

## The ECFTX v2.0 Regulatory FTMR Tool with Seven Stress Periods

This memo documents the regulatory tool created for ECFTX v2.0 Model with seven steady-state stress periods. This version of ECFTX v2.0 is referred to as the ECFTX v2.0 7sp FTMR model to distinguish it from the full transient version of ECFTX v2.0. The ECFTX v2.0 7sp FTMR model can be used as a regulatory tool and has been developed in Groundwater Vistas (GV) Version 9.19 build 17 or higher.

### ECFTX v2.0 Regulatory Model in Groundwater Vistas

The ECFTX v2.0 FTMR model contains seven stress periods representing End of Permit (EOP) in first three periods, Pumps Off (stress period 4), and Current Pumping (CP) in the last three periods. One Groundwater Vistas Version 9 file is provided and is called **ecftx\_7sp\_rev6.gwv**. The meaning of each stress period (scenario) is shown in Table 1.

Table 1. Stress Periods (Scenarios) for the new ECFTX tool.

SP	Scenario	All other users	Applicant	Description
1	EOP (A)	EOP	EOP	End of permit for all users
2	EOP (B)	EOP	Off	End of permit for all users with applicant wells off
3	EOP (C)	EOP	Proposed	End of permit for all users and proposed pumping for applicant
4	NP (D)	Off	Off	No pumping
5	CP (E)	CP	CP	Current pumping for all users
6	CP (F)	CP	Off	Current pumping for all users with applicant wells off
7	CF (G)	CP	Proposed	Current pumping for all users and proposed pumping for applicant

### Evaluating Effects of New or Modified Permits

This tool and associated files assume you are running the ECFTX v2.0 7sp FTMR regulatory model from a folder called *c:\SJRWMDmodels\ECFTX\_FTMR\_7sp*. If you use a different folder, make sure to copy all files into the new folder. A folder called *backup\_ImportantFiles* is provided with this tool. All files in this folder must be placed in the working directory you create so that all reports will be generated correctly. In addition, just like all ESI tools created for SJRWMD, you must create a text file in the GWV8 directory called *sjrwmd.txt*. You may also use a text file called *swfwmd.org*.

Open the base model called **ecftx\_7sp\_rev6.gwv** in Groundwater Vistas and run it. Import results from the base run (any stress period is fine for the imported results). Then use Grid/Export/Focus TMR. If necessary, we can move this tool to another menu, but it was kept here for consistency with other SJRWMD and SWFWMD models. The following dialog is then displayed, which is a simplified version of the FTMR dialog used in other models. The user enters well information and some descriptive information. Note that well coordinates should be in NAD83 UTM Zone 17 meters to be consistent with the ECFTX coordinates. Default pumping rate units are gallons per day but can be changed using the drop-down list below the spreadsheet.

Permit Evaluation for ECFTX, NDMv5, NFSEG, and CSM Models

Modeler 
 Project 
 WUP No.

	Well Name	X Coordinate	Y Coordinate	Top Layer	Bottom Layer	Q	
1		0.00	0.00	0	0	0.00	
2		0.00	0.00	0	0	0.00	
3		0.00	0.00	0	0	0.00	
4		0.00	0.00	0	0	0.00	
5		0.00	0.00	0	0	0.00	
6		0.00	0.00	0	0	0.00	
7		0.00	0.00	0	0	0.00	
8		0.00	0.00	0	0	0.00	
9		0.00	0.00	0	0	0.00	
10		0.00	0.00	0	0	0.00	
11		0.00	0.00	0	0	0.00	

Permit Type 
 Pumping Rate Units

☐ Use MNW2 for New Multi-Layer Well

☐ Allow Passive Pumping in Stress Periods with Zero Flow Rate

☐ Allow Injection Wells

NOTE: If this option is checked, injection well rates are positive and production well rates are

ECFTX Options

☐ Create a New Focus TMR Model

☐ Evaluate Total Permit Impact

Minimum Grid Spacing (ft) in Focus Area 
 Length of 3rd Stress Period (days)

