

# Preliminary Model Results

Central Florida Coordination Area  
Public Workshop  
October 27, 2010

*Presented by Akintunde Owosina  
South Florida Water Management District  
And  
Patrick Burger  
St John River Water Management District*

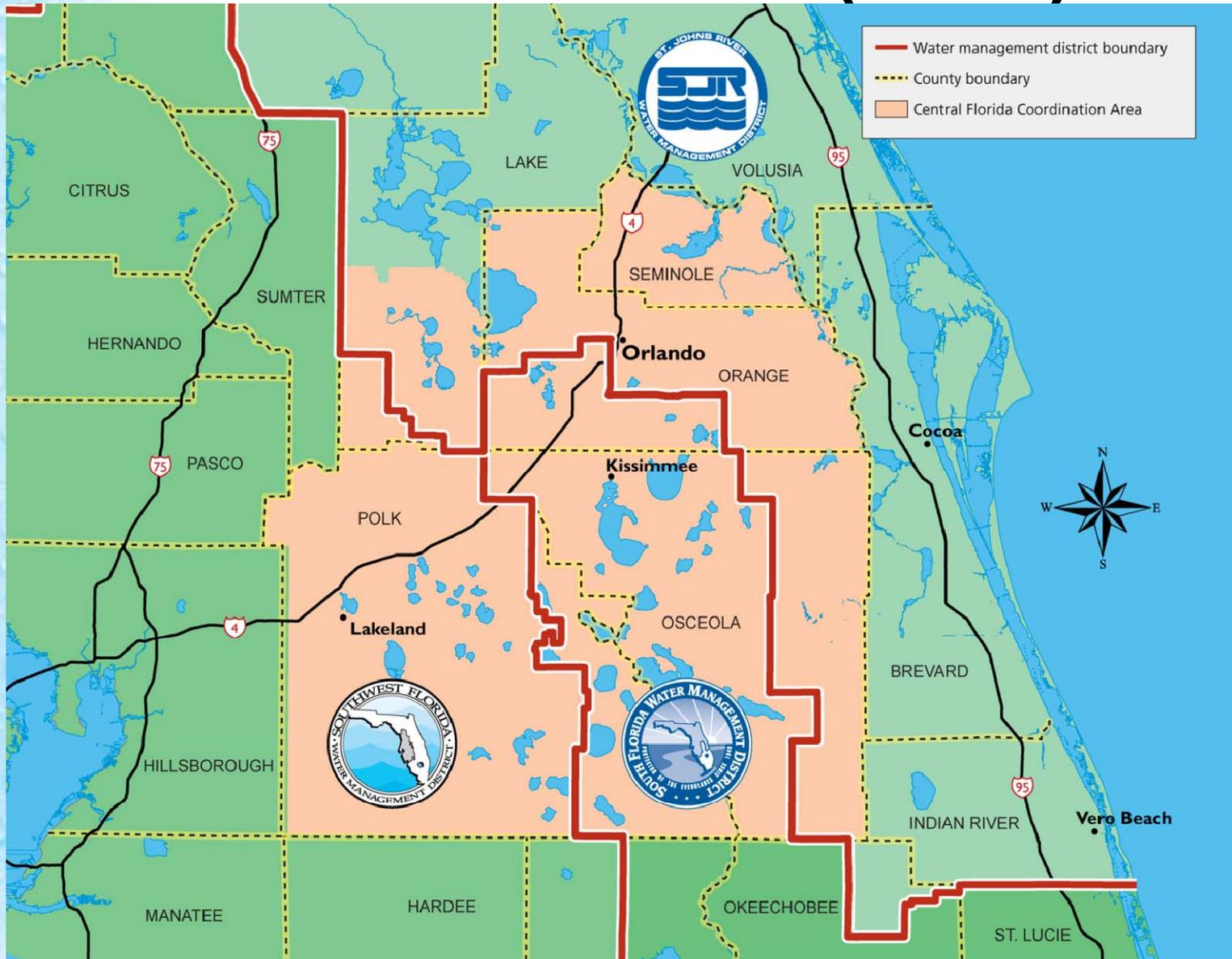
# Central Florida Coordination Area Acronyms and Abbreviations

- **DWRM** – South West Florida Water Management District's District Wide Regulation Model
- **ECFT** – South Florida Water Management District's East Central Florida Transient Model
- **CFCA** – Central Florida Coordination Area

# Central Florida Coordination Area – Presentation Overview

- Tools, simulated scenarios and implementation approach
- Pumping scenario design for the base simulations
- How results are being and will be evaluated
- Results
- Next steps

# Location of the Central Florida Coordination Area (CFCA)



# CFCA Numerical Models

- District Wide Regulation Model
- East Central Florida Transient Model

Both of these models are:

- MODFLOW Based
- Transient quasi-three dimensional groundwater models
- Spatial coverage of CFCA

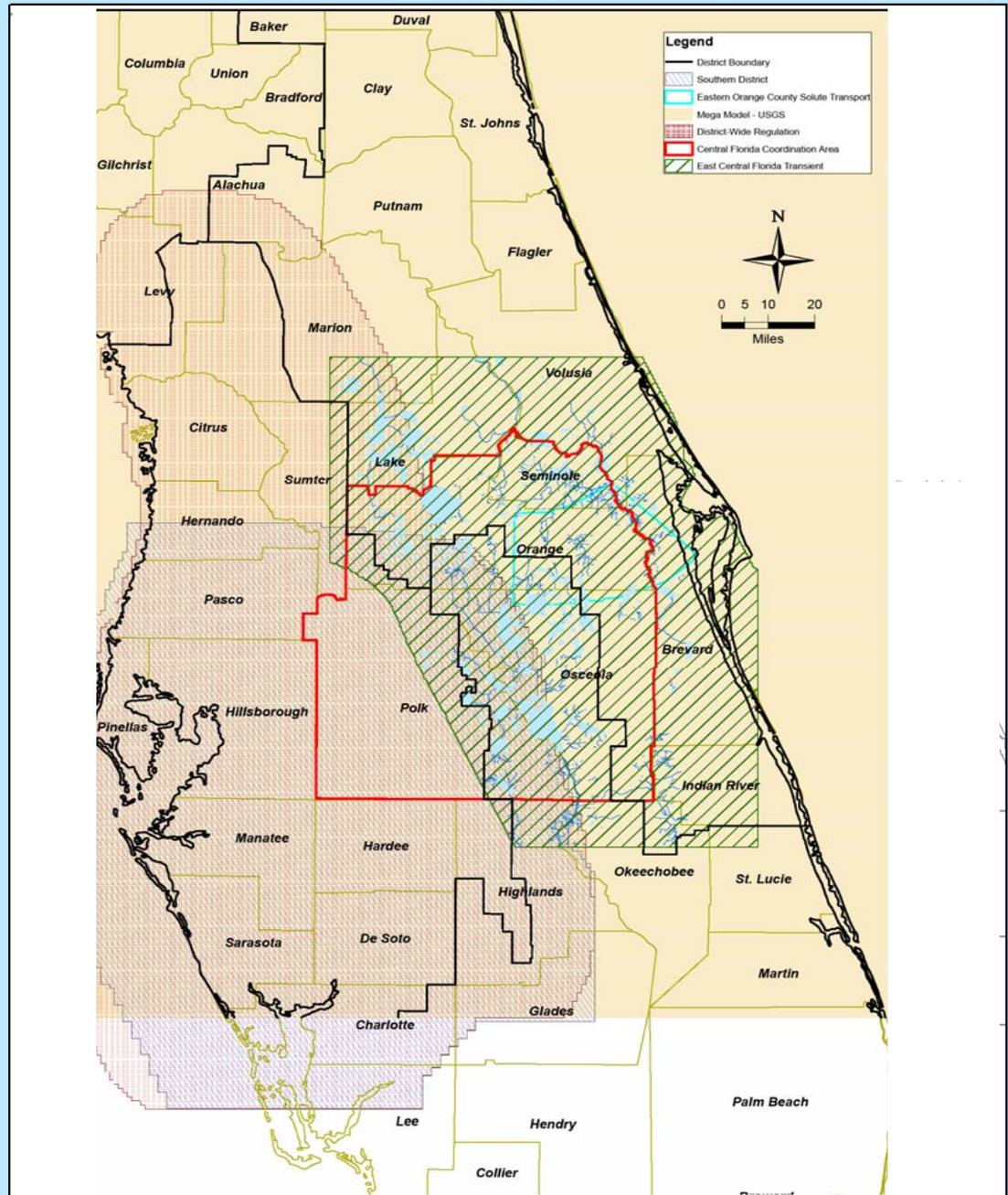
# CENTRAL FLORIDA COORDINATION AREA

## Geographical Extent of DWRM and ECFT

-  District-Wide Regulation
-  Central Florida Coordination Area
-  East Central Florida Transient



0 10 20 40 Miles



# Model Simulations to Estimate Water Level Drawdown Due to Groundwater Withdrawals

- No-pumping or reduced pumping condition
- 1995–2006 calibration period
- 1995 estimated water use
- 2006 estimated water use

# No-pumping or reduced pumping condition

- Represents response of the calibrated model to an environment of reduced withdrawal or no withdrawals
- Does not represent true pre-development conditions
- Based on climate observed between 1995 and 2006 which is the model calibration period
- Retains boundary conditions from the calibration period which have built into then some of the influence of withdrawals.

## 1995 – 2006 calibration period

- Represents response of the CFCA to stresses and conditions that were observed during the calibration period.
- Represent (subject to the limitations and assumptions of the models) the conditions observed between 1995 and 2006.
- Based on climate observed between 1995 and 2006 which is the model calibration period.
- Based on best estimate of withdrawals observed during the calibration period.

# 1995 Estimated Water Use

- Represents response of the CFCA to a “1995 level” of withdrawal.
- Applies the “1995 level” of withdrawal under varying climate conditions observed between 1995 and 2006 (the model calibration period.)
- Growth or reduction in withdrawals other than those resulting from climatic conditions are not reflected in this scenario.

## 2006 Estimated Water Use

- Represents response of the CFCA to a “2006 level” of withdrawal.
- Applies the “2006 level” of withdrawal under varying climate conditions observed between 1995 and 2006 (the model calibration period.)
- Growth or reduction in withdrawals other than those resulting from climatic conditions are not reflected in this scenario.



# ECFT Predictive Simulation Pumping Scenario Design

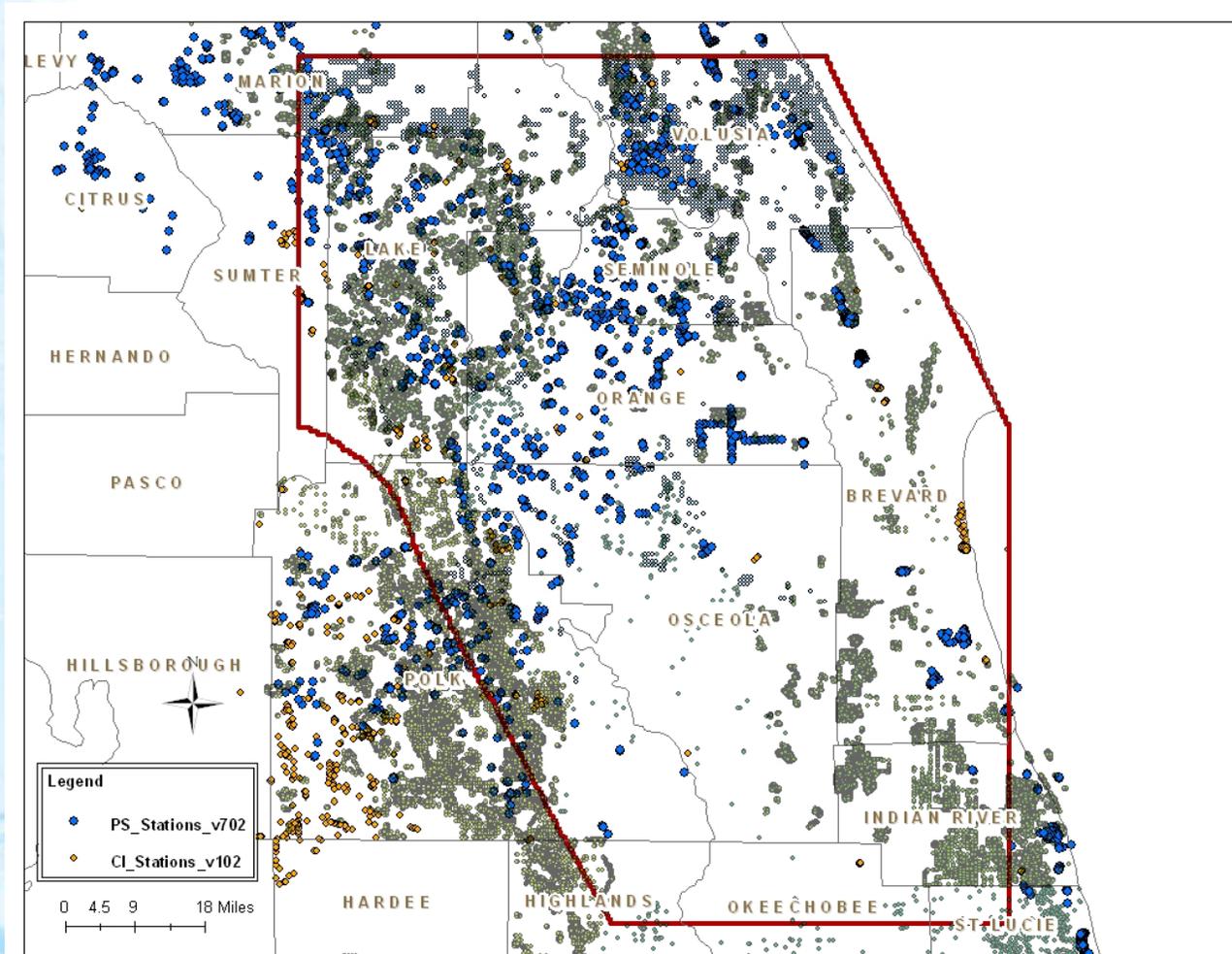
## Objective

Develop a method for converting annual average groundwater withdrawal values to a transient monthly pumping data set for use in the ECFT groundwater model.

# Basic Assumptions

- Model simulations will rely on the observed 12 year period of monthly rainfall from 1995 through 2006.
- Only public supply water use type will be changed for scenario development.
- Agricultural and commercial/industrial water use is not changed.
- The problem is spatial as well as temporal, location considerations will need to be made for changing pumping for selected years at selected sites.

# Distribution of public supply and commercial Industrial Wells across the ECFT Model Domain – Pumping scenarios deal with spatial component of assigning flow to the wells.



