WRAT Meeting

Reference Condition and Groundwater Modeling Scenarios

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Maitland, Florida

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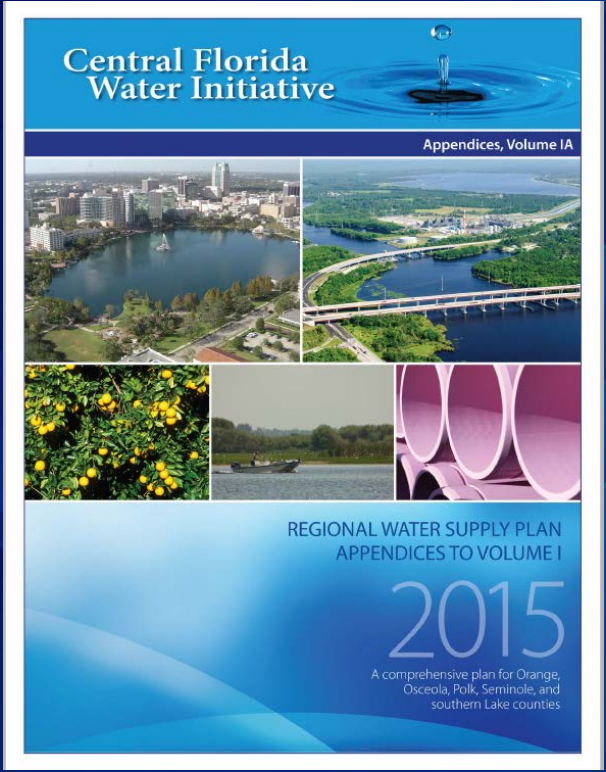
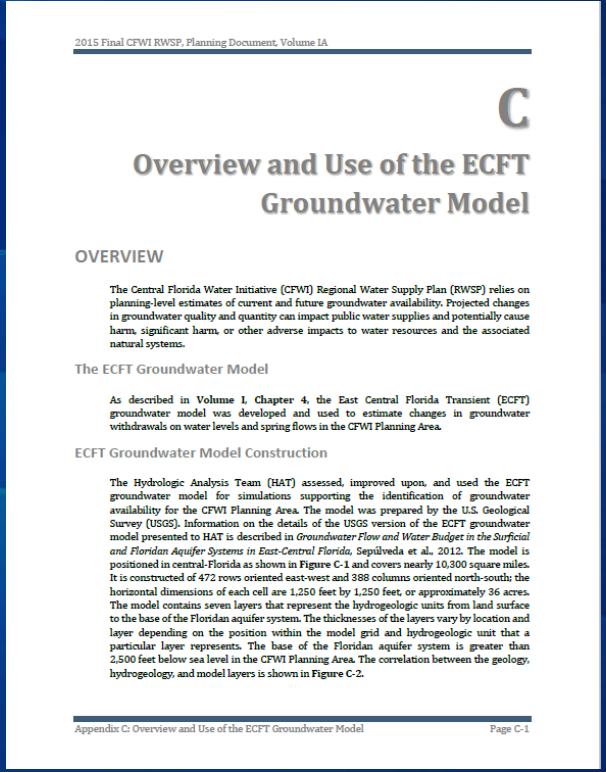
2015 RWSP Appendices





2015 Final CFWI RWSP, Planning Document, Volume IA

C

Overview and Use of the ECFT Groundwater Model

OVERVIEW

The Central Florida Water Initiative (CFWI) Regional Water Supply Plan (RWSP) relies on planning-level estimates of current and future groundwater availability. Projected changes in groundwater quality and quantity can impact public water supplies and potentially cause harm, significant harm, or other adverse impacts to water resources and the associated natural systems.

The ECFT Groundwater Model

As described in **Volume I, Chapter 4**, the East Central Florida Transient (ECFT) groundwater model was developed and used to estimate changes in groundwater withdrawals on water levels and spring flows in the CFWI Planning Area.

ECFT Groundwater Model Construction

The Hydrologic Analysis Team (HAT) assessed, improved upon, and used the ECFT groundwater model for simulations supporting the identification of groundwater availability for the CFWI Planning Area. The model was prepared by the U.S. Geological Survey (USGS). Information on the details of the USGS version of the ECFT groundwater model presented to HAT is described in *Groundwater Flow and Water Budget in the Surficial and Floridan Aquifer Systems in East-Central Florida*, Sepúlveda et al., 2012. The model is positioned in central-Florida as shown in **Figure C-1** and covers nearly 10,300 square miles. It is constructed of 472 rows oriented east-west and 388 columns oriented north-south; the horizontal dimensions of each cell are 1,250 feet by 1,250 feet, or approximately 36 acres. The model contains seven layers that represent the hydrogeologic units from land surface to the base of the Floridan aquifer system. The thicknesses of the layers vary by location and layer depending on the position within the model grid and hydrogeologic unit that a particular layer represents. The base of the Floridan aquifer system is greater than 2,500 feet below sea level in the CFWI Planning Area. The correlation between the geology, hydrogeology, and model layers is shown in **Figure C-2**.

