Central Florida Water Initiative

Water for Tomorrow

Technical Methods Workshop

April 18, 2019

www.cfwiwater.com

Central Florida Water Initiative Agenda

- **Objective**
  - Discuss the technical data and modeling tools used in support of the CFWI Regional Water Supply Plan
- **Welcome and Overview**
- **Technical Methods**
  - Hydrologic Analysis Team
  - MFLs and reservations Team
  - Environmental Measures Team
  - Groundwater Availability Team

Regional Water Supply Plan Team

Tammy Bader-Gibbs
Regional Water Supply Plan

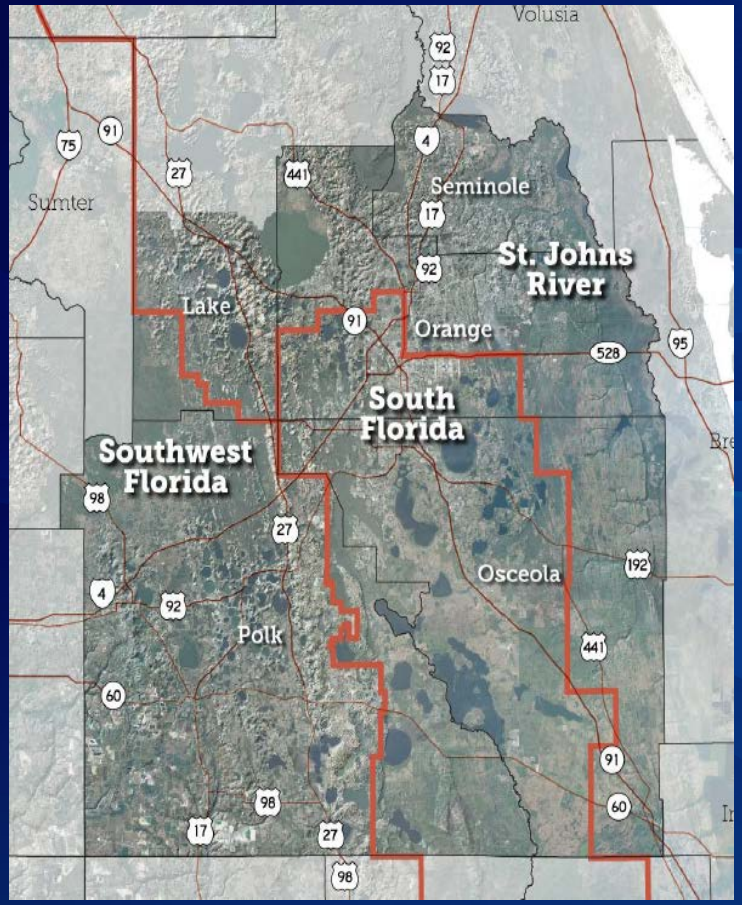
What is the CFWI?

- A collaborative water supply planning effort to: Protect, develop, conserve and restore central Florida's water resources
- Goals
  - Identify sustainable quantities of groundwater sources
  - Develop strategies to meet water demands
  - 2020 CFWI RWSP

Regional Water Supply Plan

- Water demands for all water use categories
  - 20-year planning horizon
- Evaluation of water resources
- How to meet the water demands
  - Potential sources
  - Project options
- Funding options
- Update every 5 years

CFWI Planning Area



Planning Horizon 2015-2040

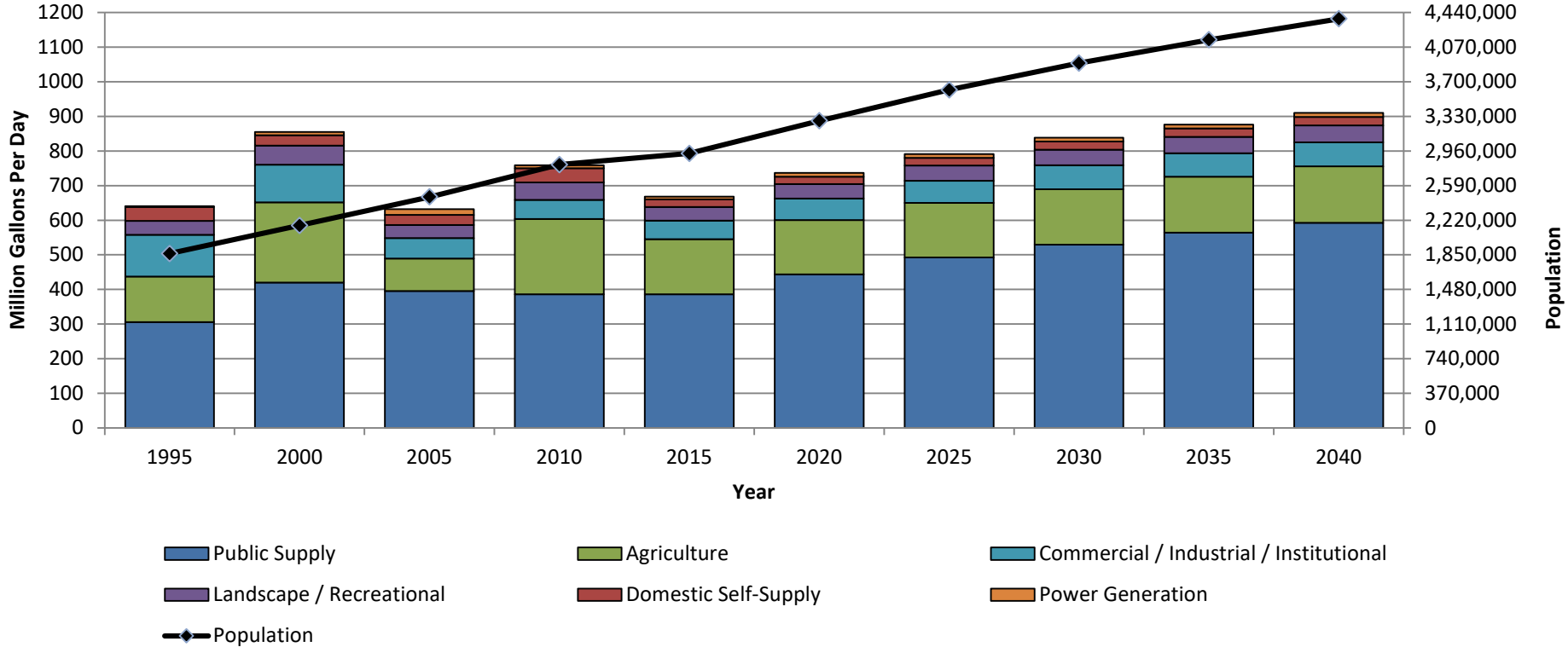
- Population:
  - 2015 2,933,915
  - 2040 4,373,309

  49% increase
- Irrigated agricultural acreage:
  - 2015 135,700 acres
  - 2040 134,300 acres

  1% decrease
- Gross water demands:
  - 2015 669 mgd
  - 2040 910 mgd

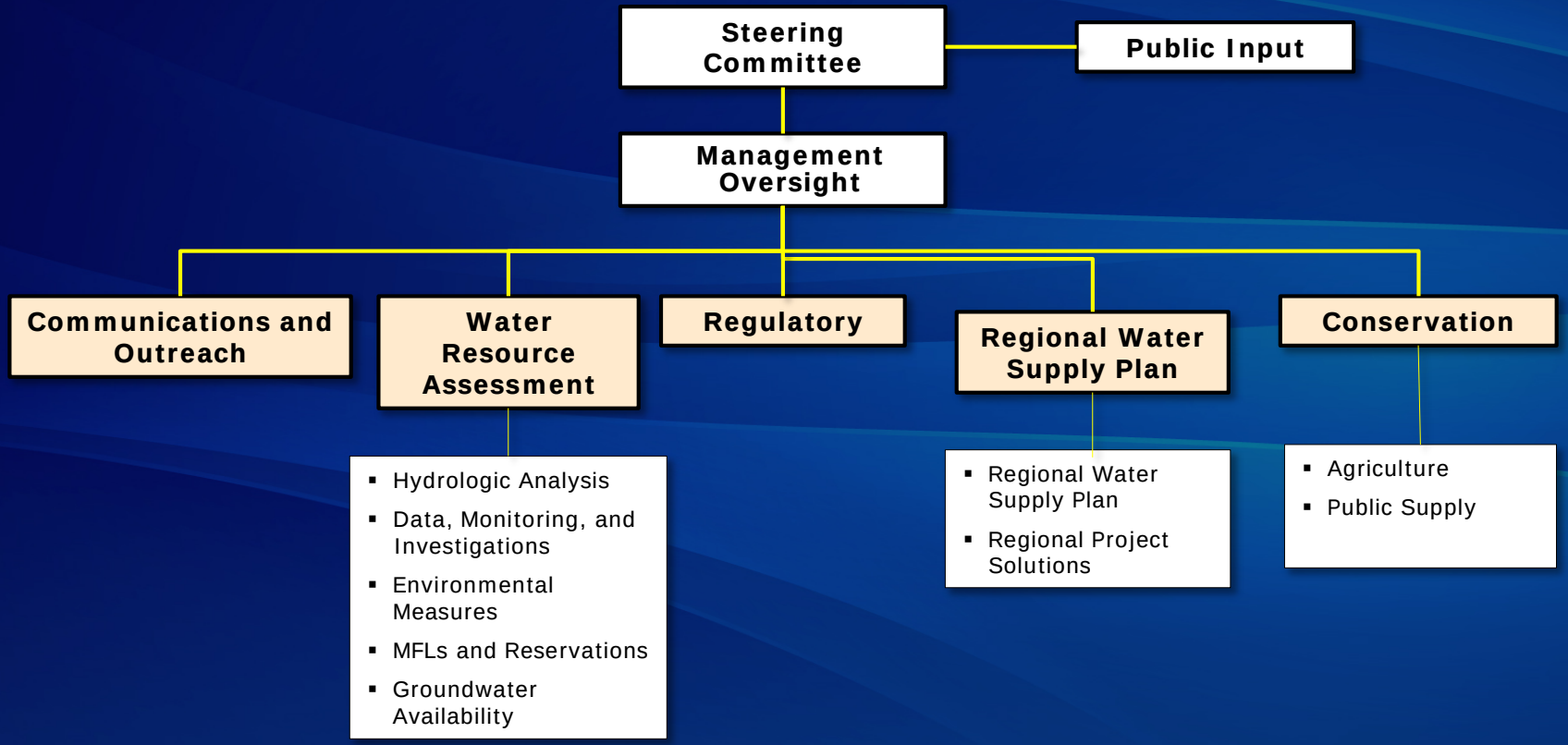
  36% increase

Historic Water Use and Projected Water Demand – vs – Historic Population and Projected Population

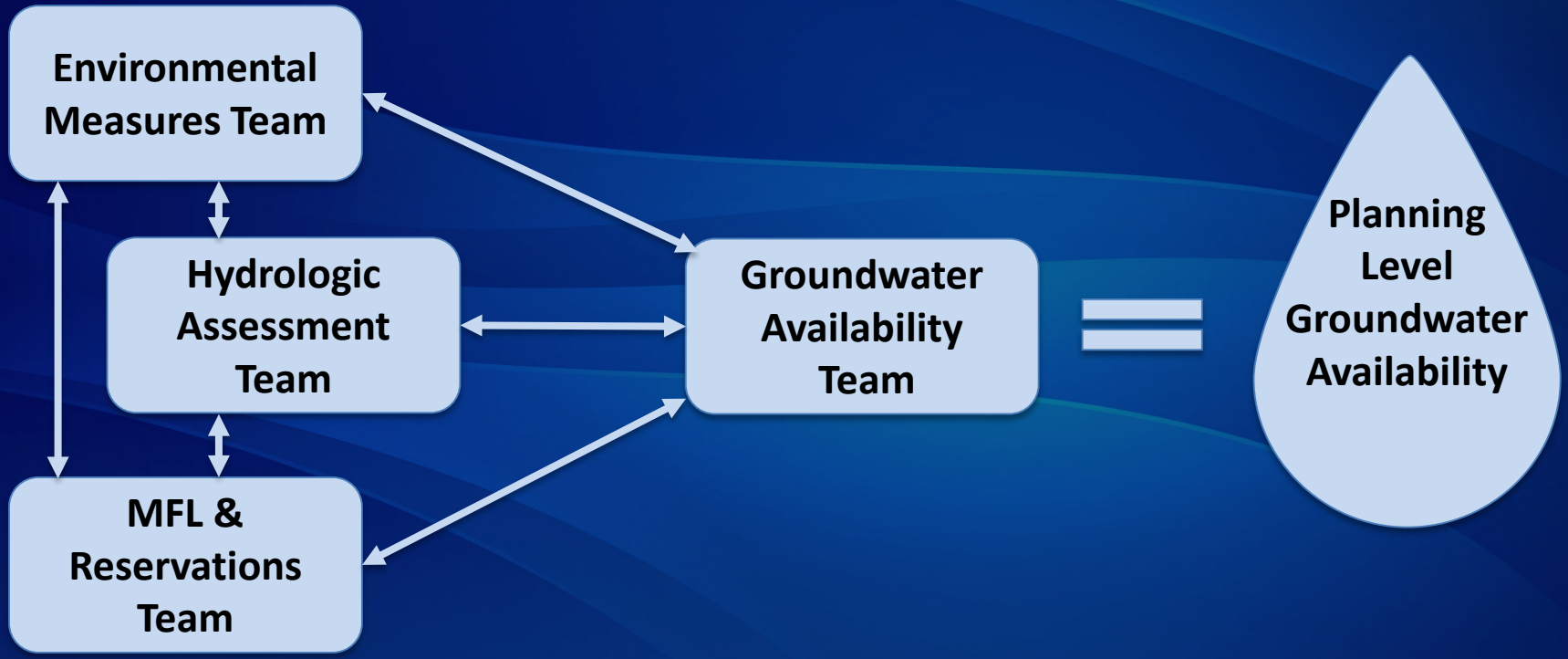


1995-2015 is historic data / 2020-2040 is Projected data

2020 Organizational Structure



Estimating Groundwater Availability

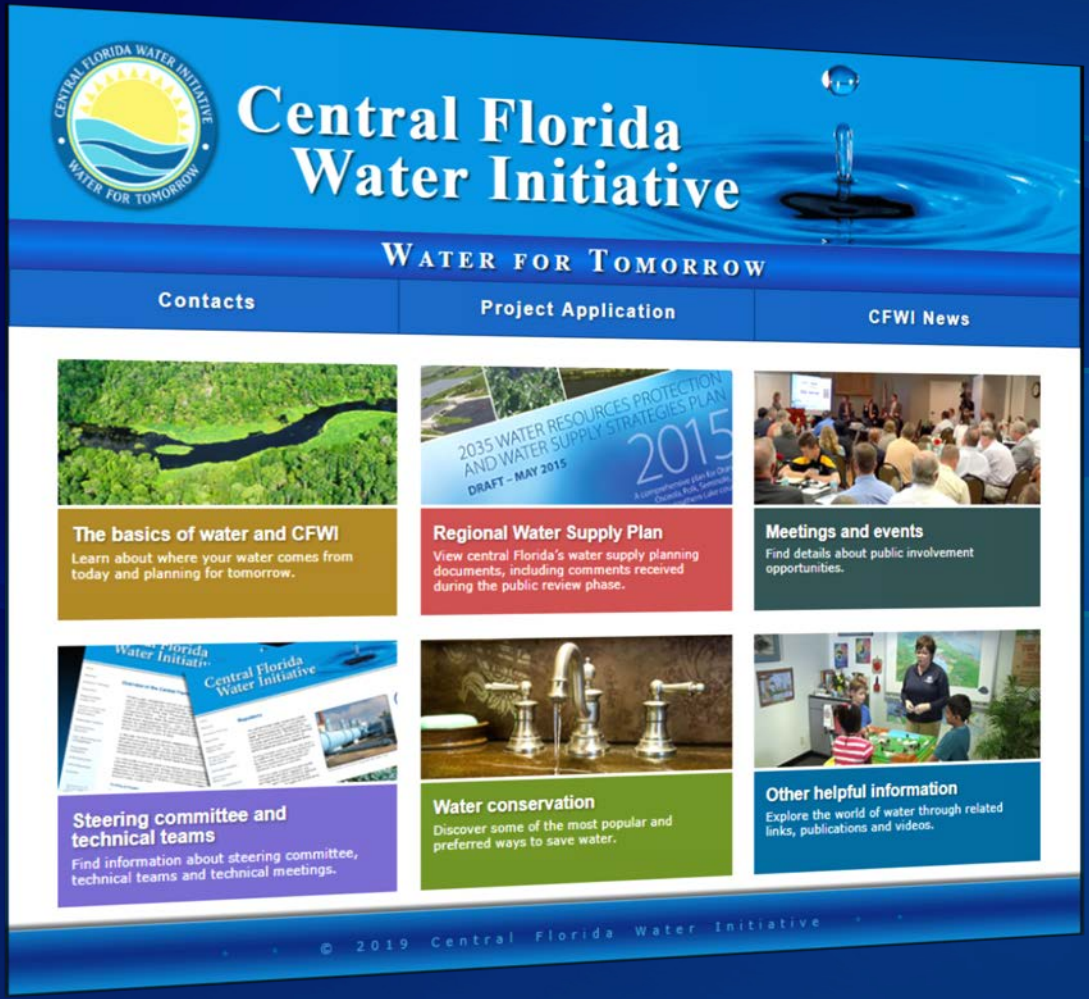


Public Involvement and Collaboration

SWFWMD
SFWMD
FDEP
Public Supply Utilities
SJRWMD
FDACS
Agriculture
Industrial
Mining
Environmental
Local Governments
Power Generation
Landscape / Recreation
General Public
Commercial

Schedule

- Draft 2020 RWSP with results – March 2020
- Public Workshops – April 2020
- Public Comment Ends – May 2020
- Governing Board Approval – November 2020



Questions?

