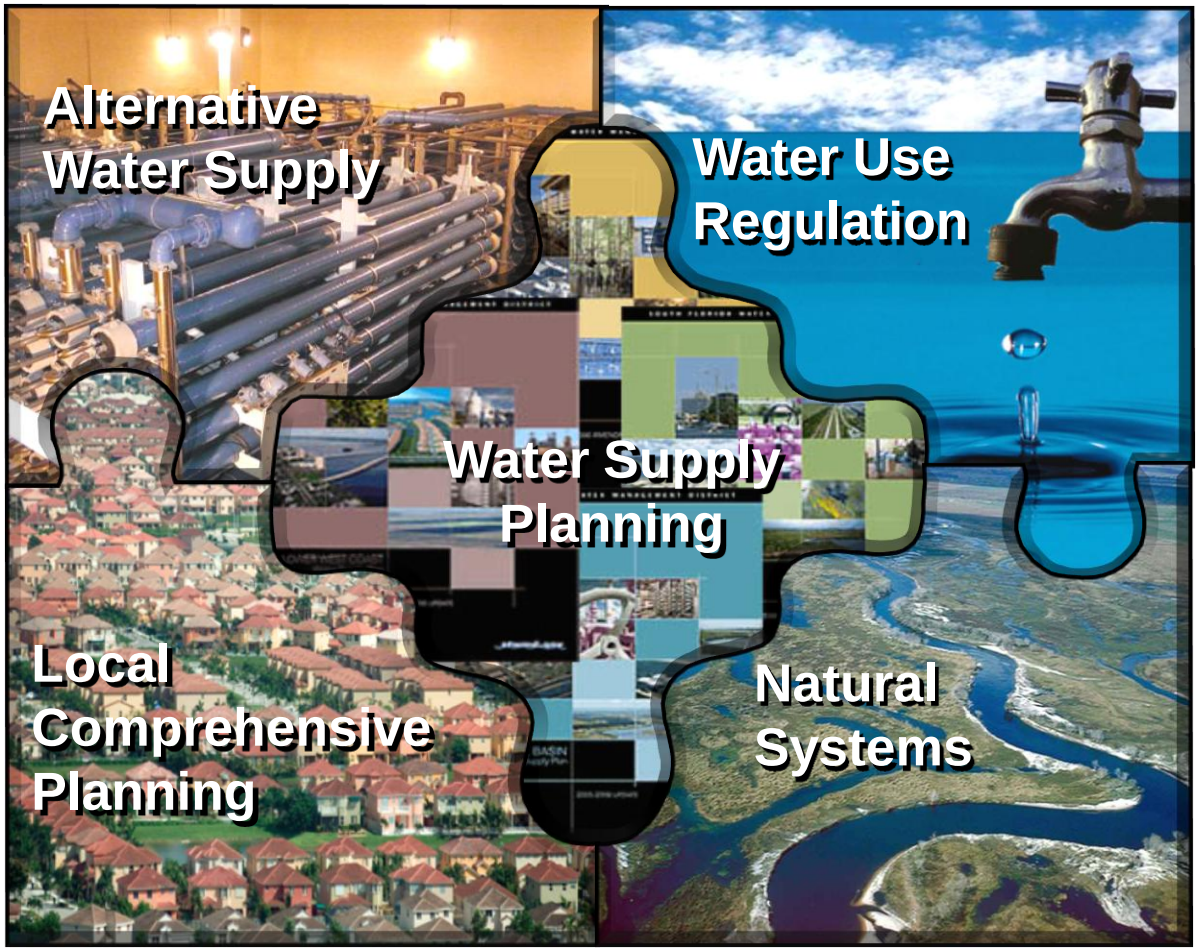
***Big Cypress Basin Board***
***February 26, 2010***

# What is a Regional Water Supply Plan?

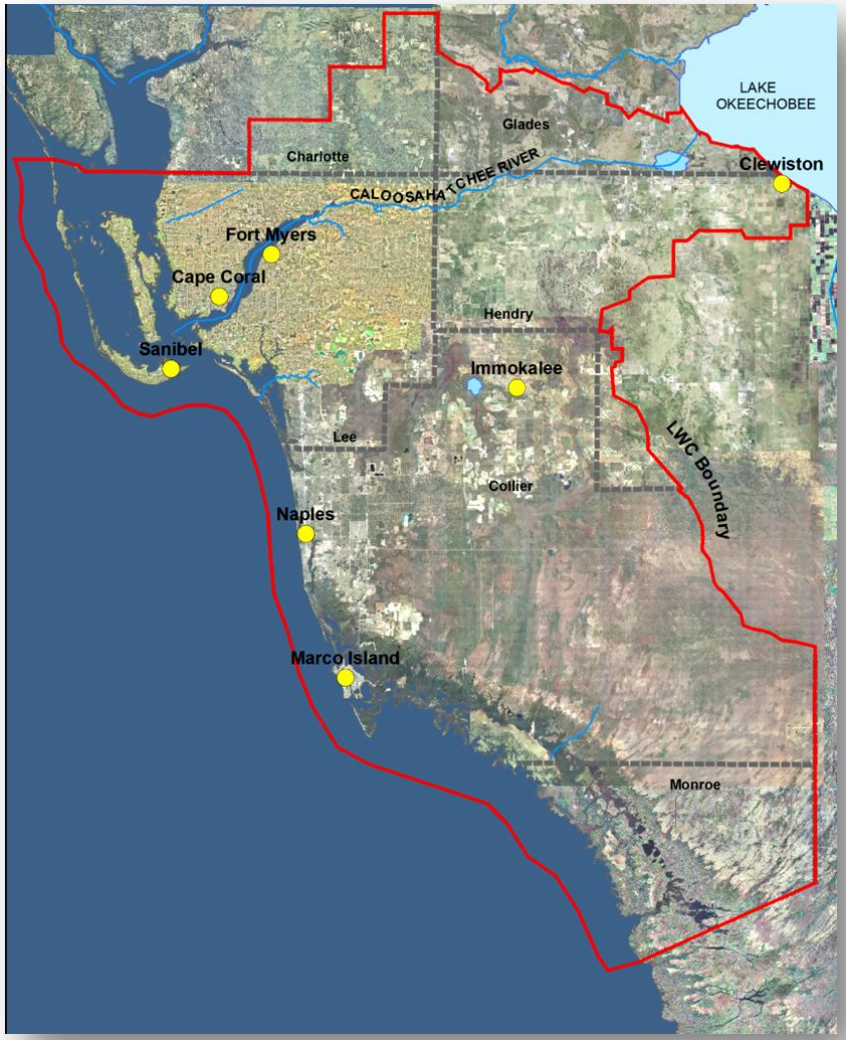
- Current and future look at water needs
- Strategies to meet future water demands and the needs of the environment
- Based on at least a 20-year future planning horizon
- Updated every 5 years



# Water Supply Planning Linkages



# Lower West Coast Planning Area




## Includes:

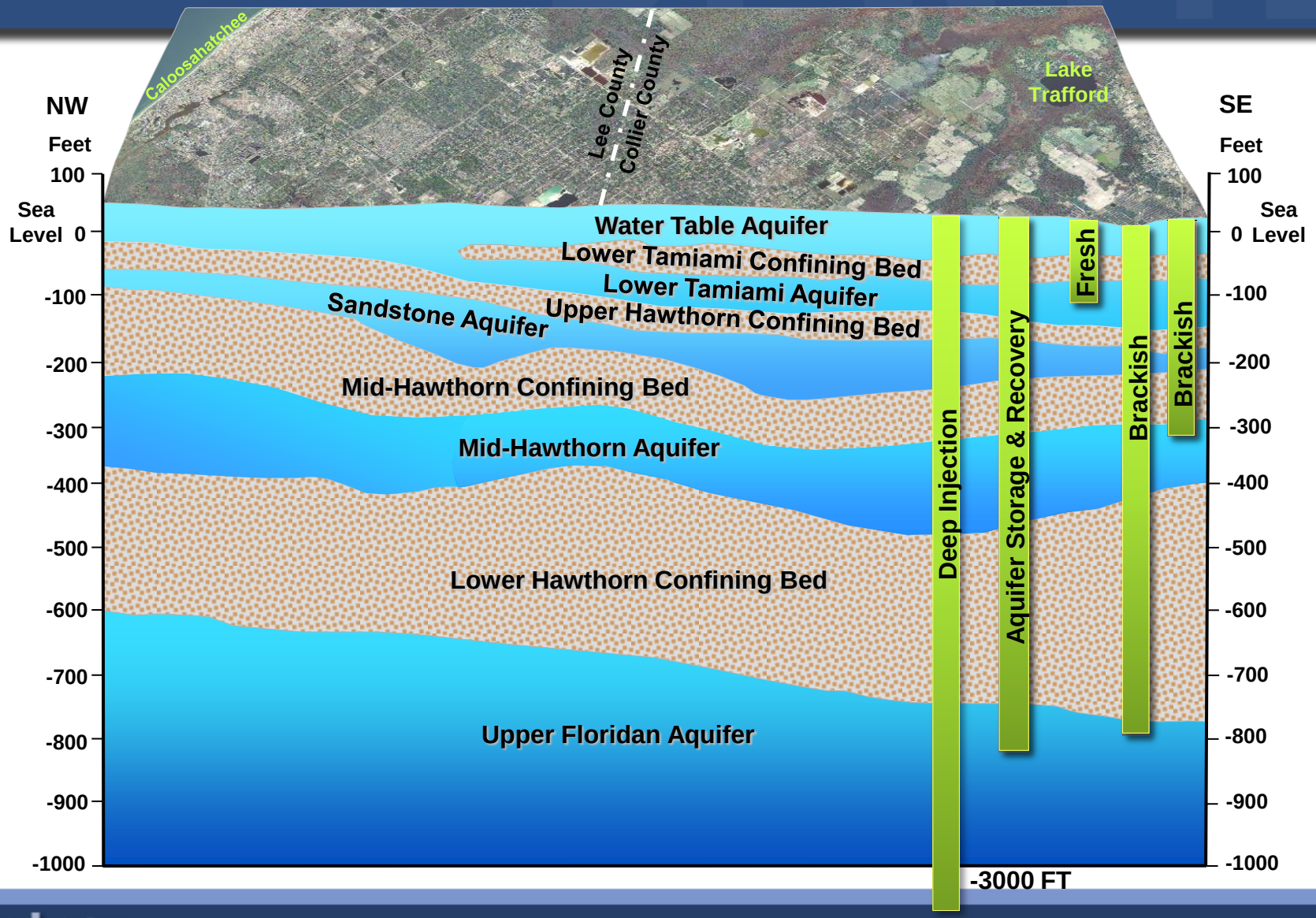
- Lee County
- Portions of Collier, Charlotte, Glades, Hendry and Monroe counties

- Population*

| | LWC | Collier County |
|---|---|---|
| 2010 | 995,000 | 341,565 |
| 2030 | 1,506,000 | 472,000 |

*Draft – 2011 Update

# LWC General Hydrogeologic Cross Section



# Seasonal Rainfall

JAN

FEB

MAR

APR

MAY

JUN

JUL

AUG

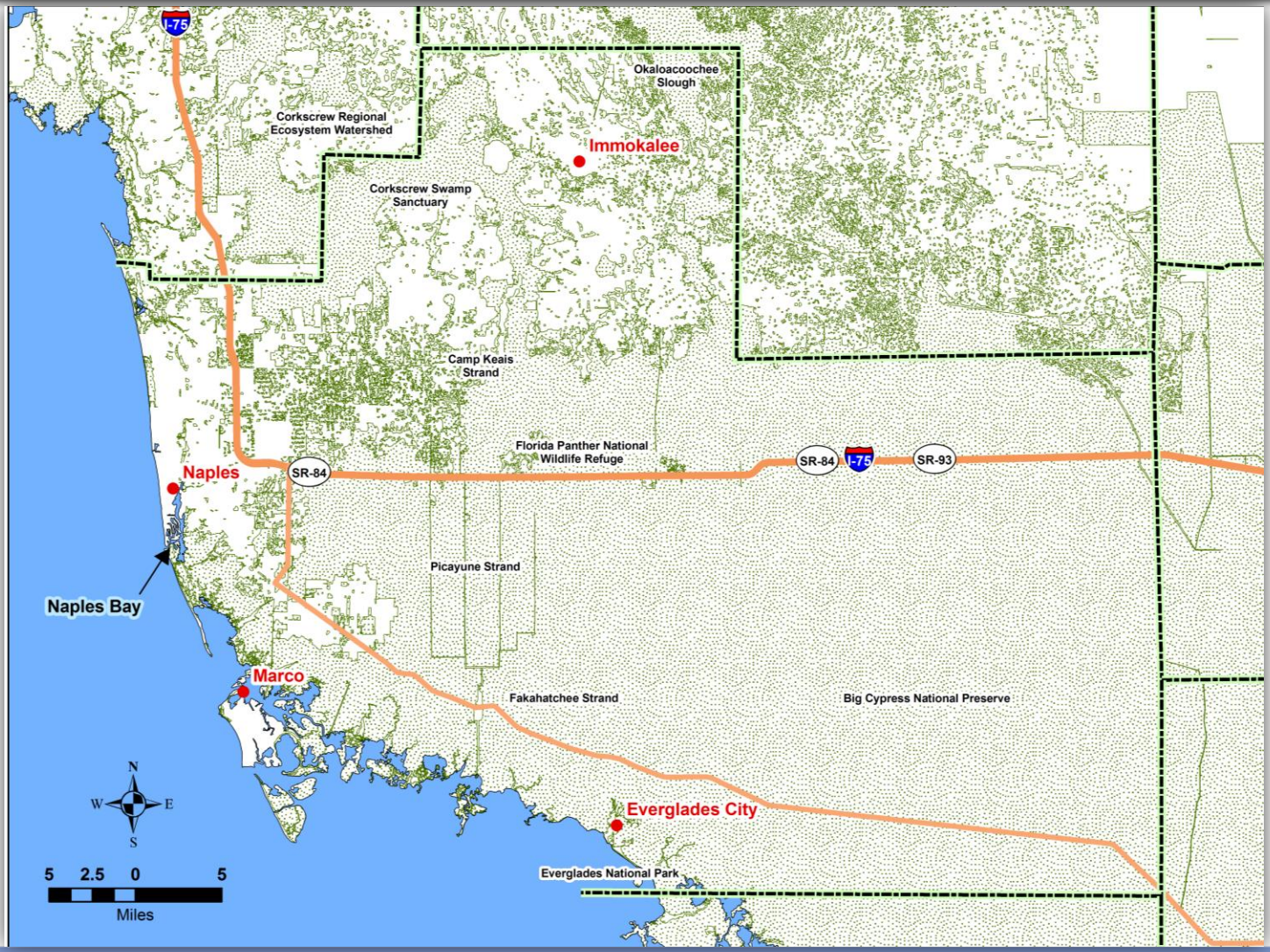
SEPT

OCT

NOV

DEC

# Natural Systems



# Water Source Options

Conservation

Reclaimed Water

Fresh Groundwater

Aquifer Storage & Recovery

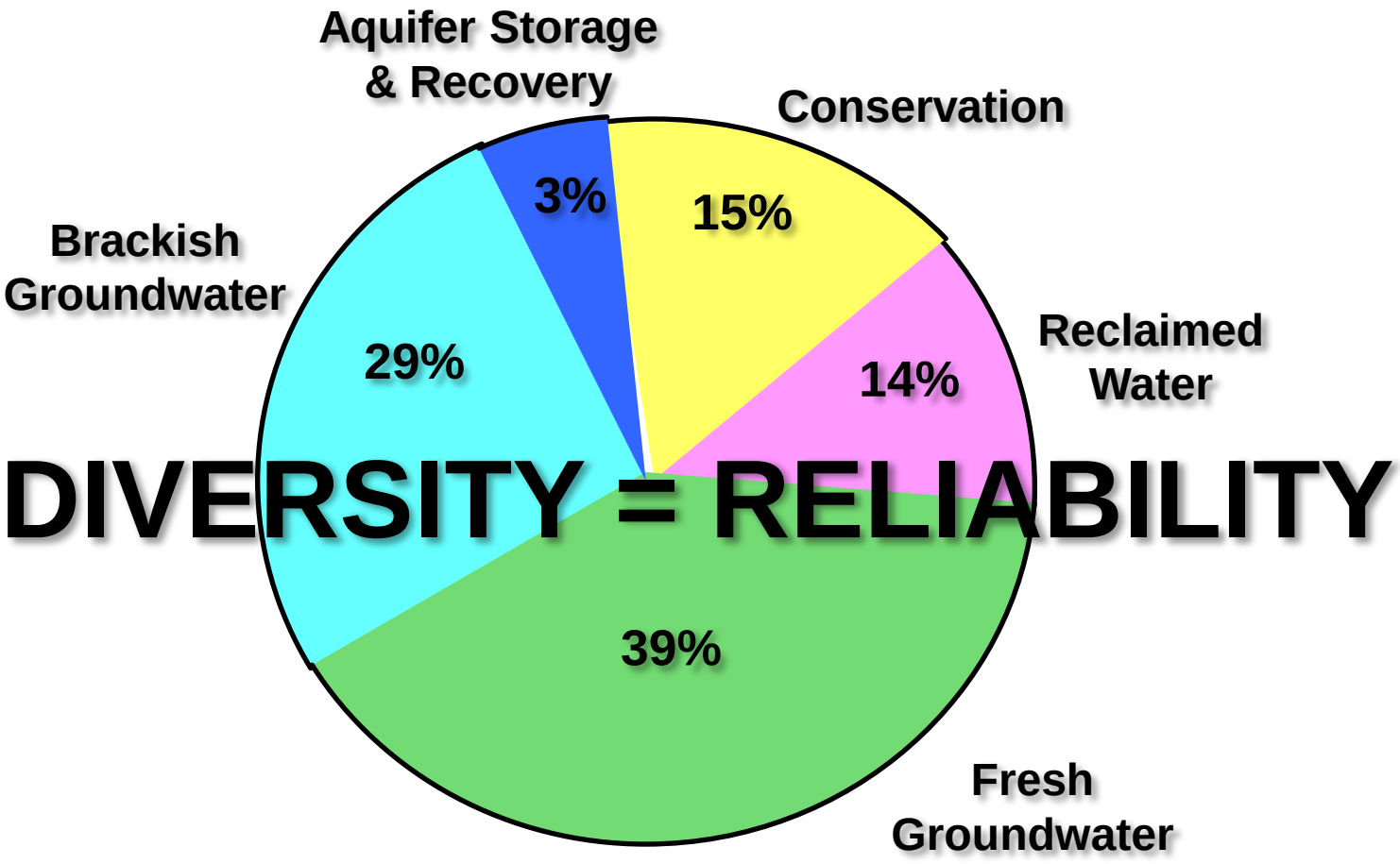
Reservoirs

Surface Water

Brackish Groundwater

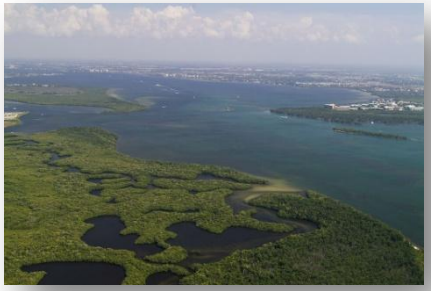
Seawater

# Integrated Water Supply Portfolio Example



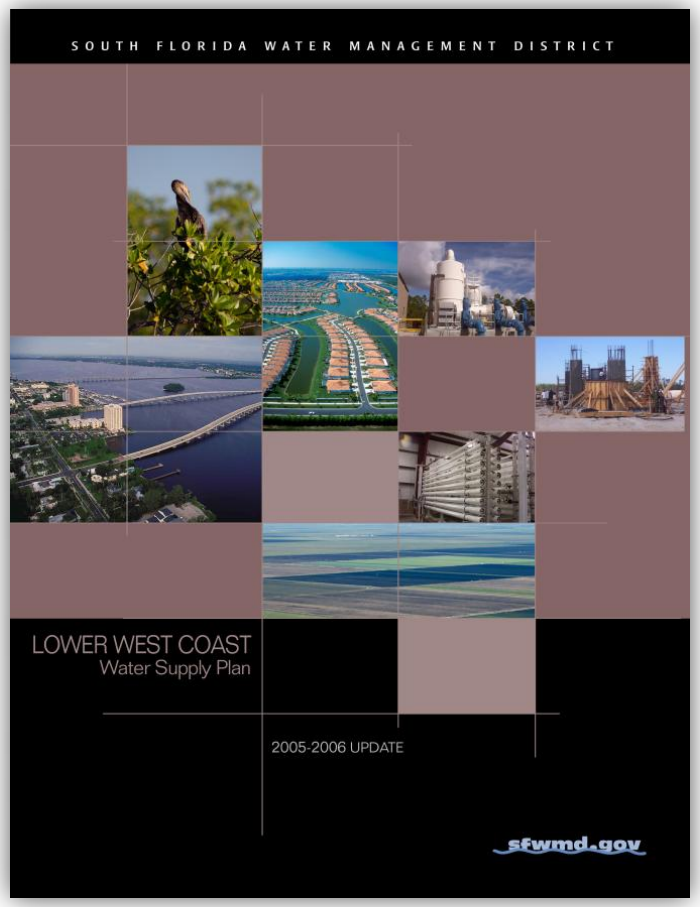
# 2006 LWCWSP Water Supply Issues

- Increases in withdrawals from fresh water aquifers limited
  - Wetlands
  - Salt water intrusion
  - Aquifer protection