## Available Data

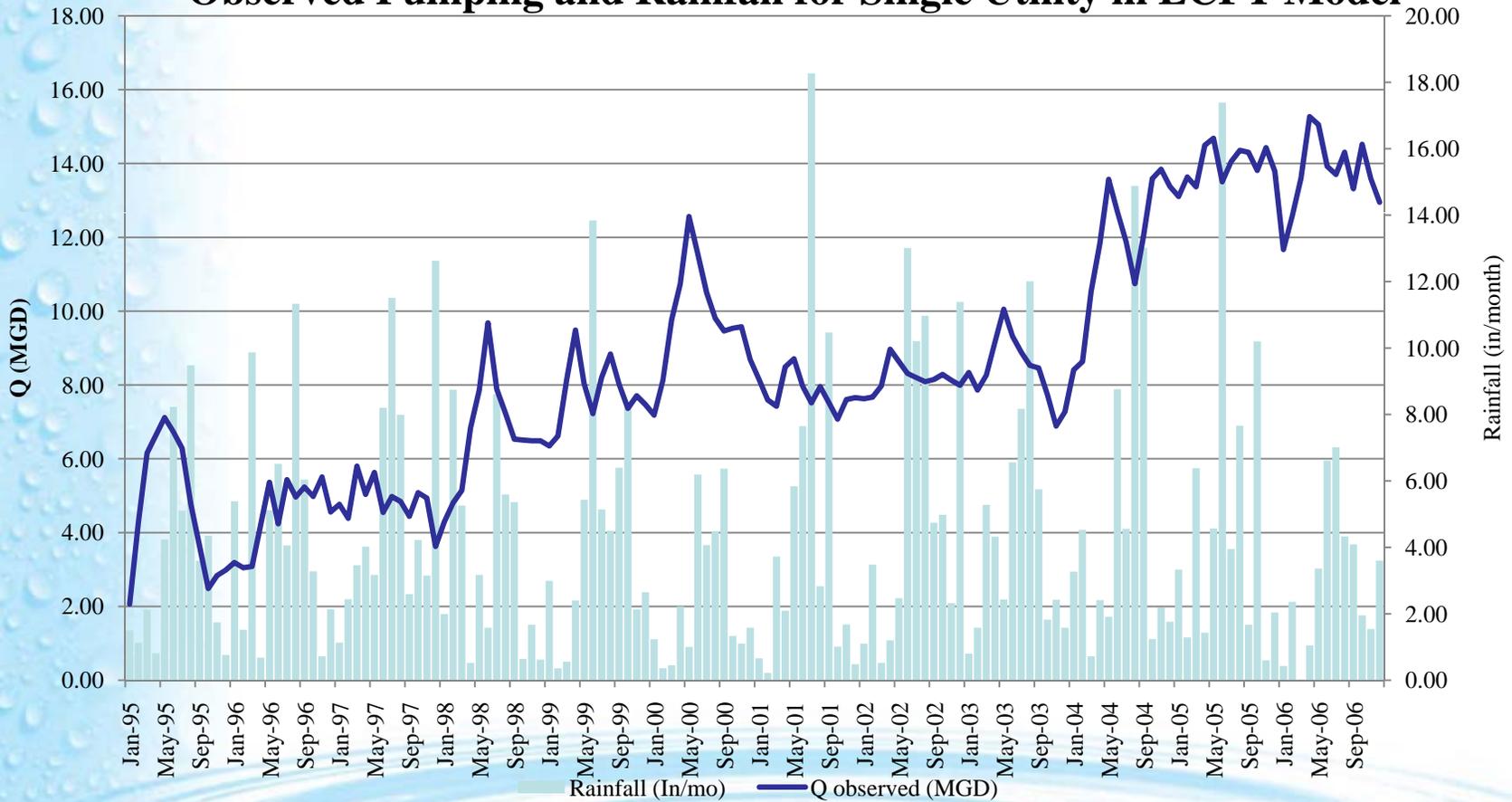
- Existing monthly rainfall for the period 1995 through 2006
- Monthly withdrawal rates for public supply and commercial industrial wells across the model for 1995 through 2006
- Projected/permitted annual flows for public supply and commercial industrial uses for 2006 to 2013

# ECFT Water Use Scenario Development Method

- Annual average for each PERMIT is calculated
- Monthly percent fluctuations are calculated about the observed annual mean
- The percent fluctuations are applied to the annual average value to develop permit level monthly rate for all PS permits and all months in the simulation
- Monthly permit values are then distributed to wells based on the appropriate yearly percentage for scenario

# Observed data for typical Utility

## Observed Pumping and Rainfall for Single Utility in ECFT Model

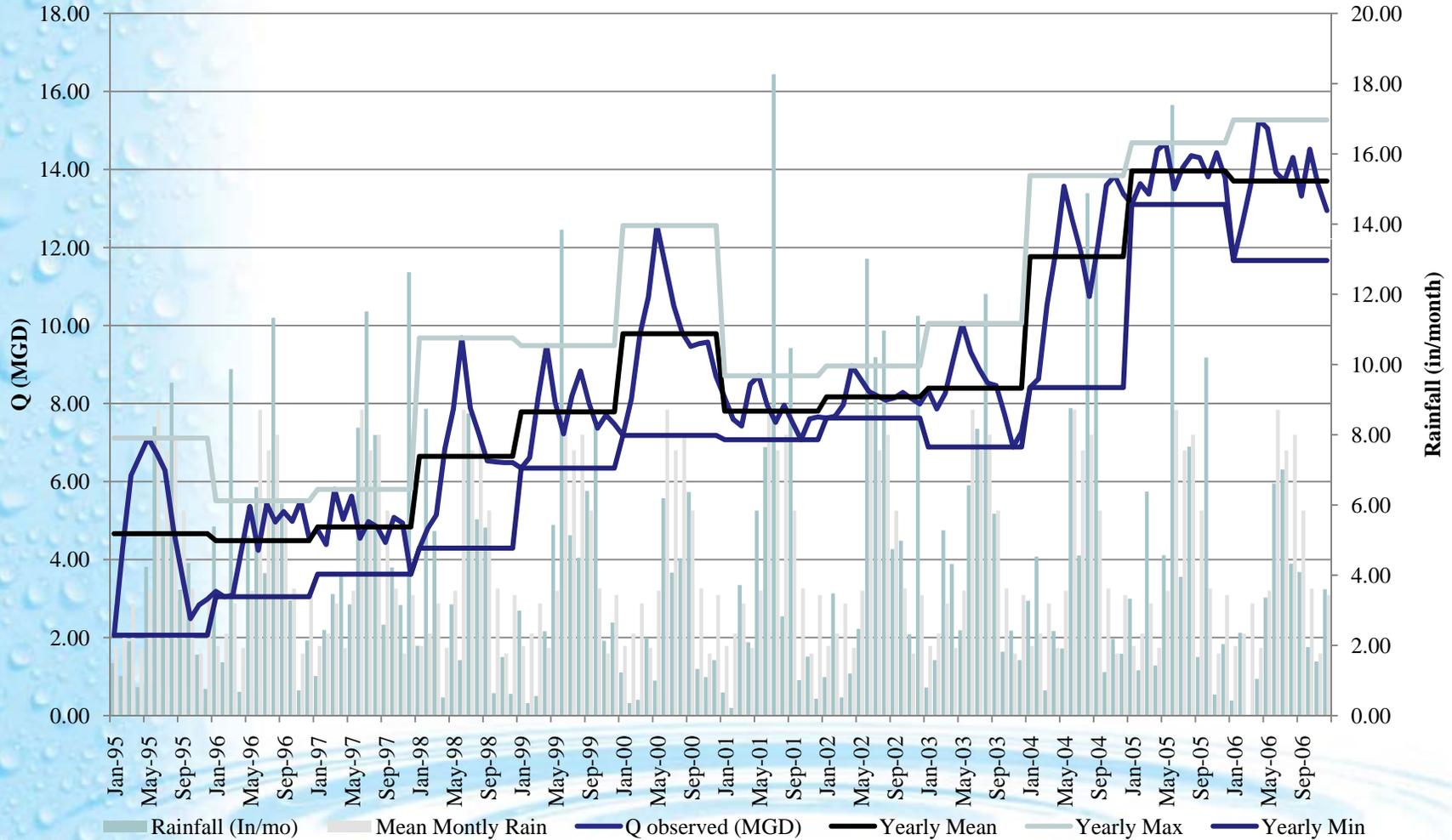


## **Analysis of existing data**

- Information from observed pumping is leveraged for developing transient water use data sets from yearly average allocations/amounts
- Pumping record is a synthesis of per capita water demand, growth, and seasonal factors
- Annual averages and deviations demonstrate characteristics about responses to climate and anthropogenic stresses

# Analysis of averages and deviations

## Observed Pumping and Rain with Averages



## **Synthesizing an average year withdrawals**

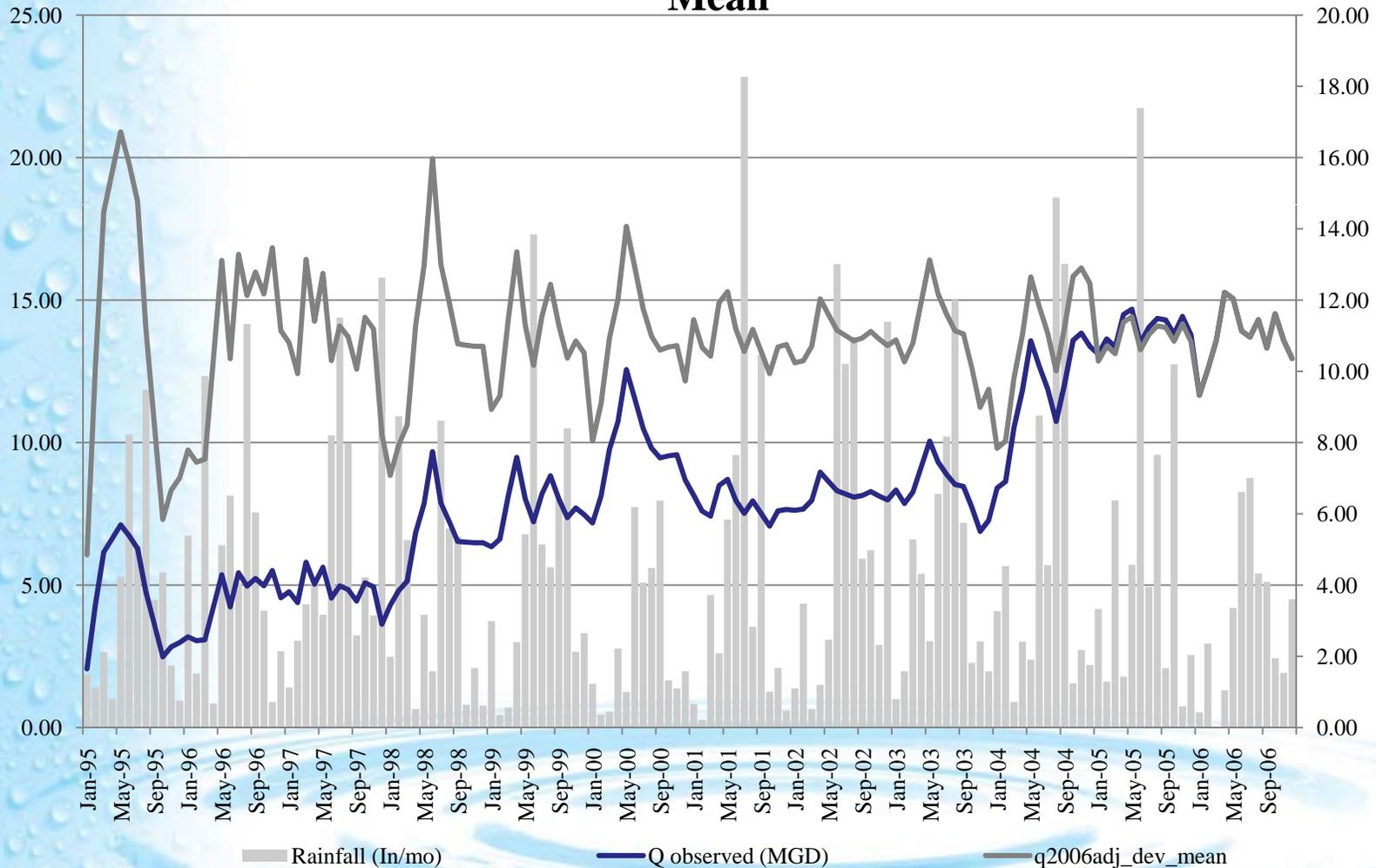
- Scenario definitions are centered around a single year allocation and are translated into a 12 year transient data set
- Method is general enough to apply to all pumping wells in the public supply and commercial industrial data sets

## Example 2006 synthetic pumping

- Uses 2006 annual average withdrawal
- Follows observed monthly deviations from the annual averages for the period 1995 through 2006
- Shows dramatic fluctuations for early years of simulation which may not be tenable for this type of analyses

# Deviations around the Yearly Mean

## Synthetic 2006 Pumping Scenario - Deviations around the Yearly Mean



# Implementation Approach

- Withdrawal Representation in the models
  - No or Reduced Withdrawals
    - 1995
    - 2006
  - Calibration
- Land use representation in the models
  - Calibration period land use updated in roughly five year increments
- Recharge Representation in the models
- Evapotranspiration representation in the models

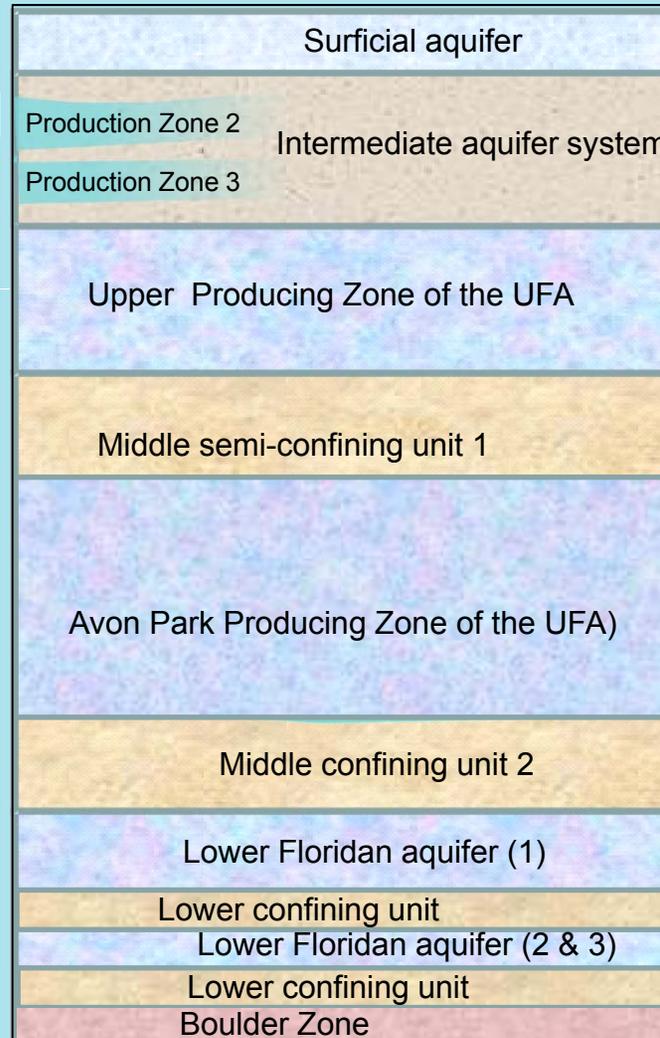
# Evaluation Approach

- Relative comparison where possible
  - Use of drawdown and other relative comparisons between the simulated scenarios.
- Based on evaluation criteria using selected subset of available sites/locations
- Ground-truthed where possible with field information or corroborated by independent analyses.

