

# A User's Guide to Model Results

## Vital information to help access and interpret Performance Graphics and Hydrographs

This guidance document is intended to assist interested parties in reviewing and interpreting the East Coast Floridan Model (ECFM) simulation results. The ECFM was first used to support the *2016 Upper East Coast Water Supply Plan Update*. The simulations described here, also called model runs, were developed to simulate withdrawals from the Floridan aquifer system (FAS) in support of the *2018 Lower East Coast Water Supply Plan Update*.

The ECFM was applied in 2018 to analyze current (2016) and future (2040) trends of water level, water quality, and water flow within the FAS, an important source of water for public water supply (PWS) utilities, power generation facilities, golf courses, and an aquaculture operation in the Lower East Coast (LEC) Planning Area.

There are three sections within the Modeling Results and Supporting Information link. The first section, *How to Access and Interpret the Model Results*, contains this User's Guide to Model Results and a List of Abbreviations, Acronyms, and Terms. This User's Guide describes how to access and interpret the extensive materials generated to display the results of the model runs. The second section, *Model Results*, contains the performance graphics and hydrographs for selected wells, which is the major focus of this User's Guide. The third section, *Demand Projections and Other Background Information*, provides technical documentation for the ECFM and its development as well as information on the water demand projections.

The ECFM does not simulate surface water or the surficial aquifer system. Projections were made for total future (2040) demand, then adjusted to include only the portion of demand anticipated to be met from the FAS.

Model results are depicted as map-based performance graphics and in hydrographs. The map-based performance graphics (**Figure 1**) show PWS utility FAS wellfields as well as FAS wells for golf course irrigation, power generation, and aquaculture. The maps also show roads, county lines, and the LEC Planning Area boundary. There are 32 map-based performance graphics, each presented as a PDF that should open using PDF viewer software such as Adobe Reader or Nuance Power PDF. Most programs will allow you to zoom in and out and to move around the image while zoomed in close. In addition, there are 104 hydrographs, which can be accessed via a single interactive map. A short description of how to use the interactive hydrograph map is provided at the end this User's Guide.

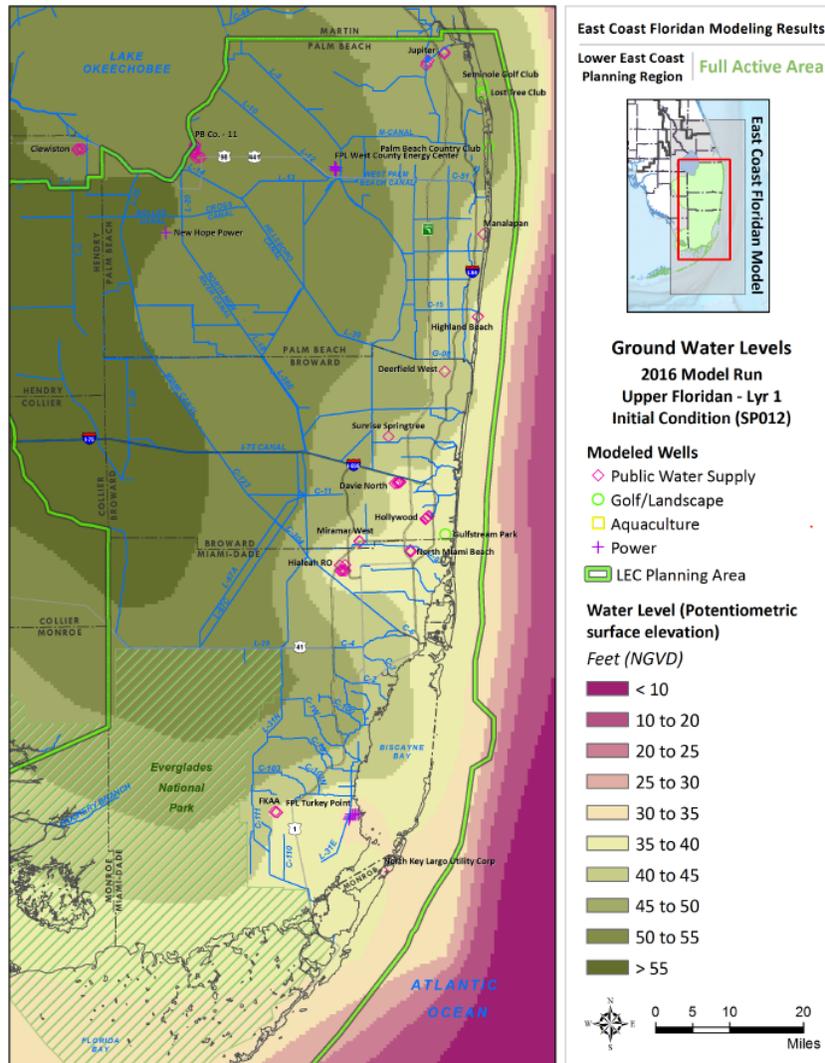


Figure 1. One of the 32 performance graphics.