- Surface water availability (storage) limited
- Freshwater discharges affecting health of coastal resources
  - Timing
  - Volume

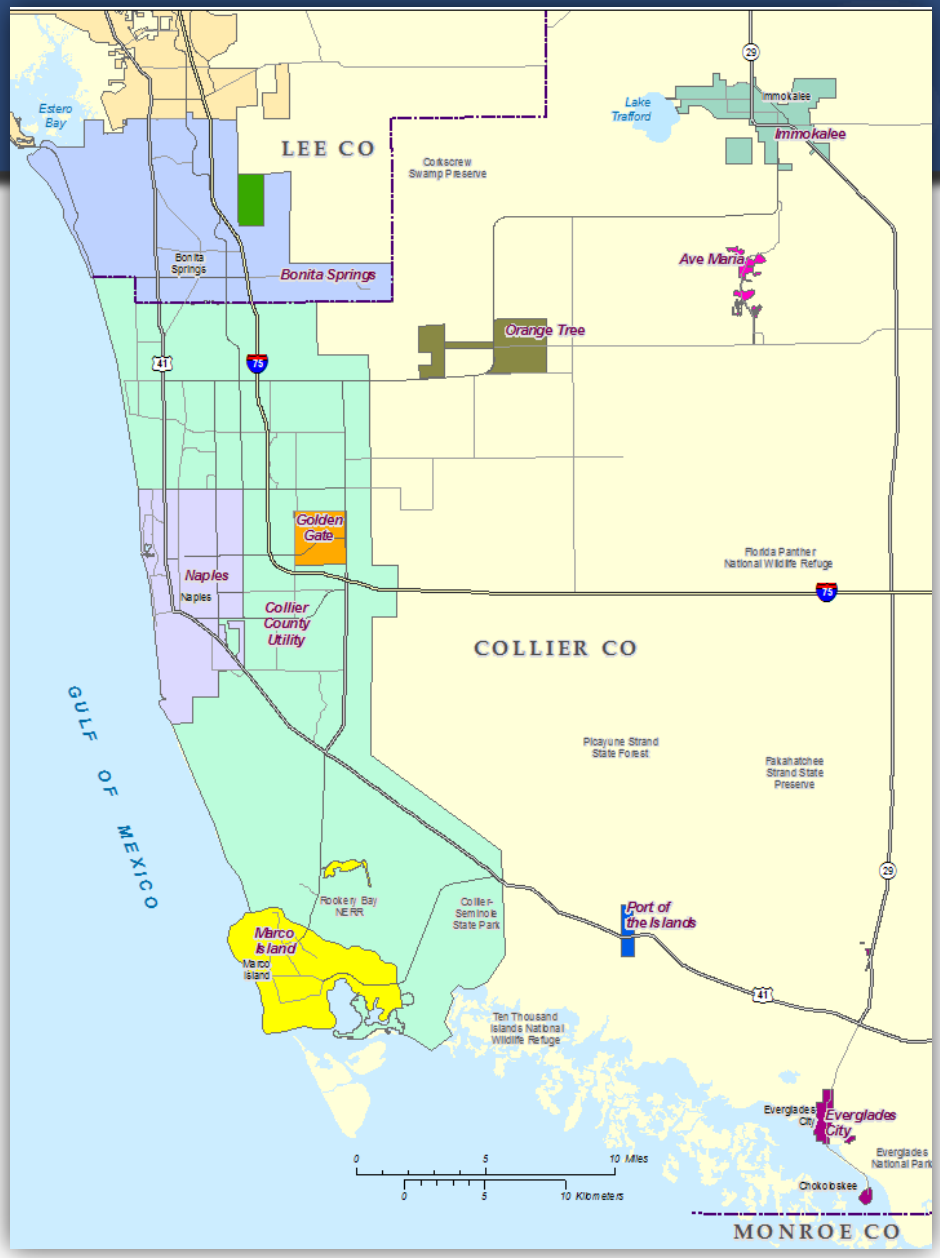
# 2006 Lower West Coast Water Supply Plan



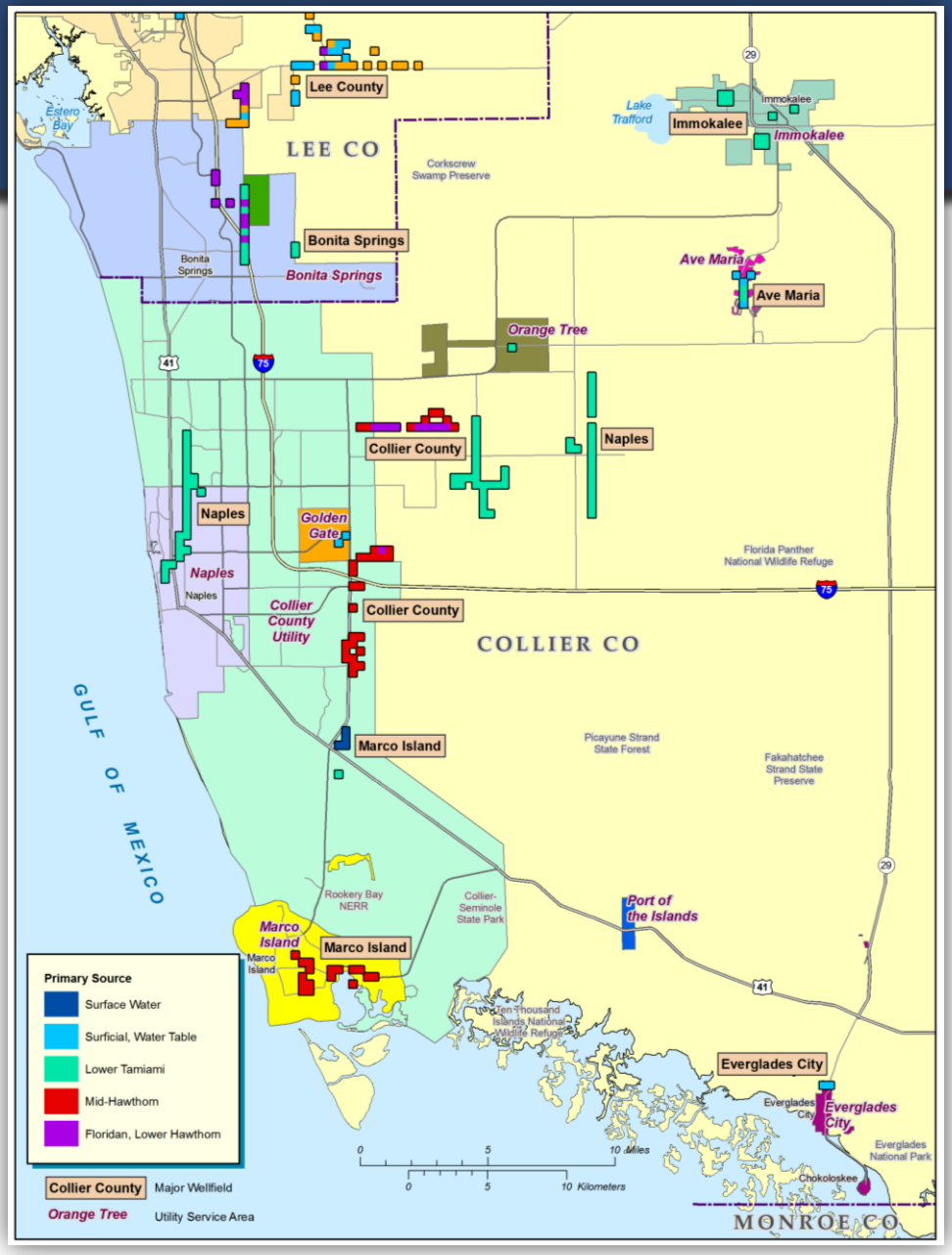

## Plan Conclusion

The needs of the region can continue to be met with appropriate management and diversification of water supply sources through 2025.

- Progress in Big Cypress Basin
  - 28% of water treatment capacity uses RO to treat brackish water
  - 95% of wastewater using reused
  - Increased ASR storage capacity and ASR testing

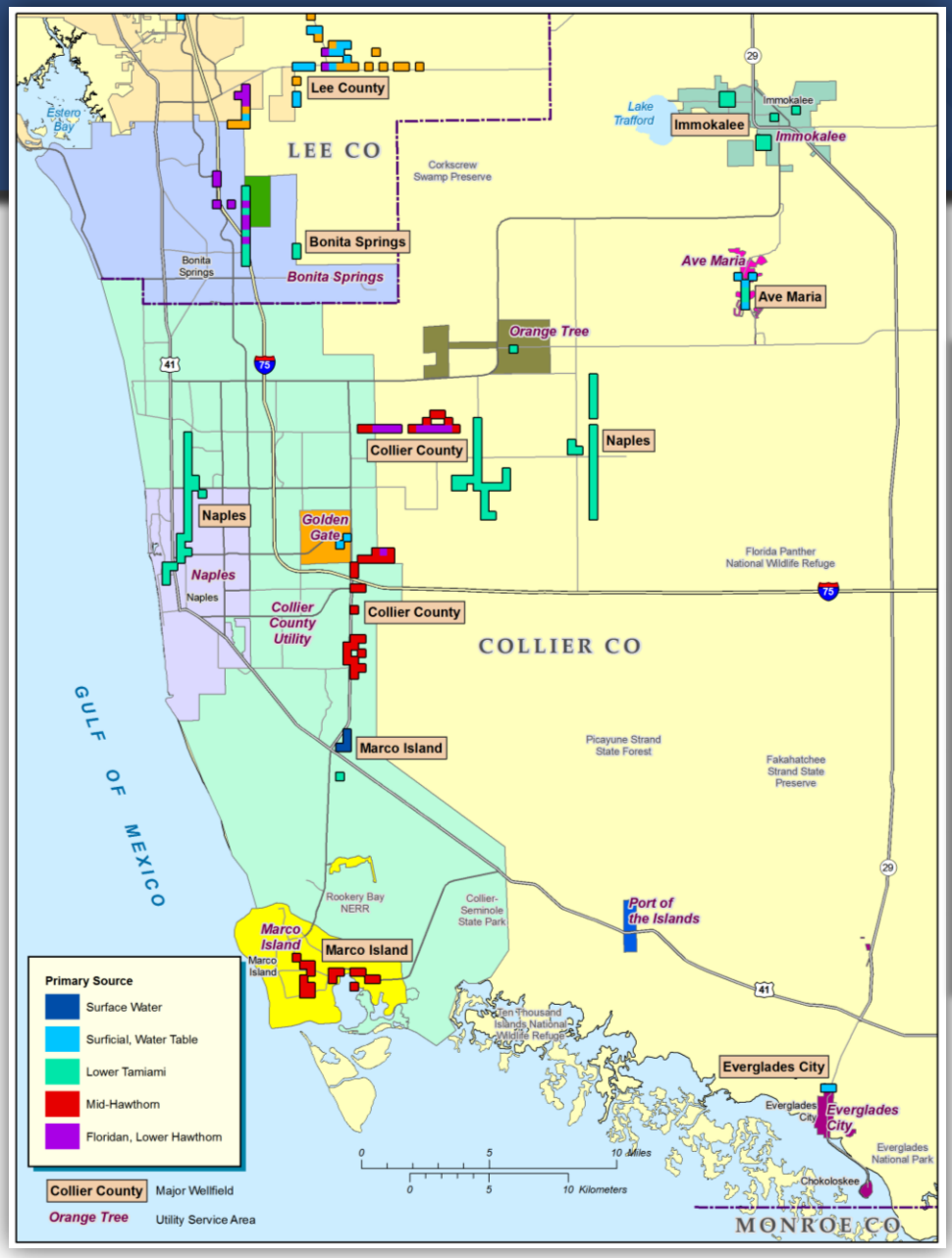



# Collier County - Public Water Supply Service Areas




# Collier County - Public Water Supply Wellfields & Service Areas

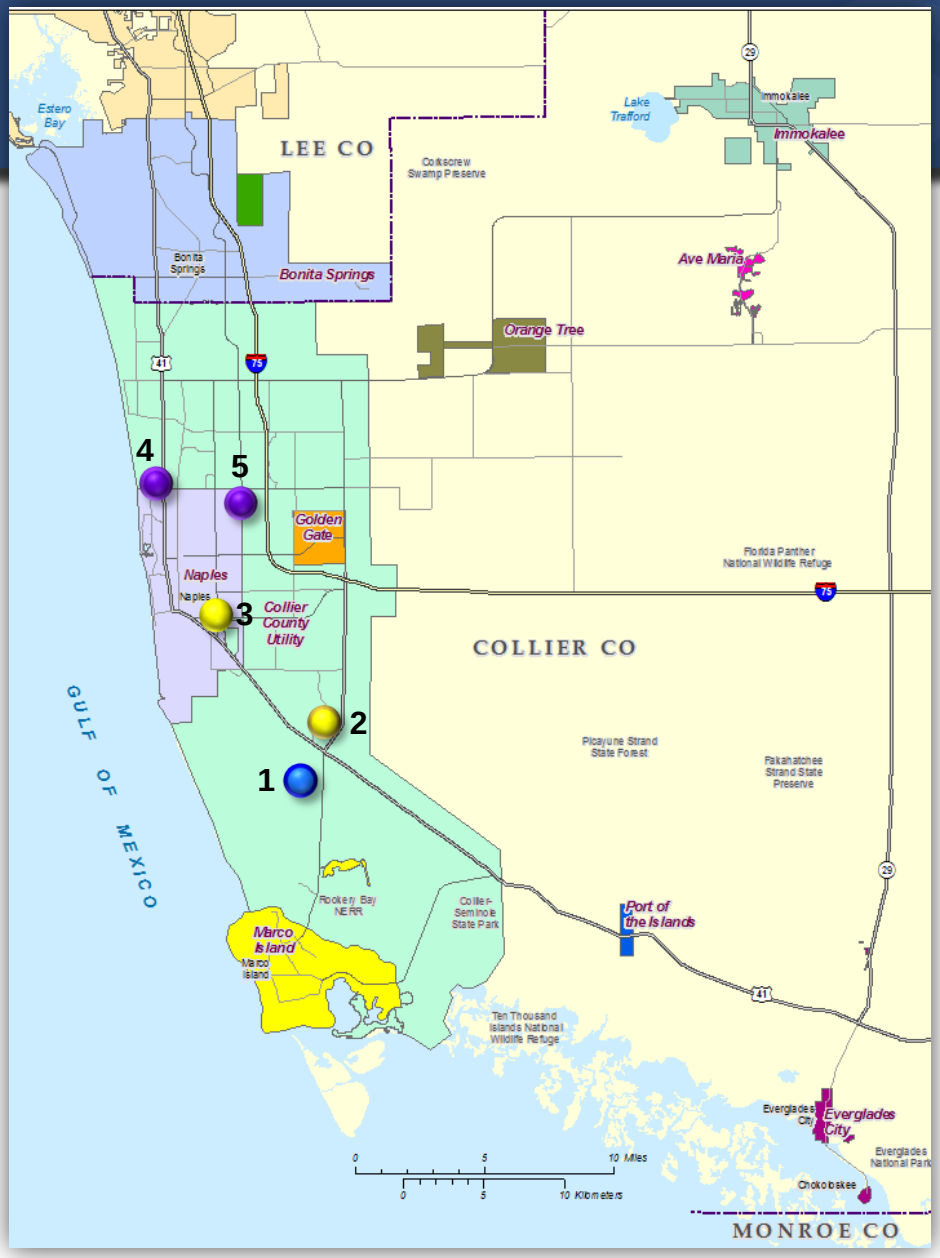
# Selected Collier County Public Water Supply Allocations




| | Average Annual Allocation (MGD) | Exp. Date |
|---|---|---|
| **Collier County** | **56.14** | **3/26** |
| **Naples** | **18.42** | **6/30** |
| **Marco Island** | **12.42** | **2/16** |
| **Immokalee** | **3.36** | **6/10*** |
| **Ave Maria** | **1.26** | **6/11** |