Additional information can be found at:

cfwiwater.com

Hydrologic Assessment Team

Peter J. Kwiatkowski, P.G.
Hydrologic Assessment Team Lead

Topics

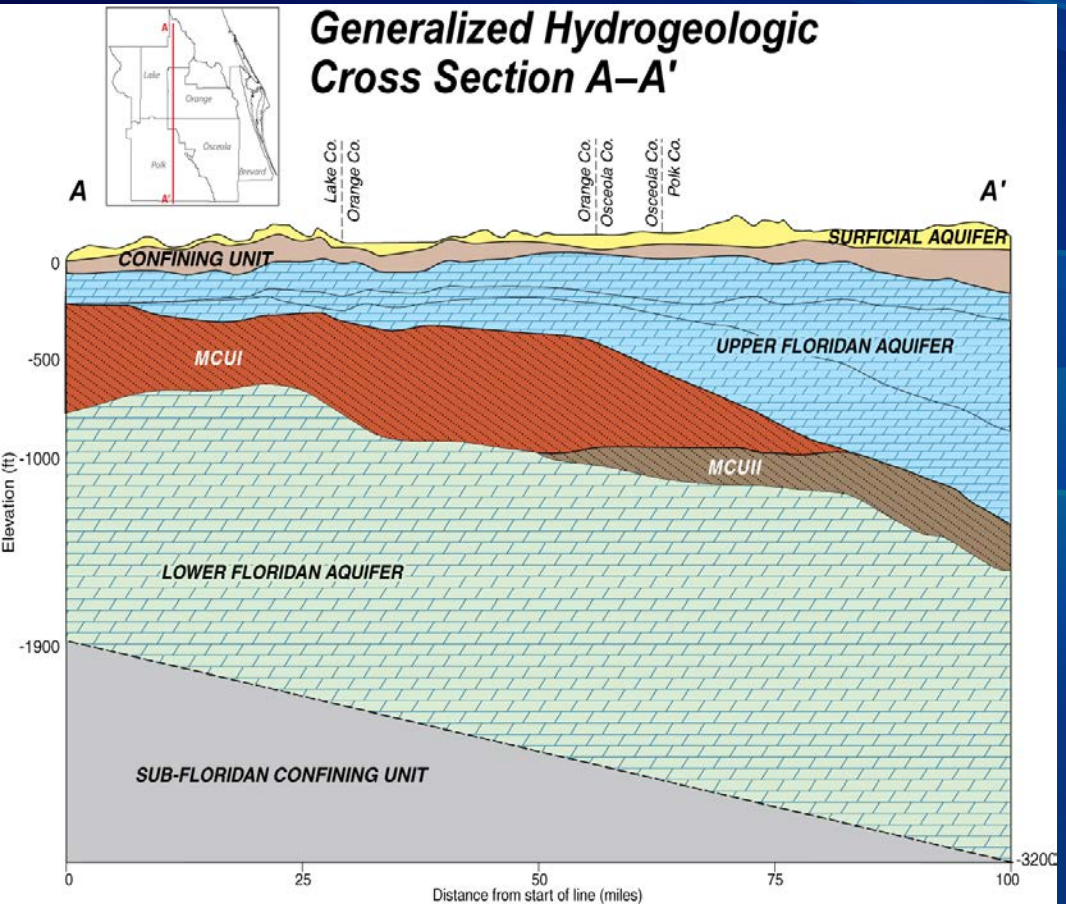
- Purpose
- Central Florida Hydrology
- East Central Florida Transient Extended (ECFTX) Groundwater Flow Model
- Example Model Output

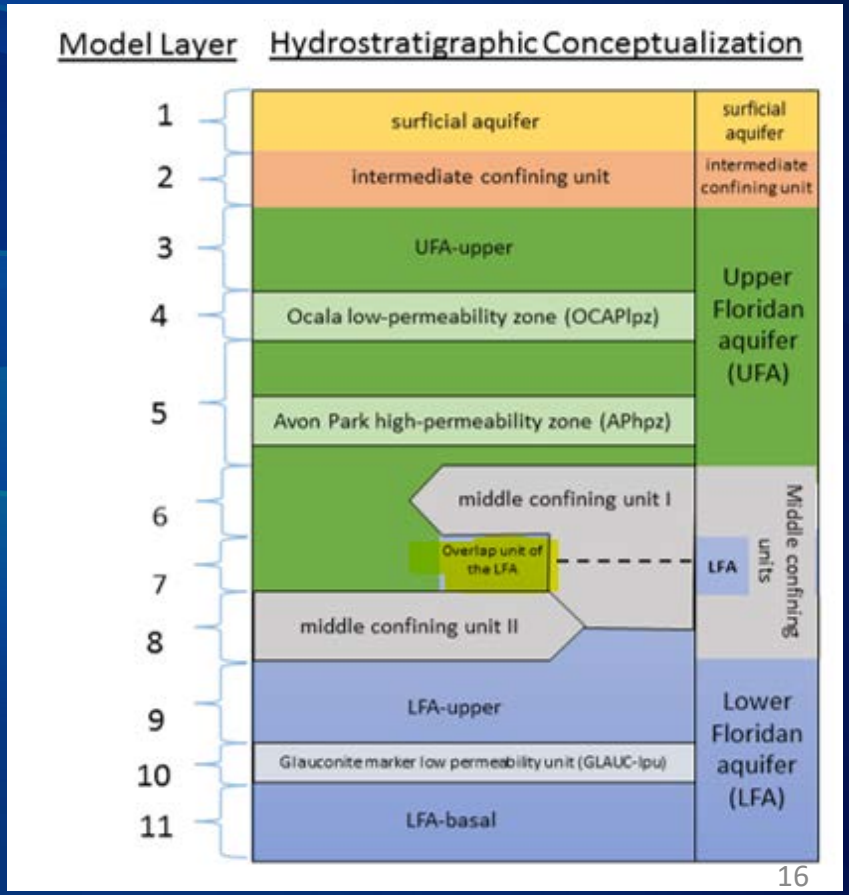
Purpose

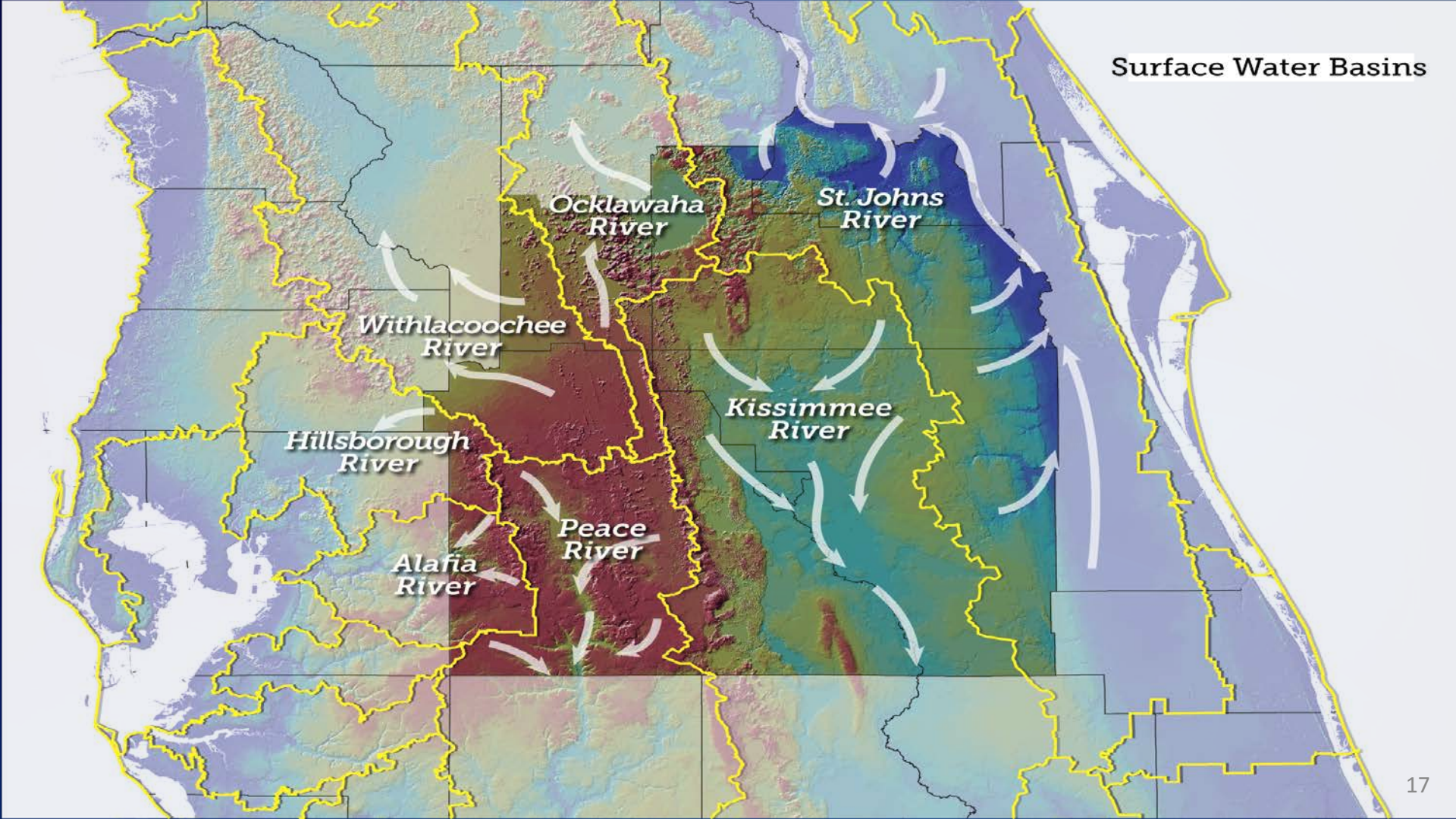
The HAT was charged with developing a calibrated groundwater flow model to:

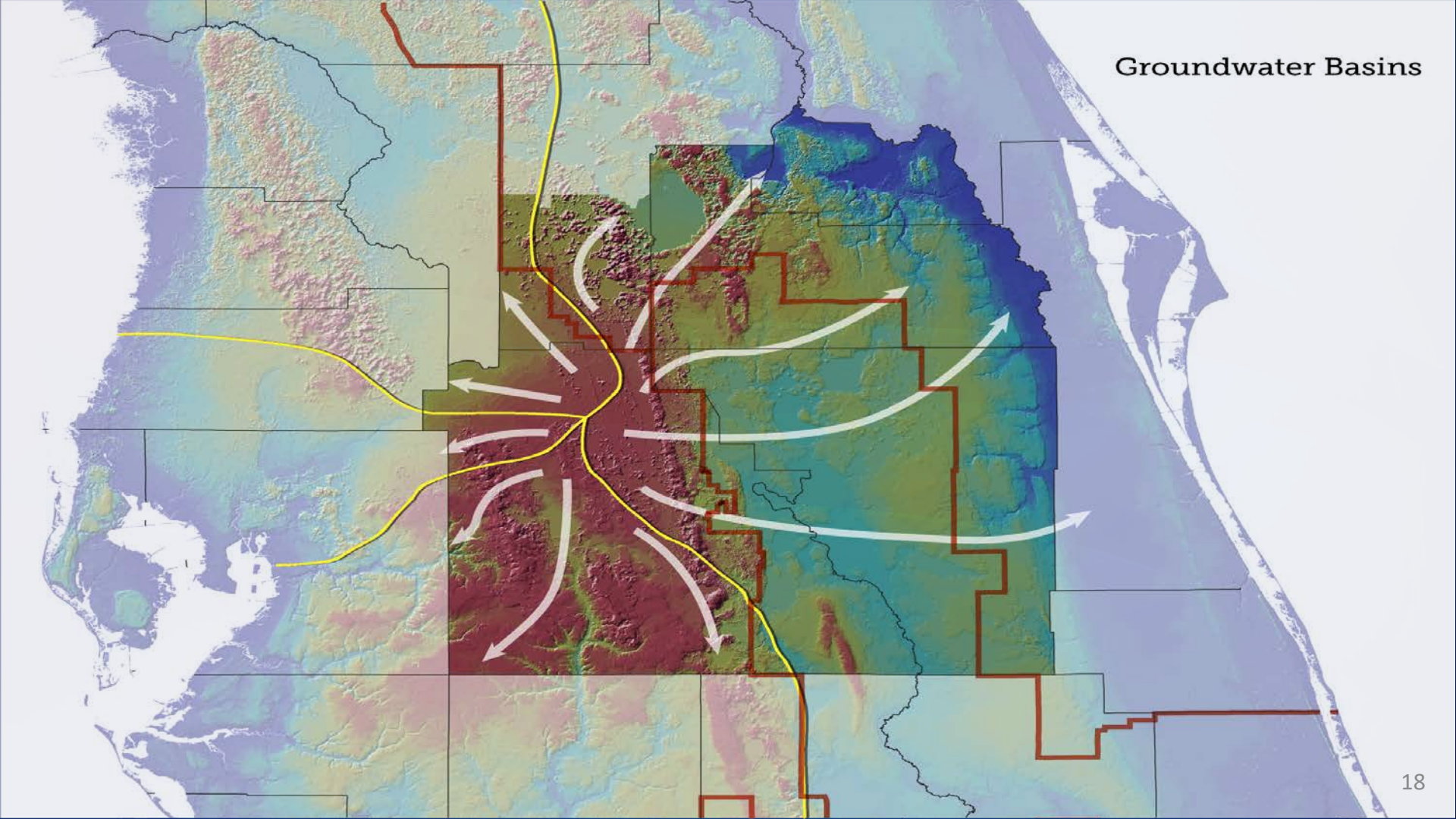
- Simulate effects of groundwater withdrawals on natural systems including springs, lakes, wetlands, and aquifers
- Assist to quantify sustainable limits of groundwater
- Assist to evaluate whether water supply demands can be met over the 20-year planning horizon