Maximum Grid Spacing (ft) in Focus Area 
 Number of Time Steps

Width of Buffer Zone (ft) 
 3rd Stress Period Steadystate ☒

Maximum North-South Distance (ft)

Maximum East-West Distance (ft)

Grid Expansion Factor ( $\geq 1.0$ )

☐ Run Subset of NFSEG Stress Periods

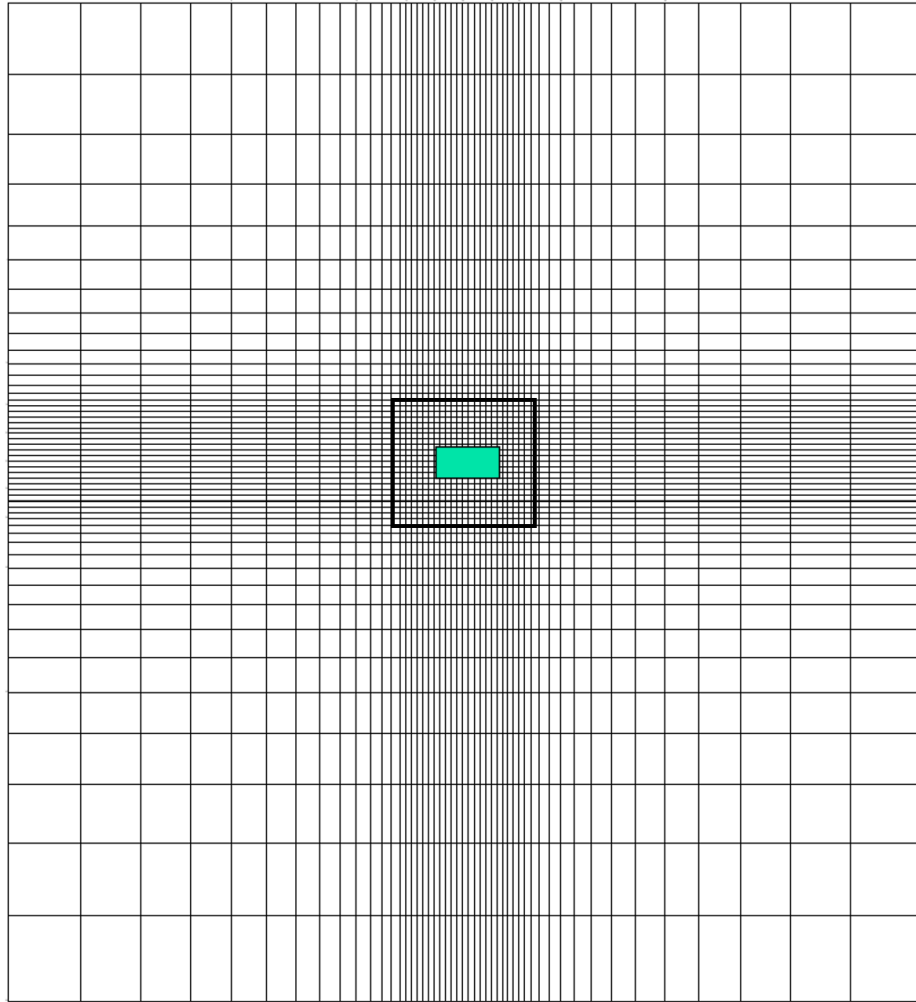
There are two ways of evaluating a permit. The first involves running the entire regional model. This is the default case where the option "Create a New Focus TMR Model" is unchecked. In this scenario, you just enter the well information at the top of the dialog box. This is the fastest way of evaluating a permit because a new model does not need to be created.

The second method of evaluating a permit is to create a new Focus Telescopic Mesh Refinement (FTMR) model with finer grid spacing surrounding the wells in the permit. Finer grid spacing is sometimes chosen to facilitate a more detailed, spatial review of

potential impacts of the groundwater withdrawals and provides greater numerical stability if the changes in groundwater levels are large within a short time frame. To use this method, check the option called “Create a New Focus TMR Model”. A series of options controlling the grid characteristics of the new model will then be available to edit. These include the minimum and maximum grid spacings, width of the buffer zone, grid expansion factor, and maximum north-south and east-west distances.