* Renewal application under review

# Collier County - Utility Aquifer Storage & Recovery Systems




1. Collier Co. – Manatee Rd.
2. Marco Lakes
3. Naples*
4. Club Pelican Bay*
5. Collier Co. – Livingston Rd.*

* Under construction/operational testing

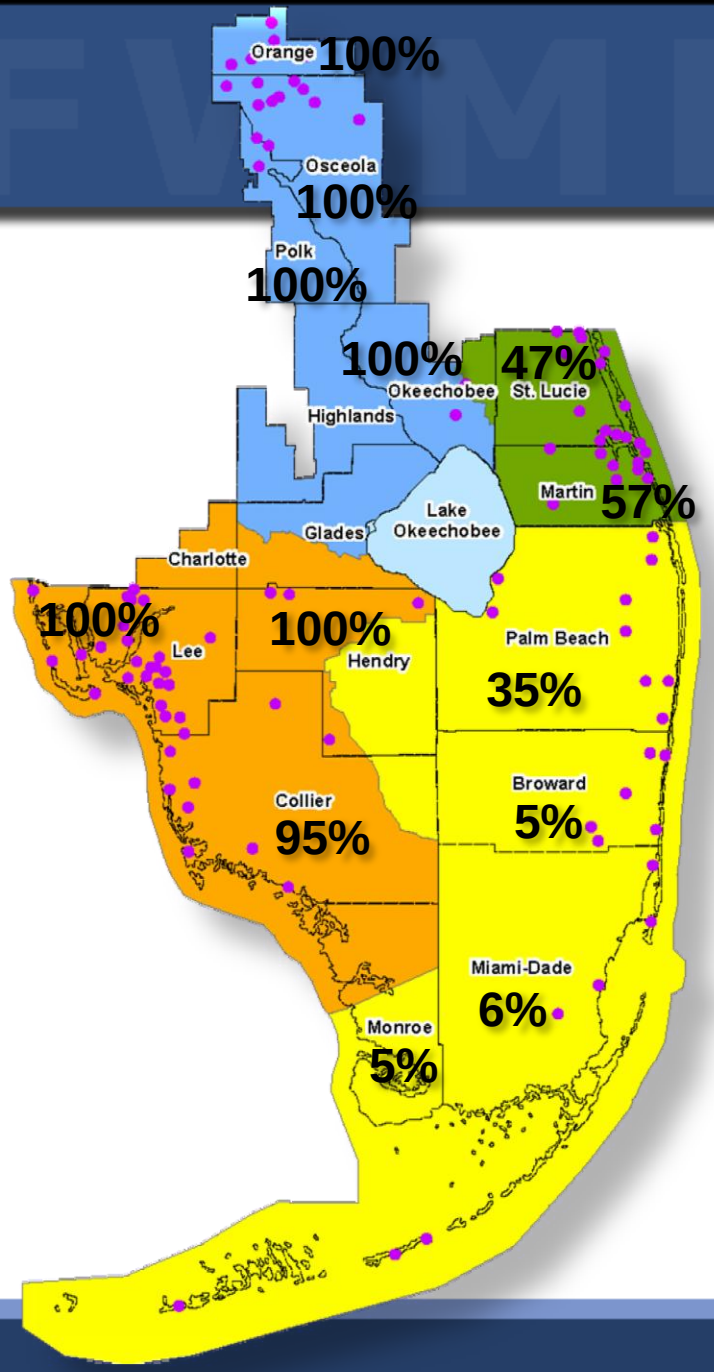
- Potable Water
- Surface Water
- Reclaimed Water

# 2009 Reuse and System Location

% of Wastewater Reused

- Reuse System

Number of Systems: 108
Total Reused: 239 MGD



# Investment in Future (2006 – 2011) Collier County

- BCBB allocated funding $15.7M
  - 37 Projects

- AWS Program allocated funding $10.5M
  - 21 Projects

Total $26.2M

# Conservation

- Reduced impact on water resources
- Reduced wastewater that has to be treated and disposed
- Postpone/negate utility capital expenditures for new infrastructure
- Reduces impact of drought
- Landscape conditioning

*The cheapest gallon of water is the gallon we don't waste*

# Water Supply Plan Update
# Opportunities for Public Participation

- Public meetings through District Water Resources Advisory Commission Issues Workshops
- Presentations to local governments
- One-on-one meetings and discussions with stakeholders
- Meetings with Southwest Florida Regional Planning Council
- Coordination with other WMDs, where appropriate

# Water Supply Plans
# Importance to Local Governments

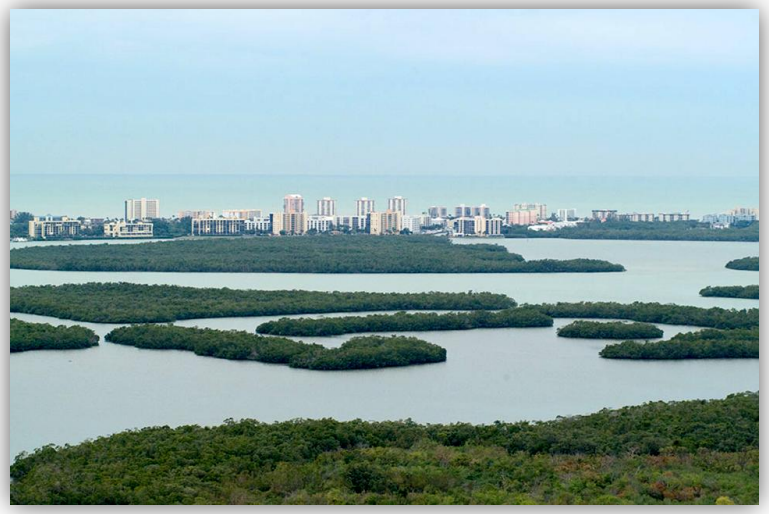
- Input used in the LWC Water Supply Plan
- Legislative mandate for Facilities Work Plan to be completed by local governments and submitted to the Department of Community Affairs (DCA) 18 months after plan is approved
  - Facilities Work Plan must demonstrate sufficient water supply for at least next 10 years
  - Water supply can be met with projects and/or conservation

# Collier County Utilities

- 40.1 MGD Reclaimed Water Production Capacity
  - 12.28 MGD reuse in 2010
- 52 MGD water treatment capacity
  - 28 MGD brackish water (RO) treatment
  - 24 MGD fresh water treatment
- 2 Aquifer Storage & Recovery Wells
  - 1 – Surface water
  - 1 – Reclaimed water

# Naples Utilities

- 10 MGD Reclaimed Water Production Capacity
  - 4.65 MGD reuse in 2010
- 24 MGD fresh water treatment
  - 2 Wellfields – East Golden Gate; Coastal
- Aquifer Storage & Recovery wells under development
  - 1 – Surface water



# Marco Island Utilities

- 3.5 MGD Reclaimed Water Production Capacity
  - 1.46 MGD reuse in 2010
- 12.7 MGD water treatment capacity
  - 6 MGD brackish water (RO) treatment
  - 6.7 MGD fresh water treatment
- 7 Aquifer Storage and Recovery wells (10.5 MGD)
  - Surface water

# Questions

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

# Water Supply Planning Modeling in Big Cypress Basin

**Jayantha Obeysekera (Obey)**
**Director, Hydrologic & Environmental Systems Modeling Department**

**Big Cypress Basin Board Water Supply Workshop**
**February 25, 2011**

# Modeling Support to BCB

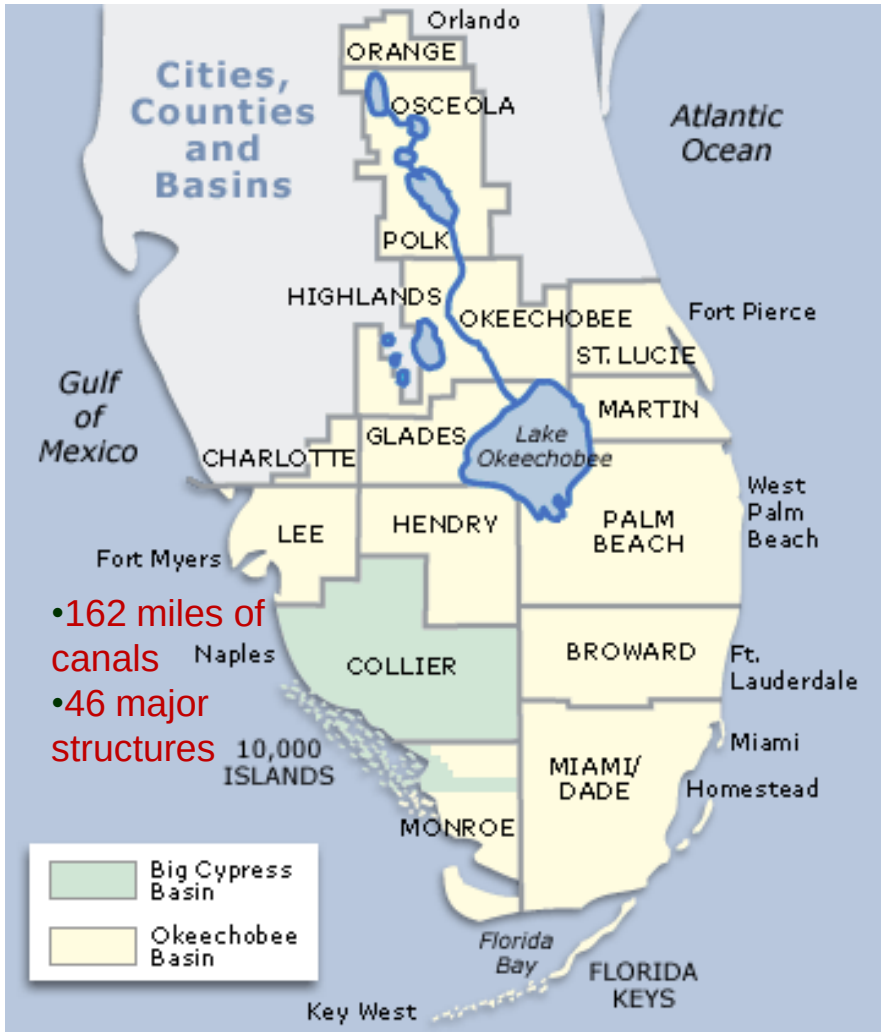
Goal

- To provide technically sound modeling for hydrologic-hydraulic assessment of short and long range planning, construction and operation of BCB projects

Success Indicators

- Compliance with industry standards and best practices
- Successful application of state-of-the-art modeling tools

# Modeling Support (cont.)




## Strategies

- Continuously improve modeling processes and practices
- Develop, maintain, and apply a suite of modeling tools to address water resource planning and operational issues in the Basin

# Major Water Supply Planning Modeling Efforts

## Subregional Water Supply Modeling Efforts

- Lower West Coast Floridan Aquifer System (LWCFAS) Model (SEAWAT)
- Lower West Coast Surficial Aquifer System Model (MODFLOW)
- A 3-D Finite Difference Ground Water Flow Model of Western Collier County, Florida (MODFLOW) 1992, Bennett

## BCB Initiated Major Modeling Efforts

- BCB Integrated Surface & Groundwater Model (MIKESHE\MIKE11) 2000-current
- BCB Salt Water Intrusion Model (SEAWAT) 2009 – 2010, two phases
- BCB Real-time Hydrologic Monitoring & Modeling System (Floodwatch, MIKESHE\MIKE11) 2008-current

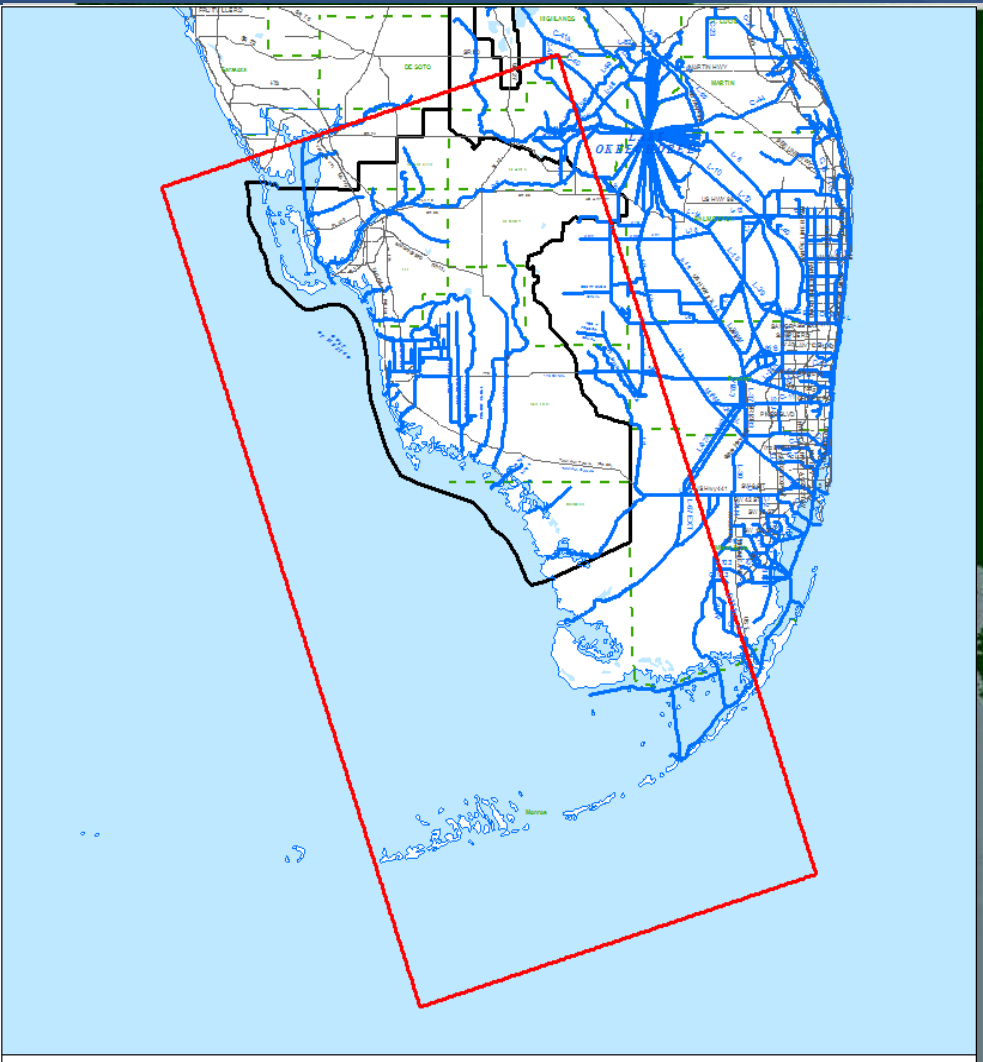
# Subregional Modeling - LWCFAS Model Status

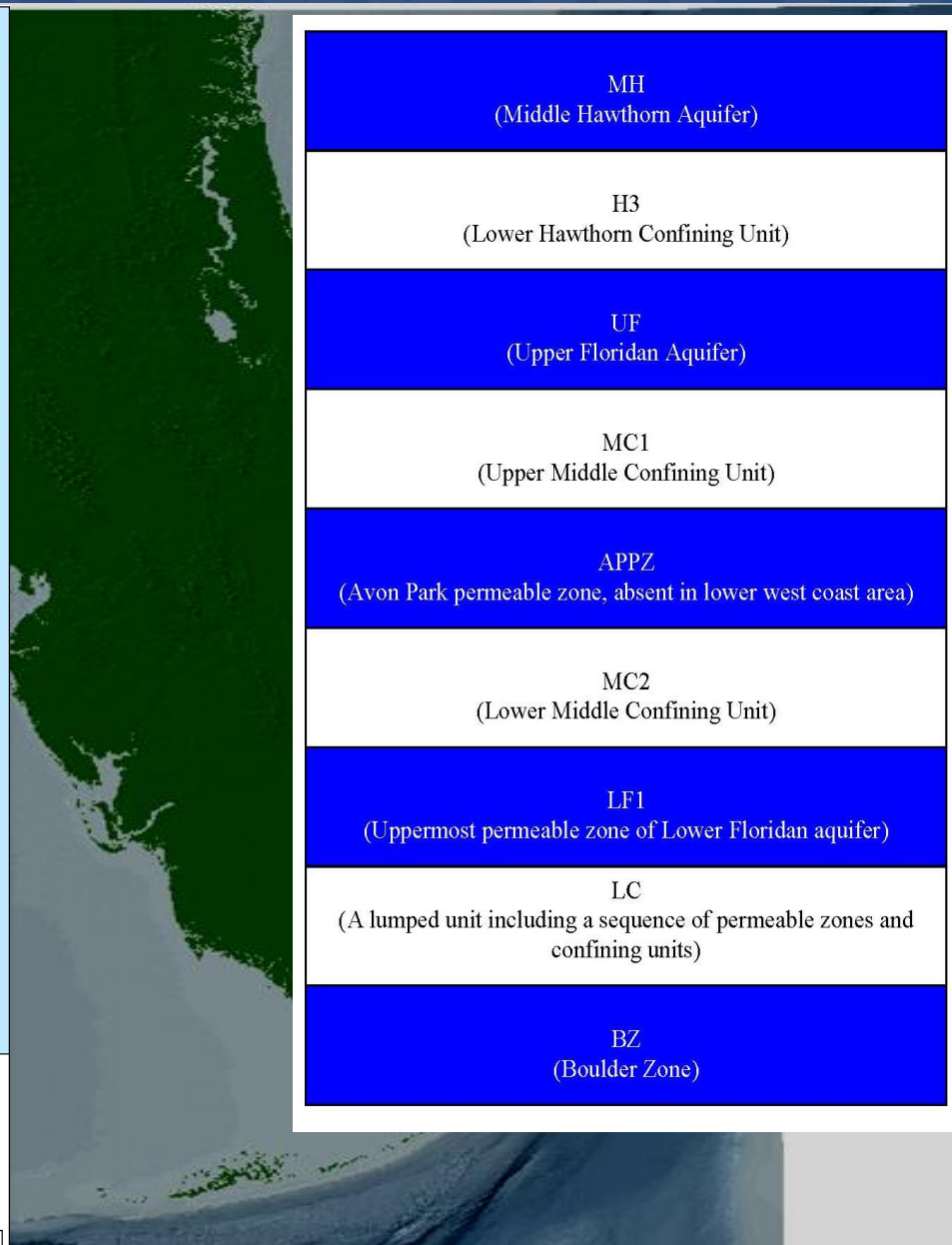
1. Lower West Floridan Aquifer System model (LWCFAS): Phase I (FAU, 2008)
2. Peer review of the LWCFAS model (2008)
3. Implementation of peer review comments on the LWCFAS model (Western Floridan Aquifer System model: Phase II)
    - Quasi-steady state model construction and calibration
    - Transient model calibration (ongoing and will be completed in September, 2011)

