2021 Upper East Coast Water Supply Plan Update

Welcome

2021 UEC Technical Methods Workshop

July 16, 2021
Welcome and Introduction – Tom Colios, Section Leader

East Coast Floridan Model – Rob Earle, Lead Modeler
  • Model overview
  • Model updates since 2014
  • UEC planning model scenarios and results
  • Modeling conclusions

Public Comments and Questions

Next Steps – Nancy Demonstranti, UEC Plan Manager
Water supply plans
- Road map to meet future demands while protecting water resources and natural systems
- Planning-level analysis to determine water supply availability
- Summary of modeling results

Regional groundwater models
- Regional evaluation of groundwater resources
- Specific to an area and aquifer system
- Used for determining regional trends, not for local analysis
- Separate technical document for detailed model updates, calibration, and results
East Coast Floridan Modeling to Support the 2021 Upper East Coast Water Supply Plan Update

Rob Earle
Lead Modeler, Groundwater Modeling Unit, Water Supply Bureau
South Florida Water Management District
The surficial aquifer system (SAS) use is limited
- Increases in water use expected to be supported by the Floridan aquifer system (FAS)
- Brackish water from the FAS can serve as a supplemental agricultural water source

- Maintain wells critical to long-term monitoring and modeling
- New Avon Park permeable zone wellfields should have greater spacing and lower per-well capacity
East Coast Floridan Model Re-Calibration and Application to the Upper East Coast
East Coast Floridan Model overview

East Coast Floridan Model re-calibration

Application to Upper East Coast planning scenarios

Upper East Coast planning scenario results
Boundaries

- Brevard County (north)
- Florida Keys/Florida Straits (south)
- Atlantic Ocean (east)
- West Coast Floridan Model (west)
Northwestern portion of model domain overlaps the East-Central Florida Transient Expanded (ECFTX) Model

Western portion of model domain slightly overlaps the West Coast Floridan Model
MODFLOW-SEAWAT Model (USGS 2012)
Calibration period: 1989-2012
288 monthly simulation (stress) periods (288 ÷ 12 = 24 years)
Cell size: 2,400 ft × 2,400 ft
7 model layers, including:
  • Layer 1: Upper Floridan aquifer
  • Layer 3: Avon Park permeable zone
Calibrated to water levels and water quality (TDS concentration [mg/L])

ECFM Domain

UEC Planning Area
Hydrostratigraphic Cross-Section and East Coast Floridan Model Layers

*East Coast Floridan Model does not include the surficial aquifer system or intermediate confining unit.
Considerations for Large Regional Models

- MODFLOW-SEAWAT: block-centered, finite-difference, cellular
- Heads and concentrations for each stress period are determined at each model cell
- Each ECFM model cell measures 2,400 ft x 2,400 ft in area (132 acres)
- **Regional** trends and differences; **local** can be deceiving
Calibration Update and Comparison
(2014 ECFM vs. 2021 ECFM)
Modified the hydrostratigraphy (model layers) to be consistent with the East-Central Florida Transient Expanded (ECFTX) Model

Incorporated new hydrogeologic information (hydraulic conductivity) into the model from six new sites

Re-calibrated the model to meet calibration criteria
Hydrostratigraphy (model layer elevation) data from the ECFTX Model was used in the area that overlaps the ECFM domain.

Within the overlapped area, ECFTX well data points were provided:

- UFA top: 446 data points
- UFA bottom: 38 data points
- APPZ top: 37 data points
- APPZ bottom: 22 data points
Updates to the East Coast Floridan Model

- Incorporated new hydrogeologic information
- New **hydraulic conductivity** was incorporated in **localized areas** in both the UFA and APPZ
  - Upper Floridan aquifer (UFA)
    - Okeechobee Clean Energy Center
    - Broward County Water Treatment Plant 1A
    - Lake Region Reverse Osmosis Treatment Plant
  - Avon Park permeable zone (APPZ)
    - S-65A structure at Kissimmee River Basin
    - Okeechobee Clean Energy Center
    - City of Sunrise Wastewater Treatment Facility
    - Seacoast Utility Authority
Water level calibration criteria, by aquifer (UFA, APPZ, LFA):