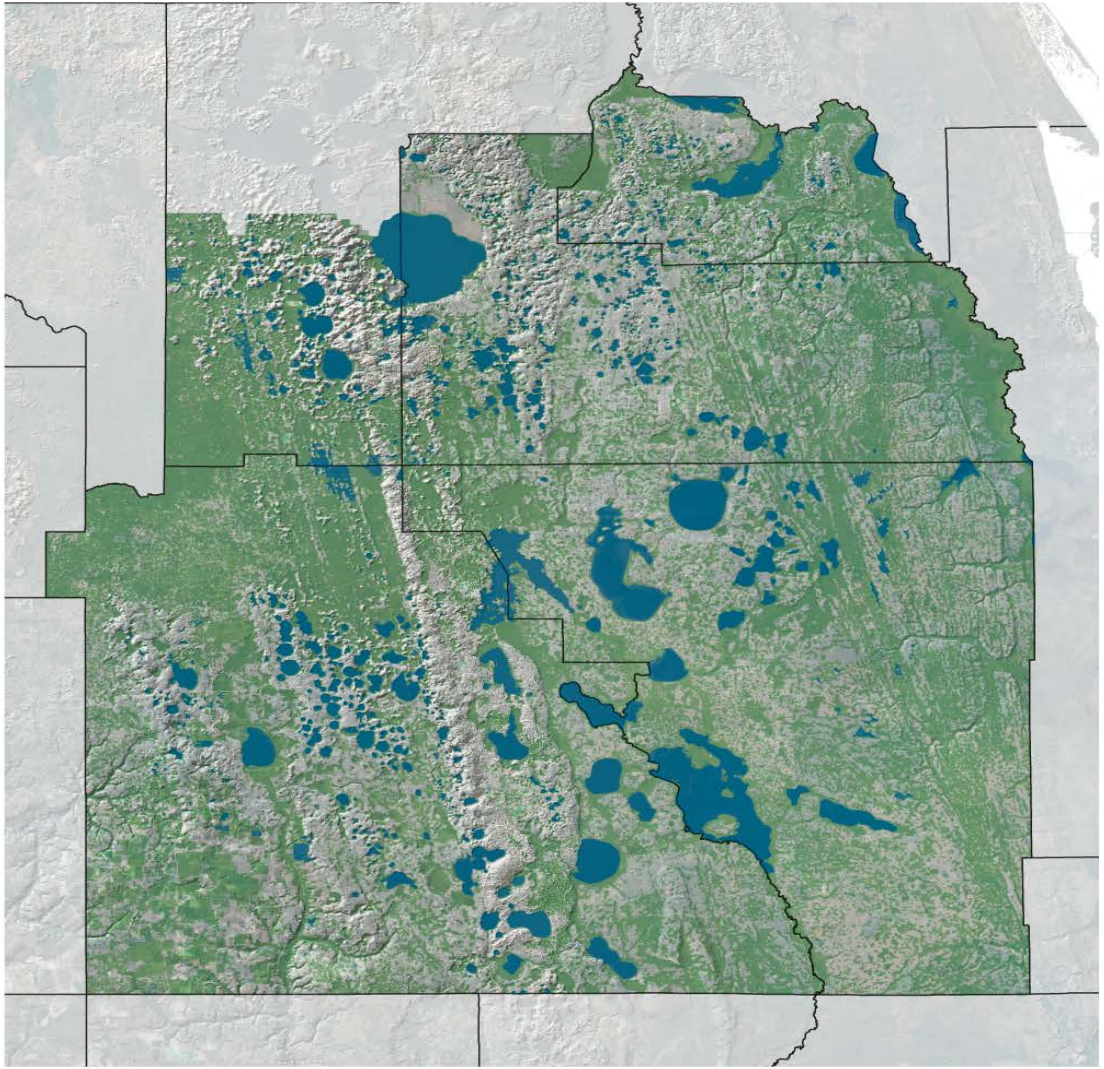
Hydrogeology



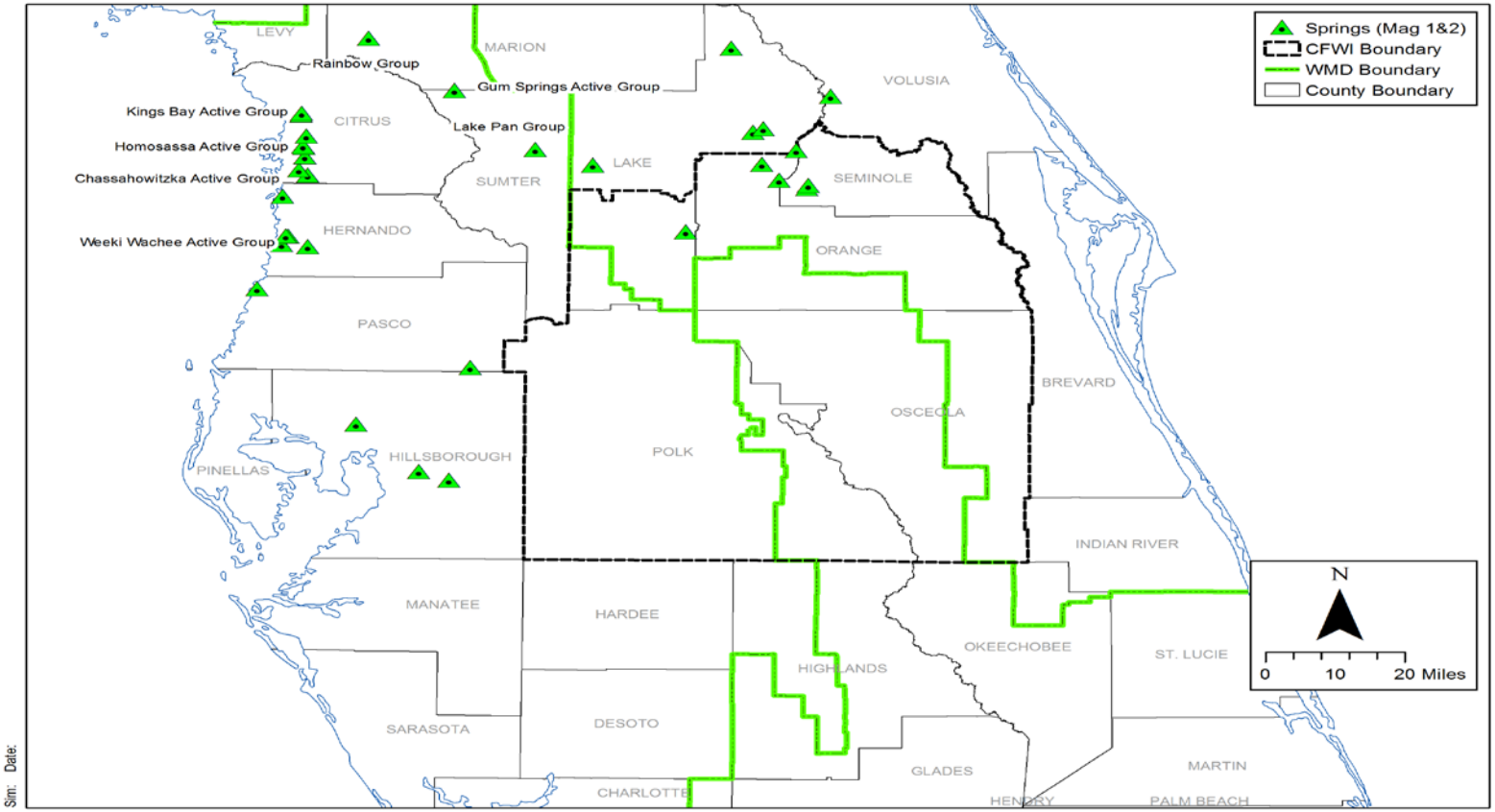



Surface Water Basins
Ocklawaha River
St. Johns River
Withlacoochee River
Kissimmee River
Hillsborough River
Peace River
Alafia River


Groundwater Basins


Lakes and Wetlands
lakes
wetlands

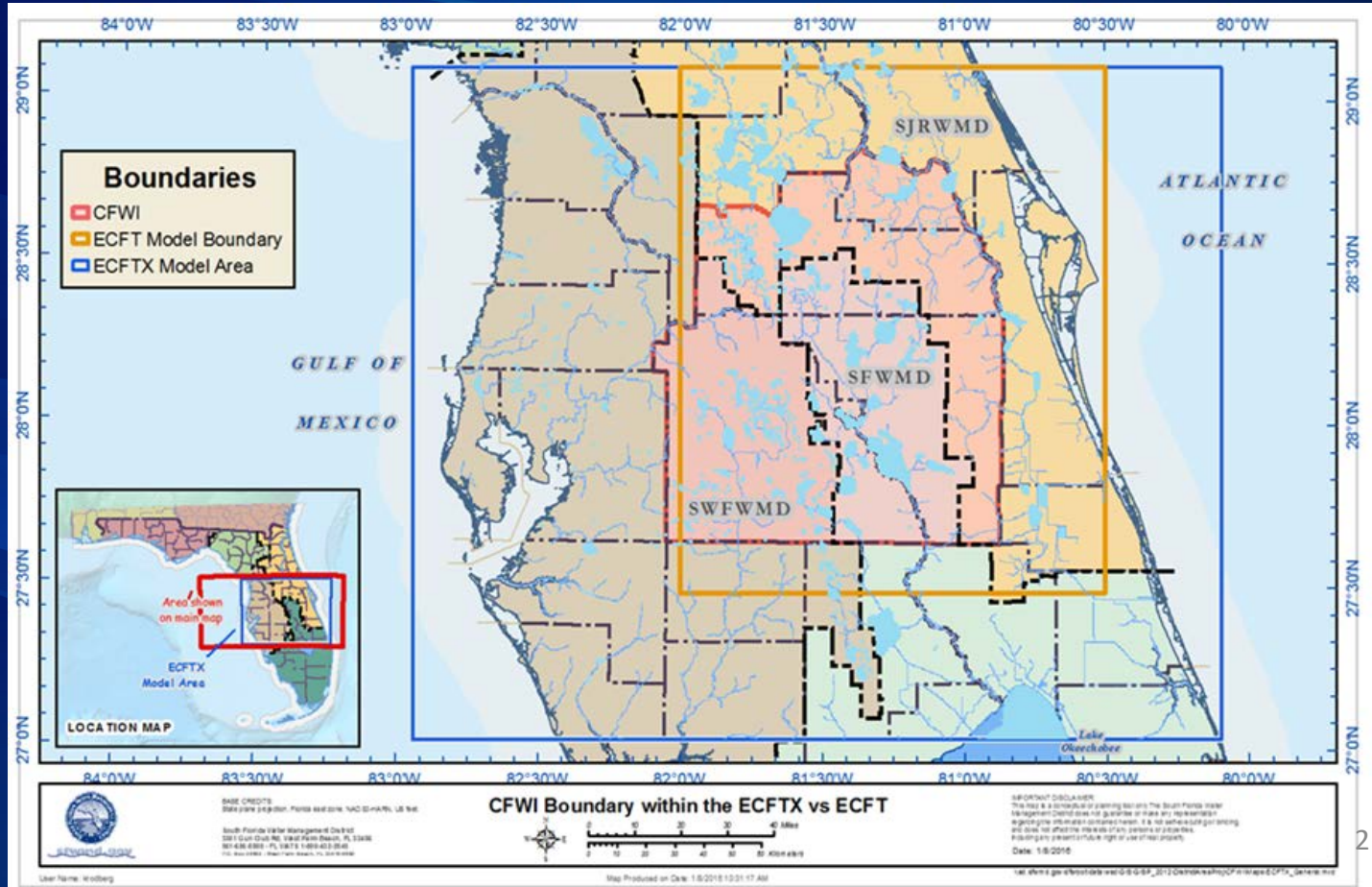
Springs



Simulated Residuals (pct) for Magnitude 1 & 2 Springs

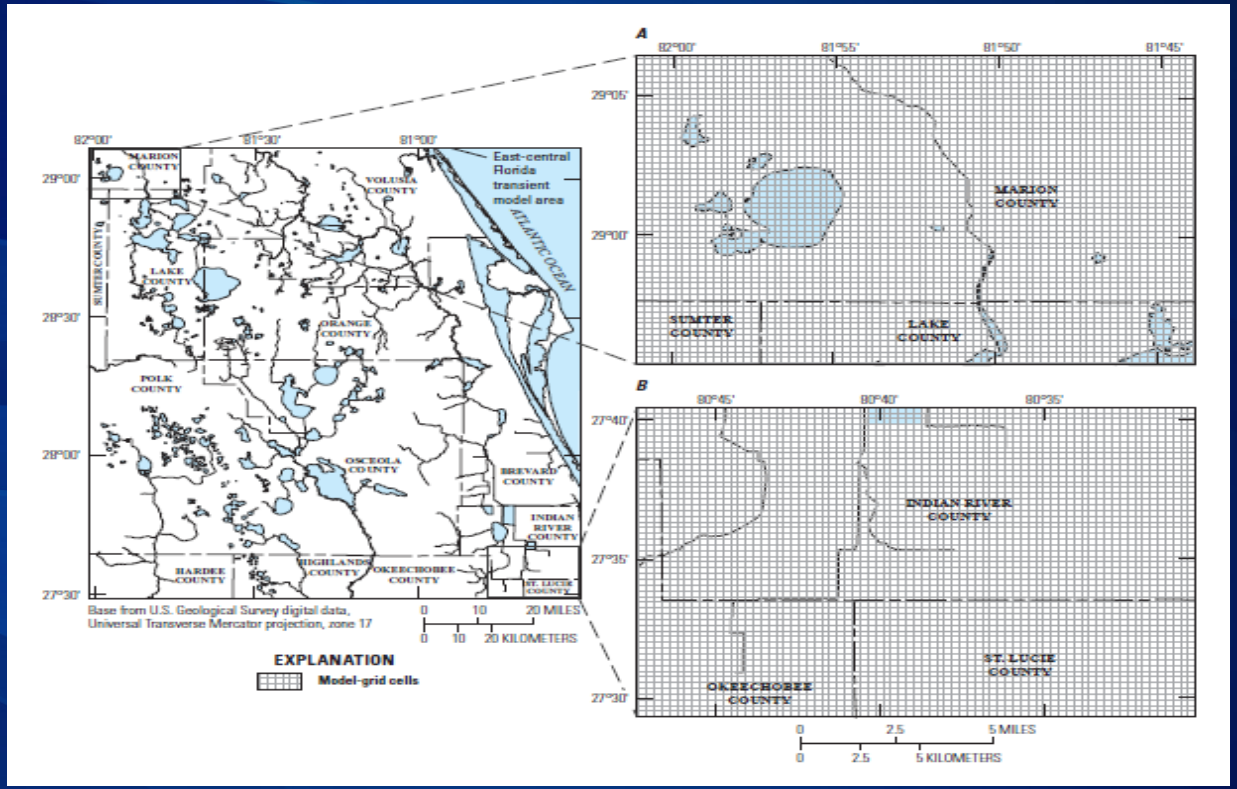
ECFTX Groundwater Flow Model Boundaries

ECFT – 10,000 sq. mi
ECFTX – 25,000 sq. mi



ECFTX Groundwater Flow Model

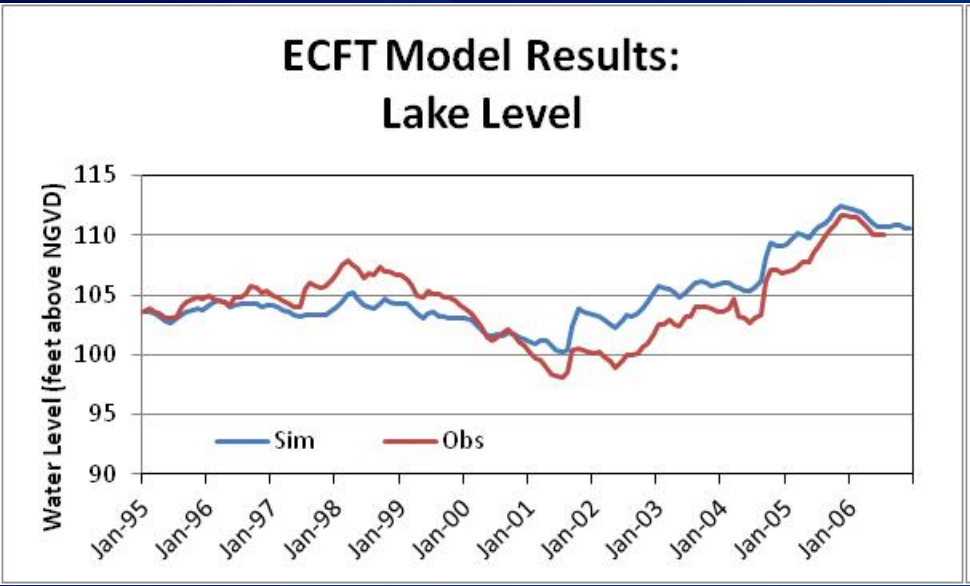
- Use USGS' MODFLOW computer code
- Overlay uniform grid over area to be simulated
- Grid spacing: 1,250 ft by 1,250 ft
- 603 rows and 740 columns
- Simulate groundwater flow incorporating rainfall, runoff, wetlands, evapotranspiration, lakes, rivers, springs, wells, RIBs, drains, etc.