# Hydrogeology and Conceptualization DWRM2 – CFCA and ECFT

## DWRM2 - CFCA

L 1
L 2
L 3
L 4
L 5



## ECFT

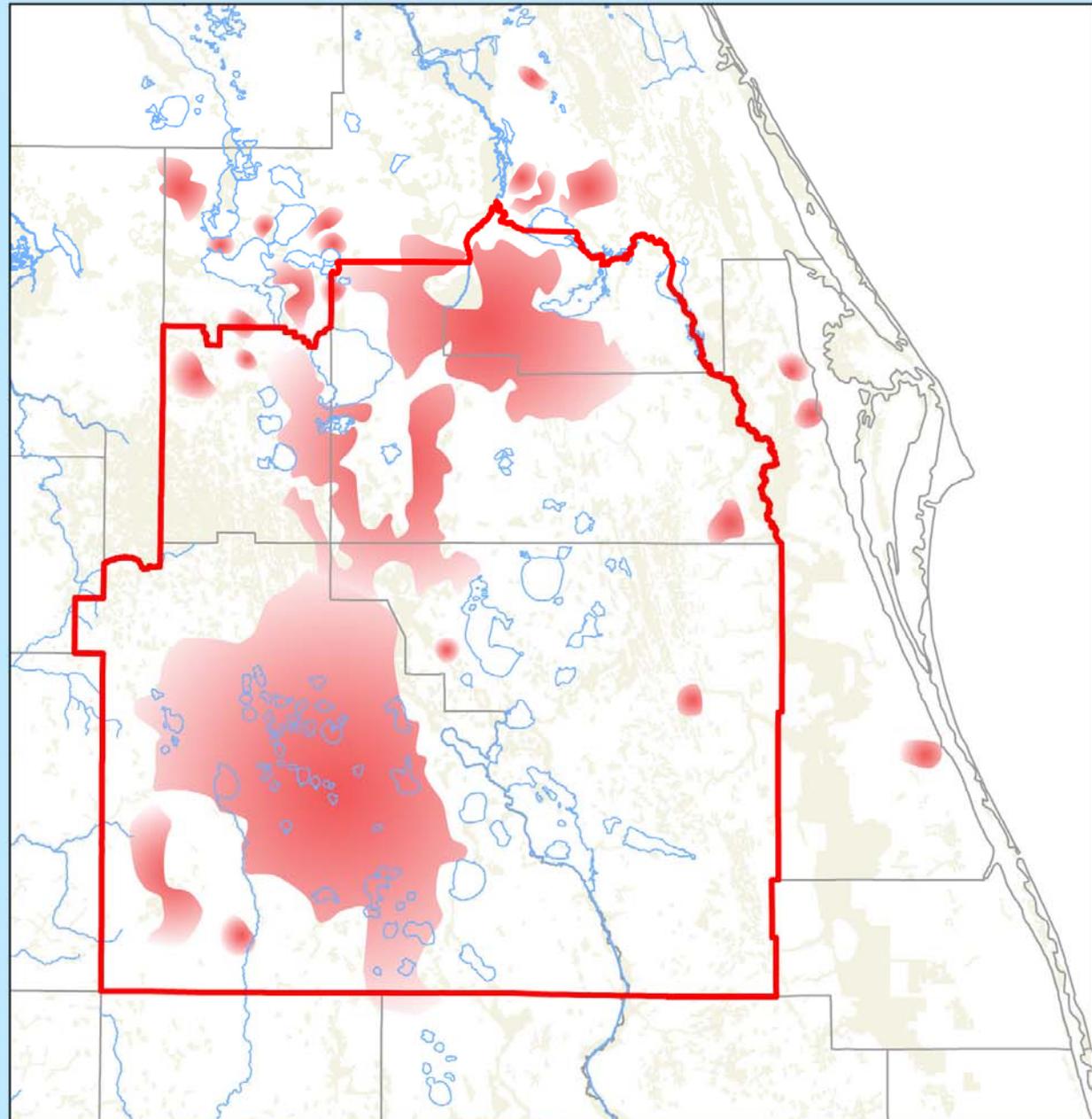
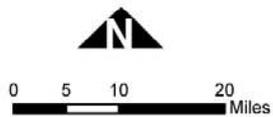
L 1
L 2
L 3
L 4
L 5

# CENTRAL FLORIDA COORDINATION AREA

## DWRM and ECFT Generalized Areas of Surficial Aquifer Drawdown

Pumps Off  
/ Reduced  
Pumping  
vs.  
Calibration  
Period

 CFCFA Boundary



# CENTRAL FLORIDA COORDINATION AREA

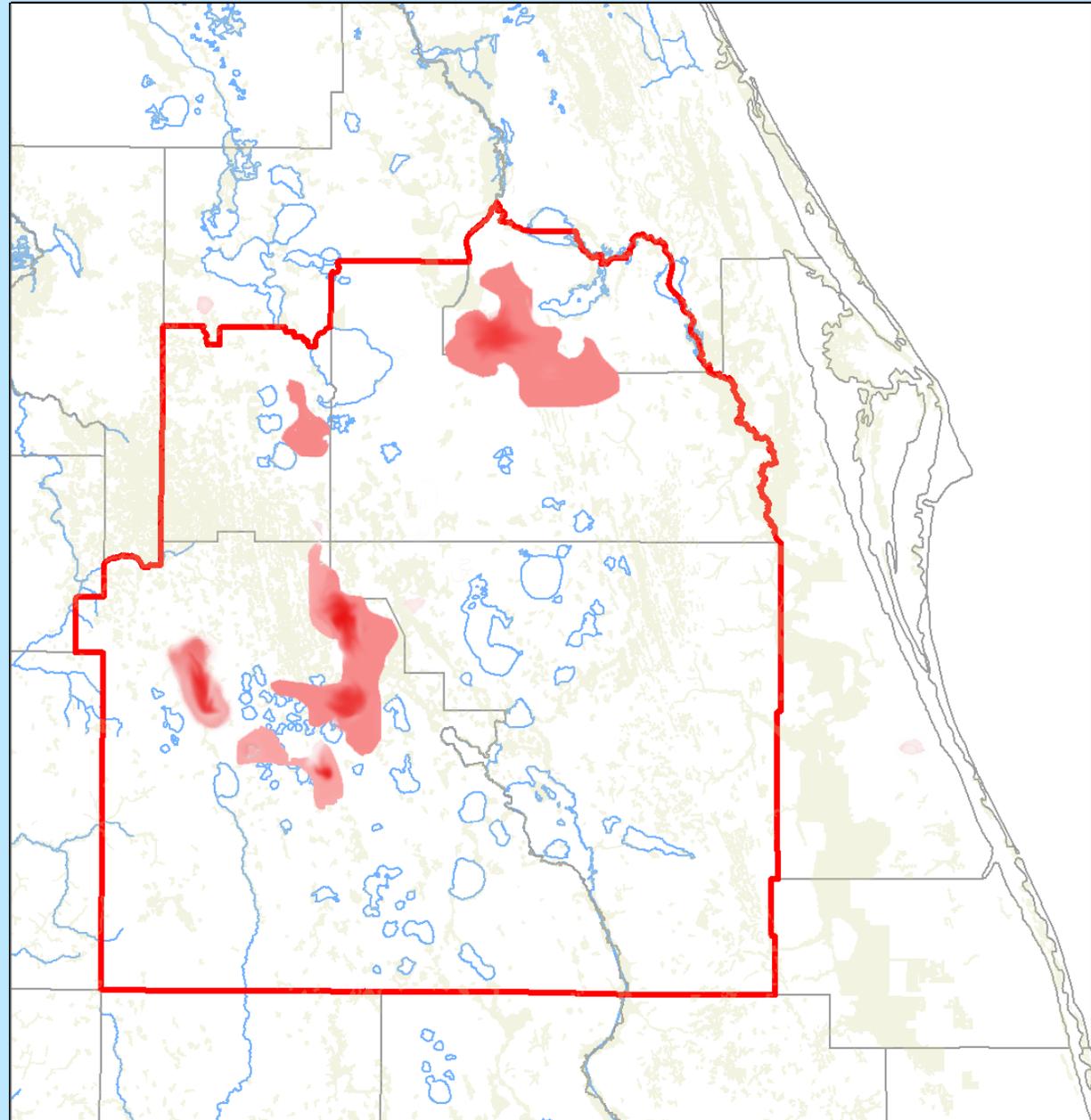
## DWRM and ECFT Generalized Areas of Surficial Aquifer Drawdown

1995 vs.  
2006

 CFCA Boundary



0 5 10 20 Miles



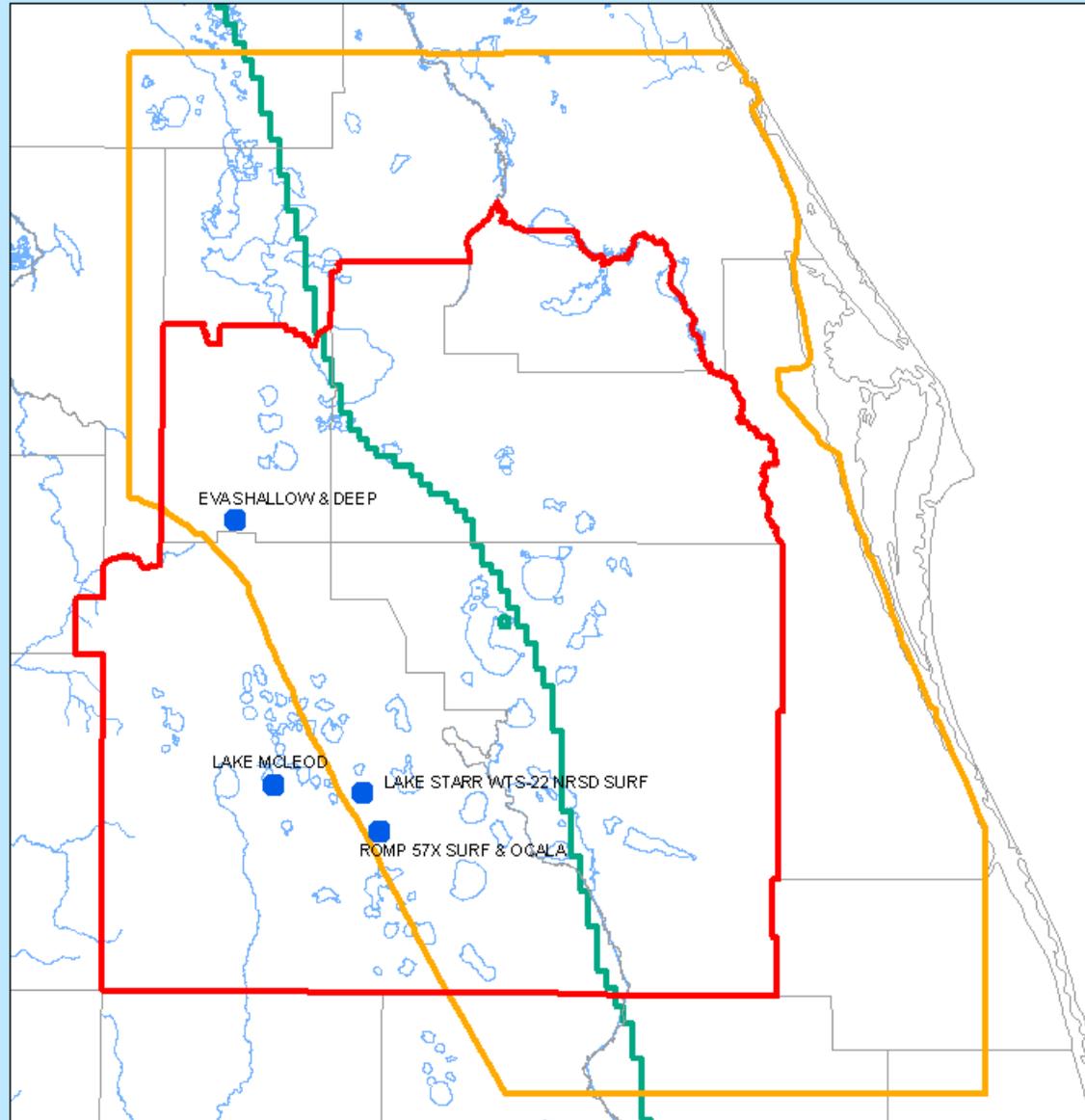
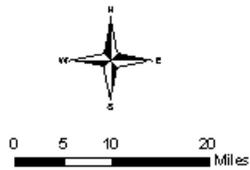
# Simulation Results - Monitoring Wells