- Percent of simulated heads within ±2.0 ft of observed heads ≥80%
- Percent of simulated heads within ±4.0 ft of observed heads ≥90%
- Mean absolute error (MAE): <2.0 ft
  - 80% of wells in an aquifer with MAE <2.0 ft
- Percentage of stations where ≥80% of the simulated heads are within ±2.0 ft of the observed heads ≥80%
Comparison of Water Level Calibration
(2021 vs. 2014)

<table>
<thead>
<tr>
<th>Aquifer</th>
<th>No. of Well Sites</th>
<th>No. of Records</th>
<th>% of Records Outside ±2.0 ft Interval</th>
<th>% of Records Outside ±4.0 ft Interval</th>
<th>% of Sites with &lt;2 ft MAE (Goal: 80%)</th>
<th>% of Sites within ±2 ft Interval (Goal: 80%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Floridan aquifer</td>
<td>110</td>
<td>6,521</td>
<td>16%</td>
<td>2%</td>
<td>90%</td>
<td>75%</td>
</tr>
<tr>
<td>Avon Park permeable zone</td>
<td>27</td>
<td>1,835</td>
<td>10%</td>
<td>0%</td>
<td>96%</td>
<td>81%</td>
</tr>
<tr>
<td>Lower Floridan aquifer</td>
<td>6</td>
<td>502</td>
<td>15%</td>
<td>1%</td>
<td>83%</td>
<td>83%</td>
</tr>
</tbody>
</table>

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</thead>
<tbody>
<tr>
<td>Upper Floridan aquifer</td>
<td>110</td>
<td>6,521</td>
<td>18%</td>
<td>2%</td>
<td>87%</td>
<td>61%</td>
</tr>
<tr>
<td>Avon Park permeable zone</td>
<td>27</td>
<td>1,835</td>
<td>13%</td>
<td>1%</td>
<td>93%</td>
<td>59%</td>
</tr>
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<td>1%</td>
<td>75%</td>
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</tr>
</tbody>
</table>

MAE = mean absolute error

* SMMS version is available at https://apps.sfwmd.gov/smmsviewer/
**Calibration Target**

For at least 80% of the monitoring wells, the model will simulate TDS within the error band:

<table>
<thead>
<tr>
<th>Observed total dissolved solids (mg/L)</th>
<th>Fresh to Brackish Water</th>
<th>Moderately Saline</th>
<th>Saline Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 4,000</td>
<td>4,000 – 10,000</td>
<td>10,000 – 18,000</td>
<td>&gt;18,000</td>
</tr>
<tr>
<td>Calibration error band (mg/L)</td>
<td>±500</td>
<td>±750</td>
<td>±3,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>±4,000</td>
</tr>
</tbody>
</table>

**Definition**

A “calibrated well” is a well for which the model simulates TDS within the error band.
### Comparison of Water Quality Calibration (2021 vs. 2014)

#### Current Version 2021 ECFM

<table>
<thead>
<tr>
<th>Aquifer</th>
<th>Desirable Interval Criteria (± mg/L)</th>
<th>No. of Well Sites</th>
<th>No. of Records</th>
<th>% of Records Outside Desirable Interval</th>
<th>% of Sites Within Desirable Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>UFA</td>
<td>500 – 750</td>
<td>102</td>
<td>5028</td>
<td>11%</td>
<td>90%</td>
</tr>
<tr>
<td>APPZ</td>
<td>500 – 4,000</td>
<td>63</td>
<td>4298</td>
<td>33%</td>
<td>71%</td>
</tr>
<tr>
<td>LFA</td>
<td>3,000 – 4,000</td>
<td>43</td>
<td>4165</td>
<td>23%</td>
<td>84%</td>
</tr>
</tbody>
</table>