# Major Changes in LWCFAS Phase II Model

1. Expanded model domain further to west and to south around the Keys
2. Re-conceptualized the Phase I model by adding recharge into Floridan Aquifer System along northwestern boundary of the model domain
3. Removed Surficial Aquifer System and set up Middle Hawthorn Aquifer as top layer
4. Divided each layer into 2-3 sublayers
5. Calibrated the model to both heads and TDS (total dissolved solids) concentrations

# New Model Domain and Geological Setting



MH
(Middle Hawthorn Aquifer)

H3
(Lower Hawthorn Confining Unit)

UF
(Upper Floridan Aquifer)

MC1
(Upper Middle Confining Unit)

APPZ
(Avon Park permeable zone, absent in lower west coast area)

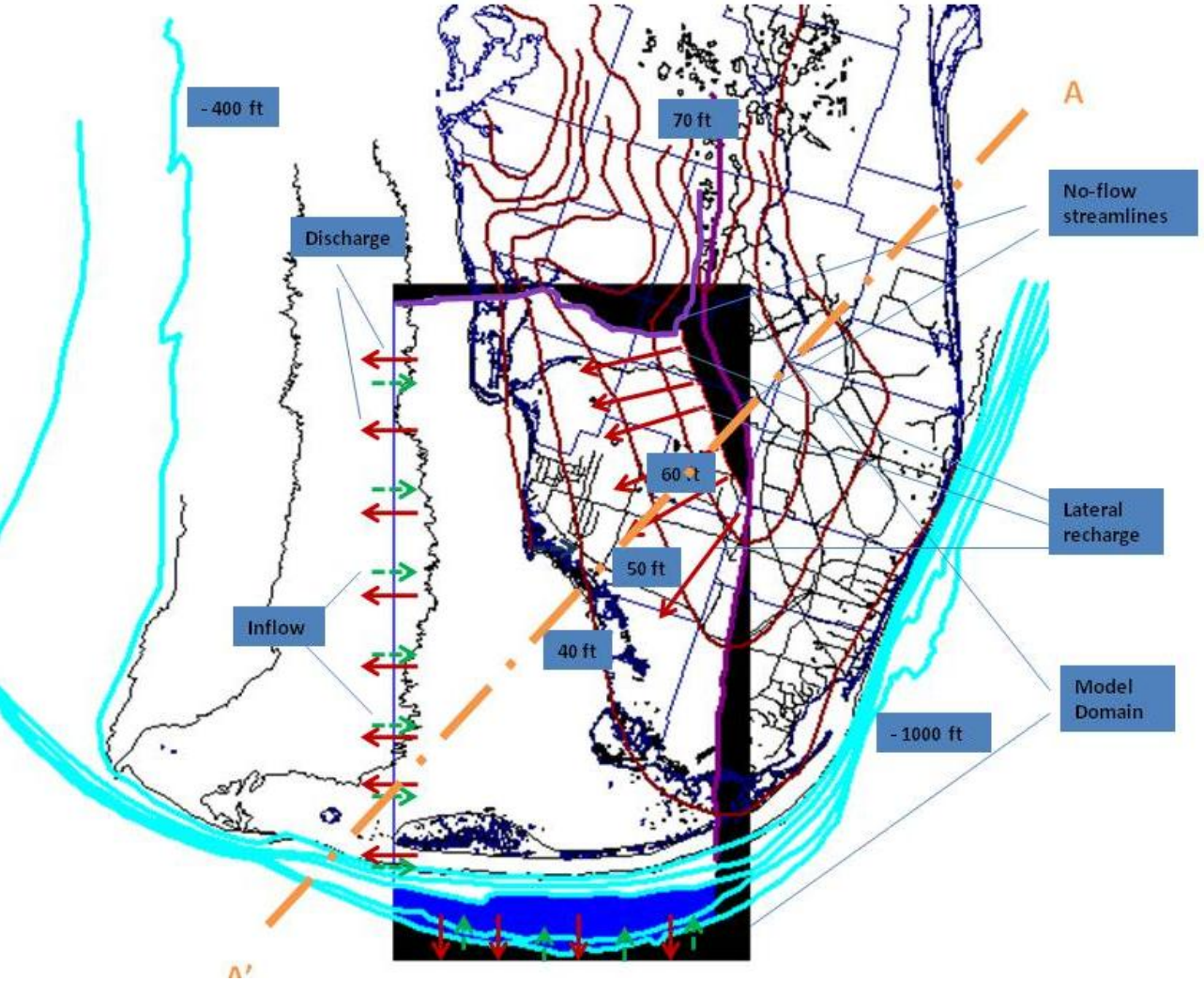
MC2
(Lower Middle Confining Unit)

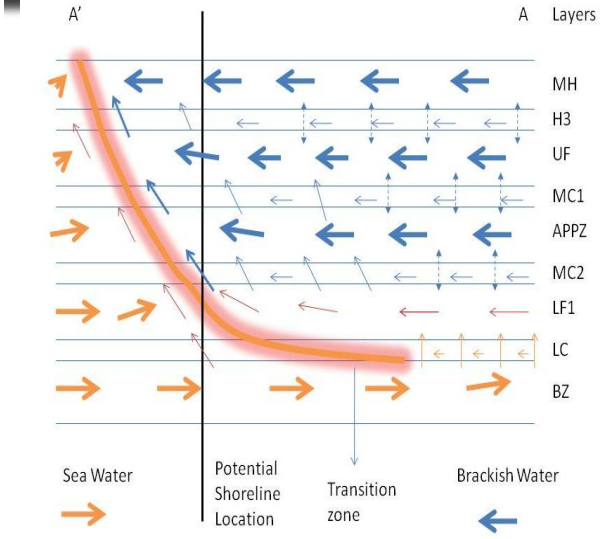
LF1
(Uppermost permeable zone of Lower Floridan aquifer)

LC
(A lumped unit including a sequence of permeable zones and confining units)

BZ
(Boulder Zone)

# New Conceptual Model: Hydrological Settings

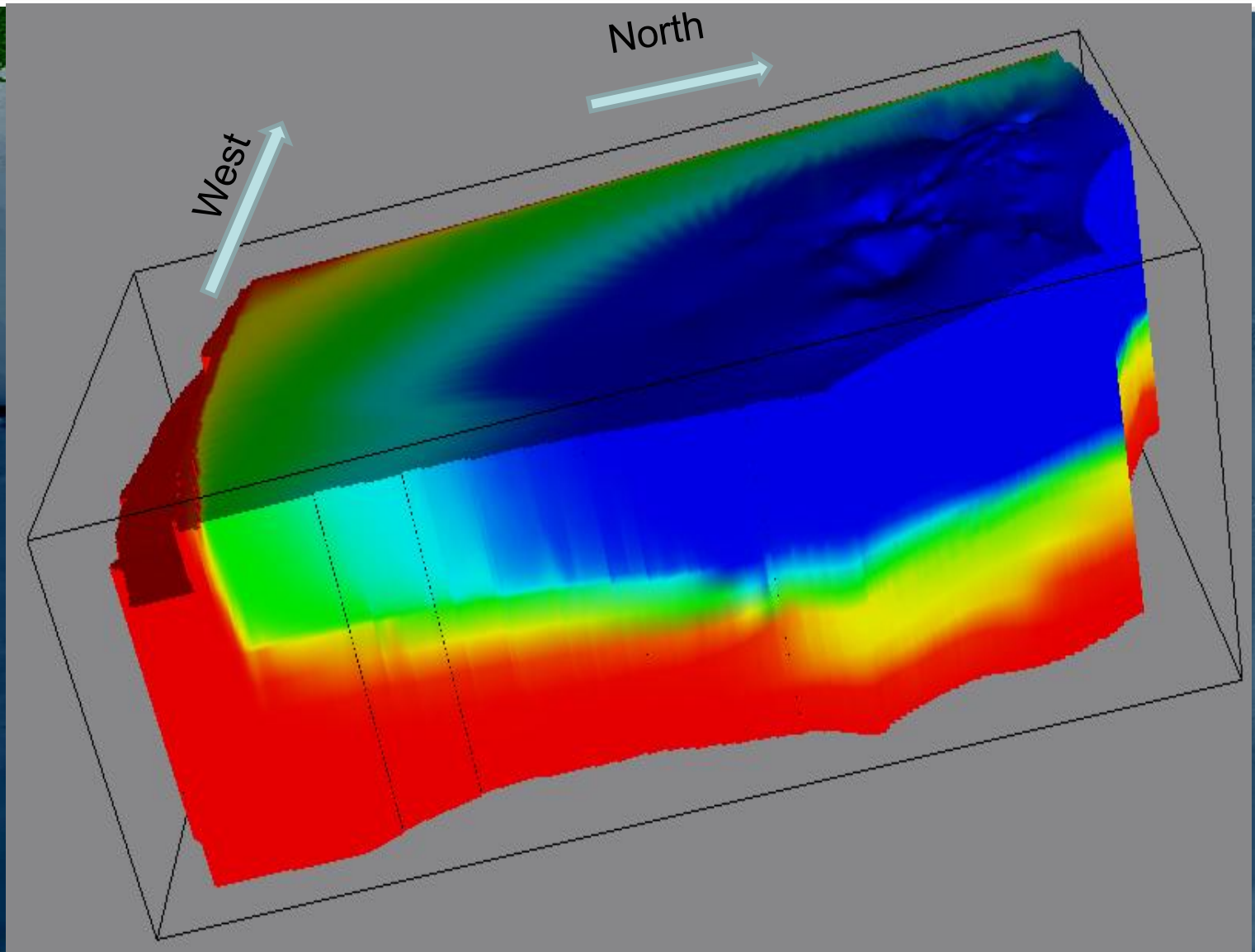


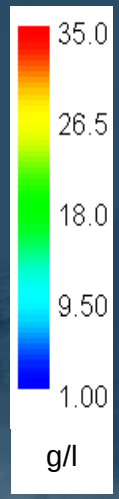





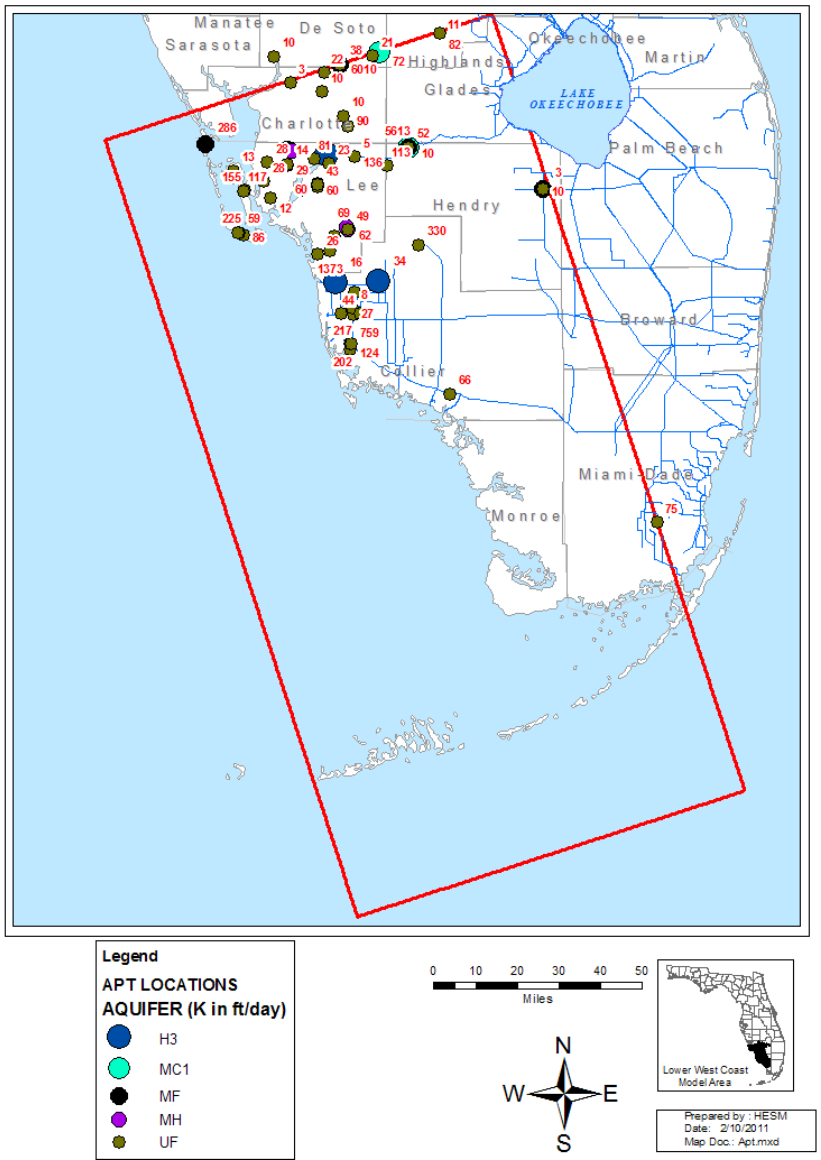

water and seawater

# Steady State Model: 3-D Display of TDS Concentrations



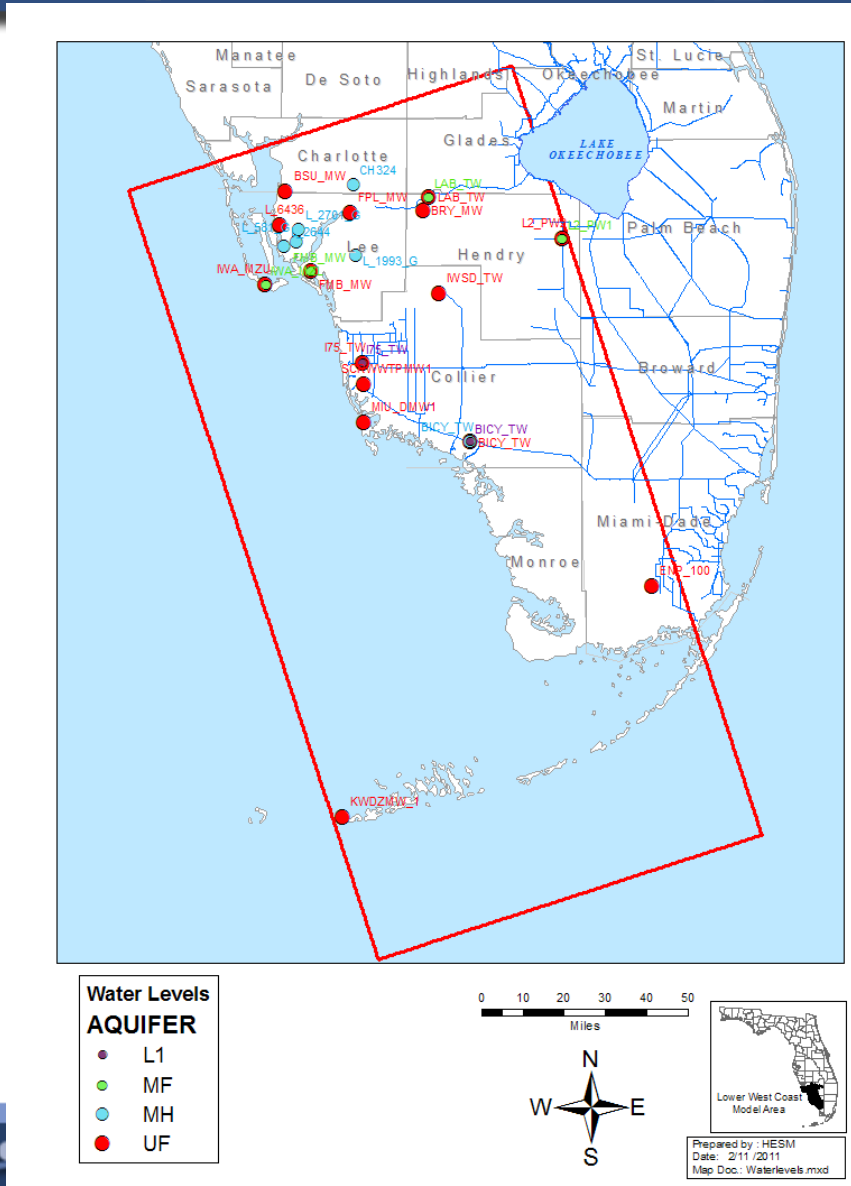



# Available Data and Data Gap: APTs




- APTs (aquifer pump test locations) are located at northern model domain
- Less APTs in deeper aquifers
- Need some APTs in southwestern model domain

# Available and Data Gap: Water Levels (heads)

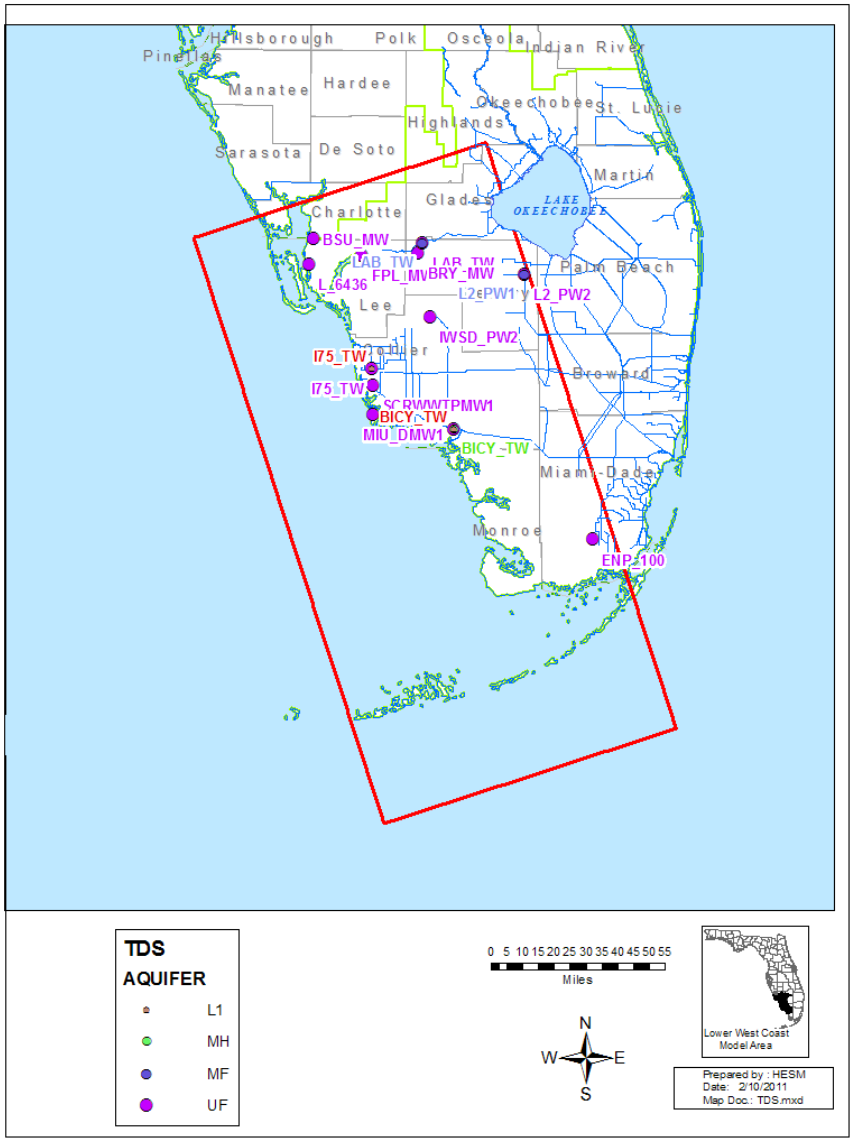



- Most water level data (heads) are for the northern domain (USGS wells are not included)

- Less water level data for the deeper aquifers

- Need some water levels, especially off west coastline to define model flow western boundary

# Available and Data Gap: Water Quality




- Limited water quality data (TDS and/or Chloride) is available only for the northern domain (USGS wells excl)
- Less water quality data in deeper aquifers
- Need water quality data, especially off western coastline to define model concentration western boundary

# Other Data Gaps:

- There is very limited flow measurement into and out of the modeled system. Recharge flux into the modeled system from northwestern corner is subject to calibration.