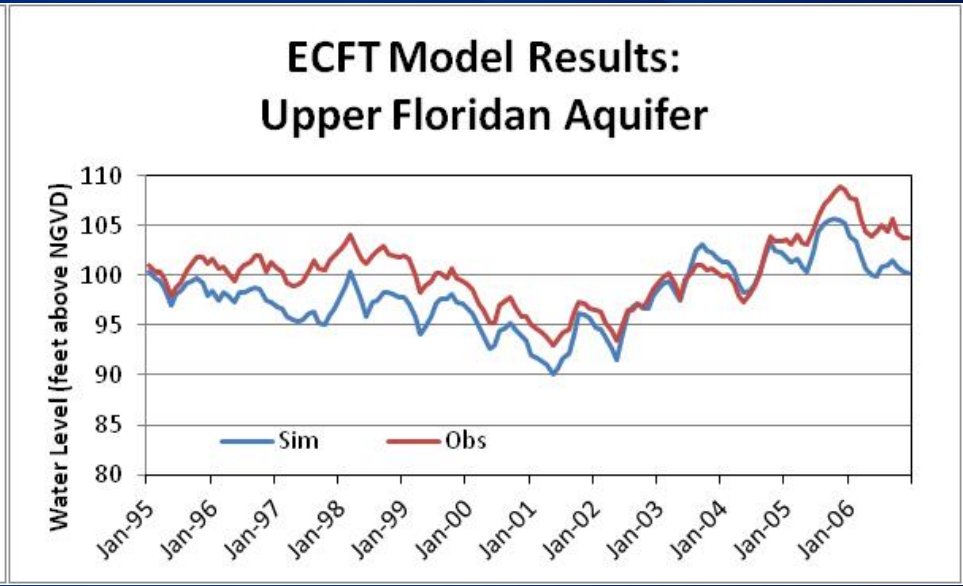


Independent Peer Review Panel

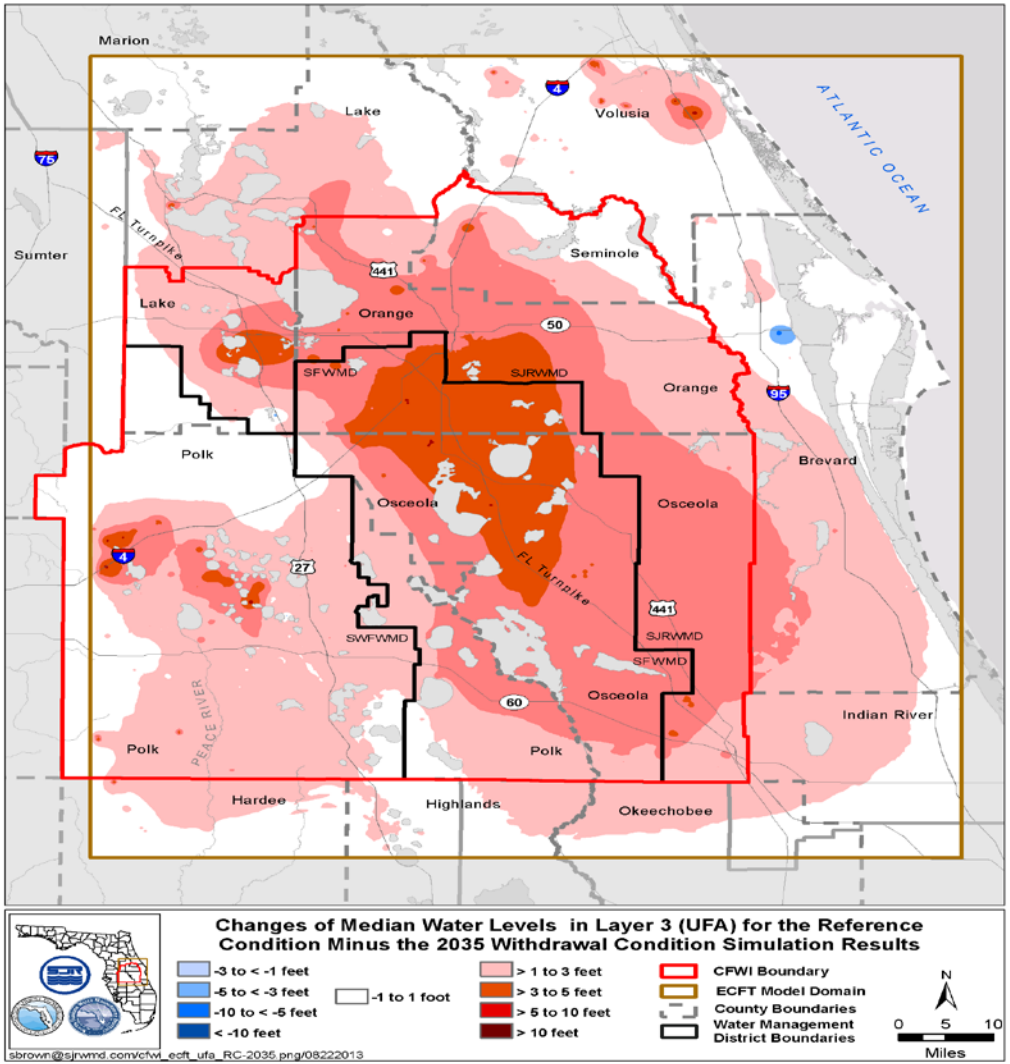
- Groundwater Modeling Experts
  - Louis Motz, PhD, Associate Professor Emeritus, University of Florida
  - Mark Stewart, PhD, Professor Emeritus, University of South Florida
  - Peter Anderson, P.E., M.S., Principal Engineer, Tetra Tech GEO
- Benefits
  - Receive and incorporate comments during model development
  - Address concerns prior to model calibration

Example Model Output: Change in Water Levels



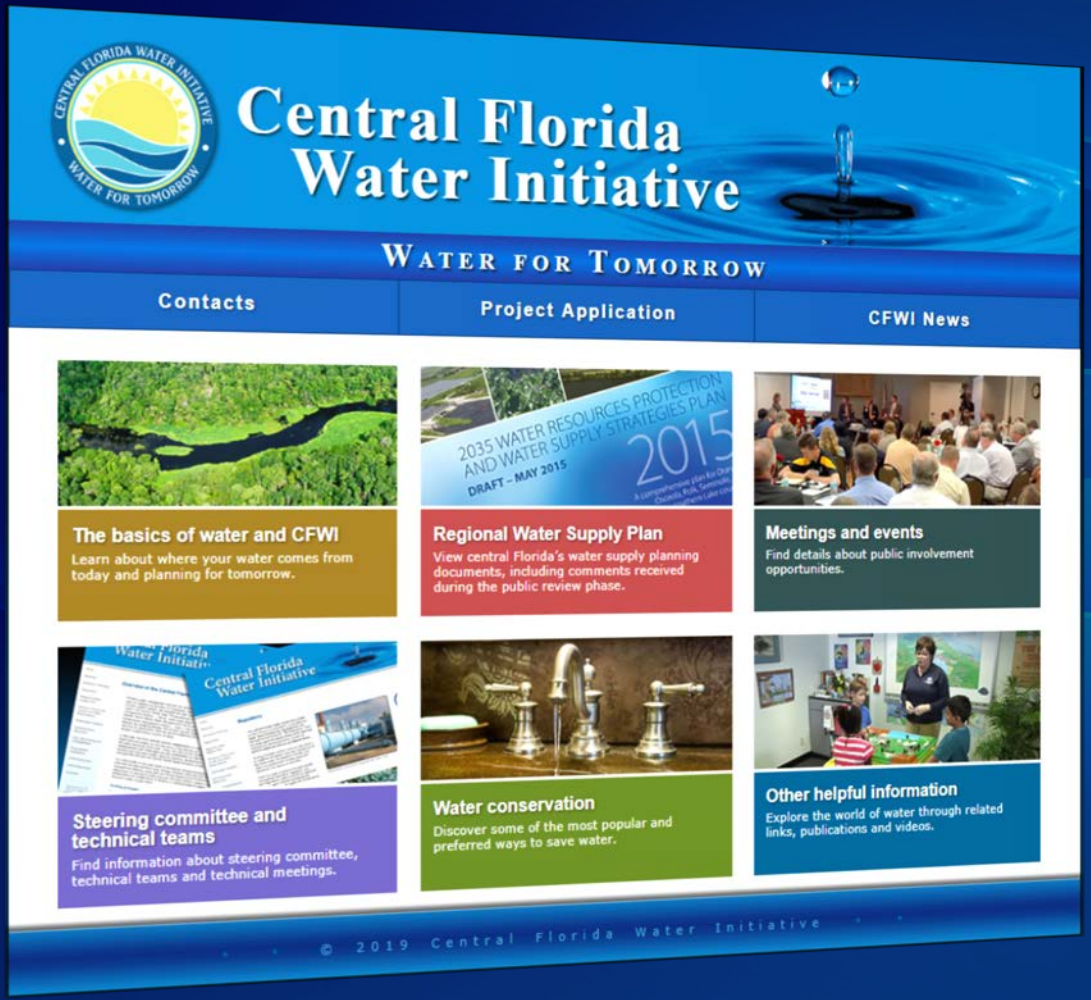


Example Model Output: Change in Water Levels in UFA



CFWI Groundwater Availability Scenarios

- Calibration from 2003 to 2014
- Scenarios include rainfall from 2003 to 2014 (wet and dry years)
  - Reference Condition
    - 2014 withdrawal condition
  - Future Conditions
    - 2030 withdrawal condition
    - 2040 withdrawal condition
- Compare simulated water levels and flows between reference condition and future condition
- Evaluate effects of groundwater withdrawals on aquifers and natural systems



Questions?

Additional information can be found at:

cfwiwater.com

Minimum Flows and Levels and Reservations Team (MFLRT)

Doug Leeper
Minimum Flows and Levels and Reservations Team Lead

What are MFLs

Minimum flows and minimum water levels.

Section 373.042, Florida Statutes

(1) Within each section, or the water management district as whole, the department or the governing board shall establish the following:

(a) *Minimum flow* for all surface watercourses in the area. The minimum flow for a given watercourse is the *limit at which further withdrawals would be significantly harmful* to the water resources or ecology of the area.

(b) *Minimum water level*. The minimum water level is the *level of groundwater in an aquifer and the level of surface water at which further withdrawals would be significantly harmful* to the water resources or ecology of the area.

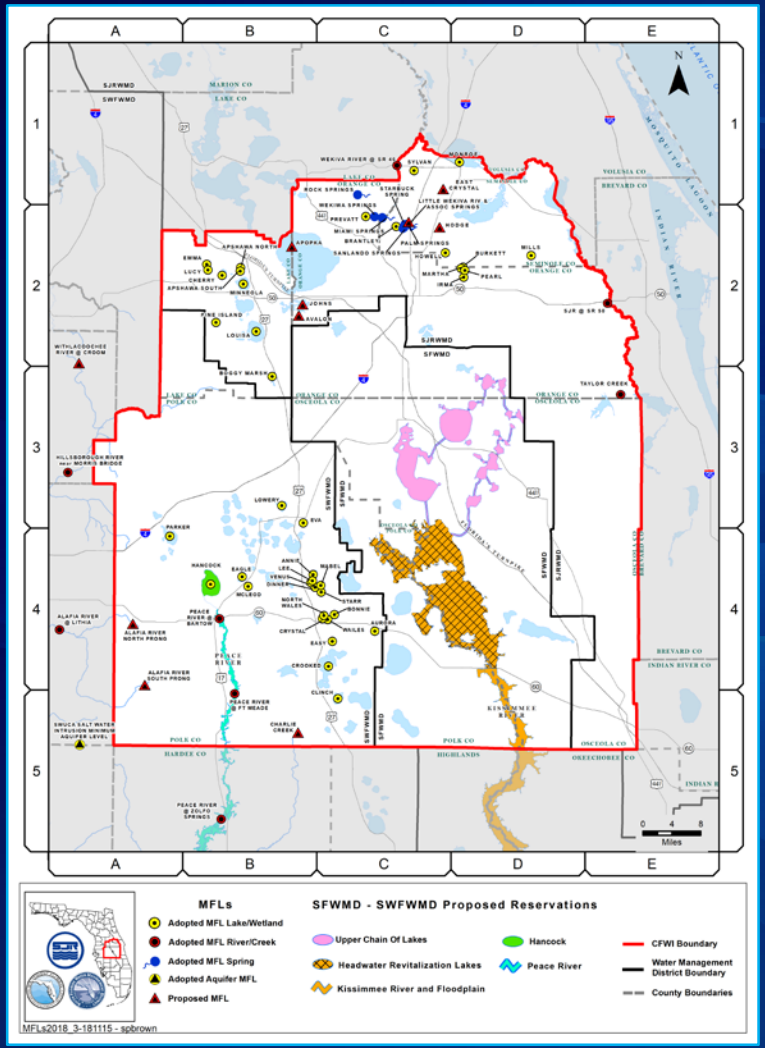
MFLs Considerations

Minimum Flows and Levels.

Rule 62-40.473, Florida Administrative Code

(1) In establishing minimum flows and levels pursuant to Sections 373.042 and 373.0421, F.S., consideration shall be given natural seasonal fluctuations in water flows or levels, nonconsumptive uses, and *environmental values* associated with coastal, estuarine, riverine, spring, aquatic, and wetland ecology, including:

(a) Recreation in and on the water;
(b) Fish and wildlife habitats and the passage of fish;
(c) Estuarine resources;
(d) Transfer of detrital material;
(e) Maintenance of freshwater storage and supply;
(f) Aesthetic and scenic attributes;
(g) Filtration and absorption of nutrients and other pollutants;
(h) Sediment loads;
(i) Water quality; and
(j) Navigation.