#### SMMS Version* 2014 ECFM

<table>
<thead>
<tr>
<th>Aquifer</th>
<th>Desirable Interval Criteria (± mg/L)</th>
<th>No. of Well Sites</th>
<th>No. of Records</th>
<th>% of Records Outside Desirable Interval</th>
<th>% of Sites Within Desirable Interval</th>
</tr>
</thead>
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<tr>
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<td>102</td>
<td>5028</td>
<td>10%</td>
<td>90%</td>
</tr>
<tr>
<td>APPZ</td>
<td>500 - 4000</td>
<td>63</td>
<td>4298</td>
<td>38%</td>
<td>65%</td>
</tr>
<tr>
<td>LFA</td>
<td>3000 - 4000</td>
<td>43</td>
<td>4165</td>
<td>25%</td>
<td>86%</td>
</tr>
</tbody>
</table>

- Percentage of data points (records) outside the desirable interval should be 20% or less
- Percentage of sites within the desirable interval should be 80% or greater

* SMMS version is available at https://apps.sfwmd.gov/smmsviewer/
2021 East Coast Floridan Model Re-Calibration Summary
39 out of 110 (35%) ECFM – UFA water level calibration targets inside the UEC Planning Area

<table>
<thead>
<tr>
<th>Criterion</th>
<th>All Layers</th>
<th>UFA in ECFM</th>
<th>UFA in UEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean absolute error (MAE)</td>
<td>&lt;2.0 ft</td>
<td>1.21</td>
<td>1.25</td>
</tr>
<tr>
<td>Number of wells</td>
<td>143</td>
<td>110</td>
<td>39</td>
</tr>
<tr>
<td>% of wells with MAE &lt;2.0 ft</td>
<td>&gt;80%</td>
<td>92%</td>
<td>90%</td>
</tr>
</tbody>
</table>

Note: Wells depicted in **green** meet calibration criteria

Wells depicted in **red** do not meet calibration criteria
Water Quality Calibration – Upper Floridan Aquifer

37 out of 102 (36%) ECFM – UFA water quality calibration targets inside the UEC Planning Area

<table>
<thead>
<tr>
<th>Criterion</th>
<th>All Layers</th>
<th>UFA in ECFM</th>
<th>UFA in UEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of wells</td>
<td>208</td>
<td>102</td>
<td>37</td>
</tr>
<tr>
<td>Number of wells meeting calibration</td>
<td>175</td>
<td>92</td>
<td>35</td>
</tr>
<tr>
<td>Percentage of calibrated wells</td>
<td>80%</td>
<td>84%</td>
<td>90%</td>
</tr>
</tbody>
</table>

Note: Wells depicted in **green** meet calibration criteria
Wells depicted in **blue** do not meet calibration criteria
### Water Level Calibration – Avon Park Permeable Zone

5 out of 27 (19%) ECFM – APPZ water level calibration targets inside the UEC Planning Area

<table>
<thead>
<tr>
<th>Criterion</th>
<th>All Layers</th>
<th>APPZ in ECFM</th>
<th>APPZ in UEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean absolute error (MAE)</td>
<td>&lt;2.0 ft</td>
<td>1.21</td>
<td>1.04</td>
</tr>
<tr>
<td>Number of wells</td>
<td></td>
<td>143</td>
<td>27</td>
</tr>
<tr>
<td>% of wells with MAE &lt;2.0 ft</td>
<td>&gt;80%</td>
<td>92%</td>
<td>96%</td>
</tr>
</tbody>
</table>

Note: Wells depicted in green meet calibration criteria
15 out of 63 (24%) ECFM – APPZ water quality calibration targets inside the UEC Planning Area