- No-flow boundary along eastern groundwater divide may continue to be a problem, since it seasonally moves eastward and westward.

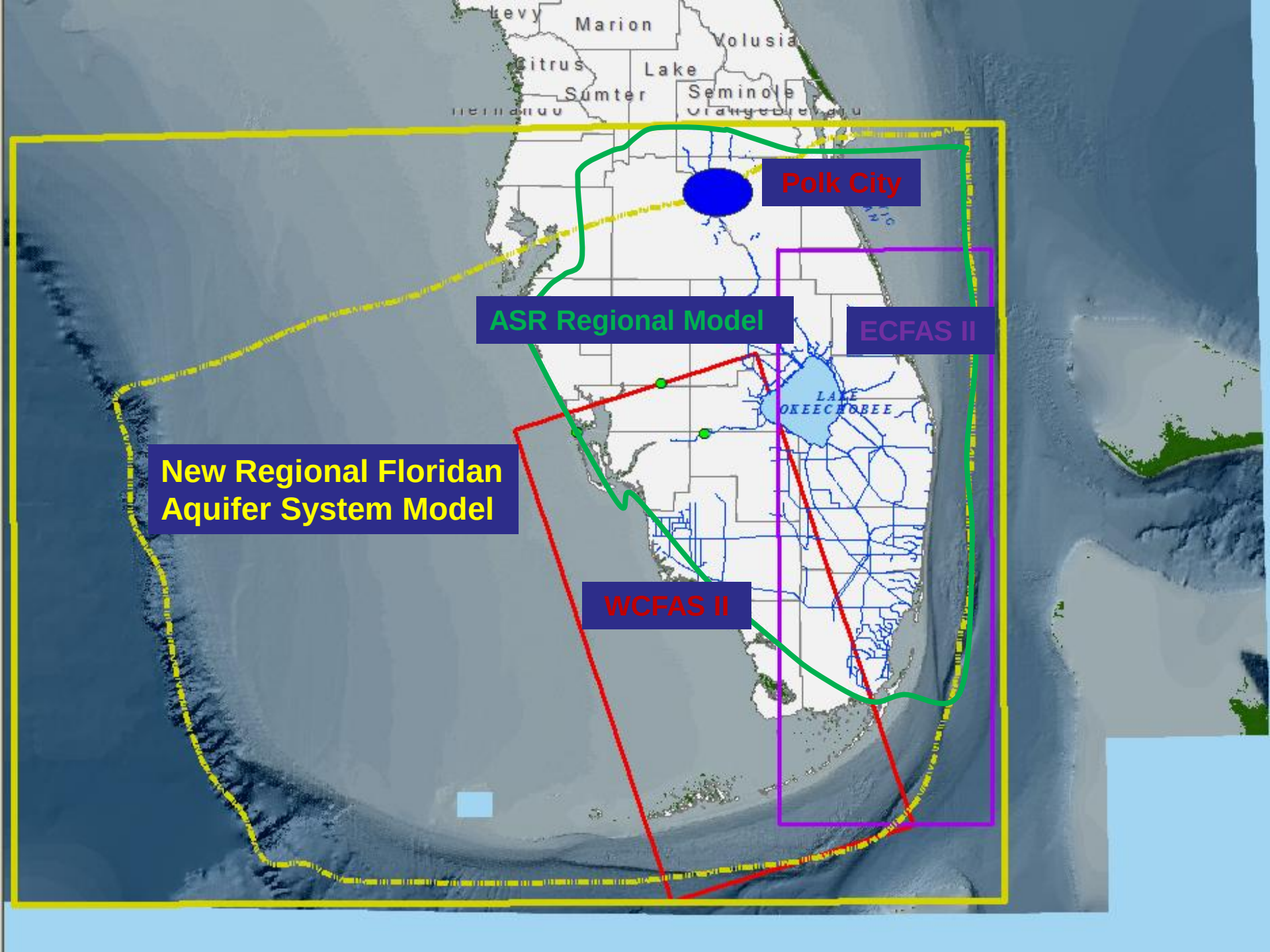
- More top and bottom surface elevation data is needed to better interpolate layer elevations, especially in the area west and south of the shoreline.

# Ten-Year Model Improvement Plan

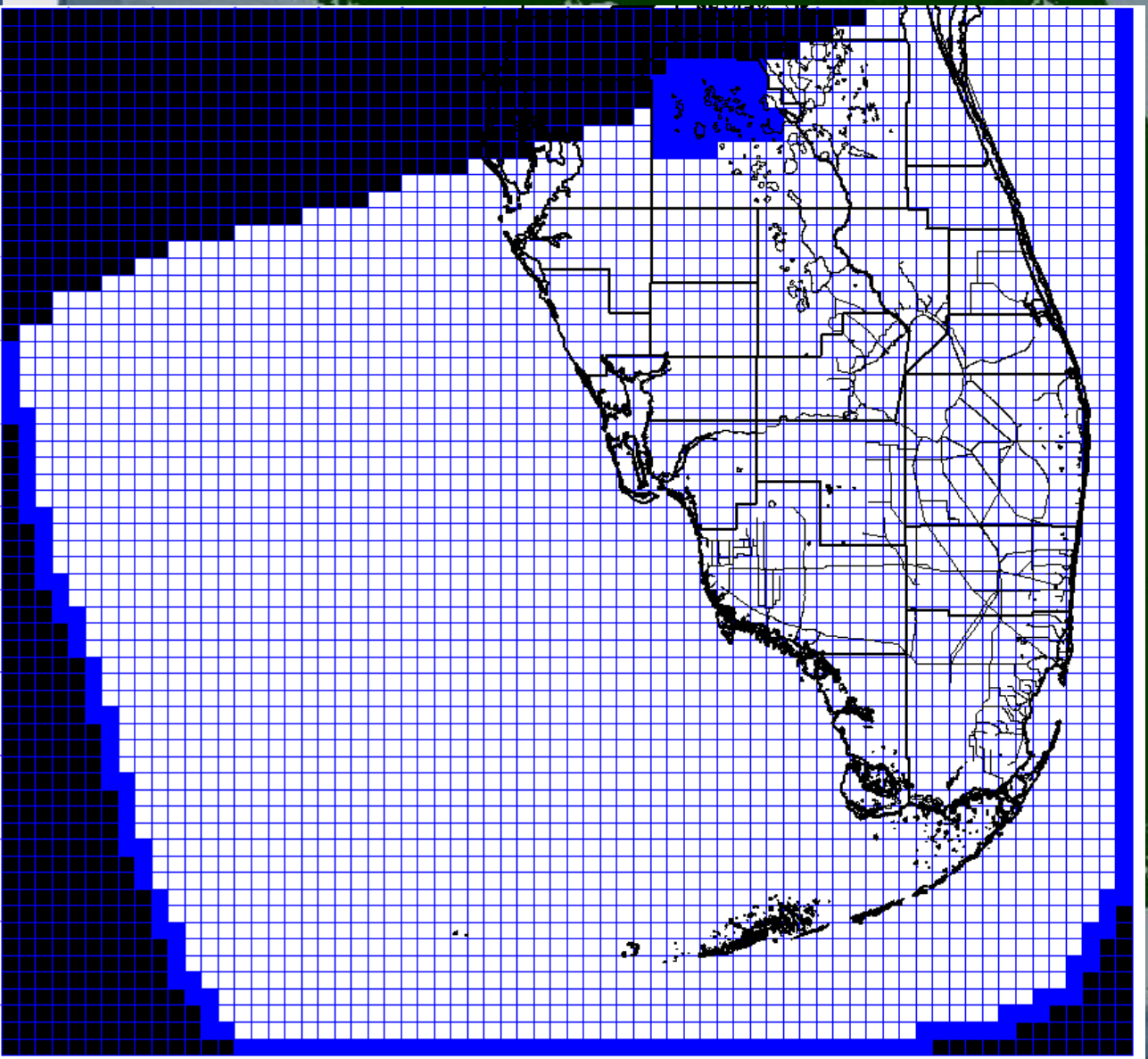
10-Year Strategic Plan to improve quality of groundwater models is underway with the objective of identifying methods and funding necessary to acquire data and tools to improve all District Models.

# Short Term Goals to Fill Data Gaps

- Find water levels and water quality data off shoreline and in the southwestern part of model domain from other sources such as oil fields an published documents
- Calibrate recharge into the modeled system and compare it with the estimated from flow-net.
- Re-evaluate no-flow boundary along eastern groundwater divide using some other regional models such as ASR regional model.


Levy
Marion
Volusia
Citrus
Lake
Sumter
Seminole
Polk City
ASR Regional Model
ECFAS II
LAKE OKEECHOBEE
New Regional Floridan Aquifer System Model
WCFAS II

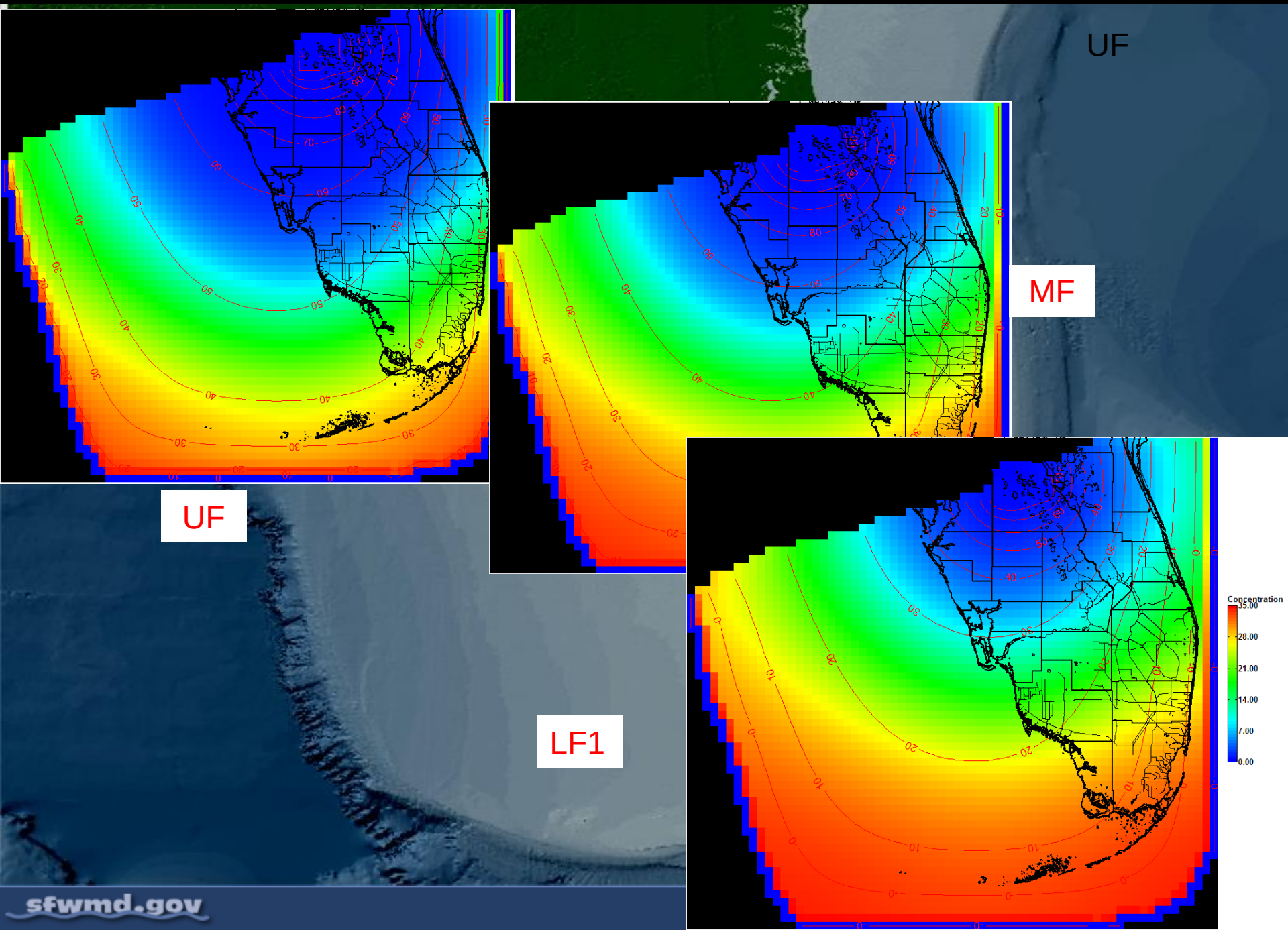
# A Demo



"Current" Condition

Boundary Condition: 0 ft, 35 mg/l TDS

Recharge: from Polk county recharge area

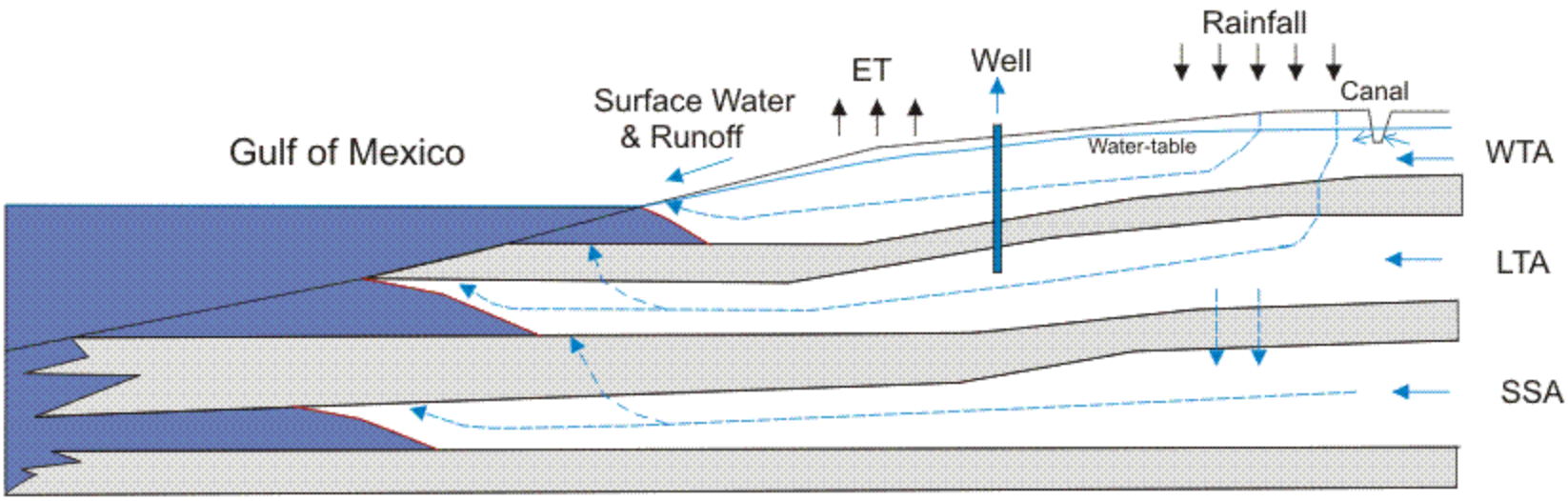

UF
MF
UF
LF1
Concentration
35.00
28.00
21.00
14.00
7.00
0.00
sfwmd.gov

# BCB Initiated Major Modeling Efforts

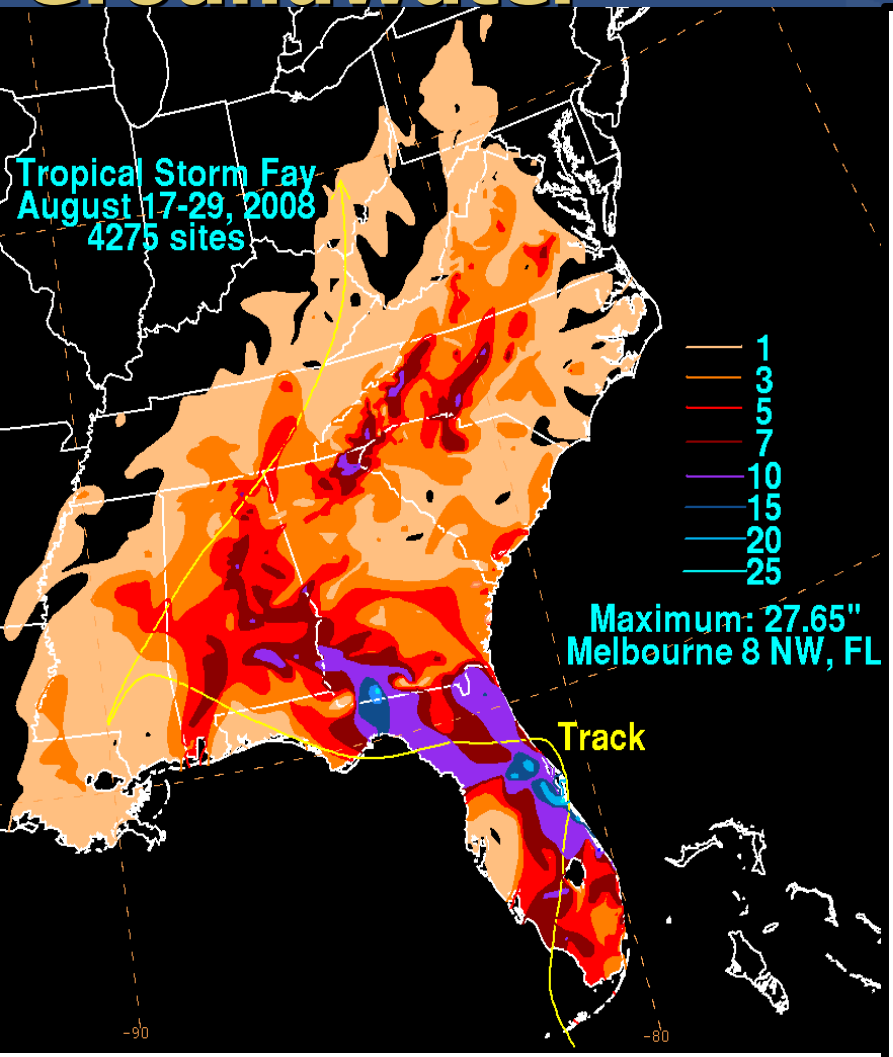
- BCB Integrated Surface & Groundwater Model (MIKESHE\MIKE11) 2000-current