Creating a FTMR model can be quite time consuming compared to the first method of just running the regional model. The time necessary to create the FTMR increases as the width of the buffer zone increases and the minimum grid spacing decreases. The overall north-south and east-west dimensions can also increase the time to make the FTMR model, although not as much as the buffer zone width and minimum grid spacing.

The figure below illustrates the meaning of these parameters. The green rectangle is the smallest rectangle containing all of the wells in the permit being evaluated. The width of the buffer zone is a distance added to each side of the green rectangle to define the area of the minimum grid spacing. The maximum north-south and east-west distances define the outer edges of the new model. Constant heads are defined at these edges unless a regional constant head or general head boundary (ghb) boundary is specified.



When evaluating an existing permit, the wells in that permit can be automatically assigned to the spreadsheet by clicking the “Import from Permit” button at the top of the dialog box. The following dialog box is displayed where you enter the permit id. For wells in SJRWMD, you can enter either the permit id or “SJ\_” followed by the permit id. For South Florida Water Management District wells, enter “SF\_” plus the permit id. For Southwest Florida Water Management District, enter “SW\_” plus the permit id.

Permit Number for Well Retrieval

Permit Number

SJ\_8213

OK

Cancel

Note: SWFWMD Permit Numbers must be 6 characters, e.g. 006362

SJRWMD Permit Numbers do not have leading zeros

When you click OK, GV will put all wells for that permit in the spreadsheet, as shown below. You then simply modify the pumping rate (Q) column for the desired changes. You can also add a well for the permit. If a well is to be removed from the permit, make the pumping rate zero. It is also a good idea to put the permit id in the field called WUP No. at the top of the dialog box. The name of the new model run will include this value, making it easier to identify the MODFLOW files associated with the simulation.

Permit Evaluation for ECFTX, NDMv5, NFSEG, and CSM Models

Import from Report   Import Shapefile   Import from Permit

Modeler:  Project:  WUP No.:

	Well Name	X Coordinate	Y Coordinate	Top Layer	Bottom Layer	Q
1	SJ_8213_105226	467534.20	3187415.00	3	3	0.00
2	SJ_8213_15268	466215.70	3179406.00	4	5	518111.70
3	SJ_8213_15269	466182.20	3179147.00	6	6	0.00
4	SJ_8213_15270	466060.50	3179299.00	3	5	518111.70
5	SJ_8213_15271	467001.70	3178563.00	4	5	230272.60
6	SJ_8213_15272	467064.60	3178611.00	3	5	921084.10
7	SJ_8213_15273	467805.50	3178557.00	3	5	518111.70
8	SJ_8213_15274	467826.70	3178545.00	3	5	359799.70
9	SJ_8213_15275	467878.30	3178578.00	3	5	518111.70
10	SJ_8213_15279	464561.10	3181695.00	4	5	0.00
11	SJ_8213_15280	464760.20	3181927.00	3	4	0.00

Permit Type:  Pumping Rate Units:

☐ Use MNW2 for New Multi-Layer Well

☐ Allow Passive Pumping in Stress Periods with Zero Flow Rate

☐ Allow Injection Wells NOTE: If this option is checked, injection well rates are positive and production well rates are negative

Add a Recharge Project...

ECFTX Options

☐ Create a New Focus TMR Mod

☐ Evaluate Total Permit Impact

Pumping Conditions:

Minimum Grid Spacing (ft) in Focus Area:  Length of 3rd Stress Period (days):

Maximum Grid Spacing (ft) in Focus Area:  Number of Time Steps:

Width of Buffer Zone (ft):

Maximum North-South Distance (ft):

Maximum East-West Distance (ft):

Grid Expansion Factor (>= 1.0):

3rd Stress Period Steadystate: ☒

Run Subset of NFSEG Stress Periods: ☐

Pick Stress Periods...