<table>
<thead>
<tr>
<th>Criterion</th>
<th>All Layers</th>
<th>APPZ in ECFM</th>
<th>APPZ in UEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of wells</td>
<td>208</td>
<td>63</td>
<td>15</td>
</tr>
<tr>
<td>Number of wells meeting calibration</td>
<td>175</td>
<td>46</td>
<td>8</td>
</tr>
<tr>
<td>Percentage of calibrated wells</td>
<td>80%</td>
<td>84%</td>
<td>71%</td>
</tr>
</tbody>
</table>

Note: Wells depicted in green meet calibration criteria
Wells depicted in blue do not meet calibration criteria
Water Level Calibration – Lower Floridan Aquifer

There is only one ECFM – LFA water level calibration target inside the UEC Planning Area

<table>
<thead>
<tr>
<th>Criterion</th>
<th>All Layers</th>
<th>LFA in ECFM</th>
<th>LFA in UEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean absolute error (MAE) &lt;2.0 ft</td>
<td>1.21</td>
<td>1.16</td>
<td>0.85</td>
</tr>
<tr>
<td>Number of wells</td>
<td>143</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>% of wells with MAE &lt;2.0 ft &gt;80%</td>
<td>92%</td>
<td>83%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Note: Well depicted in **green** meets calibration criteria
Water Quality Calibration – Lower Floridan Aquifer

12 out of 43 (27%) ECFM – LFA water quality calibration targets inside the UEC Planning Area

<table>
<thead>
<tr>
<th>Criterion</th>
<th>All Layers</th>
<th>LFA in ECFM</th>
<th>LFA in UEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of wells</td>
<td>208</td>
<td>43</td>
<td>13</td>
</tr>
<tr>
<td>Number of wells meeting calibration</td>
<td>175</td>
<td>36</td>
<td>7</td>
</tr>
<tr>
<td>Percentage of calibrated wells</td>
<td>80%</td>
<td>84%</td>
<td>84%</td>
</tr>
</tbody>
</table>

Note: Wells depicted in **green** meet calibration criteria
Wells depicted in **blue** do not meet calibration criteria
Model Application: Upper East Coast Planning Scenarios
Upper East Coast Planning Scenarios

- **2019 Base Condition**
  - Public Supply, Power Generation, Landscape/Recreational, and Commercial/Industrial/Institutional demands from historical 2019 pumpage data
  - Agricultural demands estimated based on AFSIRS (simulates irrigation demands)

- **2045 Future Condition**
  - Public Supply, Power Generation, and Commercial/Industrial/Institutional demands based on future population growth rate
  - Agricultural demands based on future land use (FSAID 2019*) and AFSIRS
  - Landscape/Recreational demands based on 2045 planning projections

- **Differences** in water levels and water quality (TDS) between 2019 and 2045 in the UFA and APPZ (model layers 1 and 3)

*Florida Statewide Agricultural Irrigation Demand Report 2019*
Limitations in Simulating Demands

- Each simulation is 24 years
  - Same as calibration period
- Model does not simulate annual demand growth
- Simulated demands are “instant on”
- Raw water demand shown for all use types
- Results from the 2045 simulation are considered conservative
Regional Model Limitations

- Large model cell size (2,400 ft × 2,400 ft)
  - Cannot accurately simulate local drawdowns
- Regional model may not capture local heterogeneity in the FAS and the response at individual wells
- Regional model results should be used as an overall planning tool; results should not be considered absolute
## Floridan Aquifer Demands in the Upper East Coast Planning Area

<table>
<thead>
<tr>
<th>Water Use Category</th>
<th>2019 (mgd)</th>
<th>2045 (mgd)</th>
<th>Difference (mgd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>37.87</td>
<td>31.45</td>
<td>-6.42</td>
</tr>
<tr>
<td>Commercial/Industrial/Institutional</td>
<td>0.18</td>
<td>0.18</td>
<td>0.00</td>
</tr>
<tr>
<td>Landscape/Recreational</td>
<td>2.74</td>
<td>4.20</td>
<td>1.46</td>
</tr>
<tr>
<td>Power Generation</td>
<td>1.45</td>
<td>3.34</td>
<td>1.89</td>
</tr>
<tr>
<td>Public Supply</td>
<td>36.18</td>
<td>59.74</td>
<td>23.56</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>78.42</strong></td>
<td><strong>98.91</strong></td>
<td><strong>20.49</strong></td>
</tr>
</tbody>
</table>
### Differences in PS Demands in the UEC Planning Area