Adopted and Proposed MFLs, and Proposed Water Reservations

- 54 MFLs adopted
- 23 MFLs proposed (scheduled for reevaluation/adoption)
- 5 reservations proposed (scheduled for adoption; includes 17 lakes and 2 river segments)

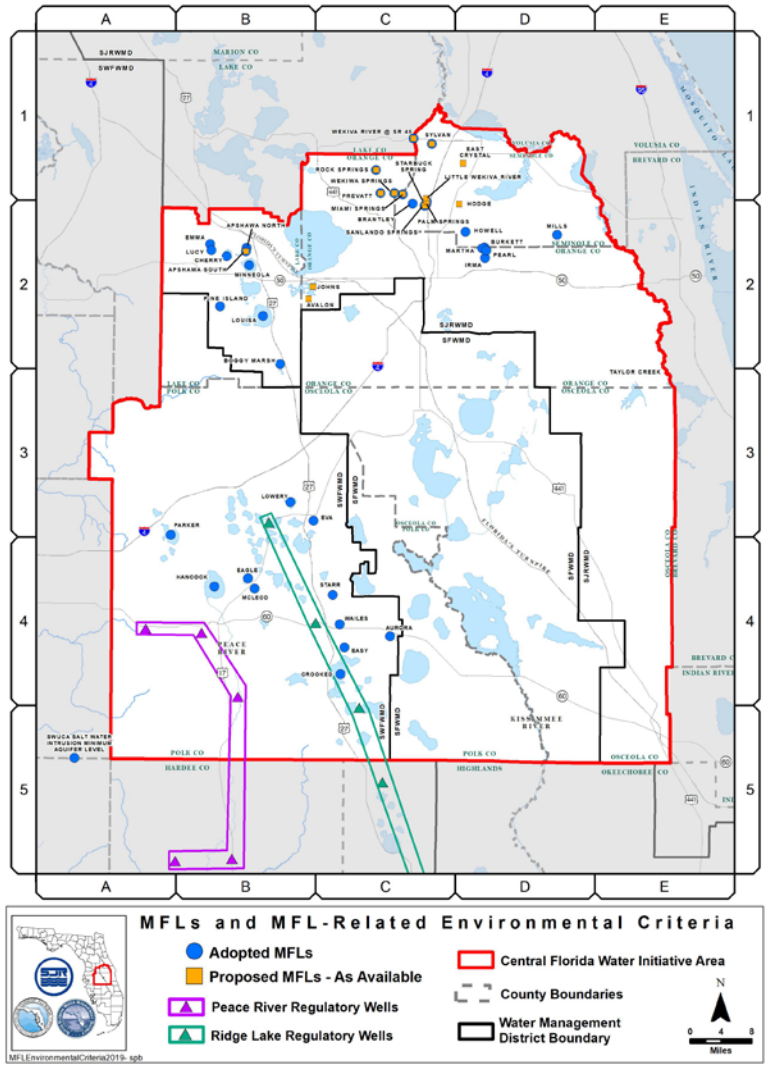
Use of MFLs

- Water use permitting
- Water supply planning

MFLs Environmental Criteria
Data / Tools / Methods

MFLs Environmental Criteria Data/Tools/Methods

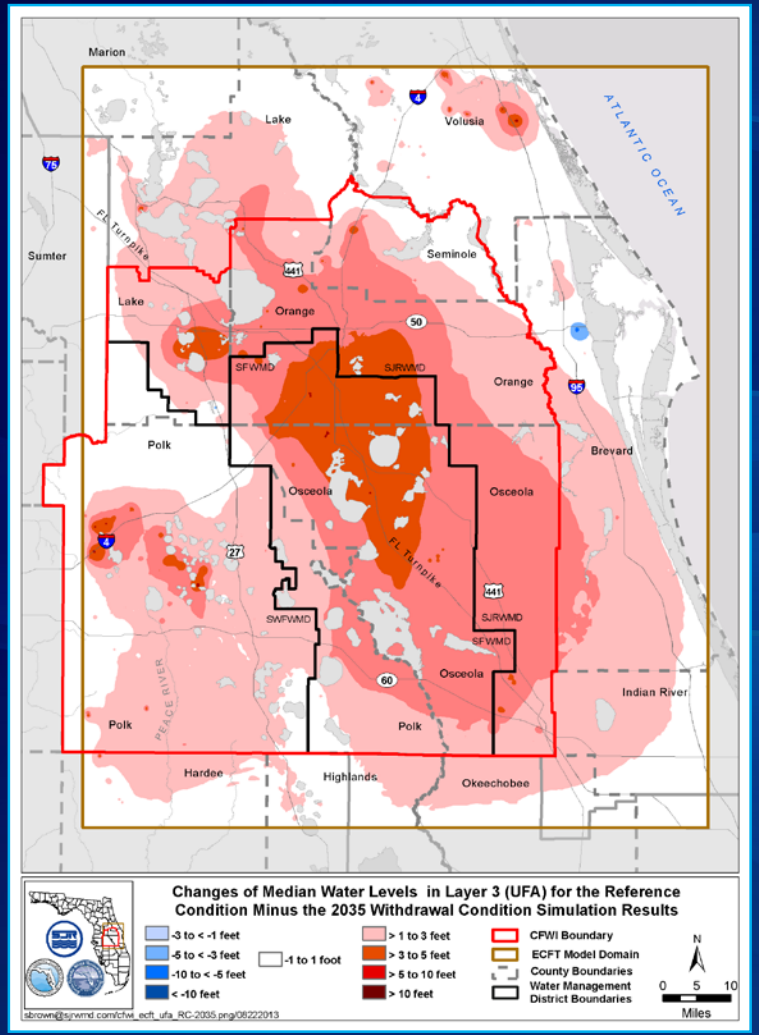
- Data
  - MFLs environmental criteria
    - Adopted MFLs
    - As available, additional new or revised MFLs
    - Regulatory well water levels for recovery of lake and river MFLs
  - Surface water levels/flows, well water levels, rainfall, evapotranspiration, and other hydrologic data
  - ECFTX model output (UFA levels and change in levels)
- Tools/Methods
  - ECFTX model output and water budget models used to determine effects of groundwater level changes on MFLs environmental criteria



MFLs and MFL-Related Environmental Criteria

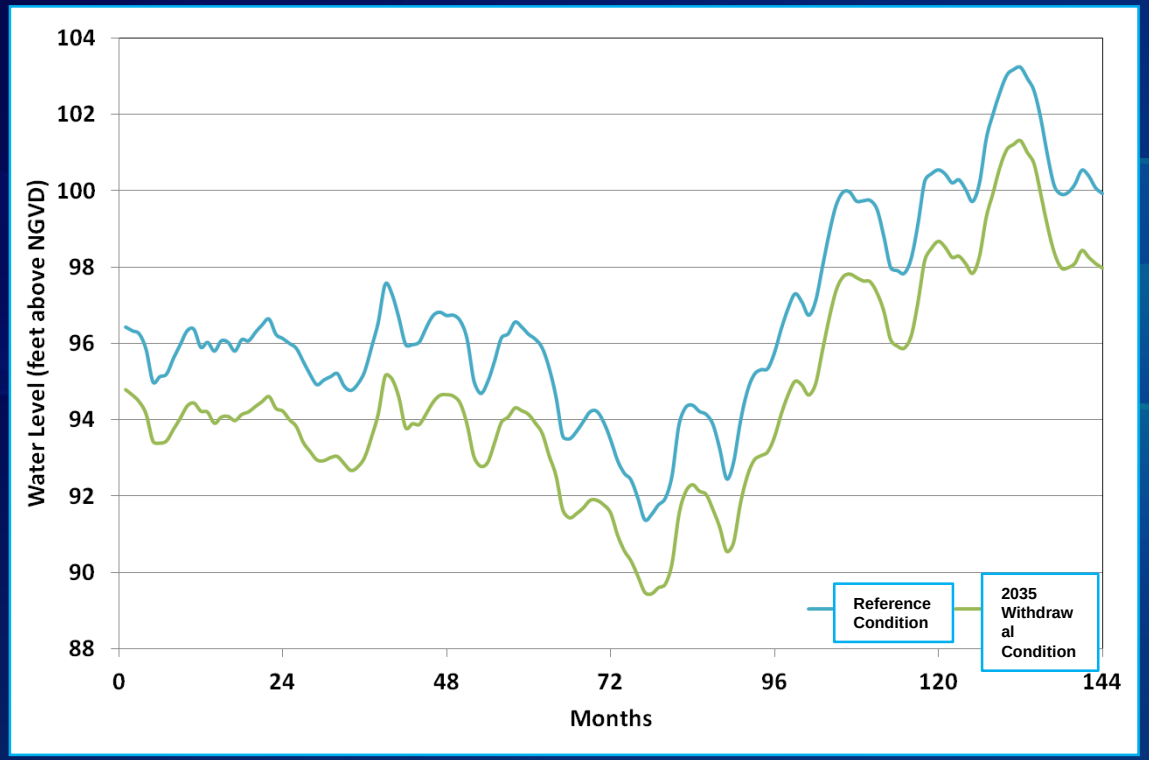
- Adopted MFLs in the CFWI Planning Area: 29 lakes/ wetlands, 6 springs, and 1 river segment
- Adopted Southern Water Use Caution Area (SWUCA) Saltwater Intrusion Minimum Aquifer Level
- Upper Peace Regulatory Wells for SWUCA recovery
- Ridge Lakes Regulatory Wells for SWUCA recovery
- As available, proposed MFLs in the CFWI Planning Area: 6 lakes, 6 springs, and 2 river segments

Predicted Changes in Upper Floridan Aquifer Water Levels



Example: Predicted UFA water level change; Reference Condition to 2035 Withdrawal Condition from previous CFWI planning effort

Site-specific Predicted Changes in Upper Floridan Aquifer Water Levels



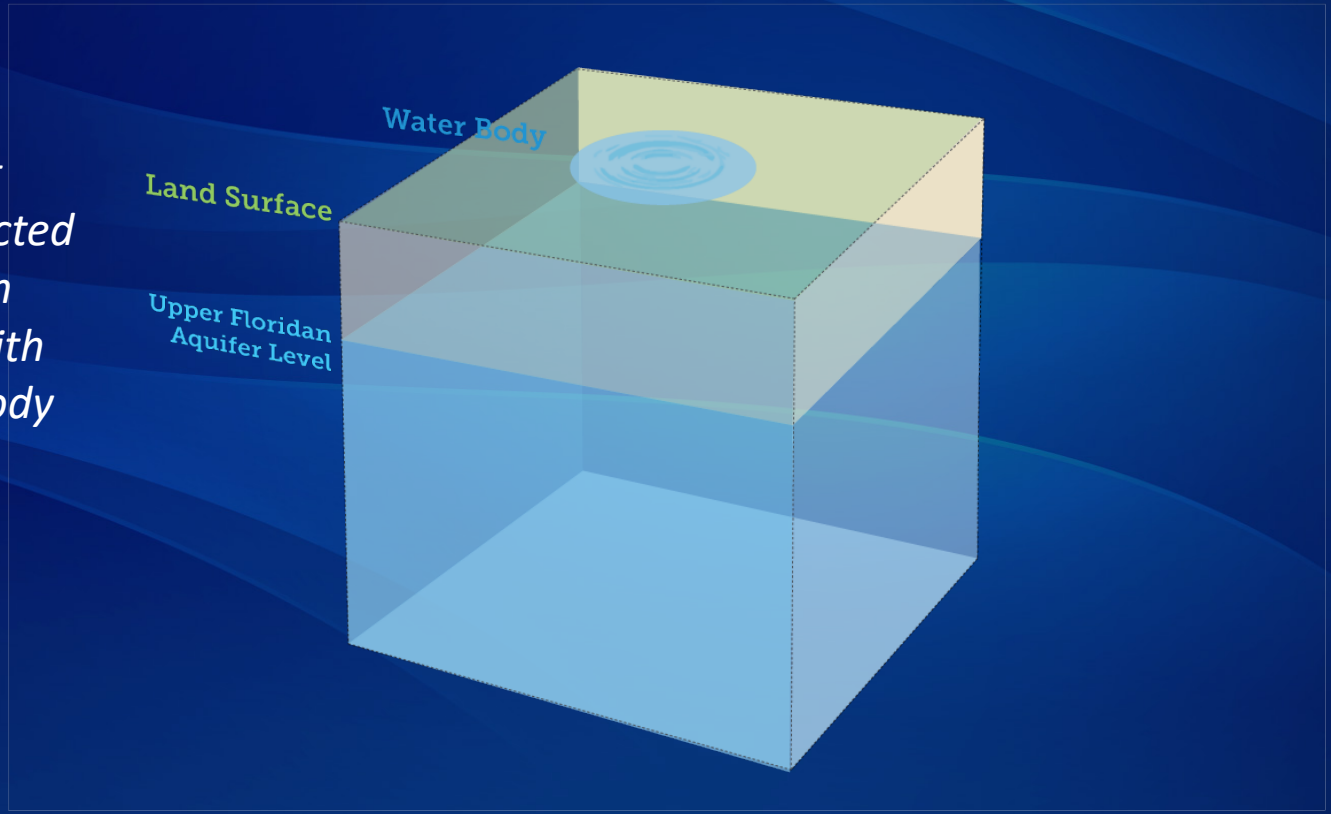
Example: Predicted UFA water levels in a well near a lake (from previous CFWI planning effort)

- *Water level differences represent UFA change*
- *UFA change linked to surface water change with water budget models*

MFLs Environmental Criteria

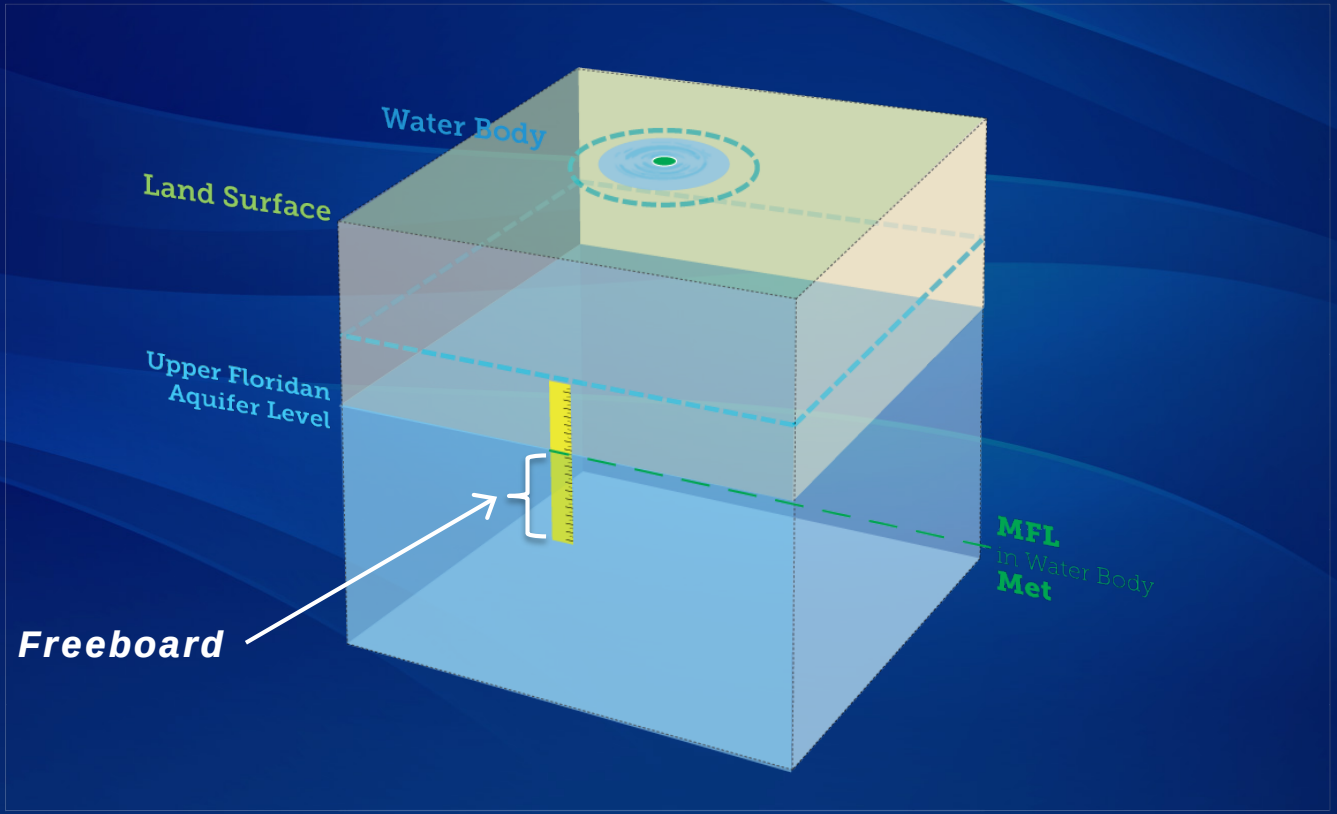
Linking Upper Floridan Aquifer Levels to Surface Water Levels