OK Cancel

After the applicant rates are modified in spreadsheet, click OK. Groundwater Vistas will automatically use **File/Save As** to create a new GWV file for the permit evaluation if you are

not using FTMR. It is important not to overwrite the base Groundwater Vistas file after clicking OK, so GV will name the file as the base run name plus an underscore character and the text located in the “WUP No.” field on the dialog (“8213” in the example above). You can alter the file name if you wish and then simply click the “save” button.

For FTMR analyses, GV will prompt you to create a new \*.tmr file. GV will then write all information defining the new model to this tmr file. Note that this step can take a few minutes to complete. If the maximum north-south and east-west dimensions are increased the time needed to write the tmr file will also increase. After creating the tmr file, select File | New, click OK, and then click on the TMR button to import the file you just saved and create a new model. This can also take a few minutes to accomplish.

After the new model is saved, or the tmr model created, click the calculator button on the toolbar and create the datasets. MODFLOW-NWT will run the seven stress periods and return to Groundwater Vistas. Import heads for any stress period. The cell-by-cell flows are not needed because all spring and river flows are computed from heads. You also do not need to import drawdown since the scenario drawdown shapefiles are computed from heads in each stress period.

Groundwater Vistas will automatically create the following reports and shapefiles in the ‘reports’ folder. The head and flux changes are computed for the scenarios listed in Table 2.

Table 2. Impact Scenarios to Evaluate with ECFTX Regulatory Tool.

Equation	Scenario	Minus	Scenario	Description
1	NP (D)	-	CP (E)	Total current pumping impact
2	CP (F)	-	CP (E)	Applicant current pumping impact
3	CP (E)	-	CP (G)	Additional applicant impact above current pumping
4	NP (D)	-	EOP (A)	Total EOP impact
5	EOP (A)	-	EOP (C)	Requested allocation impact above EOP pumping
6	EOP (B)	-	EOP (A)	Applicant existing EOP impact
7	EOP (B)	-	EOP (C)	Applicant total proposed EOP impact

- Spreadsheet of flux at springs for all stress periods and the change in flux for the drawdown scenarios listed in **Table 2**. This file is called SpringFlow\_out\_ecftx\_7sp\_permit.csv, where “permit” is the permit number entered on the setup dialog.
- Spreadsheet showing the UFA (layer 3) head beneath lakes for all stress periods and the change in head for the drawdown scenarios listed in **Table 2**. When running the full regional model, the head reported for each lake is the average head for all cells that lie within the lake polygon. For FTMR models, the head is interpolated at the centroid of each lake. This file is called Lake\_Heads\_out\_ecftx\_7sp\_permit.csv, where “permit” is the permit number entered on the setup dialog.

- Spreadsheet showing the simulated flux at river baseflow gages in the model and the change in flux for the drawdown scenarios listed in **Table 2**. This file is called RiverGage\_out\_ecftx\_7sp\_Permit.csv, where “permit” is the permit number entered on the setup dialog. Note that river gage information cannot be computed for the FTMR models because the gage information is lost during creation of the new model.
- Spreadsheet showing the mass balance budget in the model for the scenarios listed in **Table 1**. This file is called ecftx\_7sp\_permit\_Budget\_QA.csv, where “permit” is the permit number entered on the setup dialog. The spreadsheet calculates the input and output mass balance terms for each stress period in units of cubic feet per day (cfd) and million gallons per day (mgd).
- Spreadsheet showing all the permit wells with the proposed associated pumping rates. It also has additional information including a column that calculates the individual well pumping as a fraction of the sum of pumping for all the individual wells. This file is called permit\_well\_percentages.csv
- Shapefile of grid cell polygons showing head in layers 1 (SAS), 3 through 5 (UFA), and 9 (LFA) for each stress period and the change in head for the drawdown scenarios listed in **Table 2**. This shapefile contains data for all layers and is called Head\_AllStressPeriods\_ecftx\_7sp\_Permit.shp, where “permit” is the permit number entered on the setup dialog.
- Note that all shapefiles are exported in UTM meters, as defined in the project file: *C:\SJRWMDmodels\ECFTX\_FTMR\work\NAD\_1983\_HARN\_UTM\_Zone\_17N.prj*. If you move this file, you can inform GV of the new location using Edit|GIS Options.