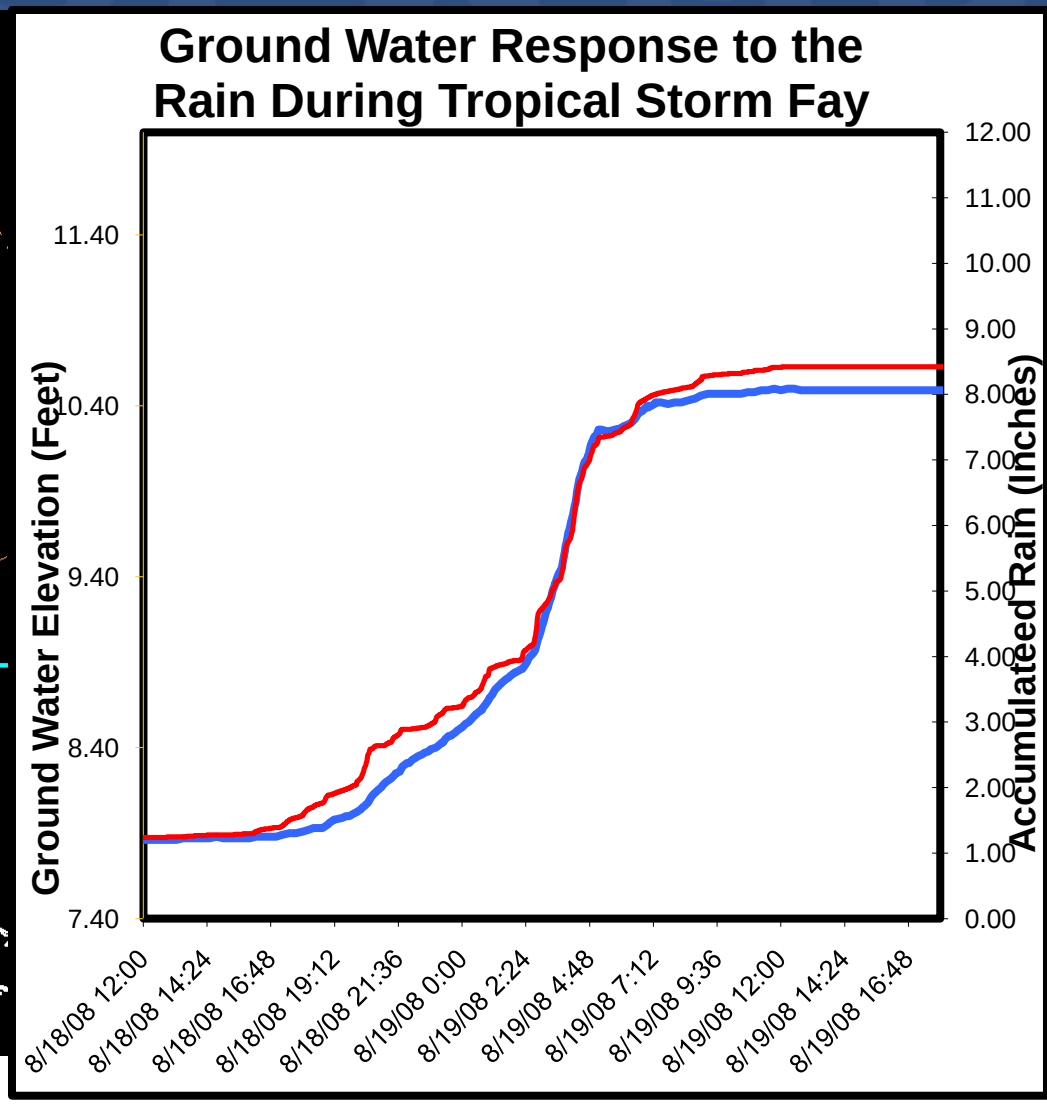
- BCB Salt Water Intrusion Model (SEAWAT)
  2009 – 2010, two phases
- BCB Real-time Hydrologic Monitoring & Modeling System (Floodwatch, MIKESHE\MIKE11)
  2008-current

# West Coast Conceptual Model



# Integrated Process of Surface Water & Groundwater



# BCB Integrated Surface & Groundwater Model (BCB Watershed Management Model)

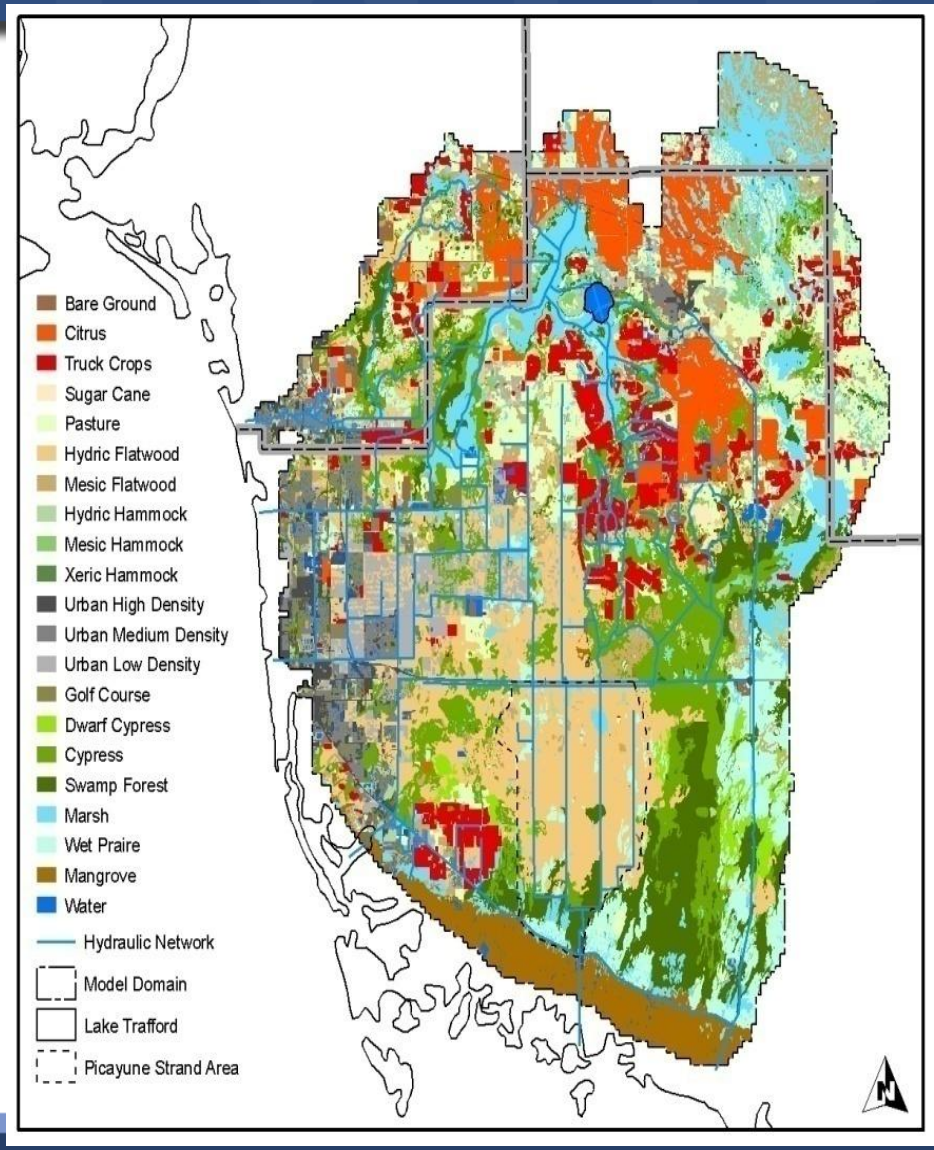
- Developed in 2000
- Integrated Surface & Groundwater
- Cover 1,200 sq. miles
- Grid 1500' by 1500', total 15,060 cells

Main Components

- Overland flow
- Evaportranspiration
- Channel flow
  - 170 miles primary canal
  - 41 control structures
  - 150 culverts & bridges
- Unsaturated groundwater flow
- Saturated groundwater flow

(3 major water supply geologic layers)

- Water use ( Public water supply agriculture, domestic use)



# Applications of BCB MIKESHE Model

- Picayune Strand Restoration Project including Water Reservations Rule formulation
- BCB Capital Improvement Projects
  1. FU#4 (2003)
  2. Corkscrew Canal Improvement Plan(2004)
  3. GG#2 (2006)
  4. GG#3 (2008)
  5. GG#6&7 (2010)
  6. Miller#3 Retrofit (2011)

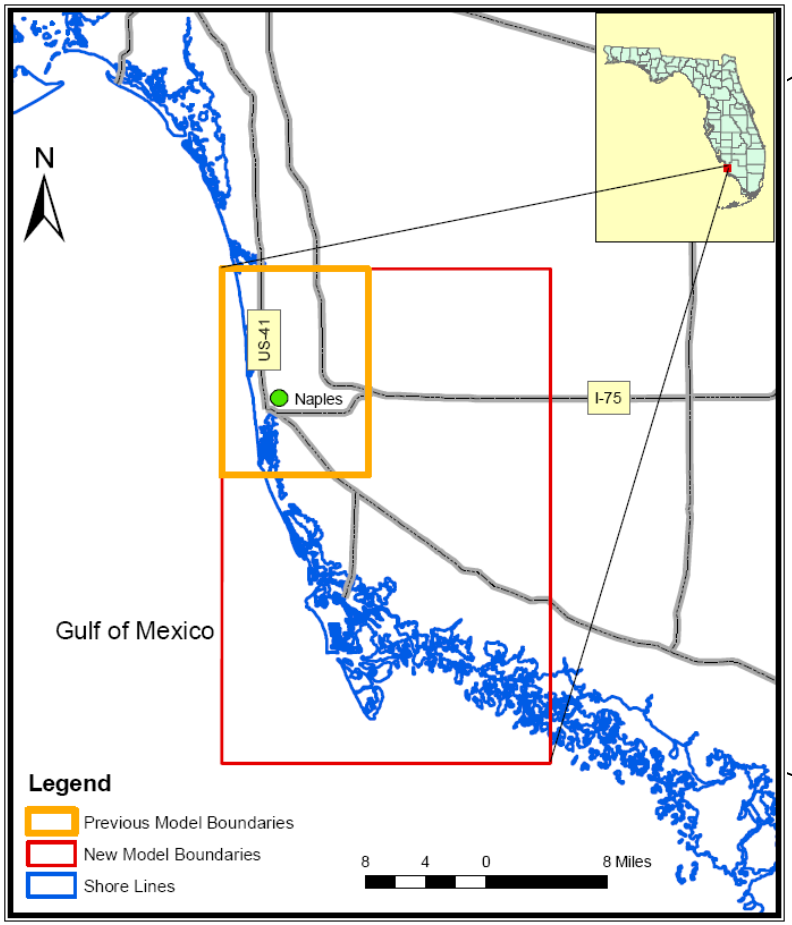
# Challenges of BCB MIKESHE Model

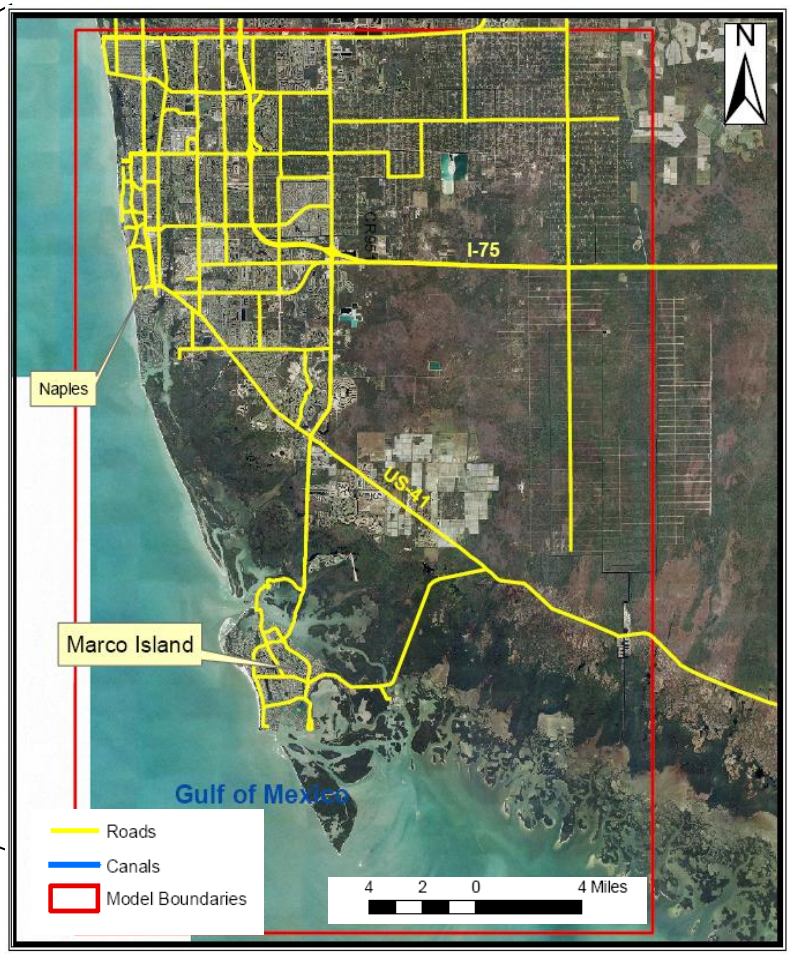
- Lost many monitoring wells due to road / urban development
- Lack reliable self supplied domestic water use data
- Lack reliable agriculture water use data
- Lack  adequate surface water flow monitoring data
- Need better quality control of groundwater monitoring data

# BCB MIKESHE Model Improvement

- Model has recently been updated as a part of Collier County Watershed Management Plan with
  1. New Topography data
  2. Inclusion of Secondary Canal System
  3. Extend Model Domain to Gulf of Mexican
- District will conduct technical peer review on the improved Model & Calibration Report in FY11

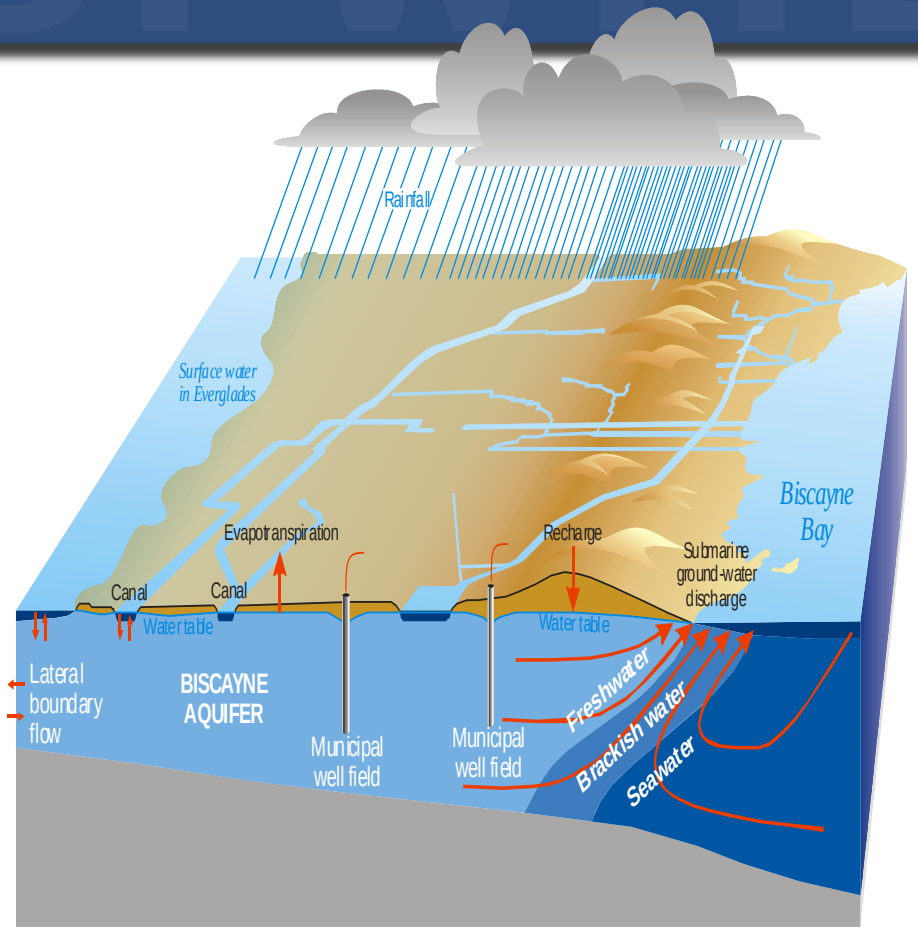
# BCB Salt Water Intrusion Modeling – 2 Phases



# BCB Salt Water Intrusion Modeling

- Developed a variable density flow model using the USGS SEAWAT Model for the surficial aquifer system in the west coastal area of Collier County
- Use the model to study the potential Saltwater Intrusion problem In the Collier County (saltwater encroachment)