Water budget models link predicted Upper Floridan aquifer levels with surface water body levels



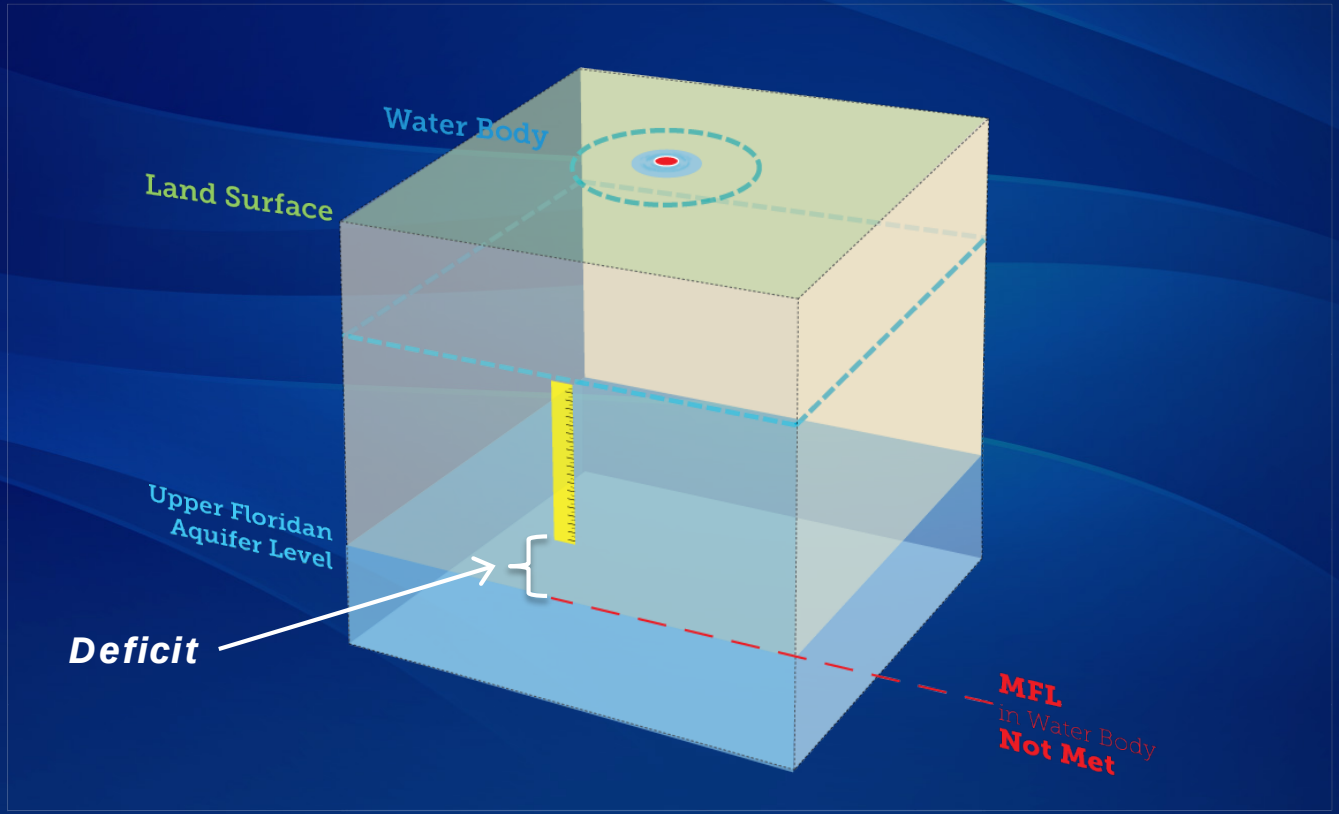
MFLs Environmental Criteria

Freeboard/Deficit Concept



MFLs Environmental Criteria

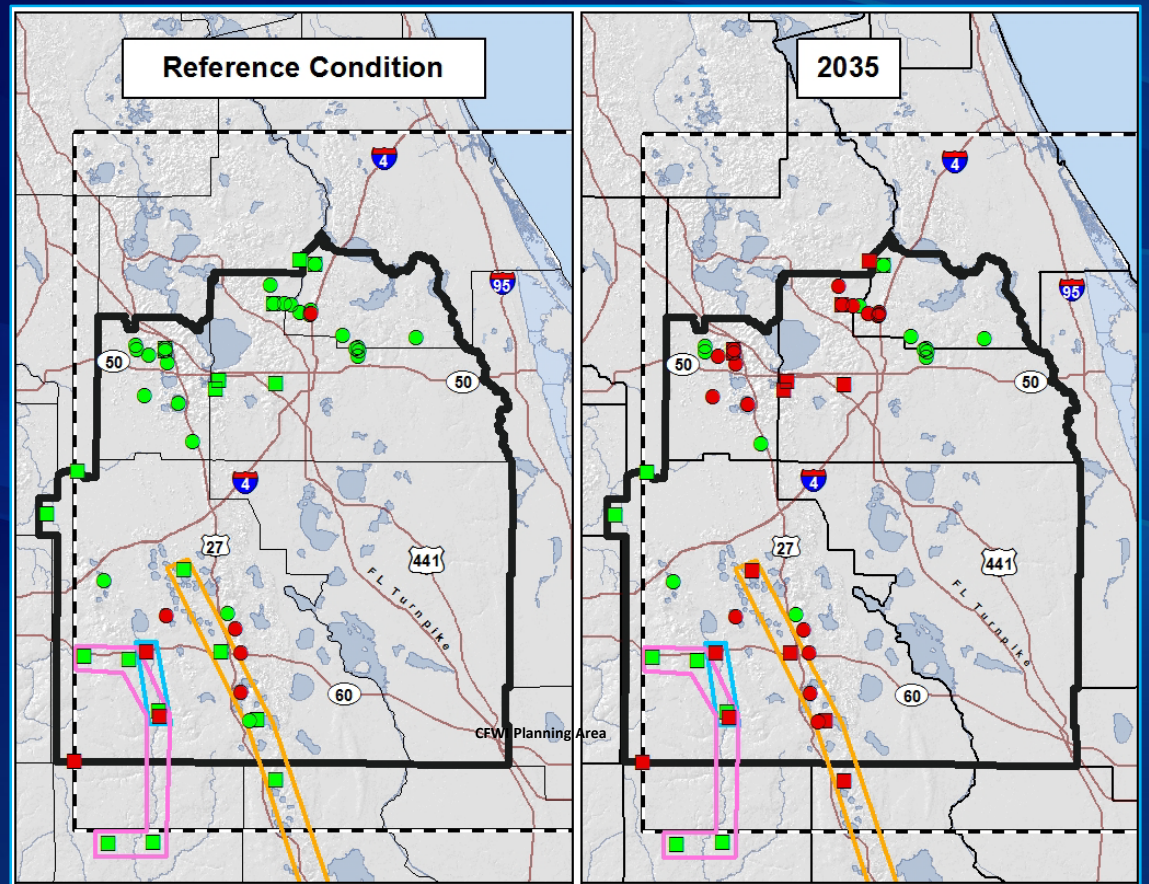
Freeboard/Deficit Concept (continued)



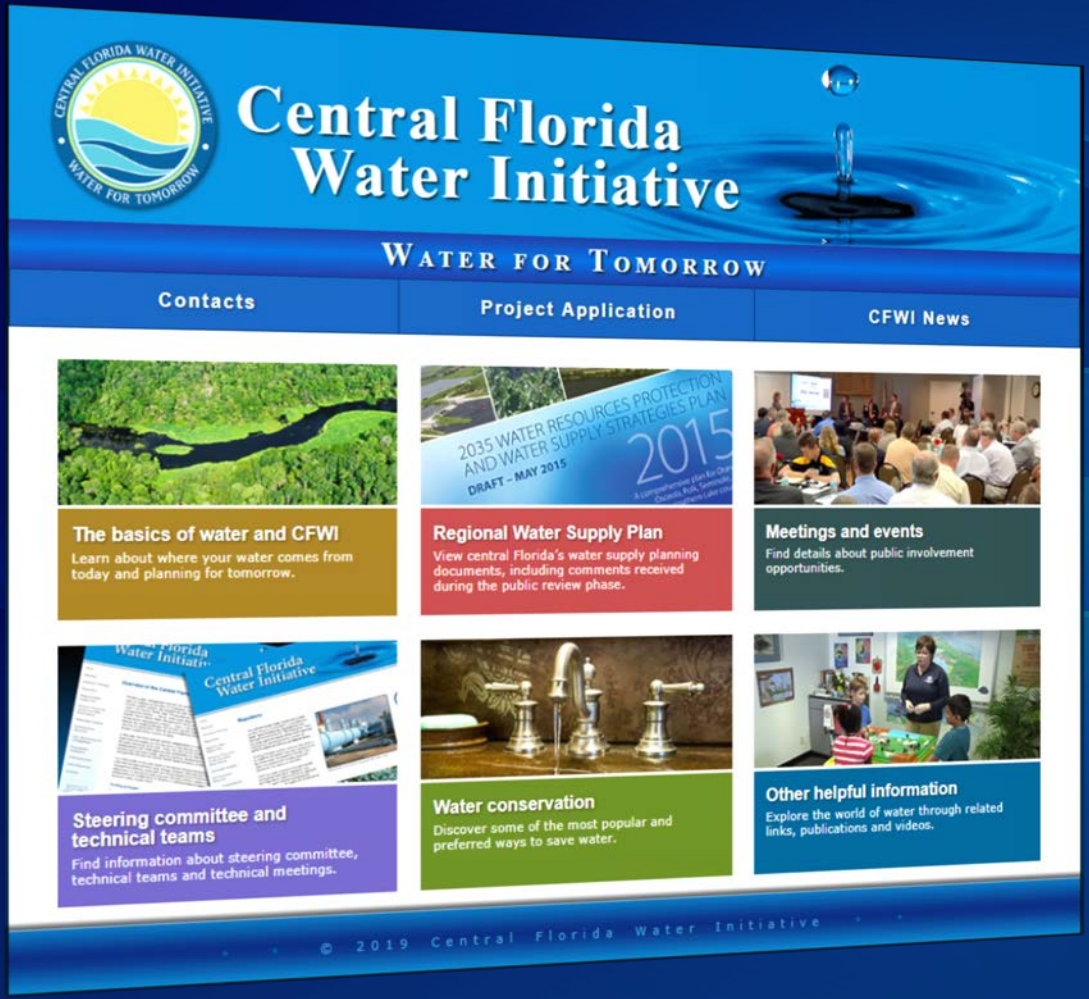
Freeboard/Deficit Expression for MFLs Environmental Criteria

- Freeboard/deficit in feet for lakes with MFLs and a groundwater MFL
- Freeboard/deficits in cubic feet per second for rivers and springs with MFLs
- Freeboard/deficits in feet for regulatory wells associated with an MFLs recovery strategy

MFL Environmental Criteria Mapping



Example: Modeled status of MFL-related criteria from the previous CFWI planning effort



Questions?

Additional information can be found at:

cfwiwater.com

Environmental Measures Team

Kym Rouse Holzwart
Environmental Measures Team Lead

Introduction and Background

- Subteam of the WRAT
- Water management district and public supply utility representatives
- Wetlands and surface waters expertise
- Determines current status of wetlands
- Develops tools to analyze future groundwater withdrawals on wetlands

Previous Wetlands Assessments

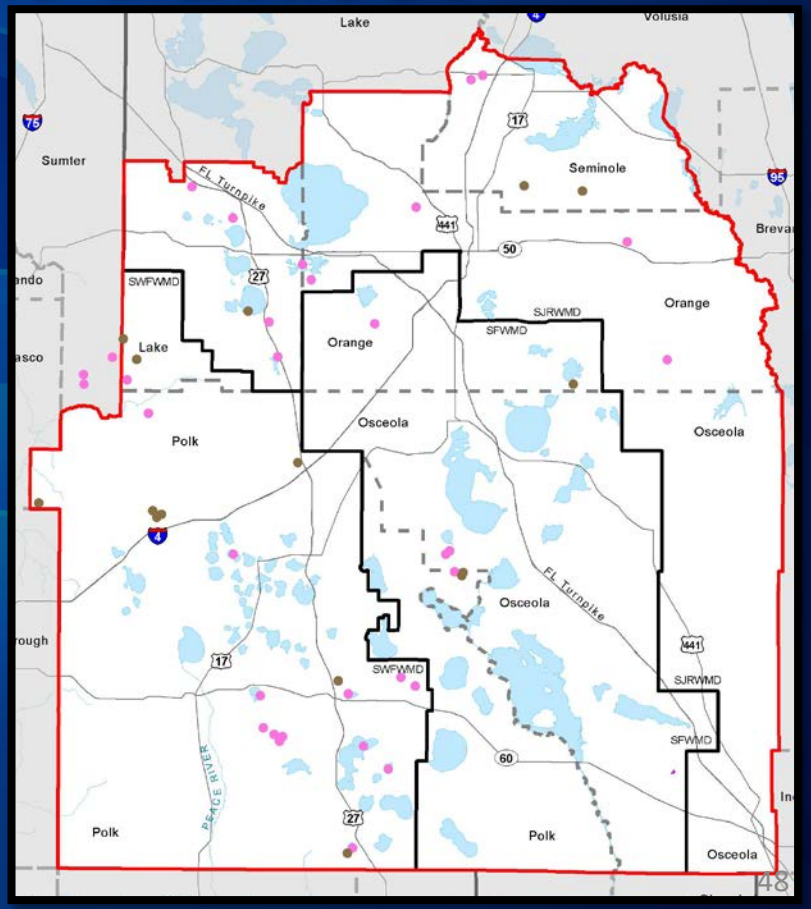
- Assessed ~350 wetlands and lakes
- Two types:
  - Class 1: Evaluated utilizing EMT-specific method, hydrologic stress and wetland edge known, long-term water level data
  - Class 2: Environmental condition known
- Third type:
  - Class 3: Location known

Current EMT Analysis Methodology

- Approved methodology:
  - Re-assess original Class 1 wetlands
  - Add new Class 1 wetlands
  - Original methodology with expanded Class 1 wetlands dataset and updated model