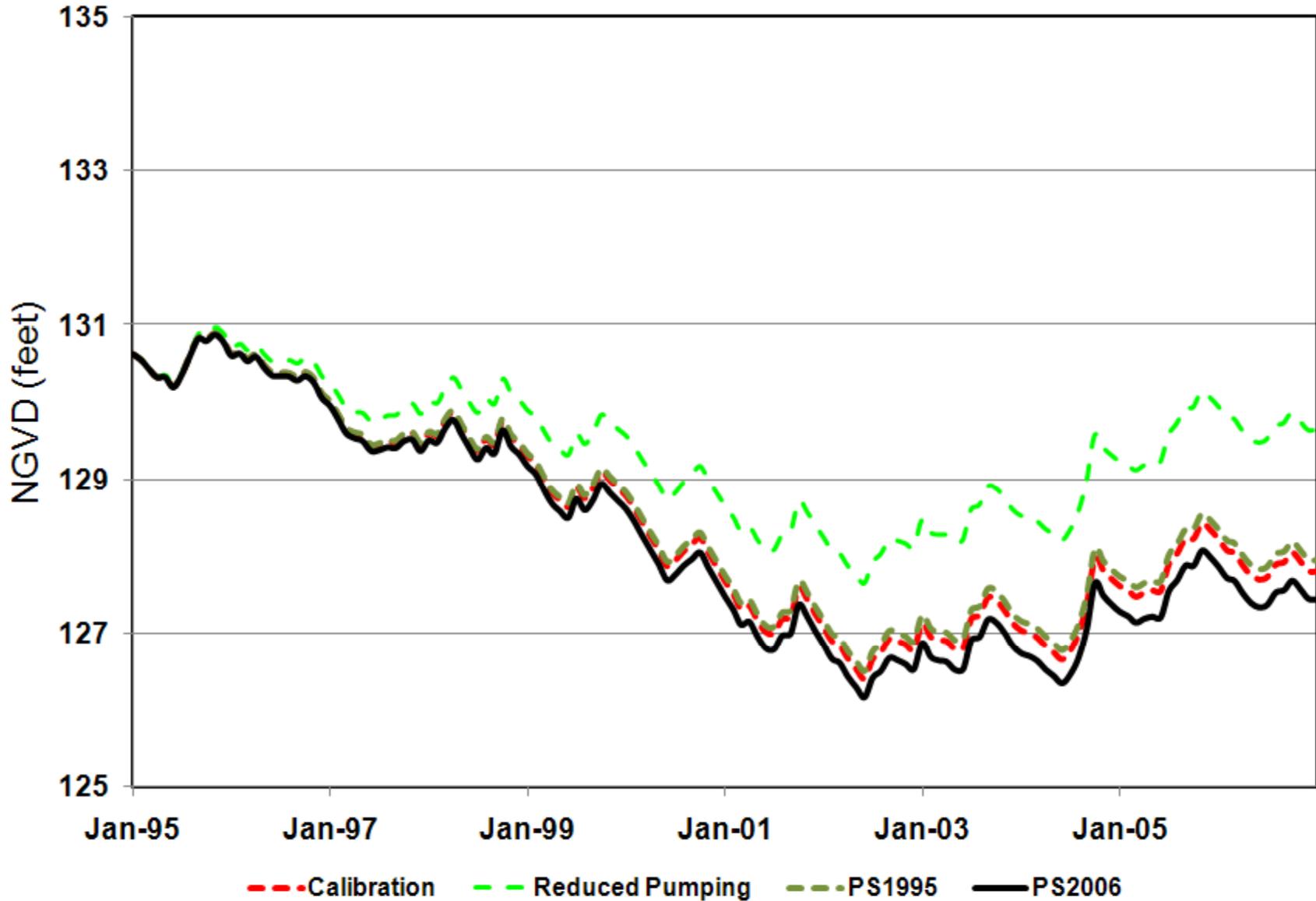
# CENTRAL FLORIDA COORDINATION AREA

## DWRM and ECFT

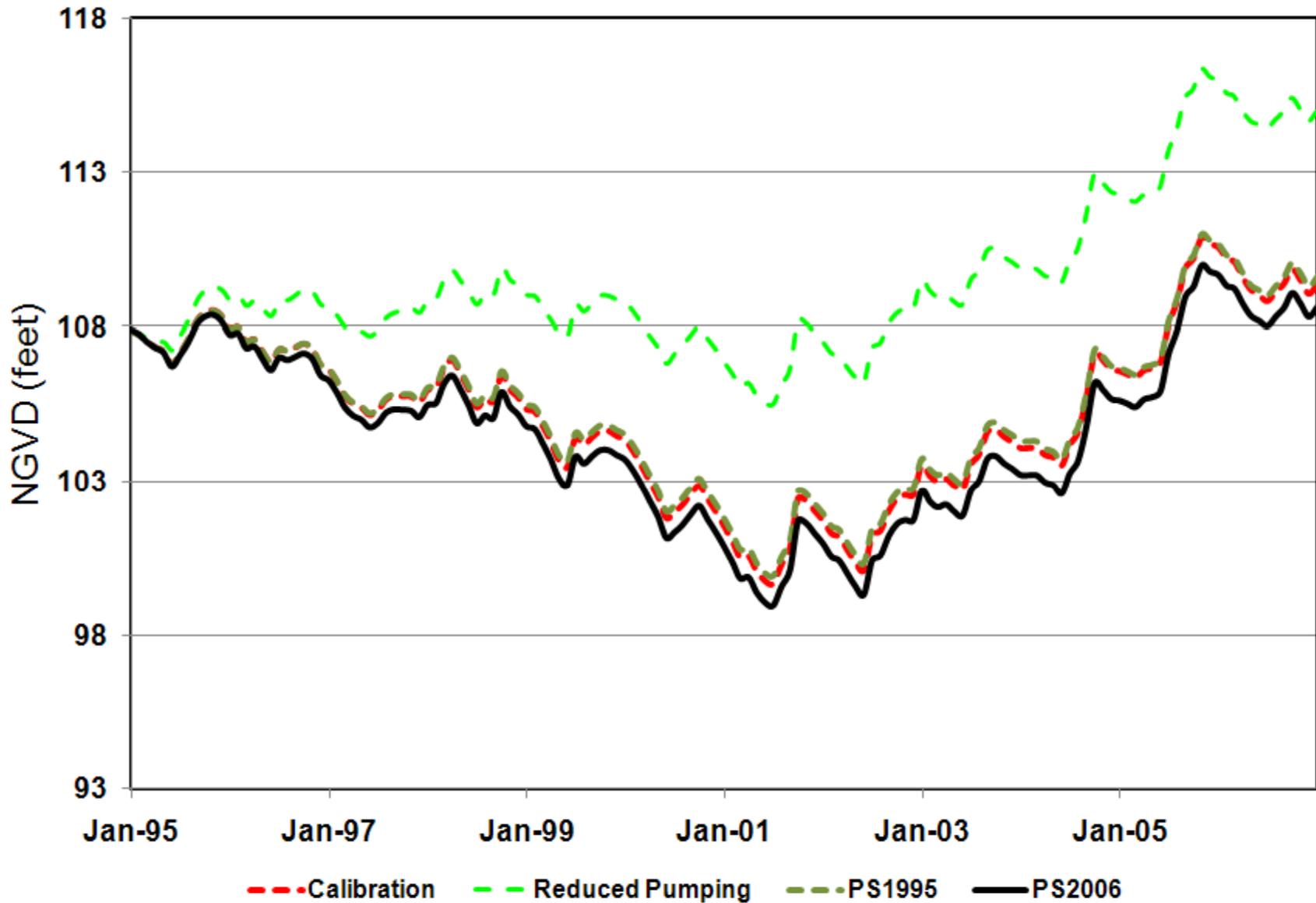
-  DWRM Results
-  CFCFA Boundary
-  ECFT Active Area
-  DWRM Active Area



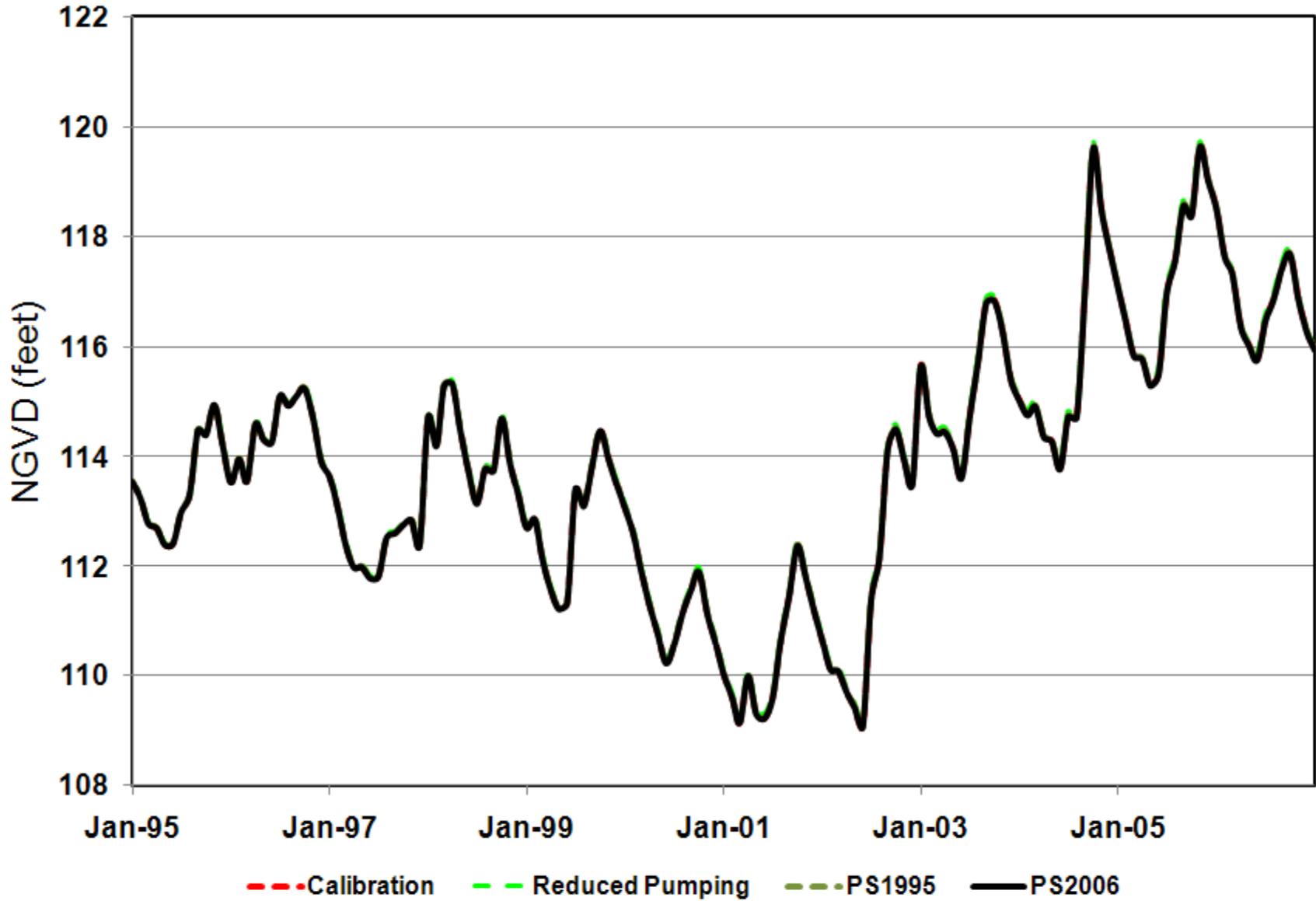
### Lake Mcleod Daily Hydrograph for Period of Record 1995 - 2006



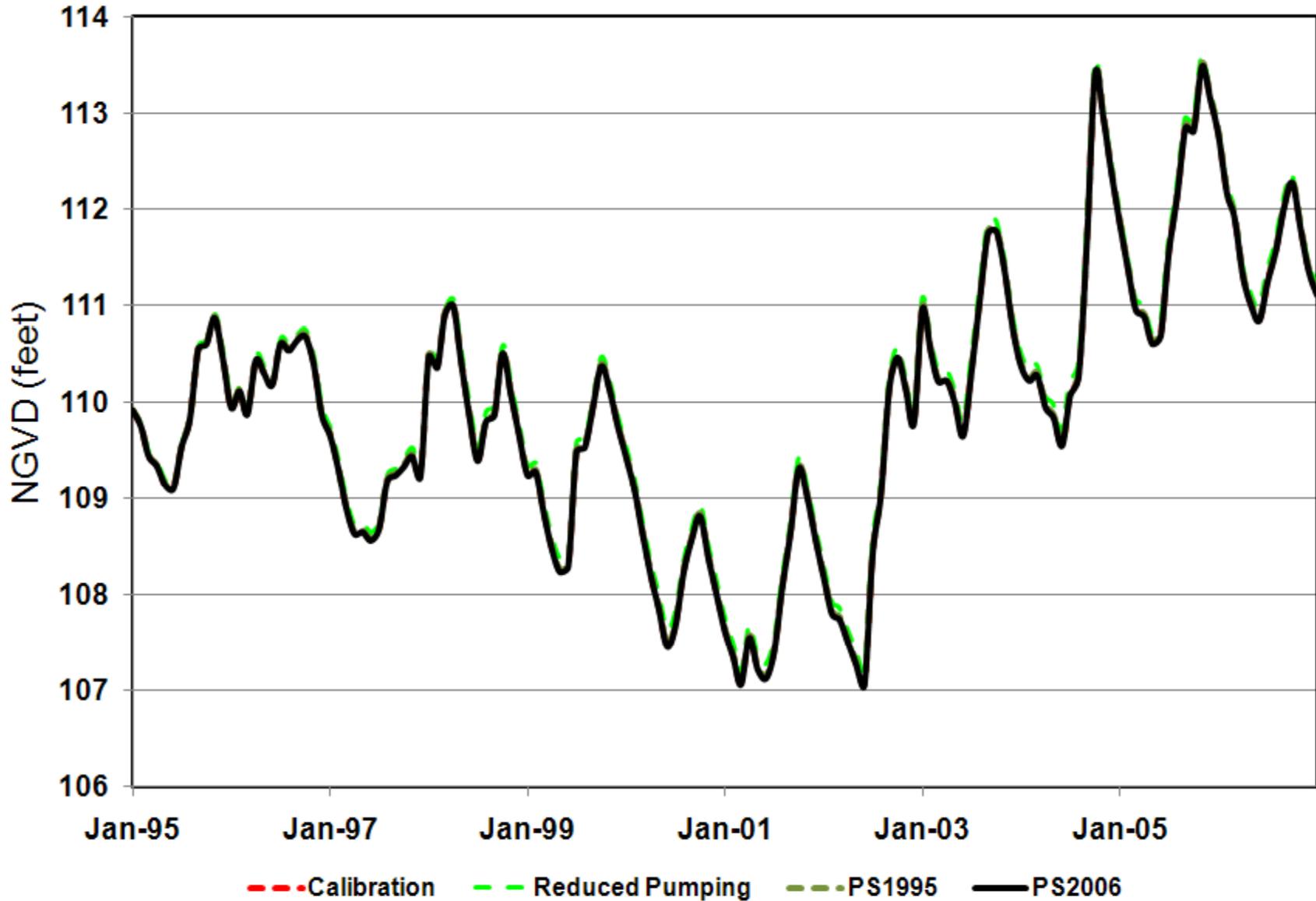
### Lake Starr WTS-22 NRSD Daily Hydrograph for Period of Record 1995 - 2006