The 2016 and 2040 model runs start with the same water levels and water quality but are simulated for 12 months to allow the model to stabilize. The Month 12 value is called the Initial Condition and is used to calculate the cumulative changes that occur in each model run as a result of the differences in withdrawals among all users.

The 2016 and 2040 model runs simulated the potential changes to water levels and water quality based on two different sets of FAS pumping demands. The 2016 model run applied the 2016 annual rate of withdrawal for 24 consecutive years to show the cumulative effect of existing use. The 2040 model run applied the projected 2040 annual FAS demands over the same 24-year period, allowing for analysis of long-term changes. The total annual demand in each scenario does not increase over time but is repeated in each year of the simulation. Monthly variation was included for the PWS withdrawals, using historical utility use patterns.

The results depend on the assumptions made during development of the model runs. Some assumptions, such as future population growth and the resulting 2040 water demand, have an unavoidable level of uncertainty.

In reviewing the map-based performance graphics, the legend will help explain which:

- Model run results are shown, either a single run or a comparison of two runs.** In most cases, separate graphics are presented for the 2016 and 2040 model runs. Graphics comparing the two runs are referred to as Difference Maps and are intended to show the location and magnitude of water quality or water level changes.
- Layer of the model being displayed.** There are seven layers in the ECFM (**Figure 2**). Two layers are shown in these results: Layer 1, the Upper Floridan Aquifer (UFA), and Layer 3, the Avon Park Permeable Zone (APPZ). These are the productive FAS layers used for water supply in the LEC Planning Area. Separate graphics are presented for these two layers.
- Parameter is being measured and the units of measurement.** Water levels are shown in feet and are referenced to the National Geodetic Vertical Datum of 1929 (NGVD29). In general terms, this represents a measurement of feet above mean sea level in 1929. Water quality is measured as total dissolved solids (TDS) in milligrams per liter (mg/L). An important component of TDS is chloride concentration. Although the percentage of chlorides as a component of TDS varies throughout the FAS, in the LEC Planning Area, chlorides make up approximately 50 percent of TDS. The results are displayed as color-coded ranges. Horizontal flow is represented by an arrow pointing in the primary direction of flow, and the arrows are scaled to represent the magnitude of flow measured in cubic feet per day. Each arrow represents the combined flow in blocks of 25 model cells. Using the 5-cell by 5-cell squares is meant to provide a less cluttered image. Vertical flows are color-coded and presented in cubic feet per day, but on a cell-by-cell basis without arrows.