Appendix C: Overview and Use of the ECFT Groundwater Model Page C-1

Also see the body of the RWSP, the Solutions Plan/Appendices and the HAT and EMT technical documents

Reference Condition Background Info

- 2015 RWSP reference condition (RC) (2005)
  - Developed to represent aquifer conditions that would be expected if 2005 water demands were repeatedly realized over the 12-year simulation period. Dependent water input variables were adjusted based on monthly changes of rainfall using observed and calculated relationships between rainfall and specific variables. The 2005 condition or period was chosen for the Reference Condition because it corresponded with the time-frames used for CFWI Planning Area hydro-ecological assessments of water body conditions, MFL assessments, and the availability of water use records.

  - Use of the 2005 water use as the Reference Condition does not imply that 2005 is considered a base year for acceptable environmental conditions. It is, rather, simply a period for which modeled environmental conditions were characterized for a common period with relatively well known hydrologic conditions

- 2015 Solutions Plan used updated RC (2005) and updated 2015 simulations (MORE LATER)

Reference Condition Background

- The Reference Condition is not intended to be used in isolation for gauging water resource conditions. Rather, it is expected to yield a common modeled result that can be compared with results from other ECFT groundwater modeling scenarios.
- Reference Condition was established and used to compare modeled results from a number of projected future withdrawal conditions. The CFWI RWSP Reference Condition is a combination of observed ecologic status of water bodies from 2005 to 2010 and the modeled hydrologic conditions of the 2005 withdrawal condition.

Reference Condition Background

- The 2005 withdrawal scenario was selected as the Reference Condition (which represents relatively recent demands) and was used as the basis to calculate differences in water levels and flows due to changes in groundwater withdrawals resulting from other model simulations.
  - corresponds with the most recent land use condition incorporated in the ECFT groundwater model,
  - consistent with the time period when environmental data were collected at wetland and lake sites.

2015 RWSP ECFT Calibration and Scenarios

- Calibration
- Reference Condition
- 2015 (intermediate)
- 2025 (intermediate)
- 2035
- End of Permit

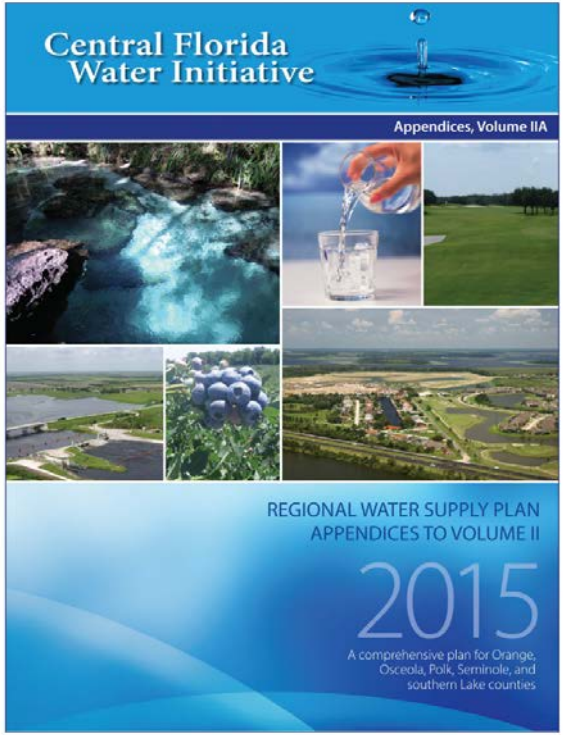
Table C-2. Model input parameters for ECFT groundwater model calibration and selected withdrawal condition scenarios.

Parameter		Scenario/Withdrawal Condition			
		Calibration	Reference Condition	End-of-Permit (EOP)	2035
Duration		144 Months	144 Months	144 Months	144 Months
Time step		Monthly	Monthly	Monthly	Monthly
Withdrawal Period or Condition		1995 to 2006	2005	EOP - Varies by Permit	2035 Projected
Land Use		1995 for 1995 - 1999 2000 for 2000 - 2003 2004 for 2004 - 2006	2004	2004	2004
Rainfall & ET		Measured 1995-2006	Measured 1995-2006	Measured 1995-2006	Measured 1995-2006
Runoff and Infiltration Partitioning		Calculated using Green-Ampt[1]	Calculated using Green-Ampt[1]	Calculated using Green-Ampt[1]	Calculated using Green-Ampt[1]
Withdrawal Sector		1995-2006	2005[1]	EOP Allocations[1]	2035 Projected[1]
	PWS	Measured	Estimated average 2005	Permitted allocations	Projected average 2035 demands
	Ag.	Measured or AFSIRS estimated	Estimated average 2005	Permitted allocations	Projected average 2035 demands
	C/I	Measured	Estimated average 2005	Permitted allocations	Projected average 2035 demands
	DSS	Estimated based on land use	Estimate average 2005	Projected average 2030 demands	Projected average 2035 demands
	REC	Measured or not included	Same as Calibration	Same as Calibration	Same as Calibration
Irrigation and RIB Recharge	IRR	Estimated based on land use (indexed to measured pumping)	Estimated (indexed to 2005 pumping)	Estimated (indexed to EOP pumping)	Estimated (indexed to 2035 pumping)
	RIBs	Measured	Estimated average 2005 RIB loading	Estimated average 2005 RIB loading	Estimated average 2005 RIB loading