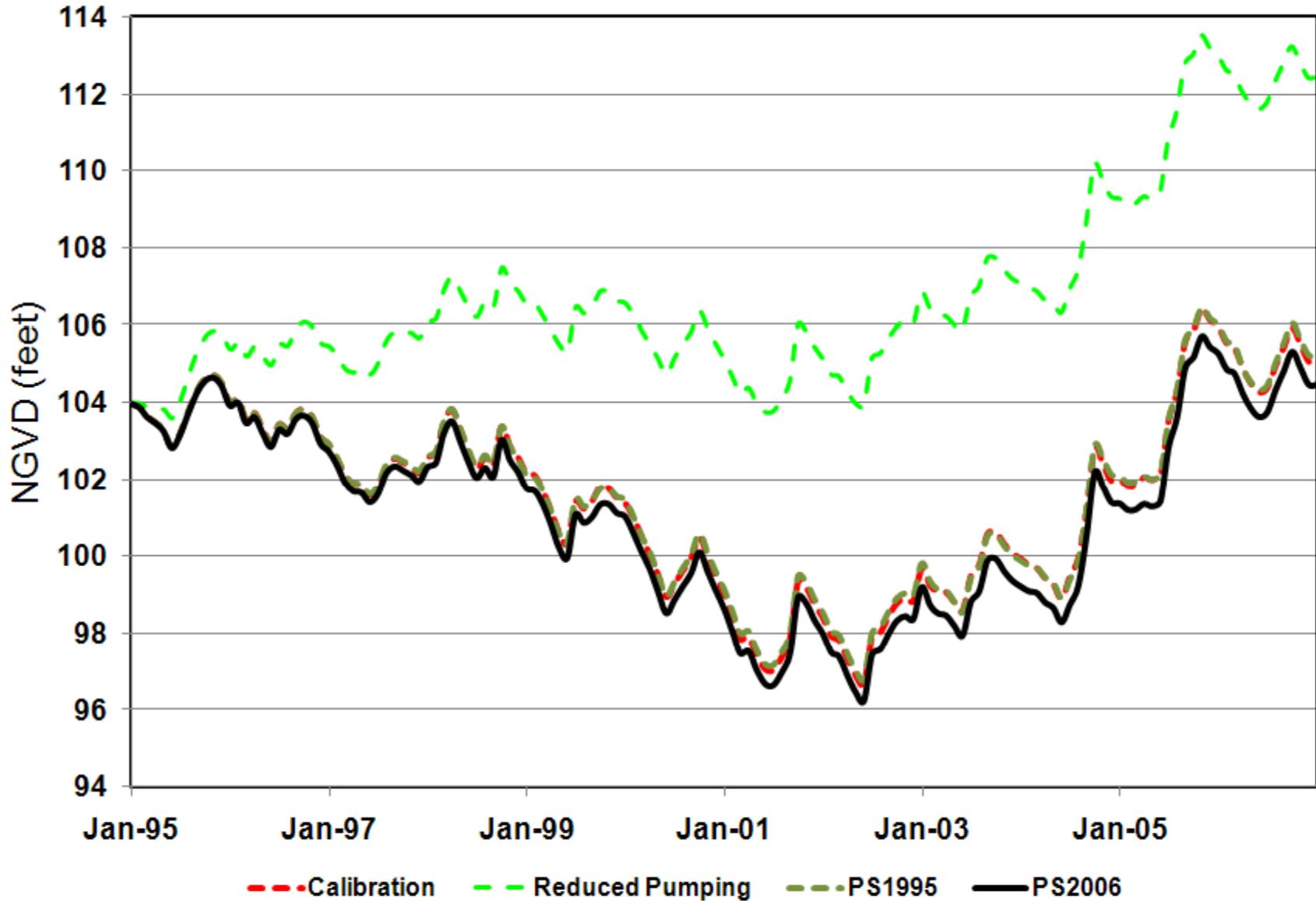
### Eva Shallow Daily Hydrograph for Period of Record 1995 - 2006



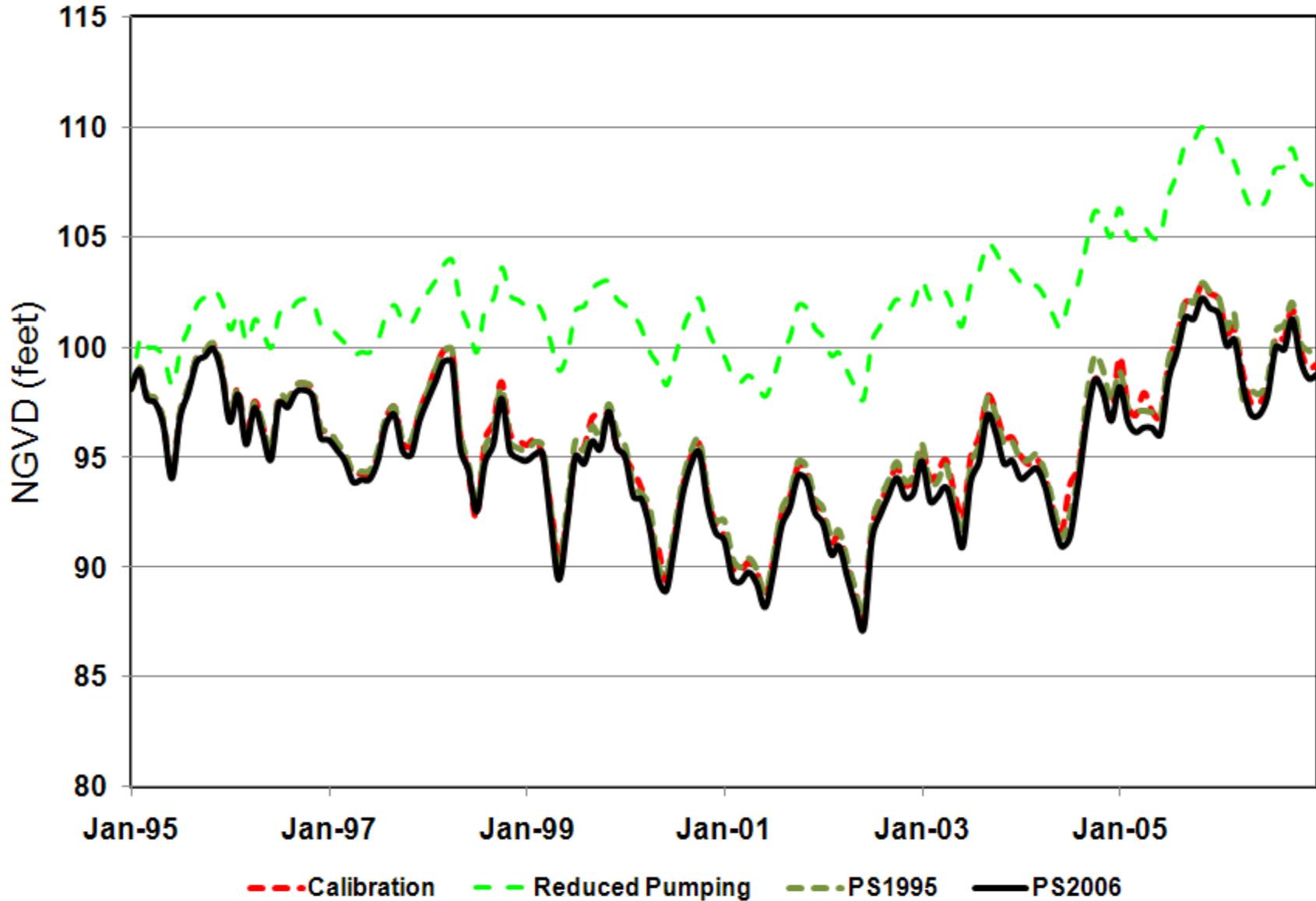
### Eva Deep Daily Hydrograph for Period of Record 1995 - 2006



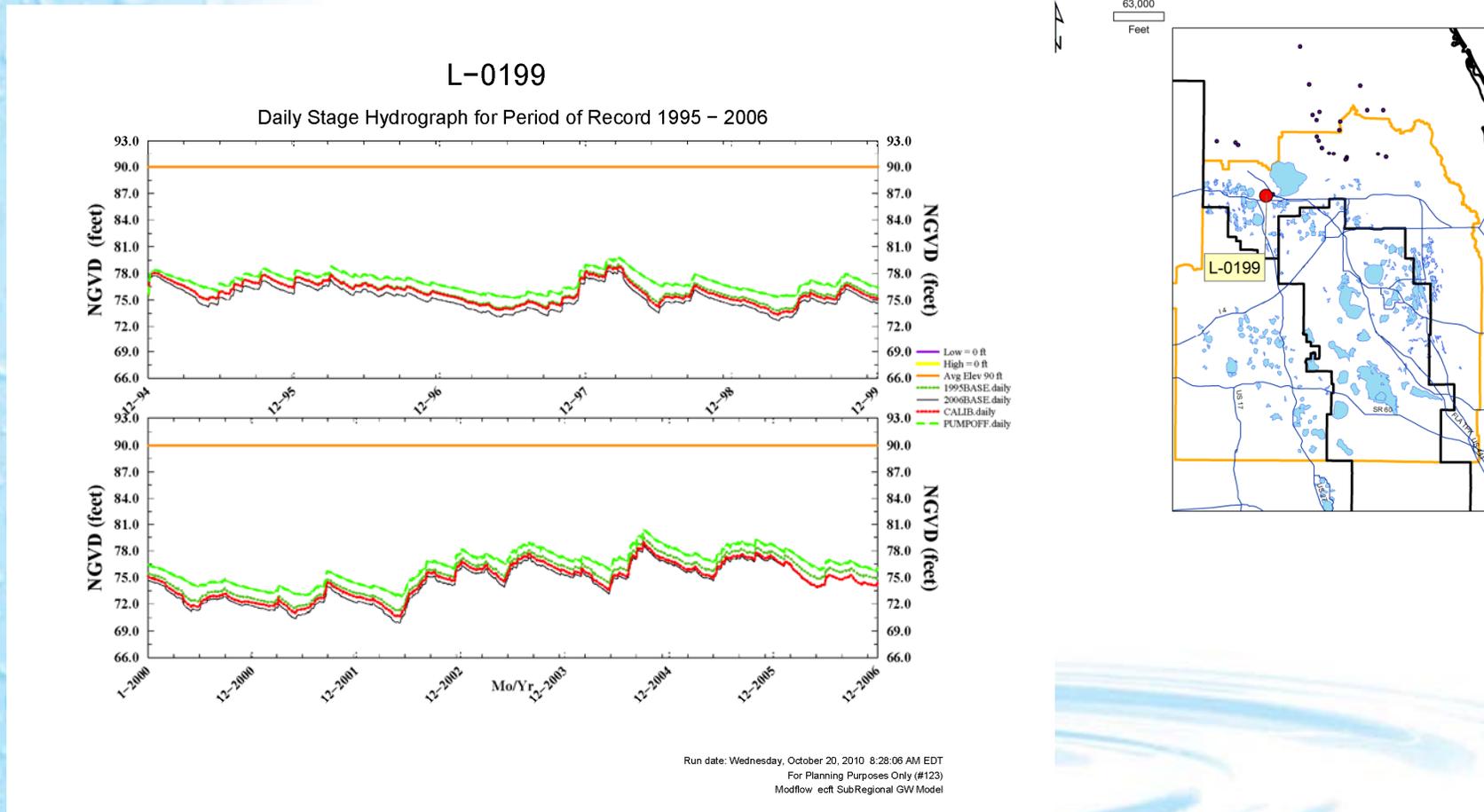
### ROMP 57X Surficial Daily Hydrograph for Period of Record 1995 - 2006



### ROMP 57X Ocala Daily Hydrograph for Period of Record 1995 - 2006



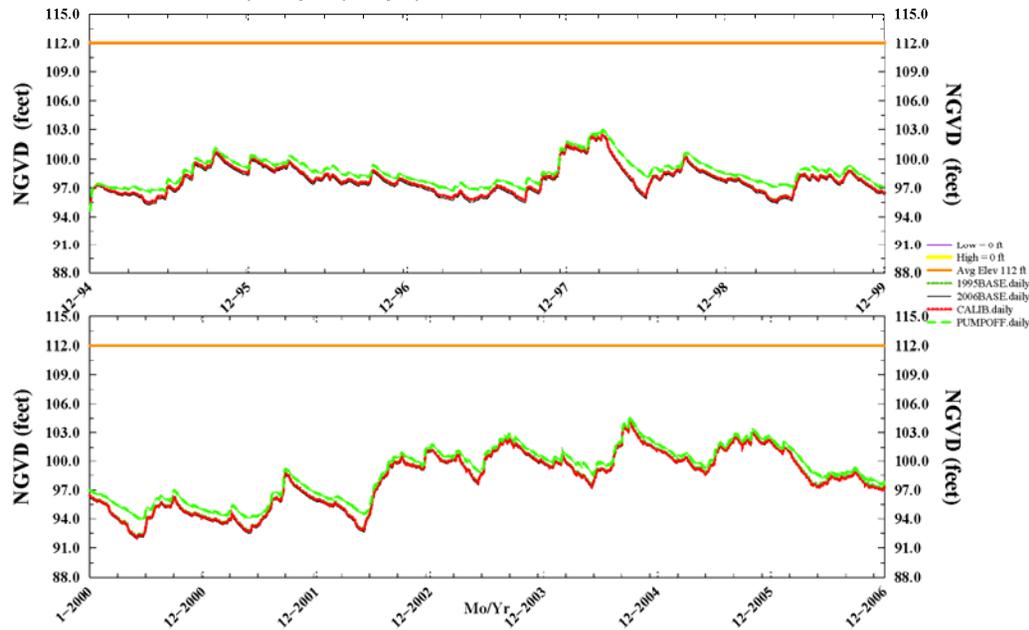
# Upper Floridan Simulation Plot Lake County (Well L-0199)



# Upper Floridan Simulation Plot Lake County (Well Lake-4)

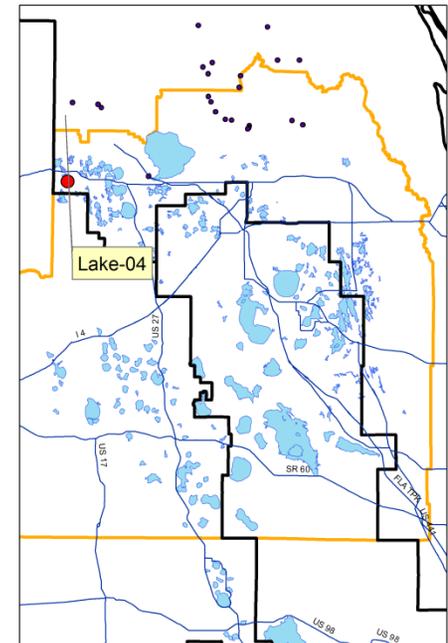
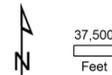
LAK004