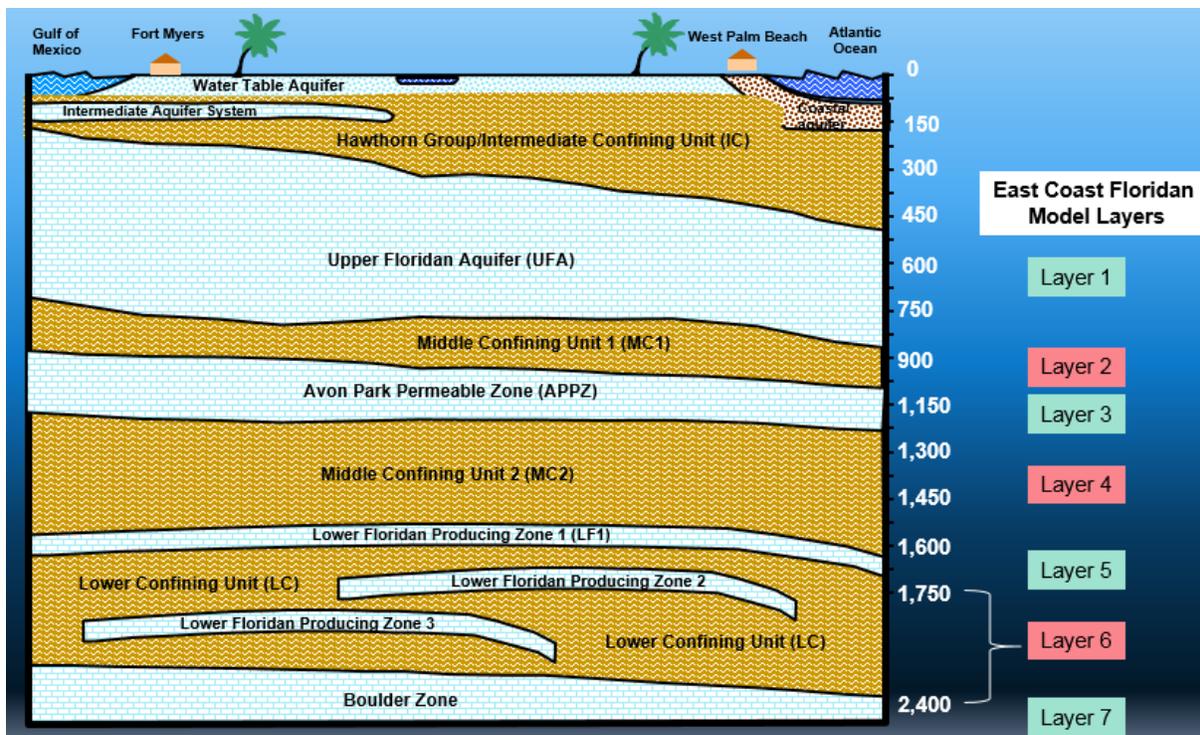


Figure 2. The seven layers of the East Coast Floridan Model shown with a generalized cross-section of the aquifer systems in South Florida.

Modeled wells are symbolized by use type, as follows:

- **PWS wells** are represented by pink diamonds. Individual utility's FAS wellfields are labeled, with specific wellfield names included for utilities that have more than one FAS wellfield. Wells are shown only for the layer from which they withdraw water; however, in a few cases, wells withdraw from both layers.
- **Power generation facility wells** are represented by a plus sign (+). There are four wellfields at three locations in the LEC Planning Area where power generation facilities are using the FAS. Florida Power & Light (FPL) has one wellfield in Palm Beach County (at the West County Energy Center) and two wellfields in Miami-Dade County (at the Turkey Point Plant). New Hope Power has an FAS wellfield in the Everglades Agricultural Area.
- **Golf and landscape wells** are shown as green circles.
- **Aquaculture wells** are shown as yellow squares.

If a well symbol appears on a map, it indicates the well was withdrawing from the specified aquifer (model layer) during the model run (2016 or 2040), as identified in the map title/legend.

Three types of maps are posted in the performance graphic section:

- Water Levels
- Water Quality
- Water Flow

The **Water Levels** graphics include:

- Water level at the beginning (Month 12) and end (Month 288) of each simulation for Layers 1 and 3 in the 2016 and 2040 model runs. These graphics show the potentiometric surface elevation in feet NGVD29.
- Water level difference maps showing how much the potentiometric surface elevation (in feet NGVD29) changes when comparing the 2040 model run (Month 288) to the 2016 model run (Month 288) in Layers 1 and 3. A positive value is a decline in water level and a negative value is an increase in water level.

The **Water Quality** graphics include:

- TDS concentrations at the beginning (Month 12) and end (Month 288) of each simulation for Layers 1 and 3 in the 2016 and 2040 model runs.
- Water quality difference maps showing the change in TDS at the end (Month 288) of each simulation between the 2040 and 2016 model runs in Layers 1 and 3. These maps identify where water quality changes occur and are intended to help display the cumulative impact of the existing and projected demands. A positive value is an increase in TDS and a negative value is a decrease in TDS.

The **Water Flow** graphics include:

- Direction and magnitude of horizontal flow from blocks of 25 model cells at the end (Month 288) of each simulation for the 2016 and 2040 model runs in Layers 1 and 3. The magnitude value is a sum of the 25 cells, and the direction is a resultant vector of the 25 individual flow directions.
- The magnitude of vertical flow is from each model cell for the 2016 and 2040 model runs. Vertical flow is the only series of maps that includes layers other than Layers 1 and 3. In these simulations, vertical flow is always upwards. Thus, the map for Layer 1 shows the movement of water into Layer 1 from Layer 2. The map for Layer 3 shows the upward flow from Layer 4 into Layer 3. A positive value indicates upward flow through the bottom of the model cell and a negative value indicates water leaving through the bottom of the model cell.
- Flow is calculated in cubic feet per day. Because horizontal flow is the sum of 25 model cells and vertical flow is for one cell, they are not directly comparable.