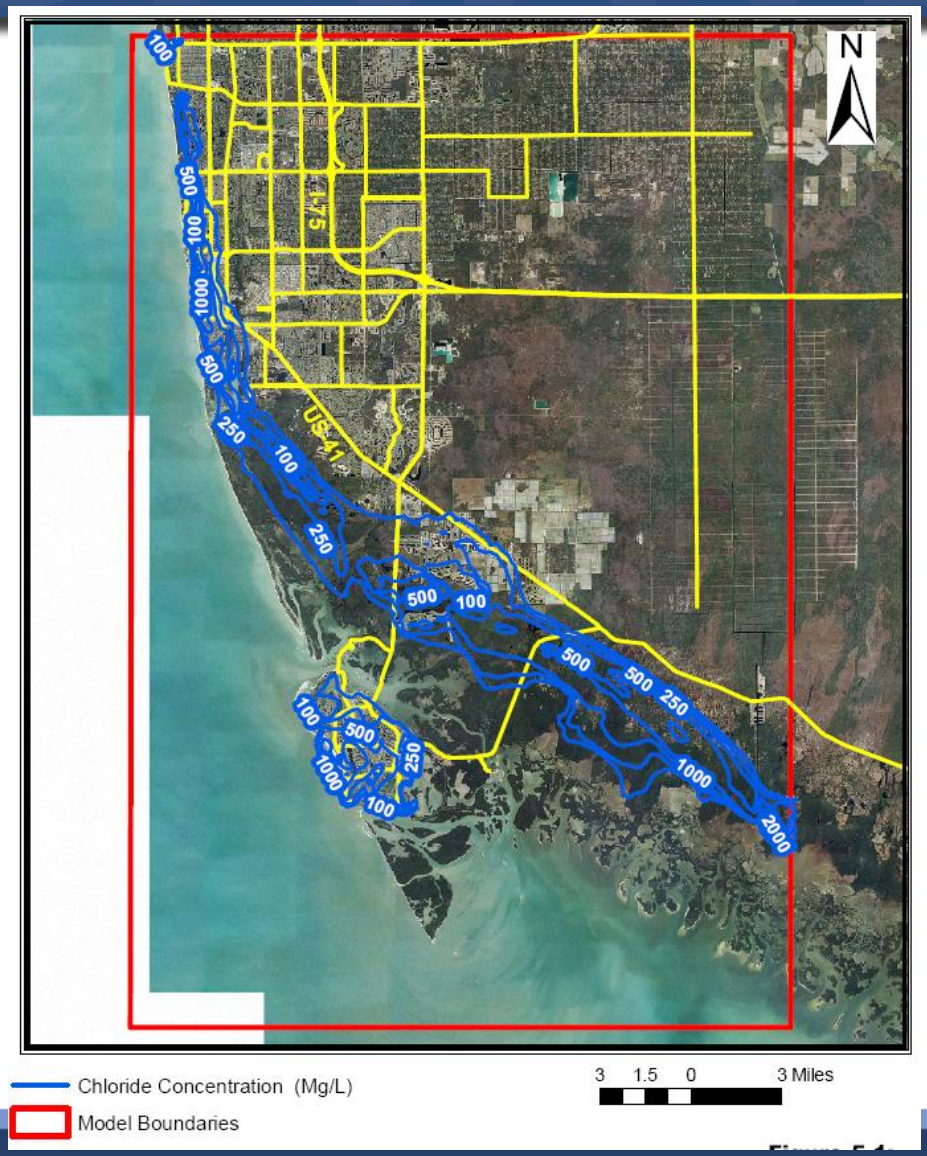



From Parker and others (1955)

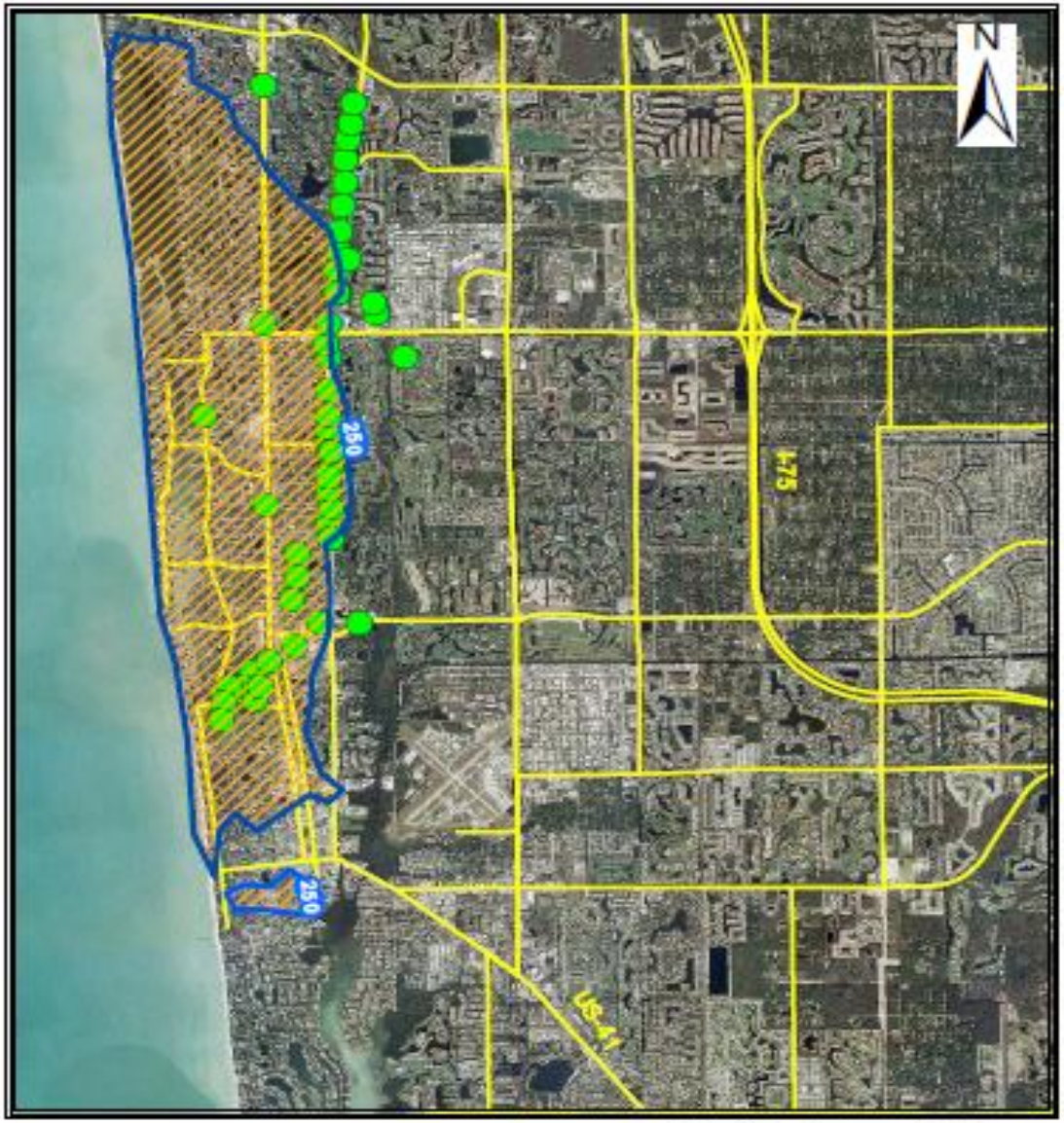
# BCB Salt Water Intrusion Modeling

## Saltwater Interface Extent (Scenario 1)

Sea Level Rises 1 foot over a 20 year time span



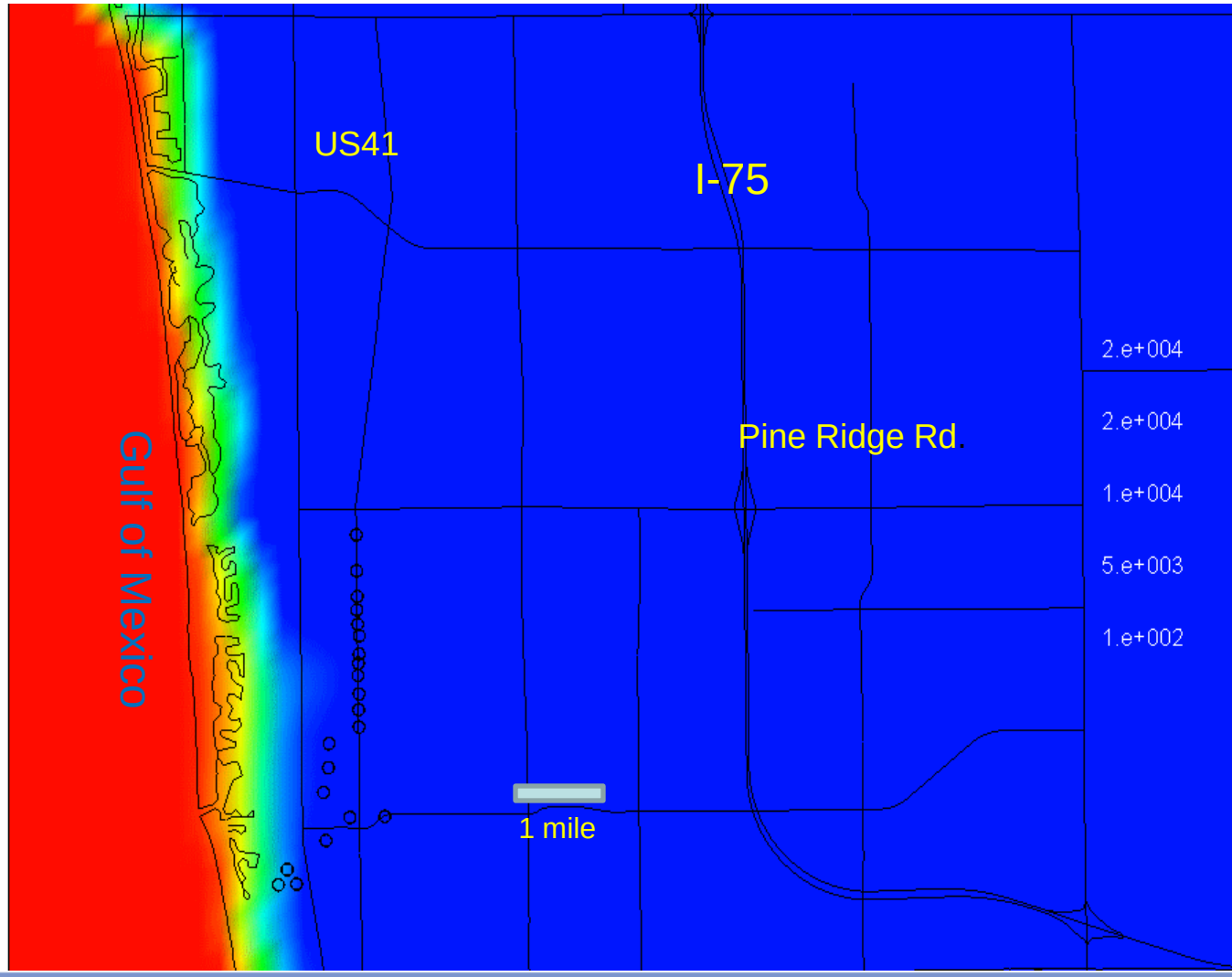
# BCB Salt Water Intrusion Modeling




## Saltwater Interface Extent (Scenario 2)

Double the Pumping Rates of City of Naples Coast Ridge Wellfield (based on Jan 2005 average pumping rates)

# Movement of Saltwater



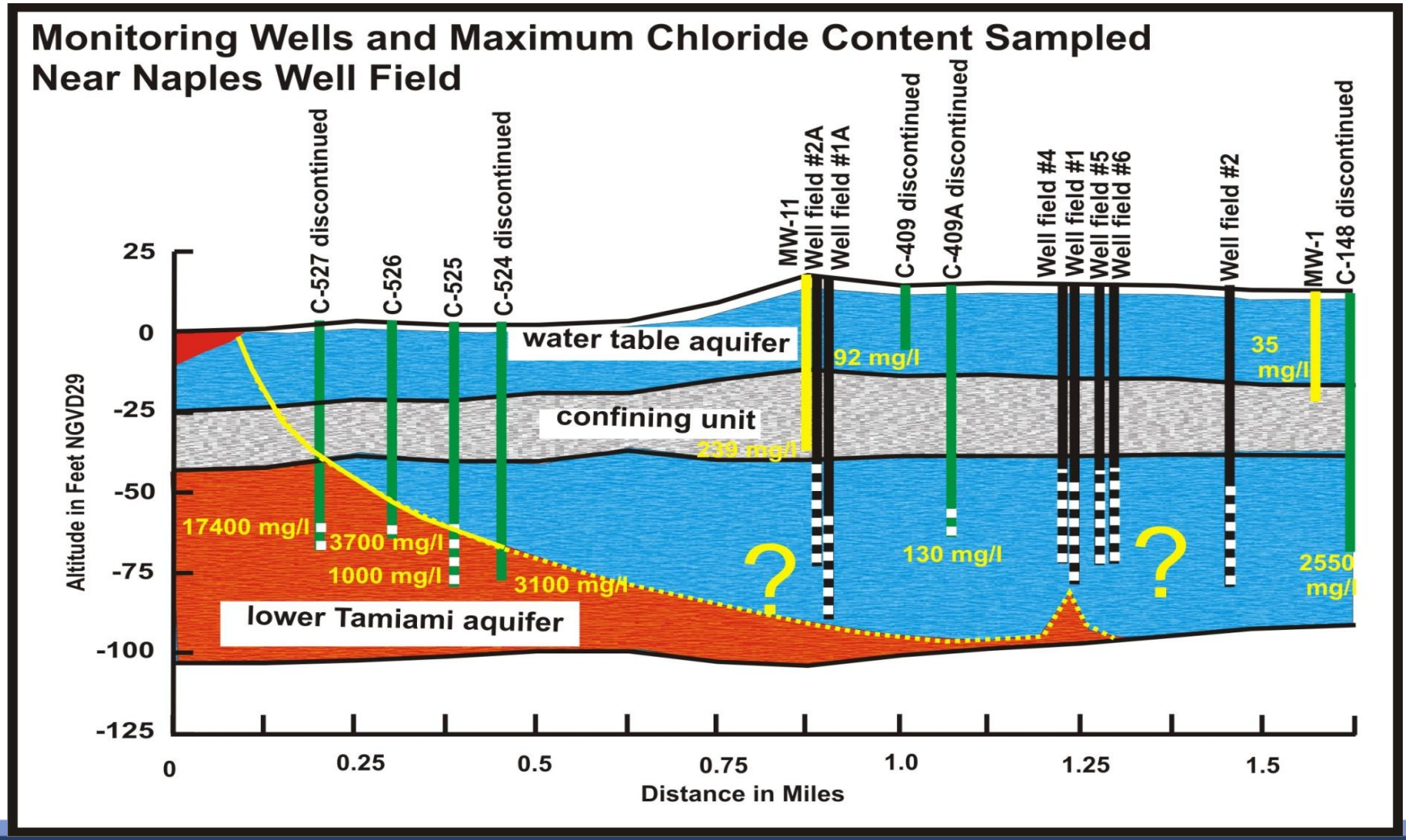

Time = 353.9 (2-1-36)

# Challenges & Data Gap in BCB Salt Water Intrusion Modeling

## Lack of WQ data from the lower portion of The Lower Tamiami Aquifer

- Many of the existing monitoring wells do not penetrate to the full depth of the aquifer to define the salt\fresh water interface properly
- If there is encroached seawater beneath the well field, none of the monitoring wells would detect it until the well field has already  become contaminated.
- Lack of pumping data from many irrigation wells

# Problems of Current Groundwater Monitoring Wells in the Major Water Supply Aquifers



# New Initiative to Address the Challenges

Saltwater Encroachment Monitoring Network Improvements Plan Development in the Big Cypress Basin

Funded USGS in FY11

# BCB Real-Time Hydrologic Monitoring & Modeling System (BCBRTHMS)

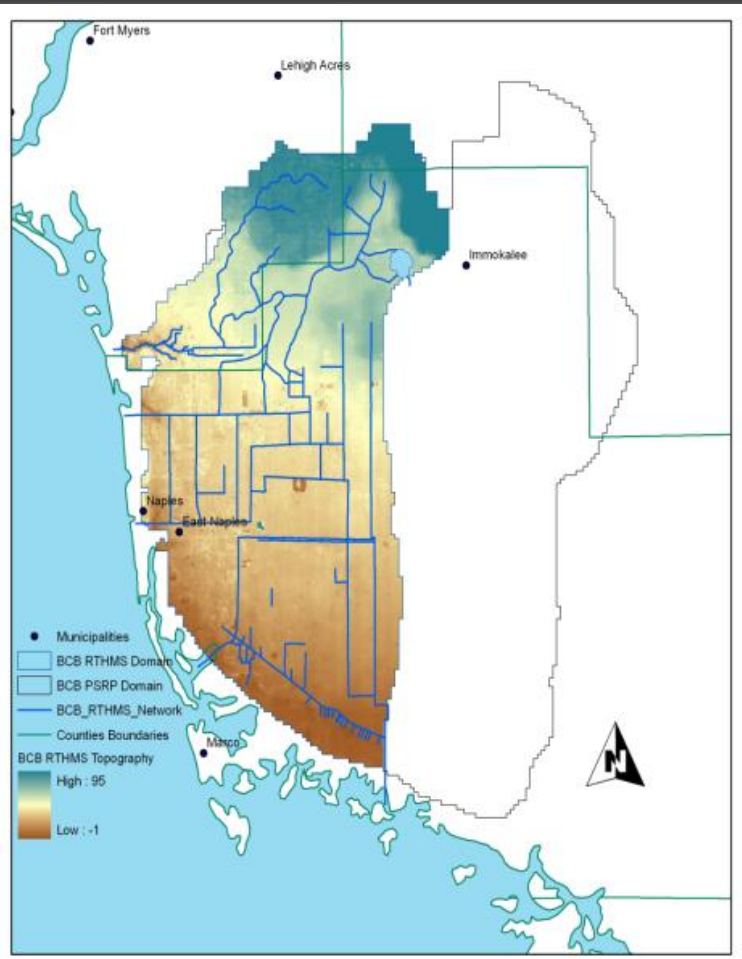
## BCBRTHMS

• Unique forecasting system - the first fully integrated surface water/ ground water real-time model in the world