Daily Stage Hydrograph for Period of Record 1995 – 2006



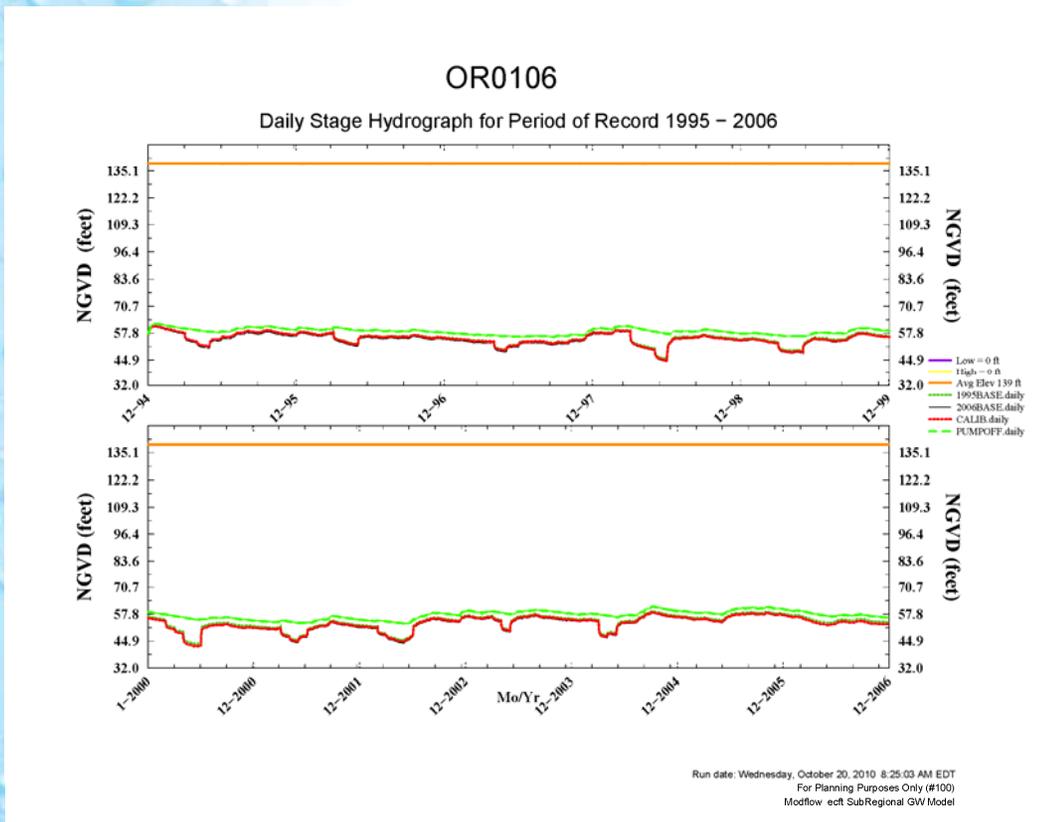
**Legend**

- springs\_k3
- trvehmj1 arc
- bdwmdwmb
- pshysurlak polygon
- CFCA\_Boundary



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For Planning Purposes Only (#128)  
Modflow ecft SubRegional GW Model

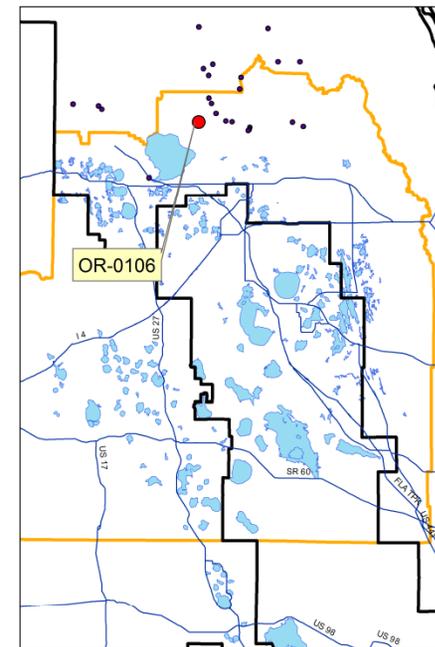
# Avon Park Simulation Plot Orange County (Well OR-0106)



**Legend**

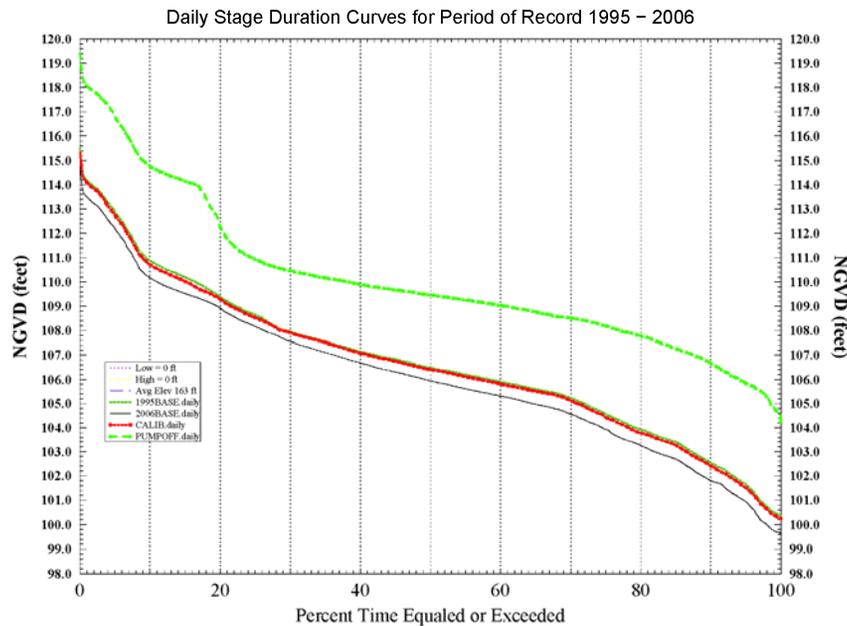
- springs\_k13
- trvehmj1 arc
- bdwmdwmb
- pstysuriak polygon
- CFCa\_Boundary

37,500  
Feet



# Surficial Aquifer Simulation Plot Polk County (Well Polk-32)

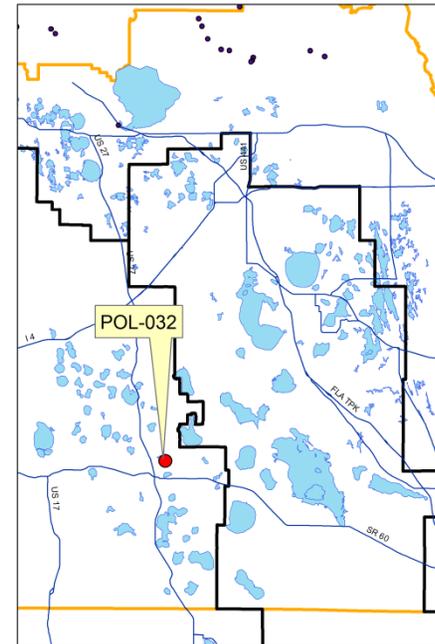
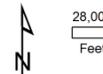
POL032



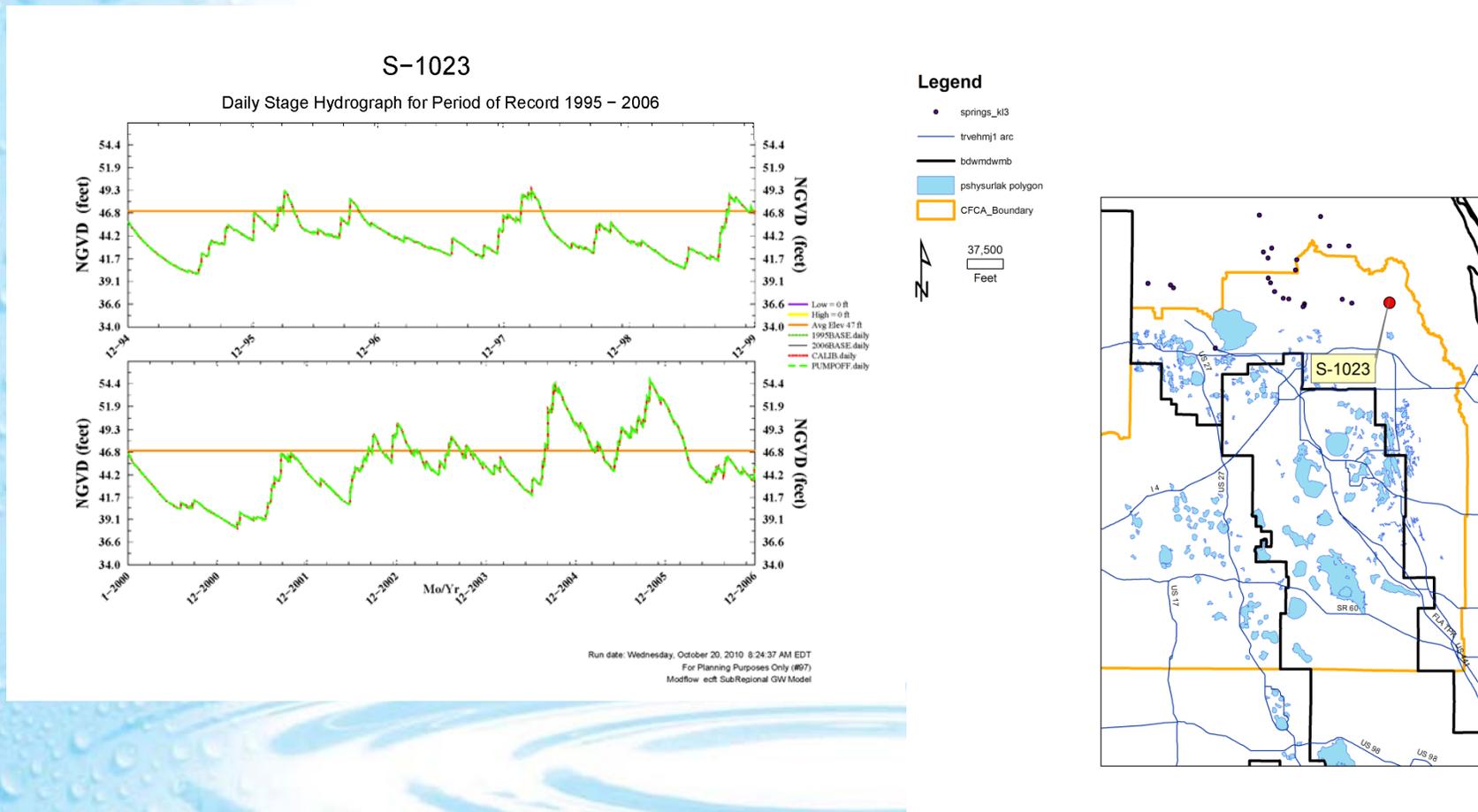
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Modflow ecf SubRegional GW Model

**Legend**

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- bdwmdwmb
- pshysurlak polygon
- CFCA\_Boundary