### Hydrographs

Presented separately from the performance graphics, hydrographs are presented in an interactive map to show the simulated change in water levels and water quality over 24 years for a large sample of locations at or near withdrawal sites. Each hydrograph shows the results from the 2016 and 2040 model runs (**Figure 3**). Due to the wide range of water quality in the FAS, the TDS scale on the hydrographs varies.

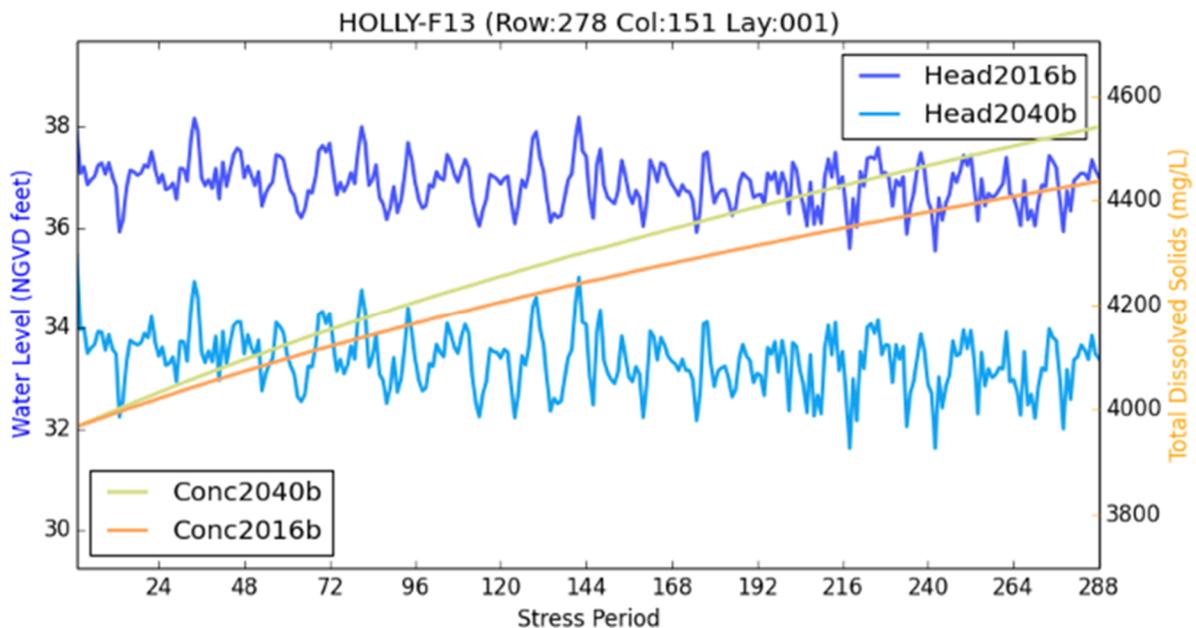


Figure 3. One of 104 hydrographs available for review.

To access a hydrograph, zoom into an area of interest and click on any well symbol (**Figure 4**; blue dot). A window will pop-up on the map (**Figure 5**). Click on the file name under "Attachments" and the hydrograph(s) for that site will appear; several wells have more than one hydrograph attached. Model cell information (i.e. row, column, area) is available in one of the other stacked windows, accessed by clicking on the arrow in the blue header.

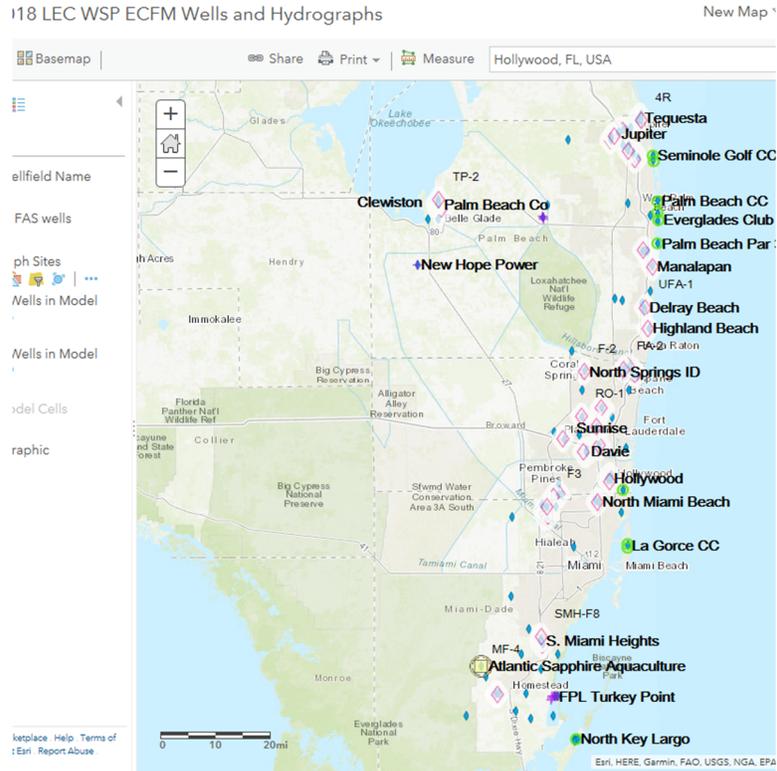


Figure 4. Interactive map for viewing hydrographs (zoomed out view).