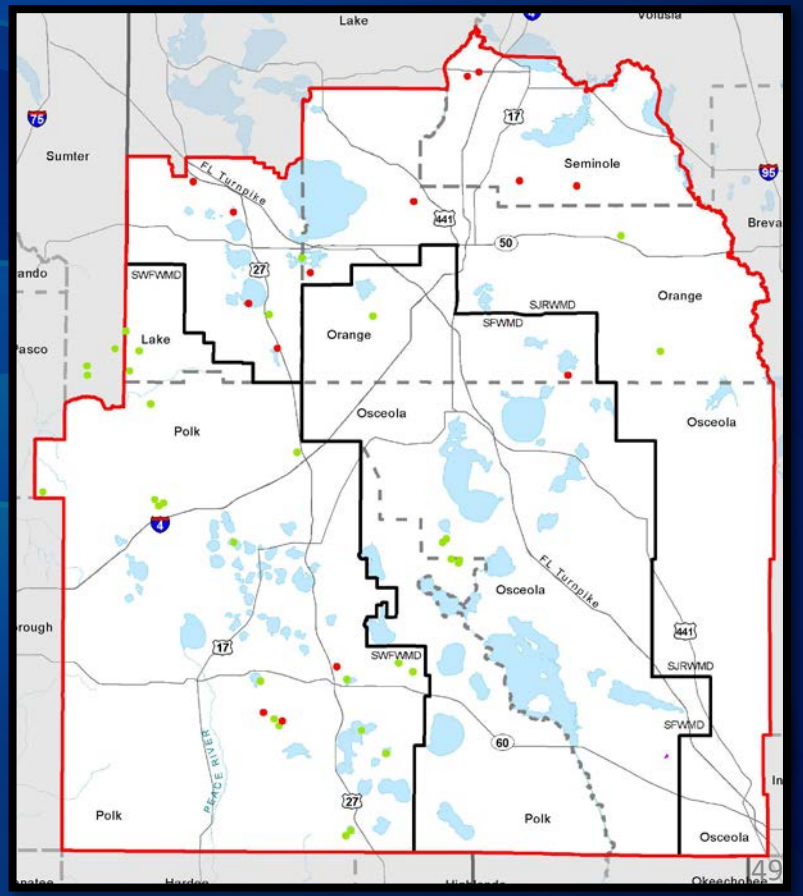
Class 1 Wetlands Dataset

- Expanded Class 1 wetlands dataset:
  56 wetlands
  (41 original + 15 new)
- 28 Plains wetlands,
  28 Ridge wetlands



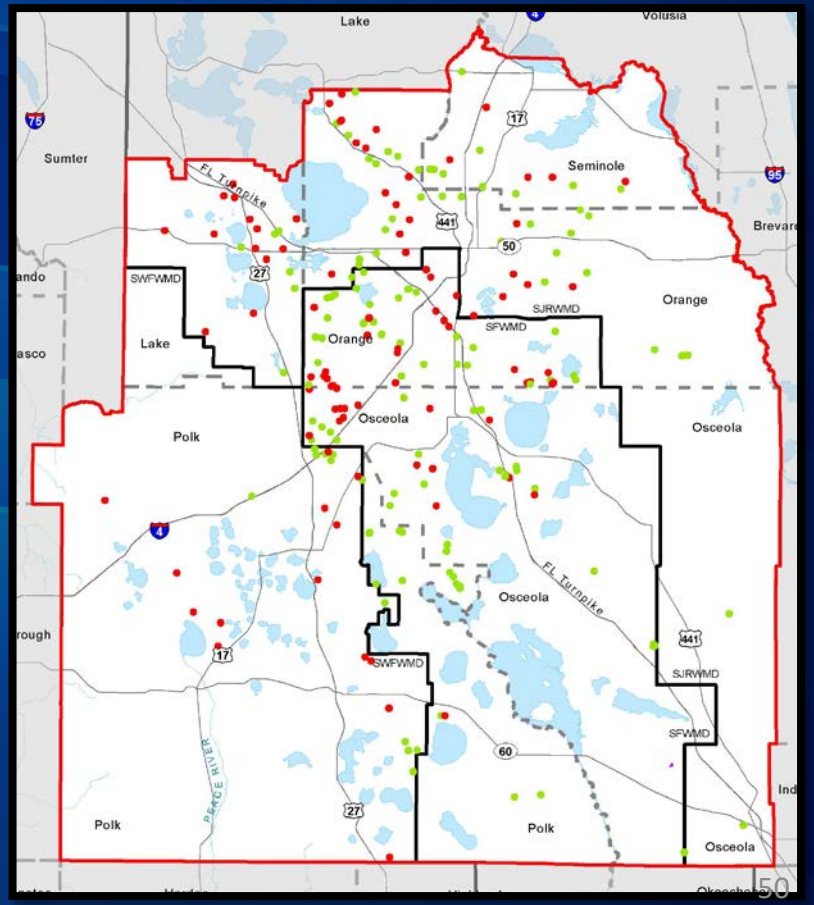
Class 1 Wetlands Dataset

- 11 of original 44 changed stress status
- 40 wetlands not stressed (21 Plains, 19 Ridge)
- 16 wetlands stressed (7 Plains, 9 Ridge)



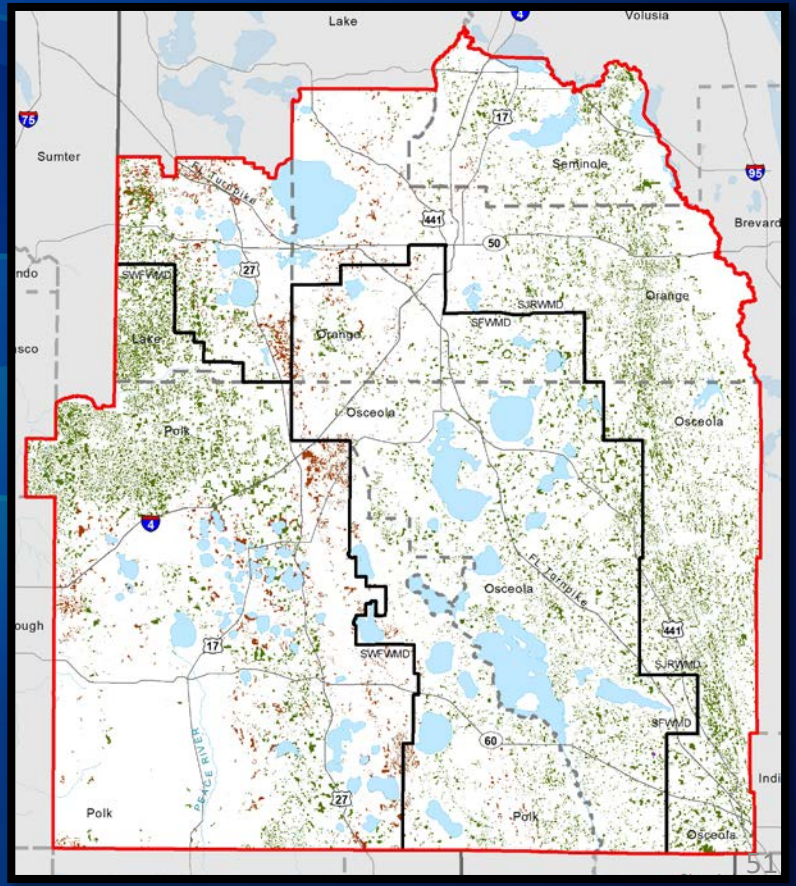
Class 2 Wetlands Dataset

- 222 wetlands (101 Plains, 121 Ridge)
- 129 wetlands not stressed (62 Plains, 67 Ridge)
- 93 wetlands stressed (39 Plains, 54 Ridge)



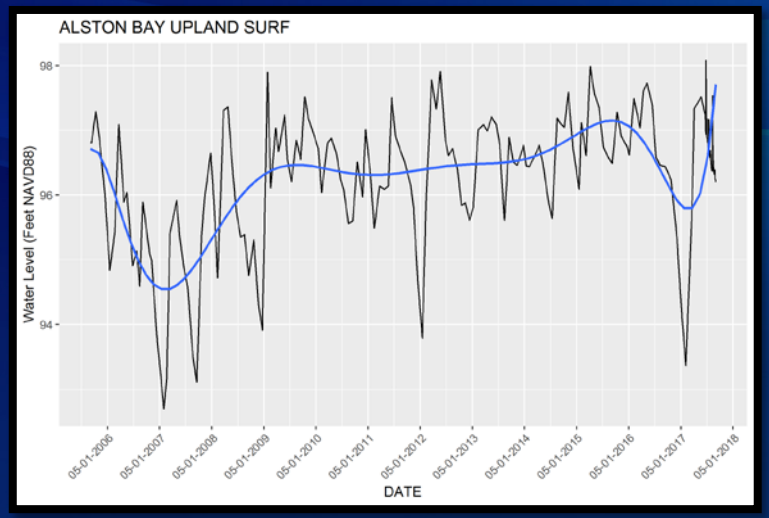
Class 3 Wetlands Dataset

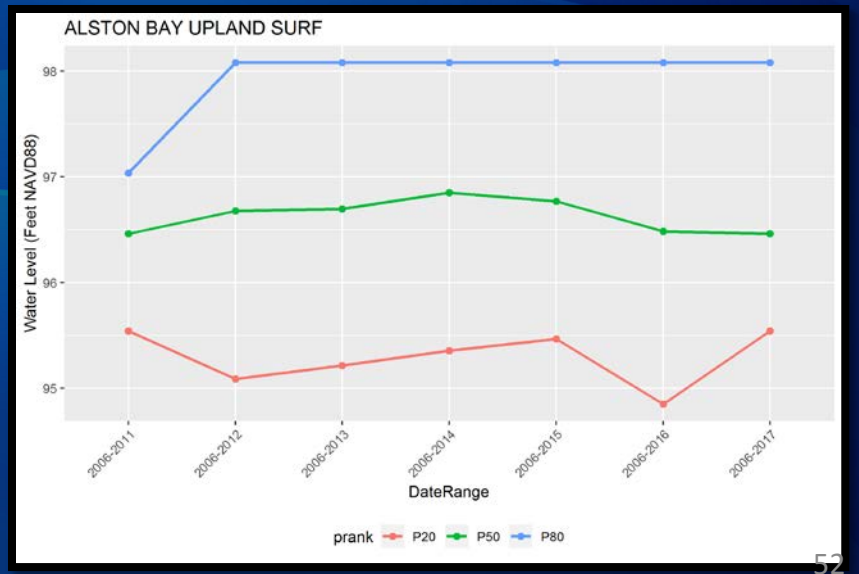
- Thousands
- Location known
- Stress status unknown



Wetlands Analysis Methodology Details

- Selected 9-year period of record (2009-2017) of Class 1 wetlands water level data to use for analysis
- Hydrologic index calculated by comparing P80 water level data to wetland edge elevation





Wetlands Analysis Methodology Details

- Class 1 wetland hydrologic index and stress status used to develop statistical relationship
- Relationship used to develop equations to estimate probability of future change in wetland stress status
- Predict probable future change in stressed and unstressed wetland acreage on a regional scale

Wetlands Analysis Example Results

Table 5. Summary of results for regional assessment of the area of stressed plains wetlands, excluding wetlands with significant hydrologic alteration.

Wetland Class	Total Area (acres)	Stressed Wetland Acreages for Each Simulation				
		2005	2015	2025	2035	EOP*
Class 1	510	460	240	300	460	320
Class 2	2,600	1,400	1,500	1,600	1,600	1,600
Class 3	79,000	14,000	15,000	16,000	17,000	16,000
Total	**82,000**	16,000	17,000	18,000	19,000	18,000

* Class 1 acreages were rounded to the nearest 10 acres; Class 2 to the nearest 100 acres; and Class 3 to the nearest 1000 acres, based on the relative quality of data obtained from GIS and field data for each class

**EOP = End-Of-Permit

Table 6. Summary of results for regional assessment of the area of stressed isolated ridge wetlands, including wetlands with significant hydrologic alteration (see text).

Aquifer Layer Used to Predict Wetland Water Level Change	Wetland Class	Total Area (acres) **	Stressed Wetland Acreages for Each Simulation				
			2005	2015	2025	2035	EOP**
Surficial Aquifer System	**Class 1**	18,300	13,420	13,480	13,640	13,880	13,690
	Class 2	9,800	2,800	3,300	3,900	4,900	4,200
	Class 3	64,000	25,000	27,000	29,000	32,000	30,000
	Total	**92,000**	**41,000**	**44,000**	**47,000**	**51,000**	**48,000**
Upper Floridan Aquifer	**Class 1**	18,300	13,420	13,860	14,740	16,400	16,440
	Class 2	9,800	2,800	3,800	6,000	8,400	7,000
	Class 3	64,000	25,000	31,000	38,000	45,000	43,000
	Total	**92,000**	**41,000**	**49,000**	**59,000**	**70,000**	**66,000**

* Class 1 acreages were rounded to the nearest 10 acres; Class 2 to the nearest 100 acres; and Class 3 to the nearest 1000 acres, based on the relative quality of data obtained from GIS and field data for each class

**EOP = End-Of-Permit

Questions?

Additional information can be found at:

cfwiwater.com

Groundwater Availability Team (GAT)

Brian Starford, P.G.
Water Resource Assessment /
Groundwater Availability Team Lead

Guiding Principle

- Review and update:
  - 2015 Regional Water Supply Plan
  - Sustainable quantities of traditional groundwater sources
    - Without causing unacceptable harm
      - Water resources
      - Associated natural systems

DMIT Goal

- Ensure collected hydrologic, environmental, and other pertinent data
  - identified, inventoried, and accessible
  - support CFWI technical initiatives and regulatory activities
- Create/maintain an inventory of sources of existing monitoring data
- Determine data collection needs and develop work plan to meet those needs

FY2015-FY2025 DMIT Well Status

Fiscal Year	Wetland Sites	Wetland SA	General SA	UFA	LFA
2015	0	0	2	3	1
2016	13	4	5	4	2
2017	8	7	7	7	3
2018	9	5	8	6	2
Total (2015-2018):	30	16	22	20	8
2019	20	17	6	4	8
2020-2025	57	53	31	23	20
Total (2015-2025):	107	86	59	47	36

- Red line divides completed from proposed
- There are currently 46 monitoring sites in progress

Environmental Criteria

- MFL and MFL-Related Criteria
- Non-MFL Lakes/Wetlands Criteria
- Non-MFL Spring Criterion
- Water Quality Criteria

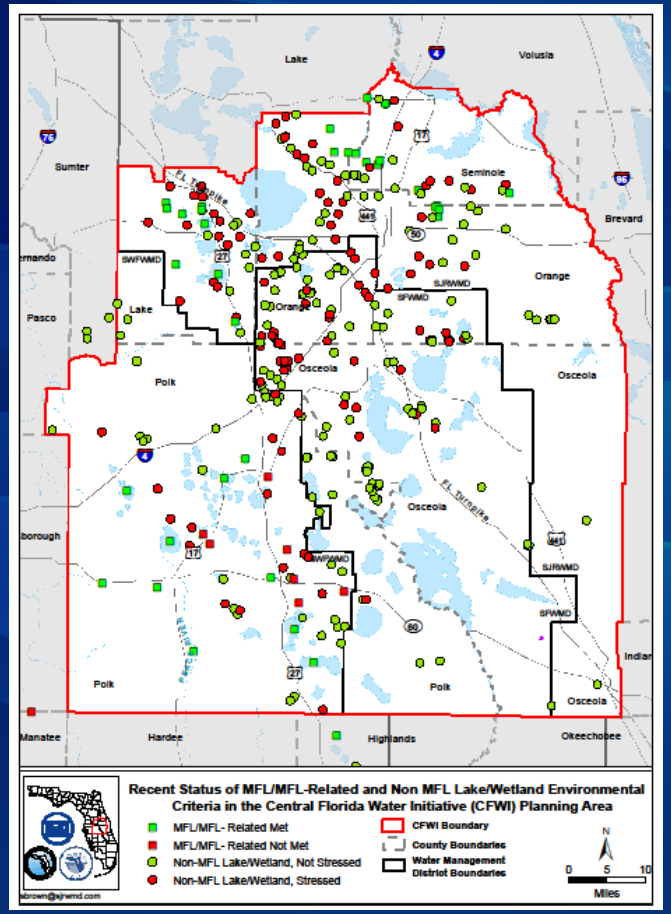
Environmental Criteria Factors

- Hydrogeology
- Rainfall
- Drainage
- Land Use Changes
- Basin Configuration Changes
- Groundwater Withdrawals