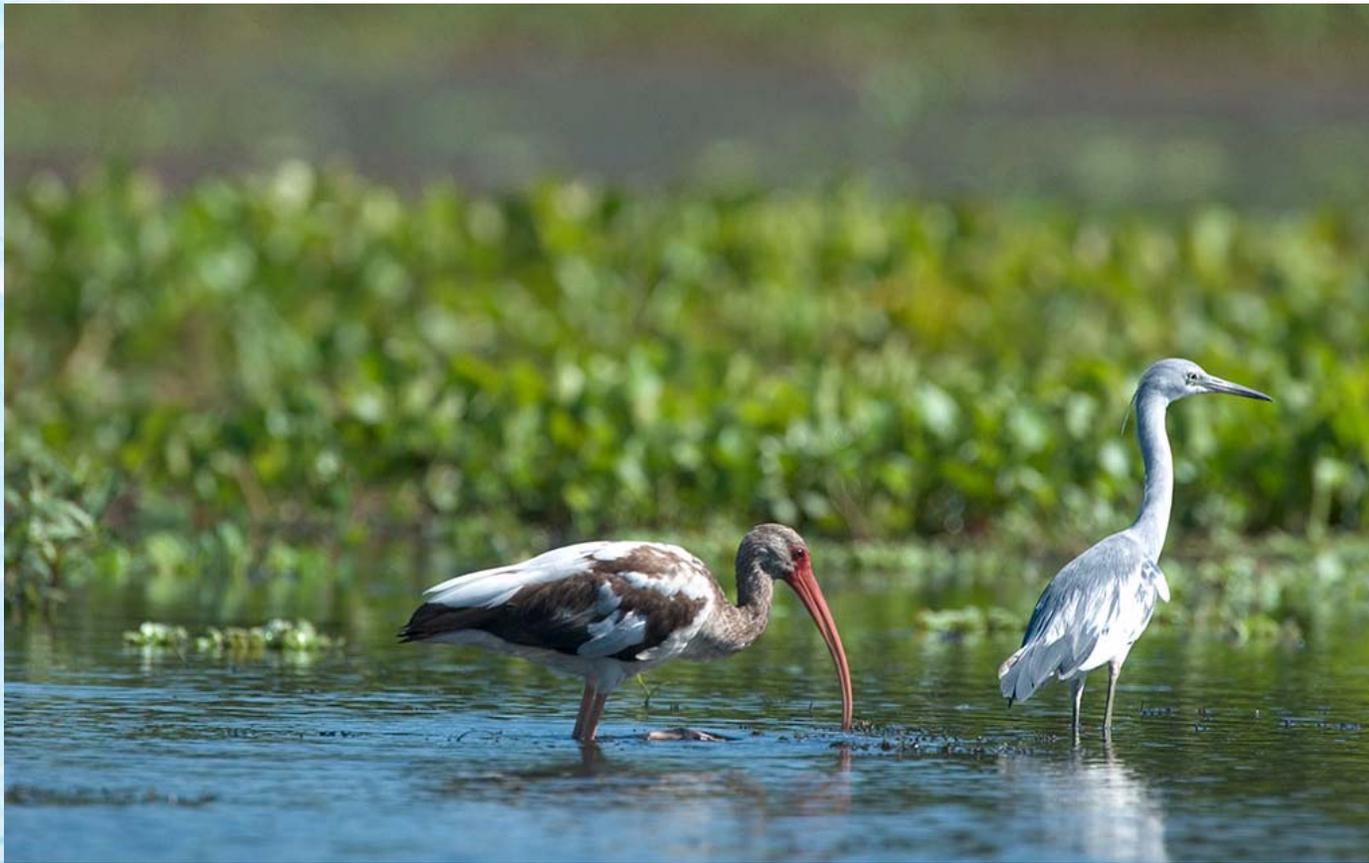


# Surficial Aquifer Simulation Plot Seminole County (Well S-1023)

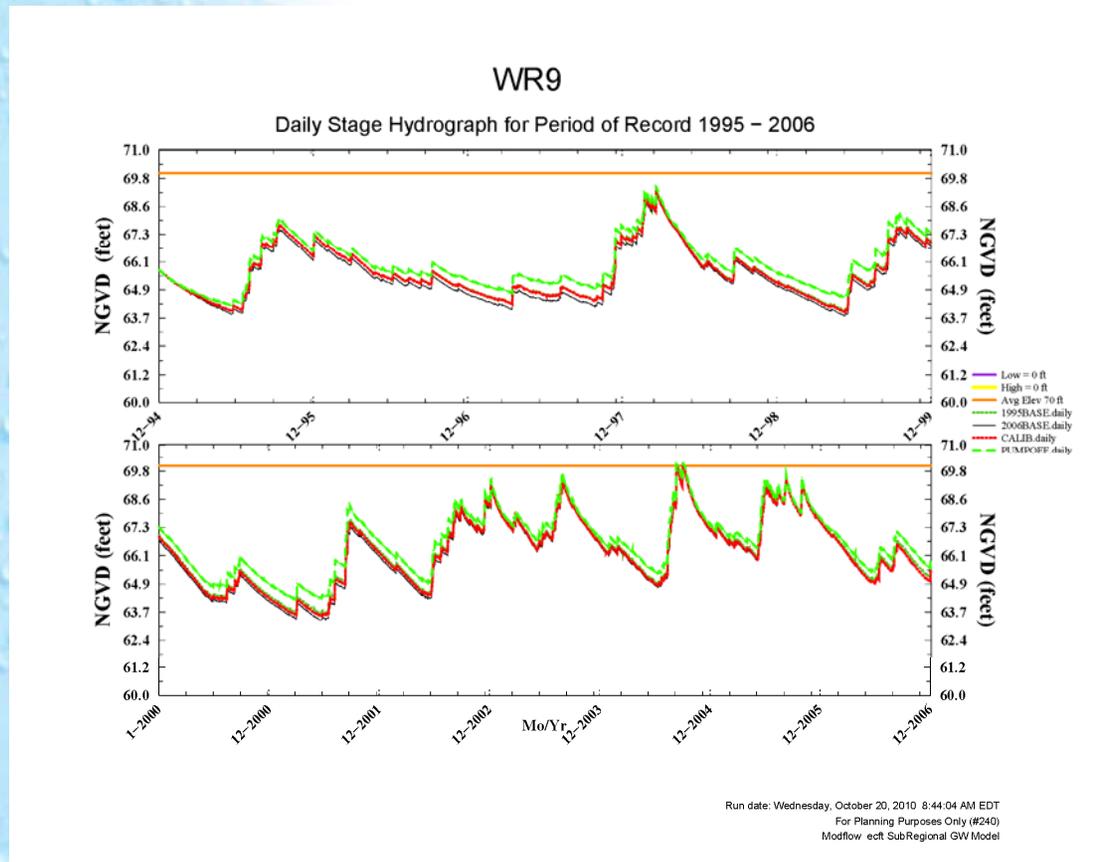


# Simulation Results

## Wetland Example Areas

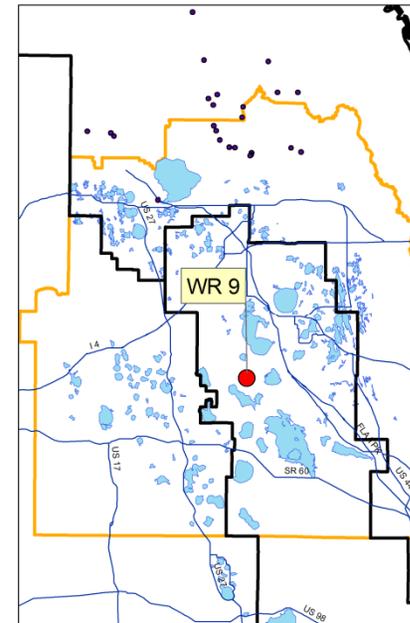


# Walker Ranch Wetland Gage Number 9 Simulation Plot

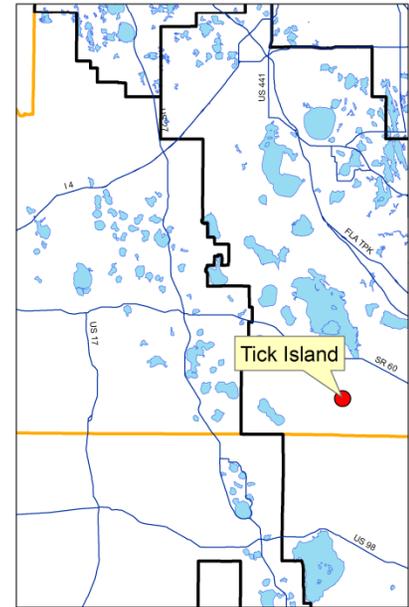
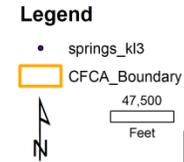
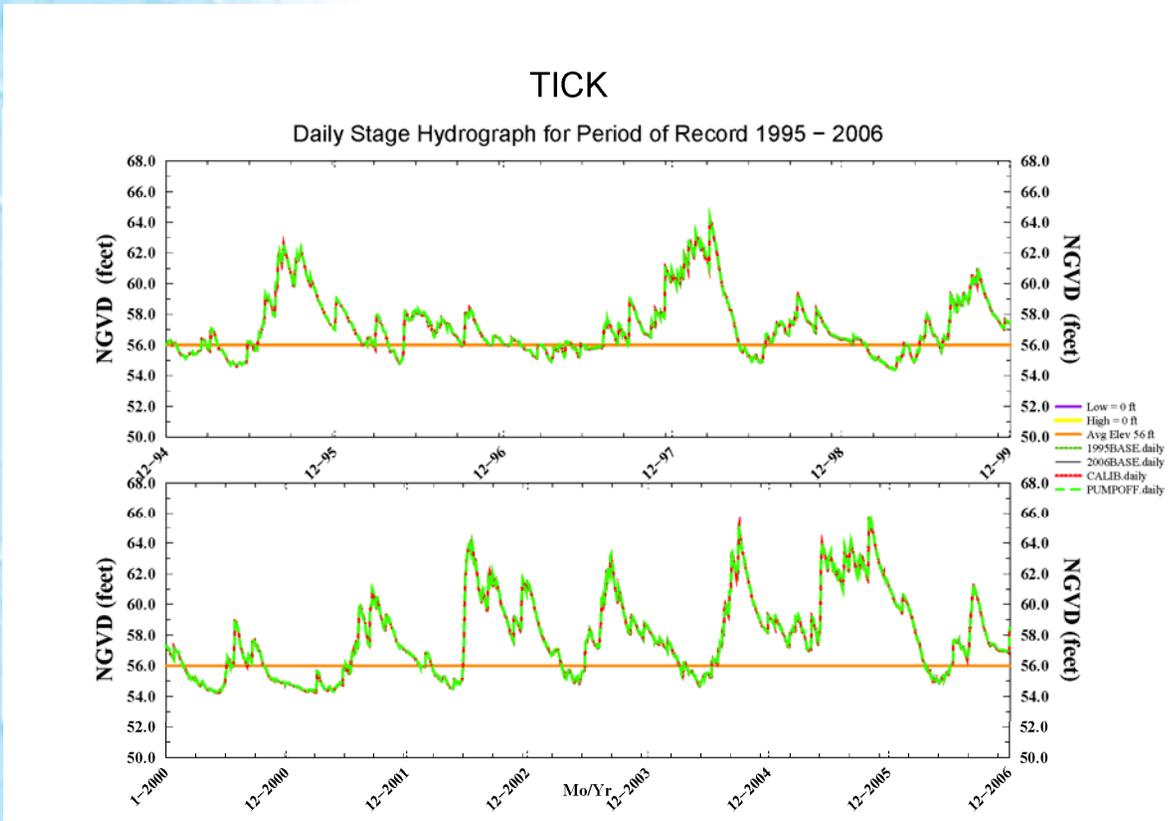


**Legend**

- springs\_kl3
  - CFCA\_Boundary
- 64,000  
Feet



# Tick Island Wetland Gage Simulation Plot



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For Planning Purposes Only (#305)  
Modflow ecft SubRegional GW Model

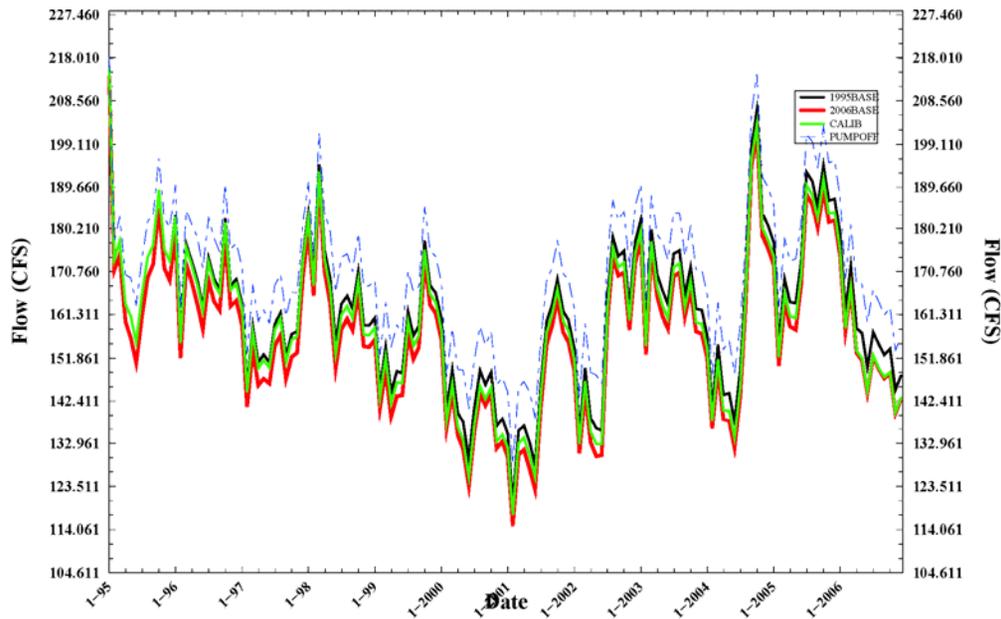
# Simulation Results

## Springs Example Areas



# Blue Springs Simulation Plot Volusia County

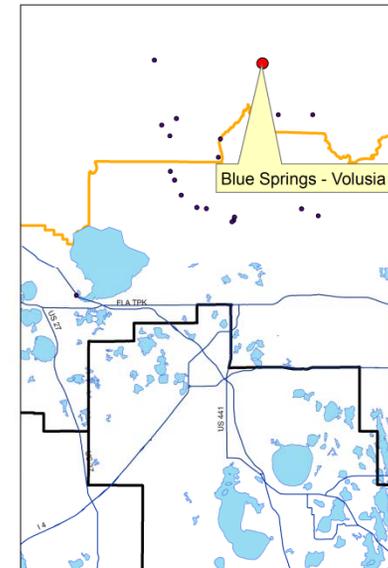
Monthly Spring flow  
Blue (Volusia Co)



Run Time: Thu Oct 21 15:36:28 2010  
For Planning Purposes Only  
ECFT Subregional GW Model

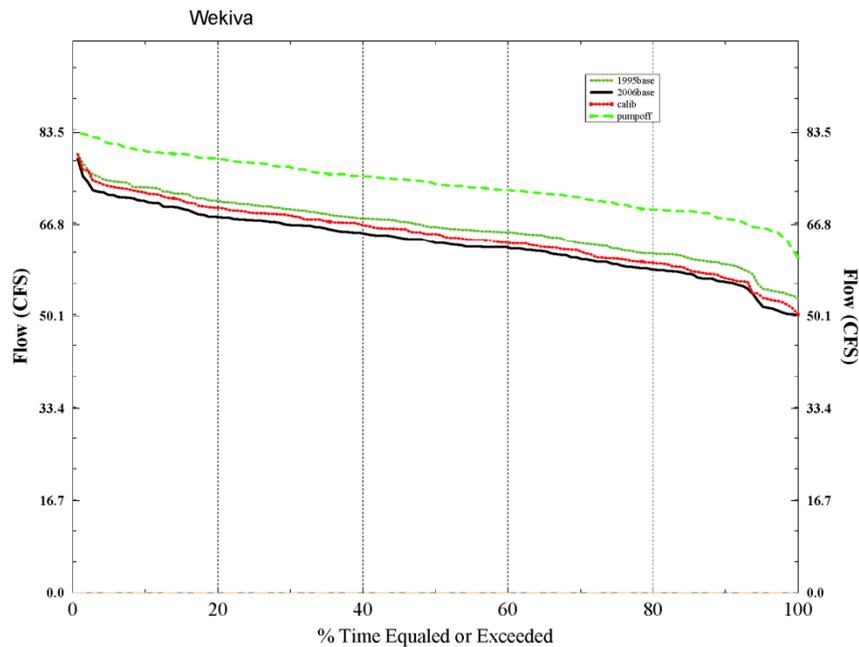
**Legend**

- springs\_k13
- trvehmj1 arc
- bdwmdwmb
- pshysurtak polygon
- CFCA\_Boundary



# Wekiwa Springs Simulation Plot Orange County

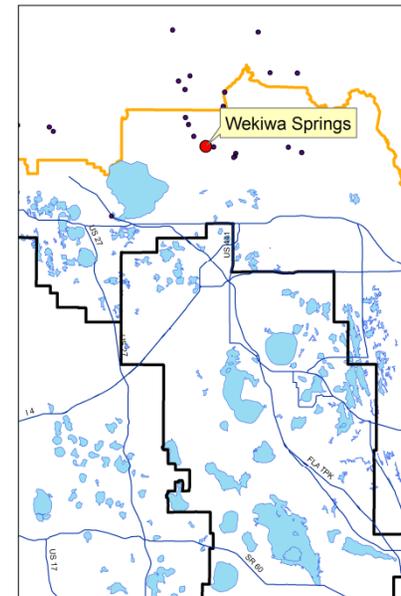
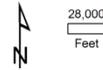
Monthly Spring Flow Duration Curve (1995–2006)