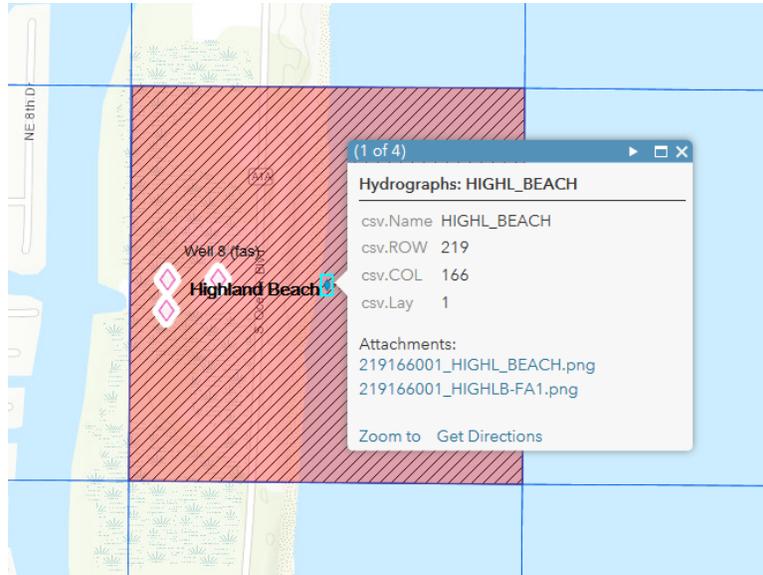


Figure 5. A pop-up window provides the link to the hydrograph(s).

To access information on a pumping well, click on the well symbol. A window will pop-up on the map, as shown in **Figure 6**. Information includes withdrawal volumes and percent withdrawn from the UFA (Layer 1) and APPZ (Layer 3). Model cell information is available in one of the other stacked windows, accessed by clicking on the arrow in the blue header.

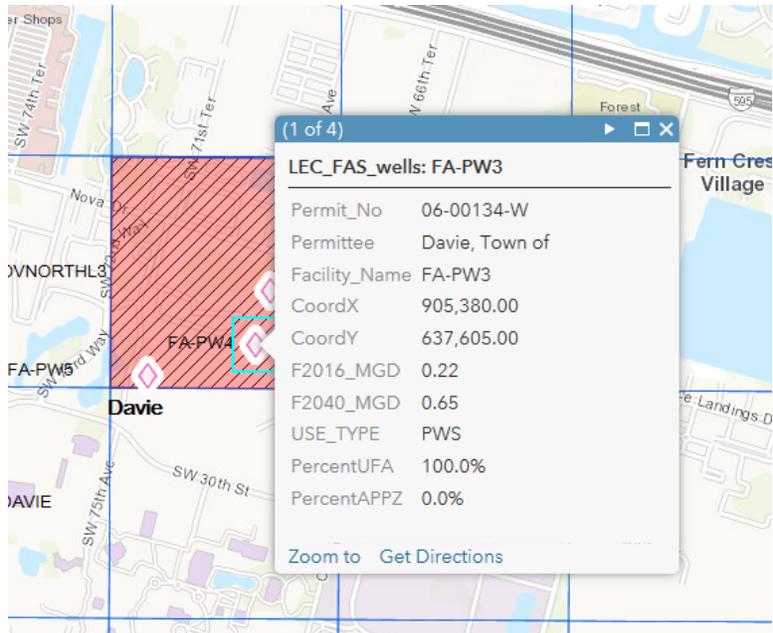


Figure 6. A pop-up window provides well information.

The ECFM is a regional model that averages water quality and water levels within a model grid cell measuring 2,440 by 2,440 feet (nearly 0.5 by 0.5 miles). The regional nature of the ECFM limits its ability to account for specific PWS utility wellfield operations to mitigate water quality degradation observed at individual wells. The hydrographs should be considered supplemental information supporting the performance graphics.