### **Changing UTM Coordinates**

To change UTM coordinates of existing permitted well, find the well in question using (Edit|Find|Well) and change the XY coordinates. Note, the coordinates that are displayed are in model coordinates, so you need to convert from meters to feet and then subtract the model XY offsets from the UTM coordinates. The XY offsets can be found in the Model|Model Information tab. Note that this needs to be completed before you use Export|Focus TMR to import a permit for evaluation. The process described above will only update locations for the full regional model simulation.

### **Allow Injection Well Options**

Injection wells can be added to a permit evaluation by checking the option “Allow Injection Wells”. When this option is checked, injection well flow rates are entered in positive units and withdrawals are entered in negative units. To ensure this functionality is applied correctly, the "Allow Injection Wells" option must be checked before importing any permitted wells by permit number. If wells are imported before selecting this option, the user will need to close the permit dialog, open it again (via Grid|Export|Focus FTMR), check the “Allow Injection Wells” option, and then re-import the wells.

### **Adding Lakes to Reports**

Adding new lakes to the report of head changes requires two things. First, a head target is added to the model with the following characteristics:

- The target name is the name of the lake
- The target group number is the lake ID

The target can actually be anywhere in the model, however, it makes sense to put it in the actual lake location. The following csv file was used to add the most recent lakes to the ECFTX model. Note that there should be no spaces in lake names.

	A	B	C	D
1	row	column	name	id
2	188	304	LAKE_NELLIE_MFL	9010
3	169	304	Lake_Minnehaha_at_Clermont_MFL	9011
4	99	418	DAWSON_LAKE_MFL	9012
5	97	420	LAKE_COMO_MFL	9013
6	102	424	EAST_CRYSTAL_LAKE_MFL	9014

This file can be imported using the AE | Import | Target Text file menu item.

The second thing to do is put a separate csv file in the working directory for each lake. This csv file contains only two columns for row and column. There are no header rows. An example is shown below.



	A	B
1	102	424
2	101	424
3	100	424
4	102	425
5	101	425
6	100	425
7	99	425
8	98	425
9	101	426
10	100	426
11	99	426
12	98	426

### **Adding Recharge Area to Permit**

A new option has been added to add a recharge area to the permit evaluation. The recharge area can be a single cell or it can be defined by a polygon shapefile. Recharge in this area is added to the existing recharge in ECCTX for stress period 3 (where the applicant's new pumping rate is active). The Focus TMR dialog has been modified to add a button for this feature, as shown below.

Permit Evaluation for ECCTX, ECFss, NDMv5, and NFSEG Models

Modeler 
 Project 
 WUP No.

	Well Name	X Coordinate	Y Coordinate	Top Layer	Bottom Layer	Q	
1		0.00	0.00	0	0	0.00	
2		0.00	0.00	0	0	0.00	
3		0.00	0.00	0	0	0.00	
4		0.00	0.00	0	0	0.00	
5		0.00	0.00	0	0	0.00	
6		0.00	0.00	0	0	0.00	
7		0.00	0.00	0	0	0.00	
8		0.00	0.00	0	0	0.00	
9		0.00	0.00	0	0	0.00	
10		0.00	0.00	0	0	0.00	
11		0.00	0.00	0	0	0.00	
12		0.00	0.00	0	0	0.00	

Permit Type 
 Pumping Rate Units

☒ Use MNW2 for New Multi-Layer Wells  
☐ Allow Passive Pumping in Stress Periods with Zero Flow Rates

ECCTX Options

☐ Create a New Focus TMR Model  
☐ Evaluate Total Permit Impact

Minimum Grid Spacing (ft) in Focus Area 
 Length of 3rd Stress Period (days)

Maximum Grid Spacing (ft) in Focus Area 
 Number of Time Steps

Width of Buffer Zone (ft)

Maximum North-South Distance (ft)

Maximum East-West Distance (ft)

Grid Expansion Factor (>= 1.0)

Pumping Conditions

Click on this button to supply the necessary data for the recharge area. The data required depends on the option chosen. For a single cell enter the recharge rate, recharge area, recharge units, row, and column of the recharge area, as shown below. Also be sure to check the first box on the dialog to use these data in the next simulation.