<table>
<thead>
<tr>
<th>Permit Number</th>
<th>Utility</th>
<th>Allocation (mgd)</th>
<th>2019 (mgd)</th>
<th>2045 (mgd)</th>
<th>Difference (mgd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>43-00053-W</td>
<td>Stuart, City of</td>
<td>3.67</td>
<td>0.00</td>
<td>2.62</td>
<td>2.62</td>
</tr>
<tr>
<td>43-00066-W</td>
<td>South Martin Regional Utility</td>
<td>2.50</td>
<td>1.78</td>
<td>2.43</td>
<td>0.65</td>
</tr>
<tr>
<td>43-00102-W</td>
<td>Martin County Utilities (Consolidated System)</td>
<td>15.09</td>
<td>9.98</td>
<td>10.63</td>
<td>0.65</td>
</tr>
<tr>
<td>43-00146-W</td>
<td>Sailfish Point Utility Corporation</td>
<td>0.22</td>
<td>0.21</td>
<td>0.22</td>
<td>0.01</td>
</tr>
</tbody>
</table>

#### Martin County

#### St. Lucie County

<table>
<thead>
<tr>
<th>Permit Number</th>
<th>Utility</th>
<th>Allocation (mgd)</th>
<th>2019 (mgd)</th>
<th>2045 (mgd)</th>
<th>Difference (mgd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>56-00085-W</td>
<td>Fort Pierce Utilities Authority</td>
<td>13.13</td>
<td>3.42</td>
<td>5.85</td>
<td>2.43</td>
</tr>
<tr>
<td>56-00142-W</td>
<td>Port St. Lucie Utility Systems Department, City of</td>
<td>30</td>
<td>18.33</td>
<td>30.08</td>
<td>11.75</td>
</tr>
<tr>
<td>56-00406-W</td>
<td>St. Lucie County Utilities</td>
<td>6.65</td>
<td>0.00</td>
<td>5.40</td>
<td>5.40</td>
</tr>
<tr>
<td>56-00614-W</td>
<td>St. Lucie West Services District</td>
<td>3.10</td>
<td>2.20</td>
<td>2.23</td>
<td>0.03</td>
</tr>
</tbody>
</table>
2045 Projected Demands at FAS Wellfields

**St. Lucie County Utilities**
- 5.4 mgd increase
  - No pumping in 2019
  - 4 mgd from North in 2045
  - 1.4 mgd from Central in 2045
  - UFA only

**City of Stuart**
- 2.62 mgd increase
  - No pumping in 2019
  - Mostly APPZ in 2045
    (2.6 mgd APPZ, 0.02 mgd UFA)

**Port St. Lucie Utility Systems Dept.**
- JEA: 0.94 mgd decrease
- Prineville: 0.27 mgd decrease
- Southwest: 12.96 mgd increase
  - 3.53 mgd from UFA, 9.43 mgd from APPZ

**Treasure Coast Energy Center (PG)**
- 1.89 mgd increase, UFA only

**Fort Pierce Utilities Authority**
- 2.43 mgd increase
  - 33rd St. UFA increase = 1.17 mgd
  - 33rd St. APPZ increase = 0.28 mgd
  - West UFA increase = 0.94 mgd
  - West APPZ increase = 0.05 mgd

**Hobart & Oslo**
- 1.93 mgd increase Hobart
- 0.7 mgd decrease Oslo
- UFA only

**City of Vero Beach**
- 1.67 mgd increase, UFA only

**Okeechobee Clean Energy Center (PG)**
- 1.37 mgd increase UFA
- 2.07 mgd increase APPZ

**Port St. Lucie Utility Systems Dept.**
- JEA: 0.94 mgd decrease
- Prineville: 0.27 mgd decrease
- Southwest: 12.96 mgd increase
  - 3.53 mgd from UFA, 9.43 mgd from APPZ
How to Read the Results