Unchanged values or processes between scenarios

[1] Adjusted through the simulation period using rainfall amounts and patterns

2015 RWSP-Solutions Plan Appendices



E

Solutions Strategies Modeling

APPLICATION OF THE ECFT GROUNDWATER MODEL TO THE CFWI SOLUTIONS PLANNING PHASE

For the CFWI Solutions Planning Phase, the ECFT groundwater model served as a common tool to simulate groundwater conditions to evaluate the effects of proposed groundwater projects and associated water use changes as well as conceptual strategies to manage the area's water resources.

For the Solutions Strategies document, several improvements to the ECFT groundwater model were made. The CFWI RWSP Reference Condition (2005) and CFWI RWSP 2015 Withdrawal scenarios were updated with revised landscape irrigation (potable and reclaimed) and rapid infiltration basin (RIB) flows, and reclaimed water irrigation values. These updated scenarios are referred to as the Updated 2005 Reference Condition and the Baseline Condition. Improvements included revisions to the simulation of landscape irrigation by refining the mass balance calculation. The Updated Reference Condition (2005) and the Baseline Condition scenario return flows were less than the estimated irrigation values used in the CFWI RWSP for Orange and Seminole counties. Improvements were made in the demand location calculation method by consistently using wells/point withdrawals rather than using areal distribution for agricultural irrigated areas, and by updating domestic self-supply for Polk County. **Volume II, Chapter 4** contains additional information on the updates to the ECFT groundwater modeling for the Solutions Strategies.

The ECFT groundwater model outputs of water levels and flows are also important to assess water resource conditions of water bodies with adopted minimum flow and level (MFL) and other non-MFL water bodies. The ECFT model results were provided to the Environmental Evaluation Subteam (EE Subteam) for them to assess the environmental impacts of specific groundwater withdrawal conditions in the CFWI Planning Area. Results of the EE Subteam assessment are presented in **Appendix F.**

E-1

Revised Landscape Irrigation Approach

For the Central Florida Water Initiative (CFWI) East Central Florida Transient (ECFT) Groundwater Flow Model

prepared by
Uditha Bandara, SFWMD 11/05/2014

OVERVIEW

Landscape irrigation (LSI) occurs generally in the residential/commercial mixed land use areas served by PS systems. LSI is an important component of the water balance that uses a portion of the available reclaimed water flow and is combined with rainfall, potable water, and other irrigation water to satisfy landscape irrigation needs. The combined irrigation water applied to the land satisfies plant water needs. Some of the irrigation water will return to the atmosphere through evapotranspiration, some will usually discharge to surface waters as runoff, and some will travel by infiltration and percolation through the soil to the water table to complete the water cycle.

The CFWI Hydrologic Analysis Team (HAT) determined that the LSI return-flow approach previously used in the ECFT Groundwater Model to support the CFWI RWSP planning phase had several drawbacks. These include inaccurate estimates of LSI quantities in some counties, mass balance errors, and lack of temporal variation in the LSI application to reflect the climatic and seasonal hydrologic conditions. As part of the CFWI Solutions Planning Phase, a revised approach has been developed, which overcomes the drawbacks of the previous method. Some of the major improvements of the revised approach are: (1) a more rigorous estimation of LSI quantities at the county level, (2) a more comprehensive accounting of the water mass balance (groundwater pumping versus irrigation), (3) use of variable temporal application rates to represent the climatic and seasonal hydrologic conditions, and (4) use of different irrigation rates for ridge and plain areas to represent increased irrigation rates in ridge areas. Compared to the previous approach, noteworthy changes in LSI quantities resulted for Orange, Seminole, Polk, Brevard, and Osceola counties. Using the revised LSI approach to simulate the 2005 Reference Condition, Orange and Seminole counties together received about 45 million gallons per day (mgd) more LSI while Polk and Brevard counties received about 18 mgd and 15 mgd less LSI, respectively.

Updated Reference Condition & Baseline

- The CFWI RWSP Reference Condition (2005) and CFWI RWSP 2015 Withdrawal scenarios were updated with revised landscape irrigation (potable and reclaimed) and rapid infiltration basin (RIB) flows, and reclaimed water irrigation values.

- These updated scenarios were referred to as the Updated 2005 Reference Condition and the Baseline Condition.

- Baseline condition was used for comparison of various “solutions” scenarios, although in one case, solutions scenario results were compared

Discussion Items

- Modeling calibration status
- Boundaries: model domain, CFWI area, etc.
- Calibration information
- Reference condition scenario
- 20-year future water-use scenario for RWSP purposes
- Other future water-use scenarios
  - Five or ten-year intermediate time-steps (i.e., demand estimates)
  - End of permit
  - Conceptual/project scenarios
- Transient vs. steady state model output

ECFT, ECFTX and CFWI Boundaries