The dialog box is titled "Add Recharge Area to FTMR Model" and has a close button (X) in the top right corner. It contains the following elements:

- A checked checkbox labeled "Add Recharge Area to this Project".
- A "Recharge Rate" text box containing the value "12".
- A "Recharge Units" dropdown menu showing "in/yr".
- A "How to Define Recharge Area" dropdown menu showing "Single Cell".
- Three text boxes: "Row" containing "642", "Column" containing "317", and "Area" containing "25000".
- A "Shapefile:" label followed by an empty text box and a "Browse..." button.
- "OK" and "Cancel" buttons at the bottom right.

When using a shapefile, row, column, and area are not needed. Instead click the browse button to find the shapefile containing one or more polygons. The recharge rate on the dialog is applied equally to all polygons included in the shapefile.

The dialog box is titled "Add Recharge Area to FTMR Model" and has a close button (X) in the top right corner. It contains the following elements:

- A checked checkbox labeled "Add Recharge Area to this Project".
- A "Recharge Rate" text box containing the value "12".
- A "Recharge Units" dropdown menu showing "in/yr".
- A "How to Define Recharge Area" dropdown menu showing "Shapefile".
- Three text boxes: "Row" containing "0", "Column" containing "0", and "Area" containing "0".
- A "Shapefile:" label followed by a text box containing the path "C:\SJRWMDmodels\NFSEG10sp\Memo\rech\_area.shp" and a "Browse..." button.
- "OK" and "Cancel" buttons at the bottom right.

Groundwater Vistas will also write a text file in the Reports folder summarizing the recharge option chosen and the resulting recharge rate applied to stress period 3. The file name is RechargeProject\_root.txt, where root is the root file name of the simulation.

### **Creating a Standardized Report for ECFTX Simulations**

After setting up the permit evaluation in Groundwater Vistas, the model is automatically configured to create a standardized report using Reports|Custom Report.

**Create Custom Report**

Report Template File : c:\SJRWMDmodels\ECFTX\_FTMR\Reports\StandardReport\_E... Browse...

Report File to Create c:\SJRWMDmodels\ECFTX\_FTMR\Reports\StandardReport\_E... Browse...

Program to View Report C:\Program Files (x86)\Microsoft Office\root\Office16\WINWORD... Browse...

☒ Automatically Launch Viewer to Display Report

Template files should be in either text or Rich Text (RTF) format

OK Cancel

The template file is called c:\SJRWMDmodels\ECFTX\_FTMR\Reports\StandardReport\_ECFTX.rtf. This file is used to create a new report which has the same name with the addition of the permit number. To create this report, GV8 assumes that you have imported results for stress period 3 (this is the default case so you do not need to browse to find any other stress period) and that you have created the spreadsheets and shapefiles for the permit (i.e., you answered Yes after importing results).

All drawdowns and fluxes presented in the report are for the difference between stress period 2 and 3. Drawdowns contoured in Groundwater Vistas are likewise for the difference between these two stress periods.

### **Deleting Lakes from the Simulation**

Lakes in the ECFTX model are simulated using the river boundary conditions. If there is drawdown beneath one of these river cells, it is possible to introduce more induced recharge than is reasonable. To be conservative, the user can remove these river cells from the model.

These river cells can be removed by first selecting BCs|Rivers and then using BCs|Delete|Reach and entering 99. Reach number 99 was coded in these river boundaries that represent lakes. This command removes them all. The user can also just remove them in a smaller area by using BCs|Delete|Window. Drag a window around the area where lakes should be removed. GV will then ask if only lakes are to be removed. Answer Yes to this prompt.