Legend

- Month 288: Last month in planning scenario model runs
- Type:
  - AG = Agriculture
  - PG = Power Generation
  - PS = Public Supply
- Well symbols
- Layer (1 or 3)
- Planning area boundary
- Head difference in feet
  - 2045 head minus 2019 head
~17 ft of drawdown at St. Lucie County Utilities (North Wellfield)
  - No FAS demand in 2019
  - 4 mgd in 2045
~6.5 ft of additional drawdown at Treasure Coast Energy Center Power Generation wells
  - 1.9 mgd increase
Up to 3 ft of rebound at City of Port St. Lucie (JEA Wellfield)
  - 0.42 mgd decrease
  - Agricultural demand decreases may contribute
SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Upper Floridan Aquifer
Water Quality Difference (2045 – 2019)

- TDS differences of <100 mg/L in most of the area
- Increase in TDS at St. Lucie County Utilities (North Wellfield):
  - Increase in demands 0 to 4 mgd
  - TDS increase as high as 4,800 mg/L
- Slight increase in TDS at Fort Pierce Utilities Authority
  - 33rd St. demand increase from 1.64 to 2.81 mgd
  - West demand increase from 1.32 to 2.26 mgd
- Slight decrease in TDS at Oslo Water Treatment Plant
  - Demand decreases from 6.28 to 5.58 mgd
SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Upper Floridan Aquifer
Water Quality % Difference (2045 – 2019)

- TDS % differences of <10% in most of the area
- Increase in TDS at St. Lucie County Utilities (North Wellfield) ~360%:
  - Increase in demands = 4 mgd
- Slight increase in TDS at Fort Pierce Utilities Authority ~14%:
  - 33rd St. demand increase from 1.64 to 2.81 mgd
  - West demand increase from 1.32 to 2.26 mgd
- Slight decrease in TDS at Oslo Water Treatment Plant ~3%:
  - Demand decreases from 6.28 to 5.58 mgd

TDS Difference Map
UEC Planning Region Month 288
2045 - 2019

TDS Difference (%)
- 30% - 25%
- 25% - 20%
- 20% - 15%
- 15% - 10%
- 10% - 5%
- 5% - 0%

Layers: Monthly

Prepared by: Returning Gravity
Date: 1/20/2021
Difference in TDS concentrations within the ECFM 2019 scenario model run (Year 1 to 24)

Highest TDS increase within UEC Planning Area is near St. Lucie County Utilities (North Wellfield at Airport)

- 2,100 mg/L
- No pumping in 2019 at North Wellfield
- Increase likely due to Oslo WTP and AG demands in 2019
Difference in TDS concentrations within the ECFM 2045 scenario model run (Year 1 to 24)

Highest TDS increase within UEC Planning Area is at St. Lucie County (North Wellfield at Airport)
- 4,600 mg/L
- North Wellfield demand = 4 mgd in 2045
% difference in TDS concentrations within the ECFM 2019 scenario model run (Year 1 to 24)

Highest TDS % increase within UEC Planning Area is near St. Lucie County Utilities (North Wellfield at Airport): 53%

- No pumping in 2019 at North Wellfield
- Increase likely due to Oslo WTP and AG demands in 2019
% difference in TDS concentrations within the ECFM 2045 scenario model run (Year 1 to 24)

Highest TDS % increase within UEC Planning Area is at St. Lucie County Utilities (North Wellfield at Airport): 291%

- North Wellfield demand = 4 mgd in 2045
Differences in flow direction and magnitude can be seen at:

- St. Lucie County Utilities (North Wellfield)
  - Increase in horizontal flow from the western area
  - Demand increases from 0 to 4 mgd