GAT Approach

- Data
  - Projected Demands Through 2040
  - Environmental Criteria
- Tools
  - ECFTX Groundwater Model
  - Geographic Information System
  - Statistical Analyses
- Method
  - Conduct Groundwater Withdrawal Scenarios
  - Determine Environmental Criteria Changes
  - Observe Spatial Pattern of Changes

Recent Environmental Criteria Status

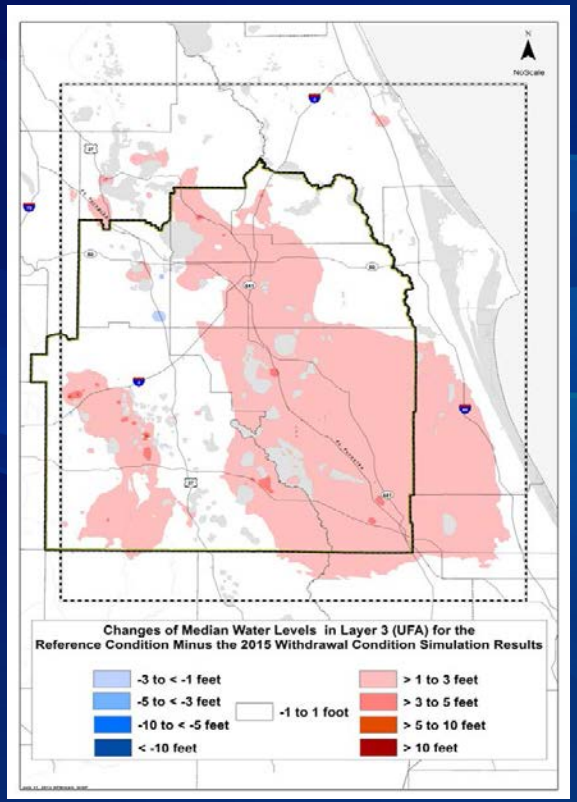


CFWI Groundwater Availability Scenarios

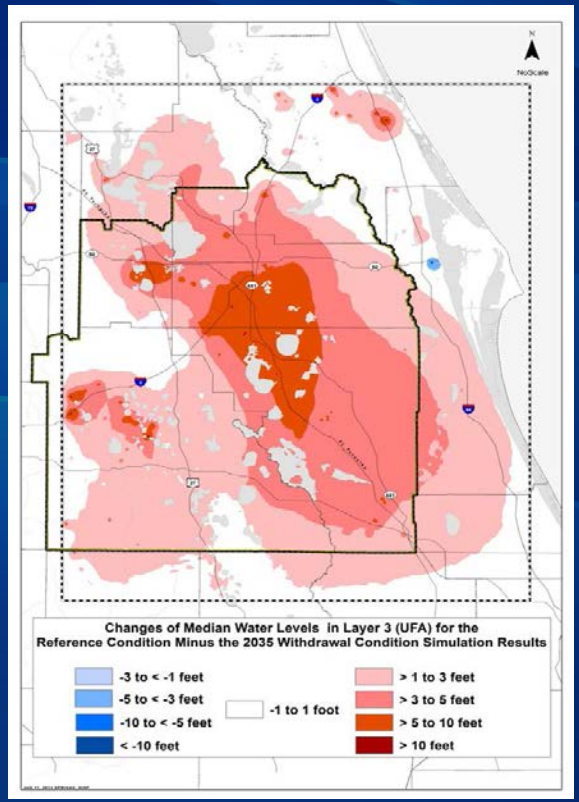
- Calibration from 2003 to 2014
- Scenarios include rainfall from 2003 to 2014 (wet and dry years)
  - Reference Condition
    - 2014 withdrawal condition
  - Future Conditions
    - 2030 withdrawal condition
    - 2040 withdrawal condition
- Compare simulated water levels and flows between reference condition and future condition
- Evaluate effects of groundwater withdrawals on aquifers and natural systems

Example Model Scenarios (2015 RWSP)

RC minus 2015

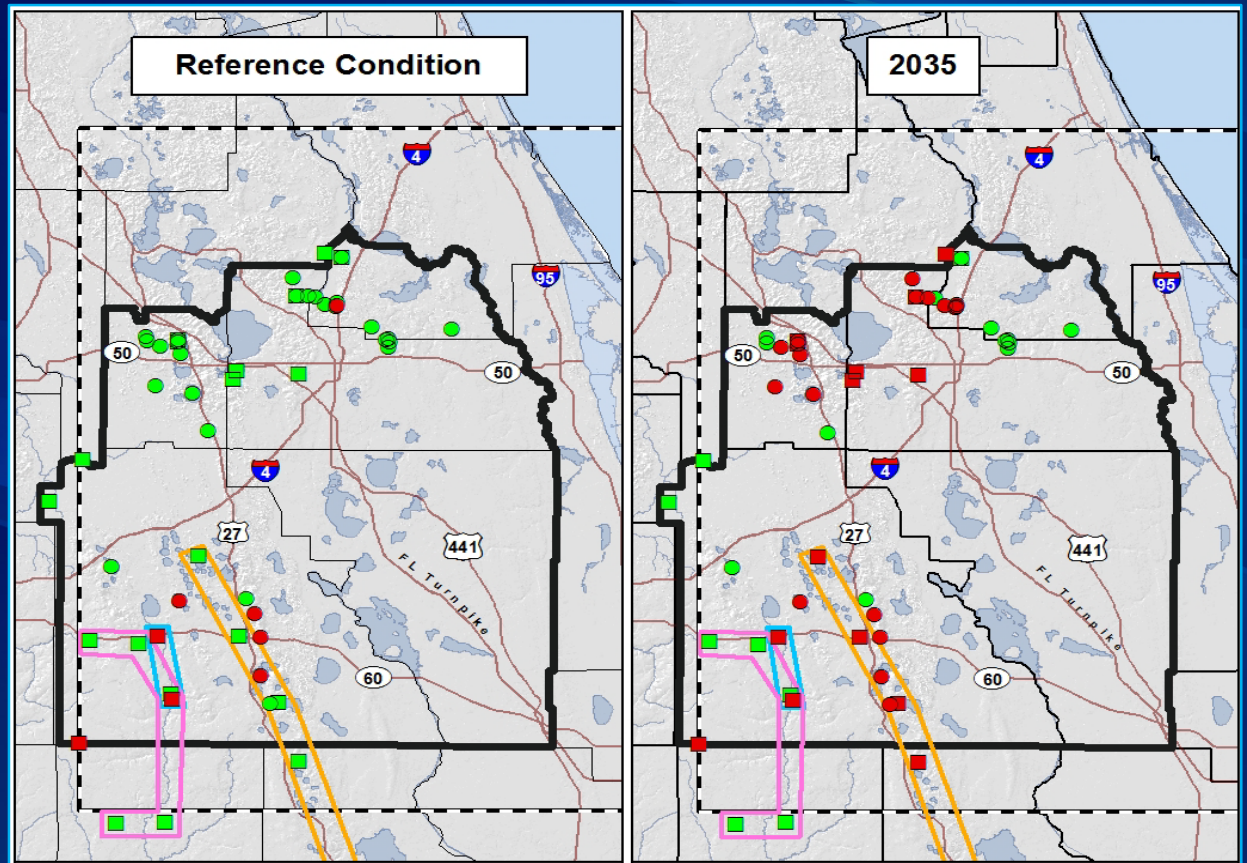


RC minus 2035

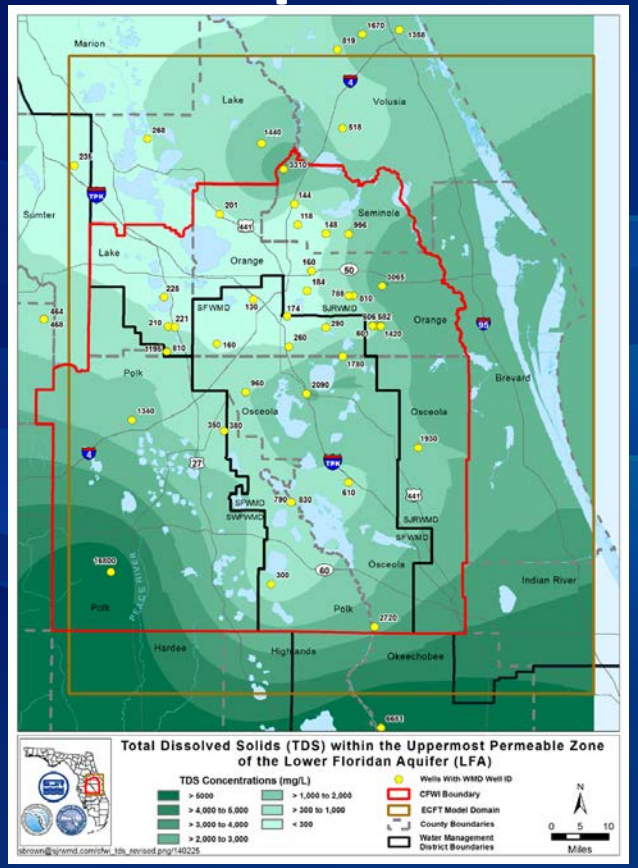


MFL Criteria Example Results (2015 RWSP)

Reference Condition and 2035 Withdrawal Conditions



Total Dissolved Solids in the Lower Floridan Aquifer



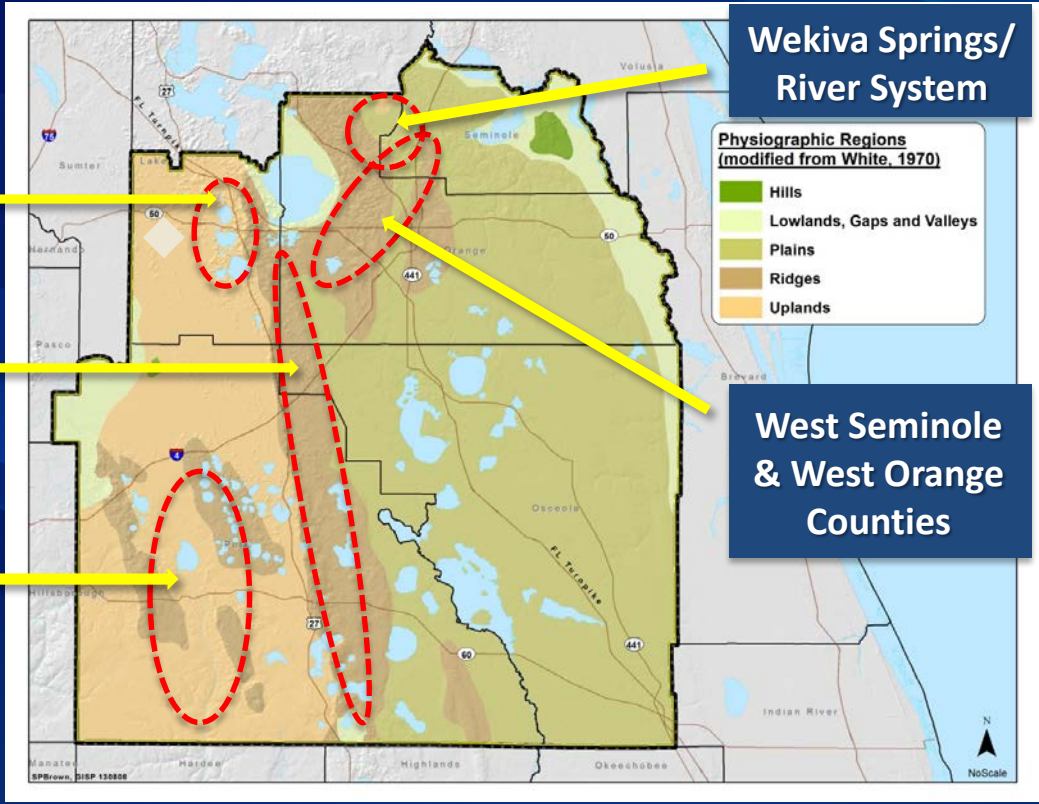
Example

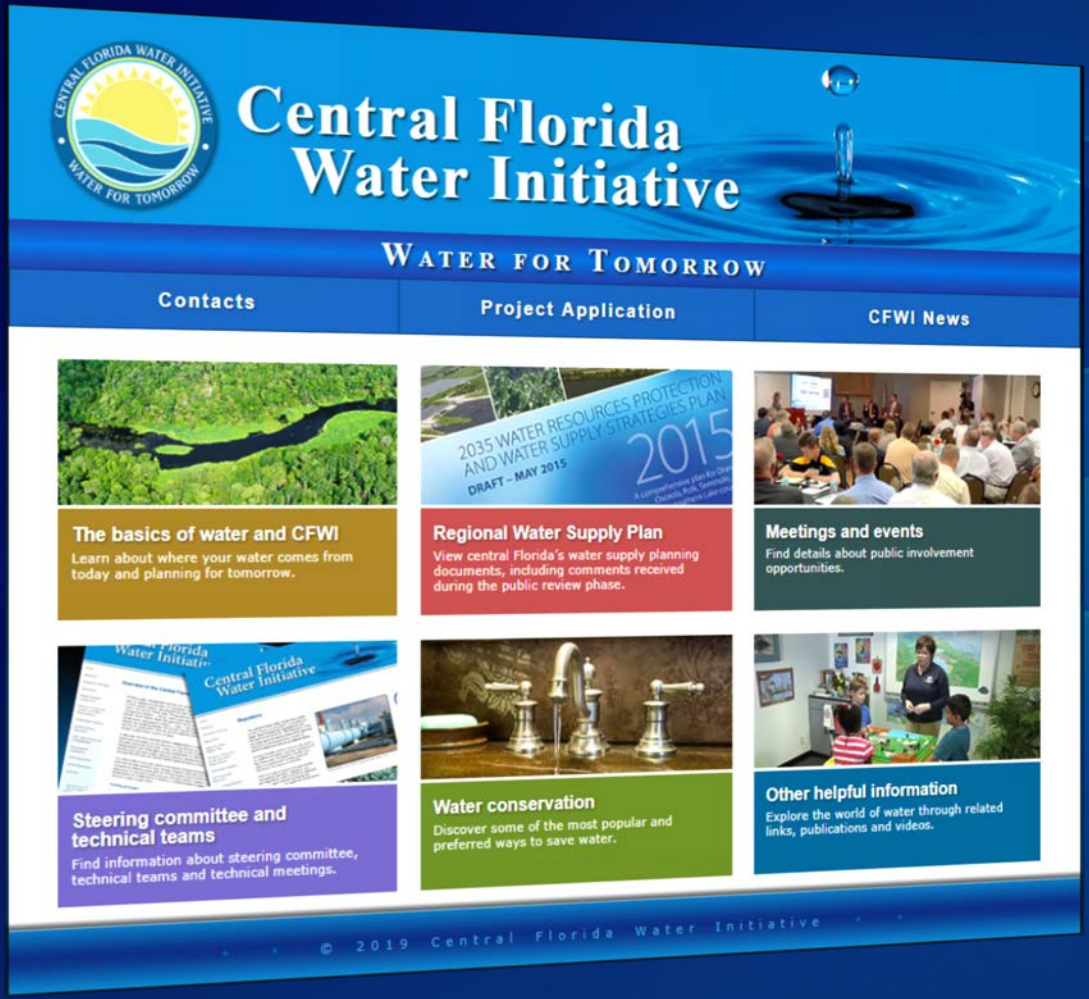
Primary Areas Susceptible to Groundwater Withdrawals (2015 RWSP Example)

South Lake County

Lake Wales Ridge

Southern Water Use Caution Area (SWUCA)





Questions?

Additional information can be found at:

cfwiwater.com