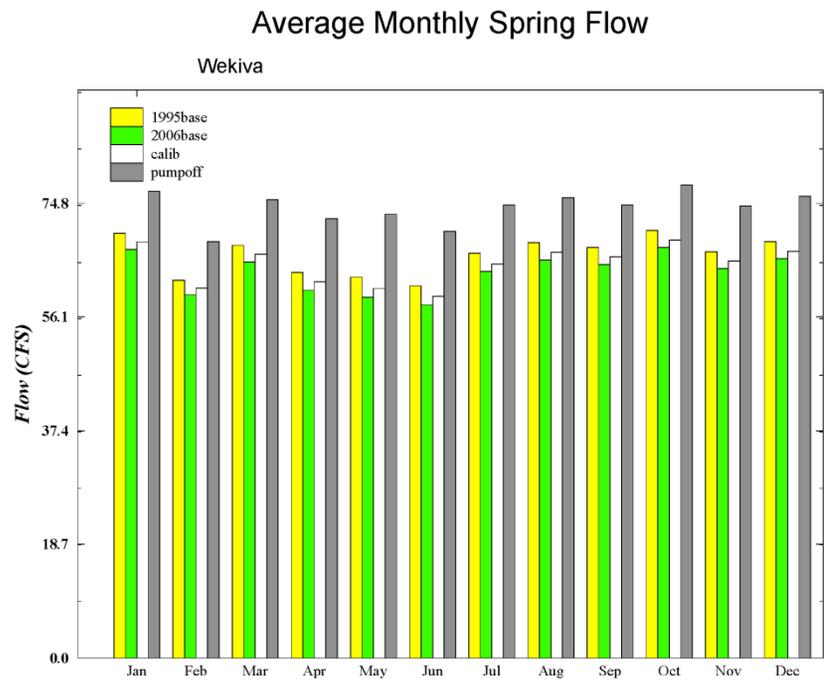
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For Planning Purposes Only (# 17)  
Modflow ECFT SubRegional GW Model

Legend

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- trvehmj1 arc
- bdwmdwmb
- psthysurlak polygon
- CFCA\_Boundary



# Wekiwa Springs Simulation Plot Orange County



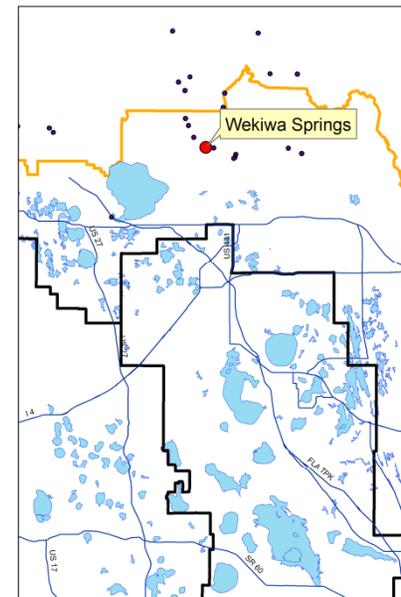
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For Planning Purposes Only (# 17)  
Modflow ECFT SubRegional GW Model

Legend

- springs\_k3
- trvehmj1 arc
- bdwmdwmb
- psthysurlak polygon
- CFCA\_Boundary



28,000  
Feet



CENTRAL FLORIDA COORDINATION AREA

# Simulation Results

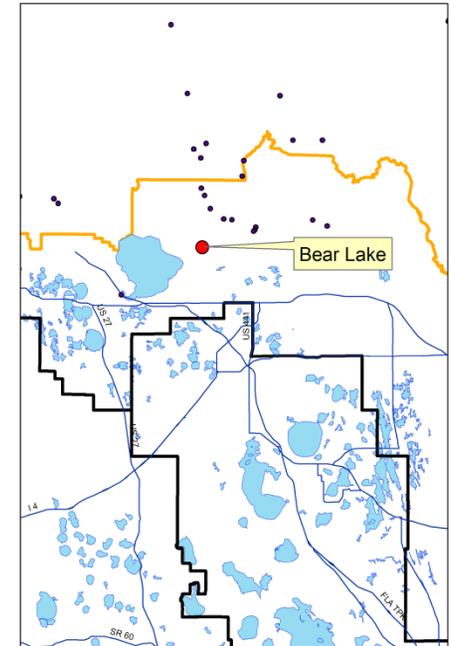
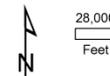
## Lake Example Areas



# Bear Lake Simulation Plot Orange County

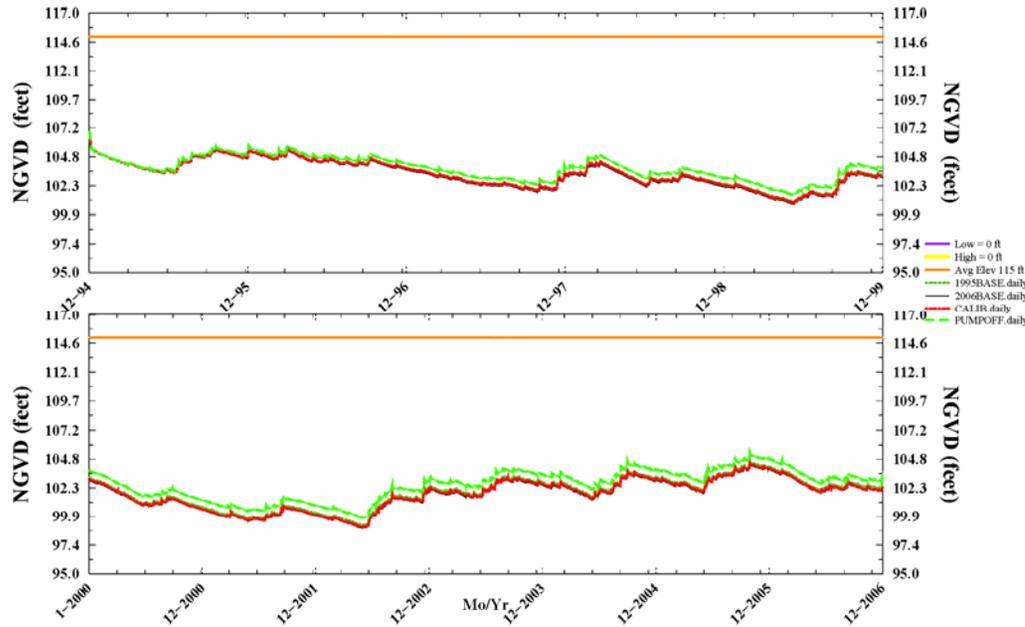
### Legend

- springs\_k13
- trvehmj1 arc
- bdwmdwmb
- pshysurlak polygon
- CFCA\_Boundary



## Bear Lake

Daily Stage Hydrograph for Period of Record 1995 – 2006



Run date: Wednesday, October 20, 2010 9:16:59 AM EDT  
For Planning Purposes Only (#1)  
Modflow eck Sub-Regional GW Model

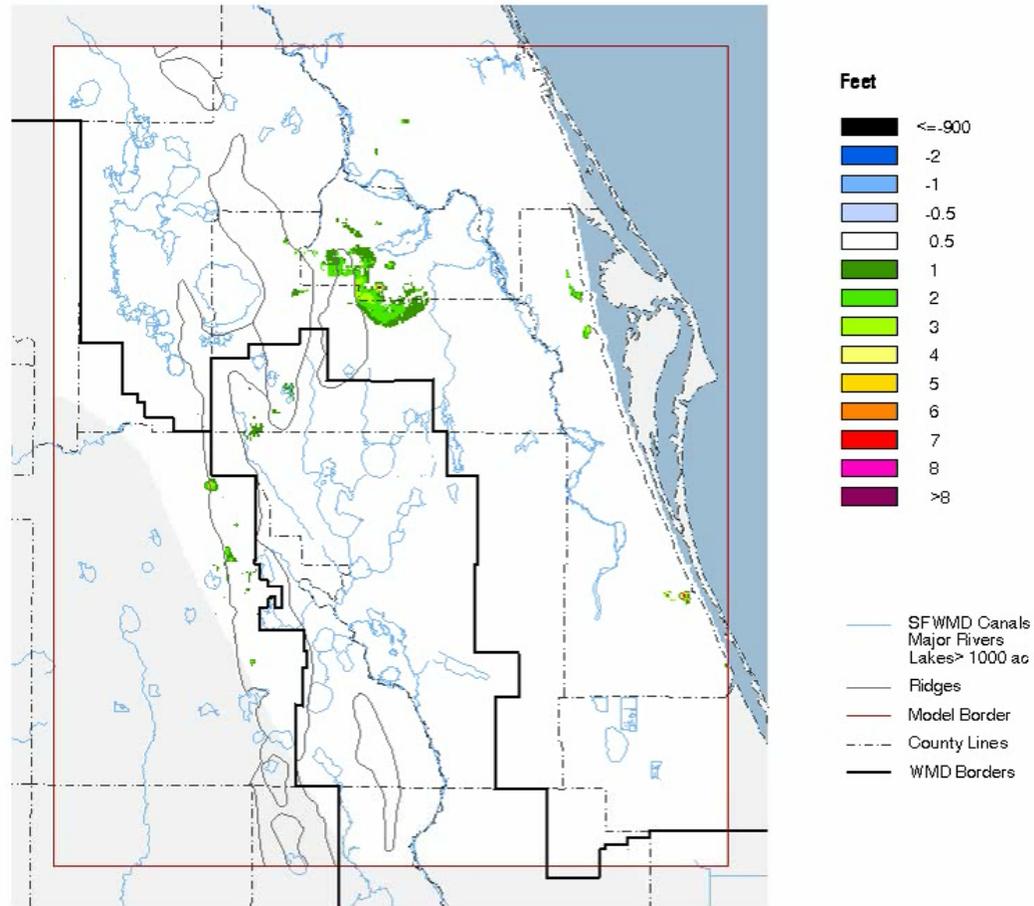
# Simulation Results Animation Examples



# Drawdown in Surficial Aquifer

[Local link to animation](#)

**Groundwater Drawdown for Upper Surficial Aquifer**  
**East Central Florida Transient Groundwater Model - 2006BASE**



Run Post Date: 101810

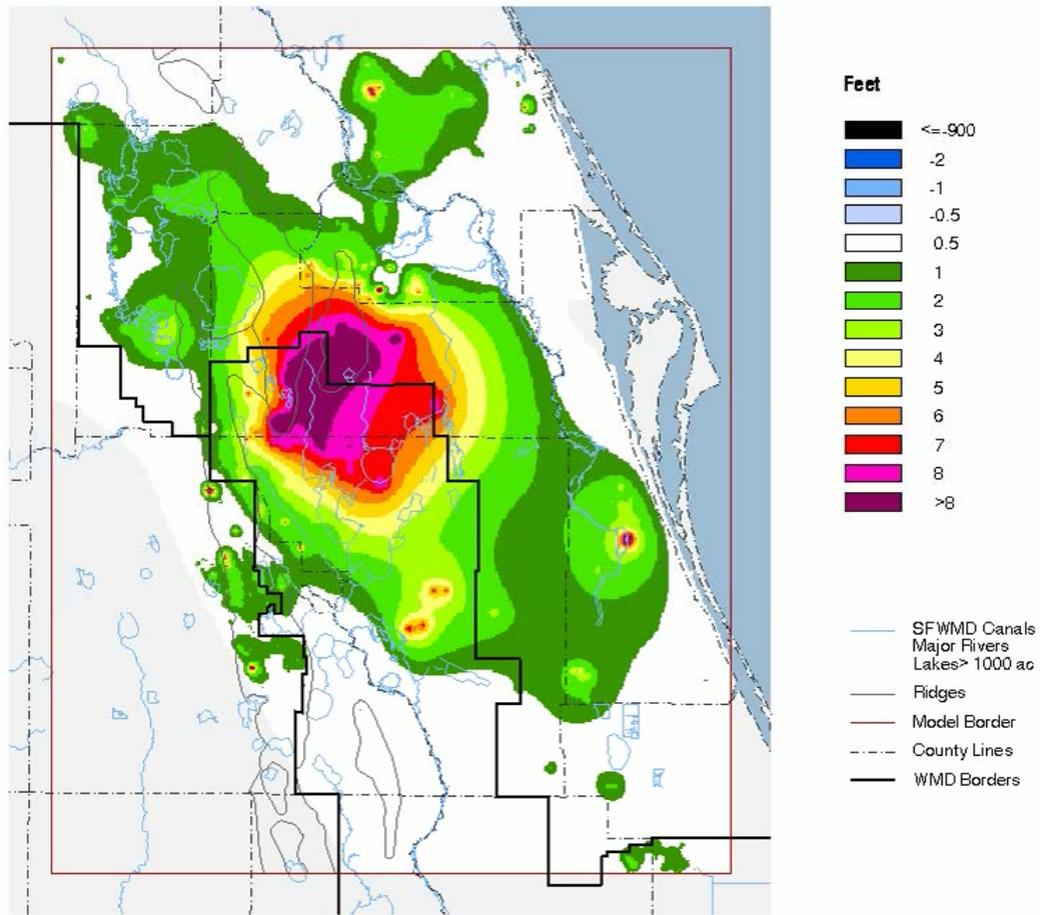
ECFT - Source MODFLOW

**Jan 31 1995**

# Drawdown in the Upper Floridan Aquifer

[Local link to animation](#)

Groundwater Drawdown for Upper Floridan Aquifer  
East Central Florida Transient Groundwater Model - 2006BASE



Run Post Date: 101810

ECFT - Source MODFLOW

**Jan 31 1995**

# PMViewer Location

- <http://my.sfwmd.gov/pmviewer/index.jsp>

# Model Results

- The ECFT Model results can be found at <http://my.sfwmd.gov/pmviewer/index.jsp>

## Planned Activities

- Finalize and vet evaluation measures and criteria
- Finalize simulations of 4 scenarios
- Set up and run 2013 scenarios (2 runs)
- Set up and run limited number of sensitivity runs
- Work with environmental assessment teams to determine areas of unacceptable stress using models and other inputs – determine availability
- Continue public involvement
- Document work effort
- Initiate solution phase

# Contacts

■ Akin Owosina

[aowosin@sfwmd.gov](mailto:aowosin@sfwmd.gov)

■ Mark Barcelo

[Mark.Barcelo@swfwmd.state.fl.us](mailto:Mark.Barcelo@swfwmd.state.fl.us)

■ Doug Munch

[dmunch@sjrwmd.com](mailto:dmunch@sjrwmd.com)