- Fort Pierce Utilities Authority
  - Increase in horizontal flow from the western area
  - Lateral saltwater intrusion
  - 33rd St. demand increases from 1.64 to 2.81 mgd
  - West demand increases from 1.32 to 2.26 mgd

- City of Port St. Lucie Utility Systems Department (JEA Wellfield)
  - Change in horizontal flow from the surrounding area
  - Slight demand decrease of 0.4 mgd

Vectors represent horizontal flow averaged over 25 model cells.
Differences in flow direction and magnitude can be seen at:

- City of Port St. Lucie Utility Systems Department (JEA Wellfield)
  - Change in horizontal flow from the surrounding area
  - Slight demand decrease of 0.4 mgd
- City of Port St. Lucie Utility Systems Department (Southwest Wellfield)
  - Slight change in horizontal flow
  - UFA demand increase of 3.53 mgd
- City of Stuart
  - No noticeable change in UFA flow
Up to 3 ft of drawdown at St. Lucie County Utilities (North Wellfield)
- 4 mgd UFA demand

Approximately 2 ft of rebound at City of Port St. Lucie Utility Systems Department (JEA Wellfield)
- 0.52 mgd decrease

Approximately 1 ft of rebound in western St. Lucie County due to agricultural demand reduction
Avon Park Permeable Zone Water Quality Difference (2045 – 2019)

- St. Lucie County Utilities (North Wellfield)
  - No wells in the APPZ
  - TDS increases as high as 1,000 mg/L

- City of Port St. Lucie Utility Systems Department (Southwest Wellfield)
  - Increase in TDS as high as 700 mg/L
  - 2019 demand = 0 mgd
  - 2045 demand = 9.43 mgd

- City of Stuart
  - Increase in TDS as high as 1,040 mg/L
  - 2.6 mgd APPZ demand in 2045
SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Avon Park Permeable Zone
Water Quality % Difference (2045 – 2019)

- **St. Lucie County Utilities (North Wellfield)**
  - No wells in the APPZ
  - TDS increases ~5%

- **City of Port St. Lucie Utility Systems Department (Southwest Wellfield)**
  - Increase in TDS ~30%
  - 2019 demand = 0 mgd
  - 2045 demand = 9.43 mgd

- **City of Stuart**
  - Increase in TDS ~21%
  - 2.6 mgd APPZ demand in 2045
Difference in TDS concentrations within the ECFM 2019 scenario model run (Year 1 to 24)
Difference in TDS concentrations within the ECFM 2045 scenario model run (Year 1 to 24)
Avon Park Permeable Zone
Water Quality % Difference in 2019

- % difference in TDS concentrations within the ECFM 2019 scenario model run (Year 1 to 24)
- % increase in TDS concentration within the UEC Planning Area ~30% at:
  - North Jensen
  - Tropical Farms
  - South Martin Regional Utility
Avon Park Permeable Zone
Water Quality % Difference in 2045

- % difference in TDS concentrations within the ECFM 2045 scenario model run (Year 1 to 24)
- Highest % increase in TDS concentration within the UEC Planning Area ~50% near City of Port St. Lucie’s Southwest Wellfield
  - 2045 demand = 9.43 mgd
Avon Park Permeable Zone Horizontal Flow Vectors (2019 and 2045)

Differences in flow direction and magnitude can be seen at:

- St. Lucie County Utilities (North Wellfield – pumping from UFA)
  - Increase in horizontal flow from the western area

- City of Port St. Lucie Utility Systems Dept. (JEA Wellfield)
  - Slight increase in horizontal flow from the surrounding area
  - 0.5 mgd decrease in APPZ demand

Vectors represent horizontal flow averaged over 25 model cells
Avon Park Permeable Zone Horizontal Flow Vectors (2019 and 2045)

Differences in flow direction and magnitude can be seen at:

- City of Port St. Lucie Utility Systems Department (JEA Wellfield)
  - Slight increase in horizontal flow from the surrounding area
  - ~0.5 mgd decrease in APPZ demand

- City of Port St. Lucie Utility Systems Department (Southwest Wellfield)
  - Only slight change in horizontal flow despite 9.43 mgd increase in APPZ demand

- City of Stuart
  - Slight change in flow direction towards the wellfield
  - 2.6 mgd from the APPZ in 2045

Vectors represent horizontal flow averaged over 25 model cells.
Artesian Head Relative to the Upper Floridan Aquifer
Land Surface Elevation

- Green shows ridge area with higher elevations
- Elevations decrease to the east and southeast
Simulated UFA head (month 218) minus land surface elevation

Month 218 (February 2007) = dry month (1-in-10 drought condition)

Lower artesian heads in areas of PS pumping
- Simulated UFA head (month 218) minus land surface elevation
- Month 218 (February 2007) = dry month (1-in-10 drought condition)
- Lower artesian heads in areas of PS/PG pumping
Change in Upper Floridan Artesian Head (2045 minus 2019)

- Month 218 (February 2007) = dry month (1-in-10 drought condition)
- Significant decrease in artesian head in areas of increasing PS/PG pumping
  - NO artesian head near St. Lucie County North PS wells
- Slight increase in artesian head in areas of decreasing AG/PS pumping
Monitoring Well Hydrographs
Upper Floridan Aquifer Near Oslo WTP
Upper Floridan Aquifer Near St. Lucie County Utilities (North Wellfield)
SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Upper Floridan Aquifer Near Fort Pierce Utilities Authority

FtPUFA (Row:061 Col:128 Lay:001)

- Water Level (NGVD feet)
- Total Dissolved Solids (mg/L)

Stress Period:
- Conc2019b
- Conc2045p

Graph showing changes over time in water level and total dissolved solids.
Upper Floridan Aquifer Near Treasure Coast Energy Center
Power Generation Wells
Avon Park Permeable Zone Near St. Lucie County Utilities (North Wellfield)
Avon Park Permeable Zone Near City of Port St. Lucie
Utility Systems Department (Southwest Wellfield)
Model Conclusions

- **Water Levels**
  - UFA – Except for northeastern St. Lucie County, predicted drawdown in most of the UFA are less than 2.5 ft
  - APPZ – Less than 1.5 ft of drawdown predicted throughout the UEC Planning Area, except in northeastern St. Lucie County where a 3 ft decrease predicted

- **Water Quality**
  - UFA – Except for northeastern St. Lucie County, predicted TDS changes in the UFA are less than 250 mg/L
  - APPZ
    - Potential upward movement of APPZ water into the UFA may degrade water quality in northeastern St. Lucie County
    - 700-1,040 mg/L increase in TDS predicted at City of Port St. Lucie’s Southwest Wellfield, City of Stuart, and St. Lucie County Utilities North Wellfield; less than 250 mg/L everywhere else

- FAS appears capable of meeting projected demands of all users through 2045 with appropriate wellfield management
Modeling Team

- Mirza Billah, Ph.D., E.I.T.
- Robert Earle
- Uditha Bandara, Ph.D., P.E.
Thank You
Questions and Public Comment

If you are participating via Zoom: Use the Raise Hand feature
If you are participating via phone: *9 raises hand, *6 mutes/unmutes
When you are called on, please state your full name and affiliation prior to providing comments and/or questions
South Florida Water Management District

Next Steps

Nancy Demonstranti, P.G.
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South Florida Water Management District
SOUTH FLORIDA WATER MANAGEMENT DISTRICT

UEC Water Supply Plan Update Process

Meetings with Utilities & Local Governments

Technical Methods Workshop
July 2021

Draft Plan Available
Sept. 2021

2021 Upper East Coast Water Supply Plan Update

General Stakeholder Meeting #1
April 2021

General Stakeholder Meeting #2
Sept. 2021

Governing Board Approval
Nov. 2021
Thank You