•First real-time modeling and forecasting system in the District

•State-of-the-art forecasting models

•State-of-the-art methods to improve forecast accuracy

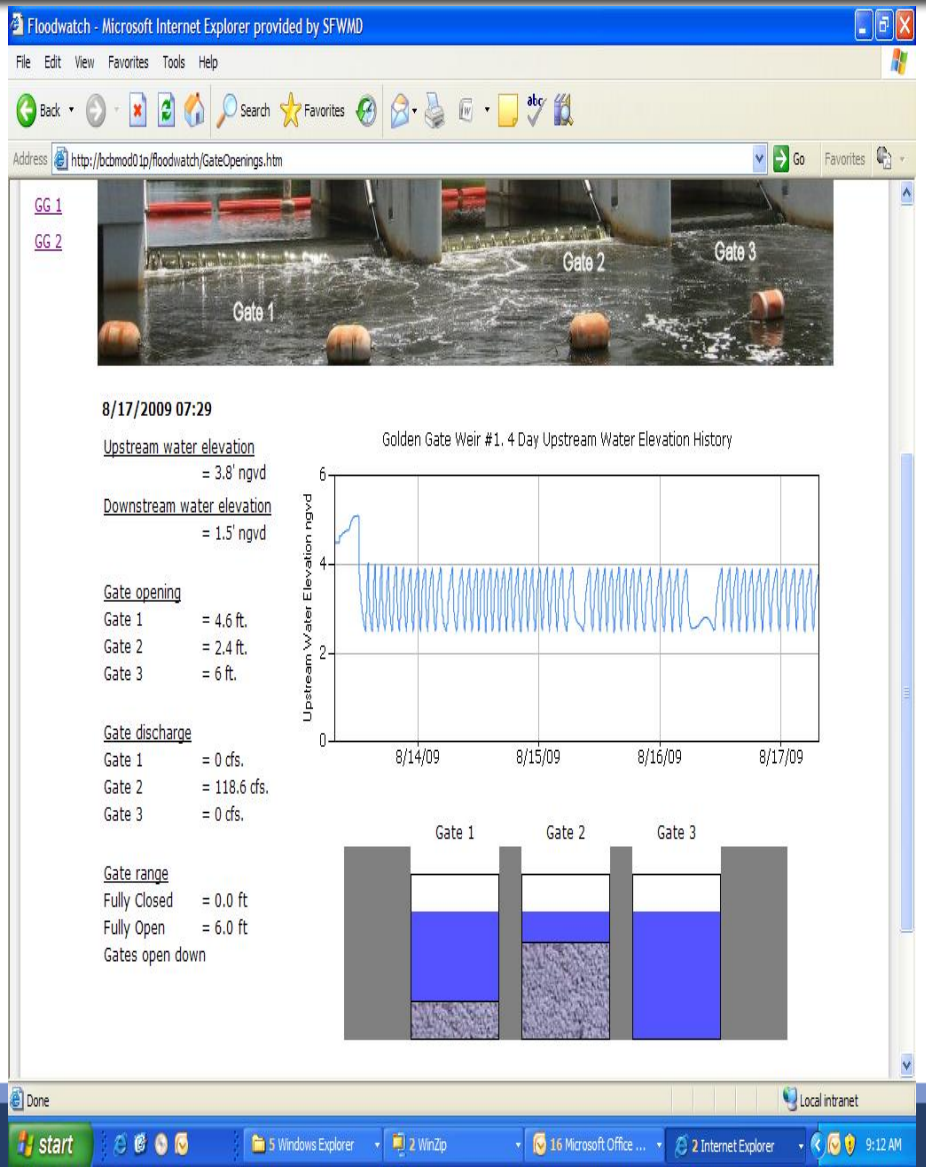



http://my.sfwmd.gov/floodwatch/index.htm

# Challenge & needs in BCBRTHMS

**Challenges:**

- Reliable forecasting rainfall
- Very Intensive need of IT & system programming knowledge
- Limited in-house expertise



# Questions

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

# Intergovernmental Policy & Planning

**Kim Shugar, Director**
**Intergovernmental Programs**

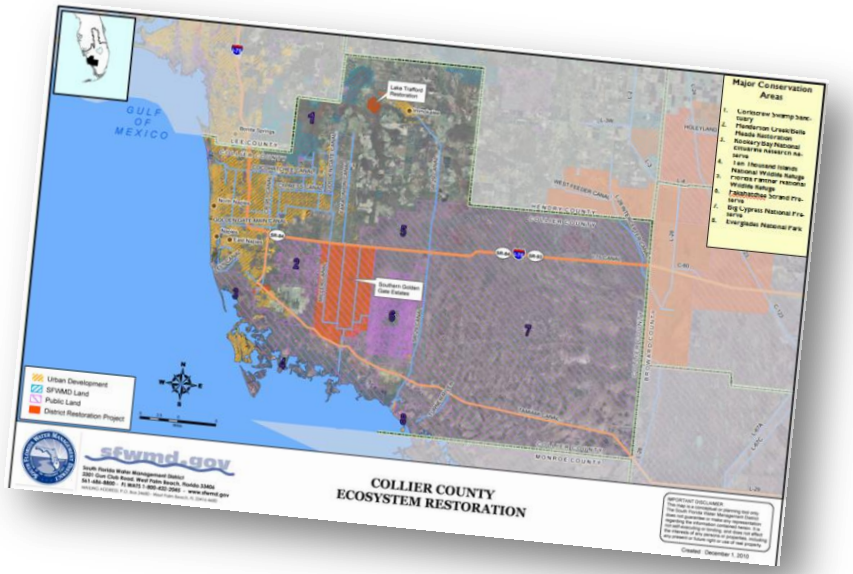
**Big Cypress Basin Board Meeting**
**February 25, 2011**

# Reviews and Coordination

- Local Government Comp Plan Amendments
- Water Supply Facilities Work Plans
- Local Government EARs and EAR-based Amendments
- Power Plant Siting
- Development of Regional Impact (DRI)
- Tribal Documents
- State Clearinghouse Items
- State Mining Permits
- FDOT Review
- 298 District Water Control Plans
- Zoning Documents
- Natural Gas Pipelines
- State Oil Well Applications

# Comp Plan and Other Documents

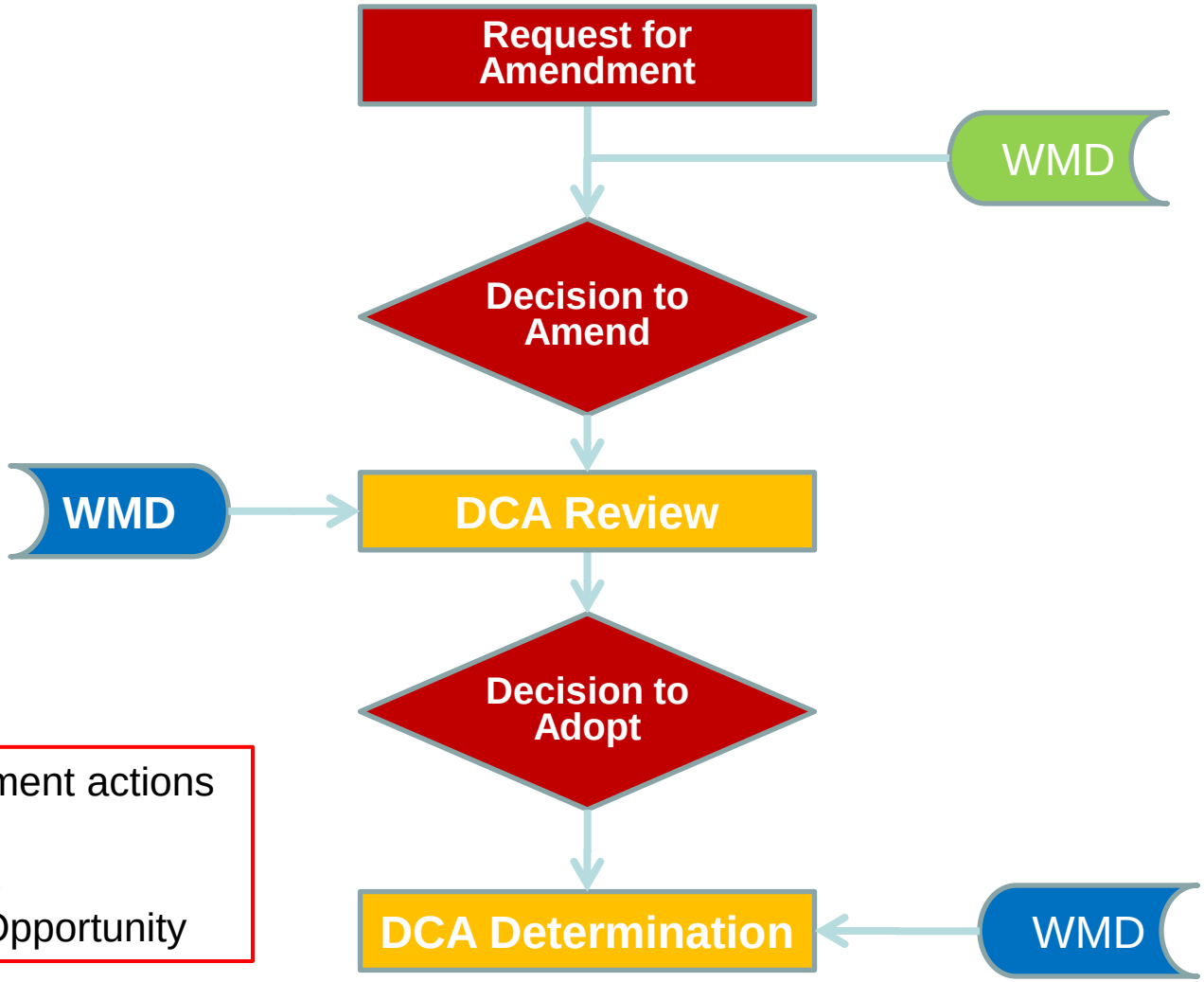
- "Due Diligence" on everything that comes through the door
  - Ecosystem Restoration
  - Water Supply
  - Water Quality
  - Flood Control
  - Natural Systems



# Focus of Plan Review and Comments

- Review comprehensive plan amendments and other planning documents for consistency w/ the District's mission
- Respond as a landowner to proposed amendments or other actions that may be adjacent to or on District-owned lands or projects
- Provide technical assistance
- 135 Proposed Comprehensive Plan Amendment Packages; 225 Adopted Comprehensive Plan Amendments

# Comprehensive Amendment Process

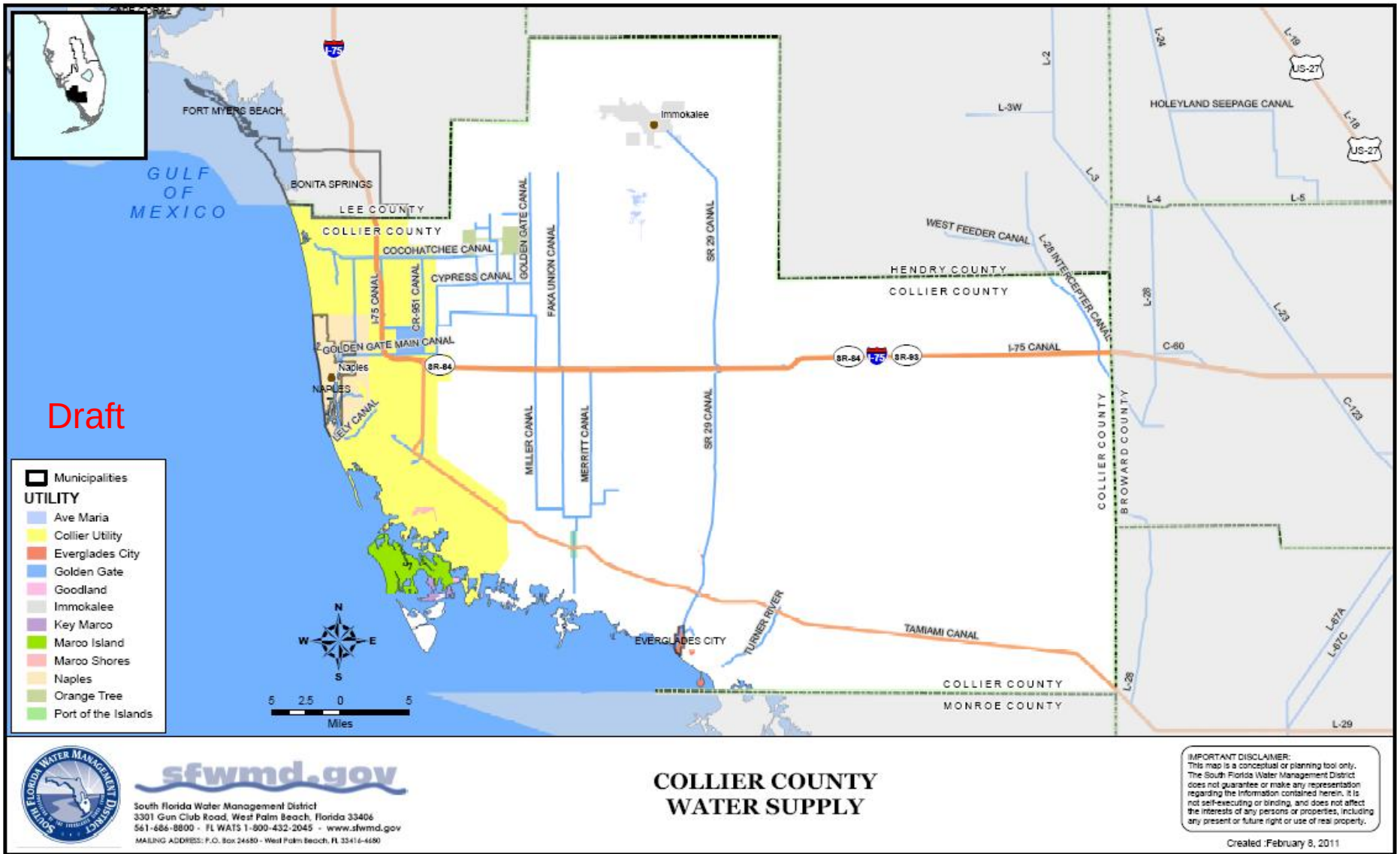



Red = Local government actions
Gold = DCA actions
Blue = WMD actions
Green = Additional Opportunity

# Water Supply Planning

- Ensure that the 10-Year Water Supply Facilities Work Plan is consistent with the Lower West Coast (LWC) Regional Water Supply Plan
- Implement water supply development projects, conservation programs and reuse programs consistent with the LWC Regional Water Supply Plan
- Identify:
  - Water supply needs
  - Future water supply source(s) and supplier
  - Required facilities and infrastructure

# Water Supply




sfwmd.gov
South Florida Water Management District
3301 Gun Club Road, West Palm Beach, Florida 33406
561-686-8800 - FL WATS 1-800-432-2045 - www.sfwmd.gov
MAILING ADDRESS: P.O. Box 24680 - West Palm Beach, FL 33416-4680

**COLLIER COUNTY WATER SUPPLY**

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This map is a conceptual or planning tool only. The South Florida Water Management District does not guarantee or make any representation regarding the information contained herein, it is not self-executing or binding, and does not affect the interests of any persons or properties, including any present or future right or use of real property.

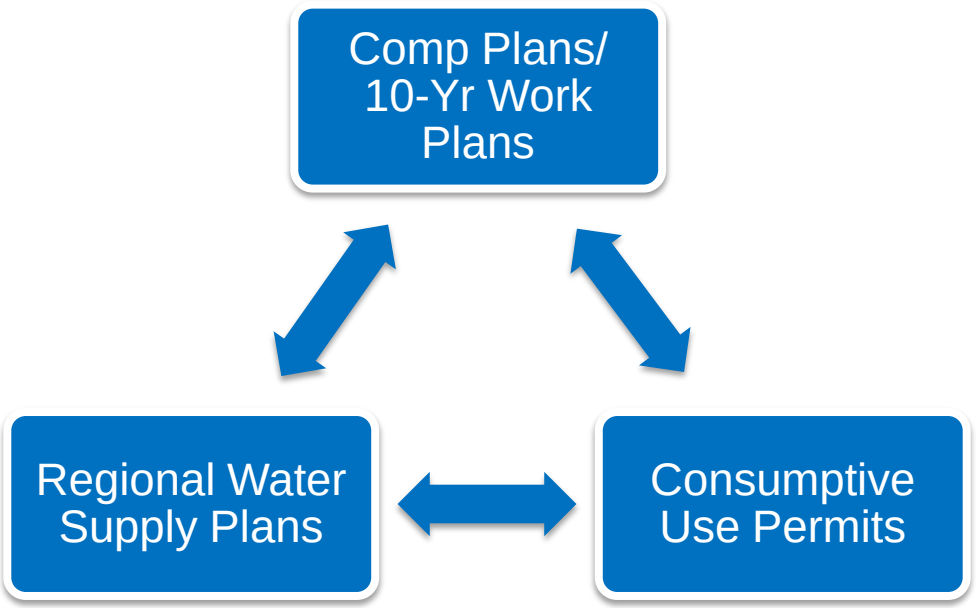
Created :February 8, 2011

# Local Government Water Supply Planning

- Chapter 373 requires local governments to develop or update a Water Supply Facilities Work Plan every 5 years
  - Within 18 months after the District updates the applicable Regional Water Supply Plan
  - Must cover projected demands for at least a 10 year period
  - Must include a financially feasible Capital Improvement Element for the first 5 years

# Water Supply Activities

- Connect the dots between the10-Year Water Supply Facility Works Plans, Regional Water Supply Plans and Consumptive Use Permits



# Connecting Land Use and Water Supply Planning

- Review 150+ local government Water Supply Facility Work Plans for consistency with:
  - Regional Water Supply Plan
  - Consumptive Use Permit conditions
  - Statutory requirements
- Provide technical assistance
  - Data collected by the District
  - Informal reviews of draft Work Plans
  - Special assistance if state finds Work Plan “not in compliance” with state law

# Evaluation and Appraisal Reports (EARs)

- Participate in the EAR process with local governments (assesses progress in implementing comprehensive plan and identifies how the plan should be revised to meet objectives and new requirements)
  - Water Supply Planning
  - Policies to Protect Water Resources
  - Not inconsistent w/ other District Programs and Projects

# Evaluation and Appraisal Reports (EARs)

- Collier County Proposed EAR (Sept. 2010)
  - Intergovernmental coordination between the County and other water suppliers to ensure sufficient supply to meet projected water demands for unincorporated areas
- Adopted EAR transmitted (February 2011)
  - Currently under review

# Collier County Evaluation and Appraisal Report (EAR)

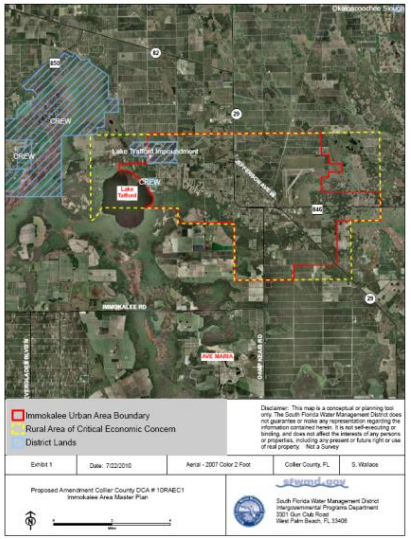
- **EAR Due Dates**

| Municipality | EAR Due Date |
|---|---|
| Everglades City* | 1/2012 |
| Marco Island | 3/2012 |
| Naples | 2/2012 |

***Everglades City has not completed the 2nd round EAR (Due 1/2005)**

# Collier County Comprehensive Plan Amendments

- **Immokalee Area Master Plan Proposed Amendment (July 2010)**
  - **Ecosystem Restoration – reduction of nutrient loading from stormwater outfalls to Corkscrew Marsh, Lake Trafford and Camp Keais Strand**
  - **Water supply – identify intensity standards**
  - **Natural Systems – wetland protection measures and secondary impacts**



# Questions and Discussion