TECHNICAL MEMORANDUM esi

The CSM Regulatory FTMR Tool

This memo documents the regulatory tool created for Central Springs Model (CSM) with two steady-steady-state stress periods. This version of CSM is referred to as the CSM FTMR model to distinguish it from the full transient version of CSM. The CSM FTMR model can be used as a regulatory tool and has been developed in Groundwater Vistas (GV) Version 8.30 build 319 or higher, or, Version 9.12 build 3 or higher.

**CSM Regulatory Model in Groundwater Vistas**

The CSM 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. CP represents an average of 2016 to 2020 pumping rates in the model domain. The CP pumping rates were imported from the following spatial datasets located in the “shapefiles” directory:

* Permitted water use: CSM\_WRWSA\_Permit\_Projection\_08162024
* Domestic self-supply (DSS): CSM\_WRWSA\_DSS\_Projection\_08162024
* Rapid Infiltration Basins (RIBs): CSM\_WVWS\_WRWSA\_GWP\_RIBs\_20241122

One Groundwater Vistas file is provided and is called **csm11\_ftmr\_7sp\_rev7.gwv**. The meaning of each stress period (scenario) is shown in Table 1.

A screenshot of a computer

Description automatically generated  
Table 1. Stress Periods (Scenarios) for the CSM tool.

**Evaluating Effects of New or Modified Permits**

This tool and associated files assume you are running the CSM FTMR regulatory model from a folder called c:\SJRWMDmodels\CSM\_FTMR. 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 **csm11\_ftmr\_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 the well information and some descriptive information. Note that well coordinates should be in NAD83 UTM Zone 17 meters to be consistent with the CSM coordinates. Default pumping rate units are gallons per day but can be changed using the drop-down list below the spreadsheet.

A screenshot of a computer

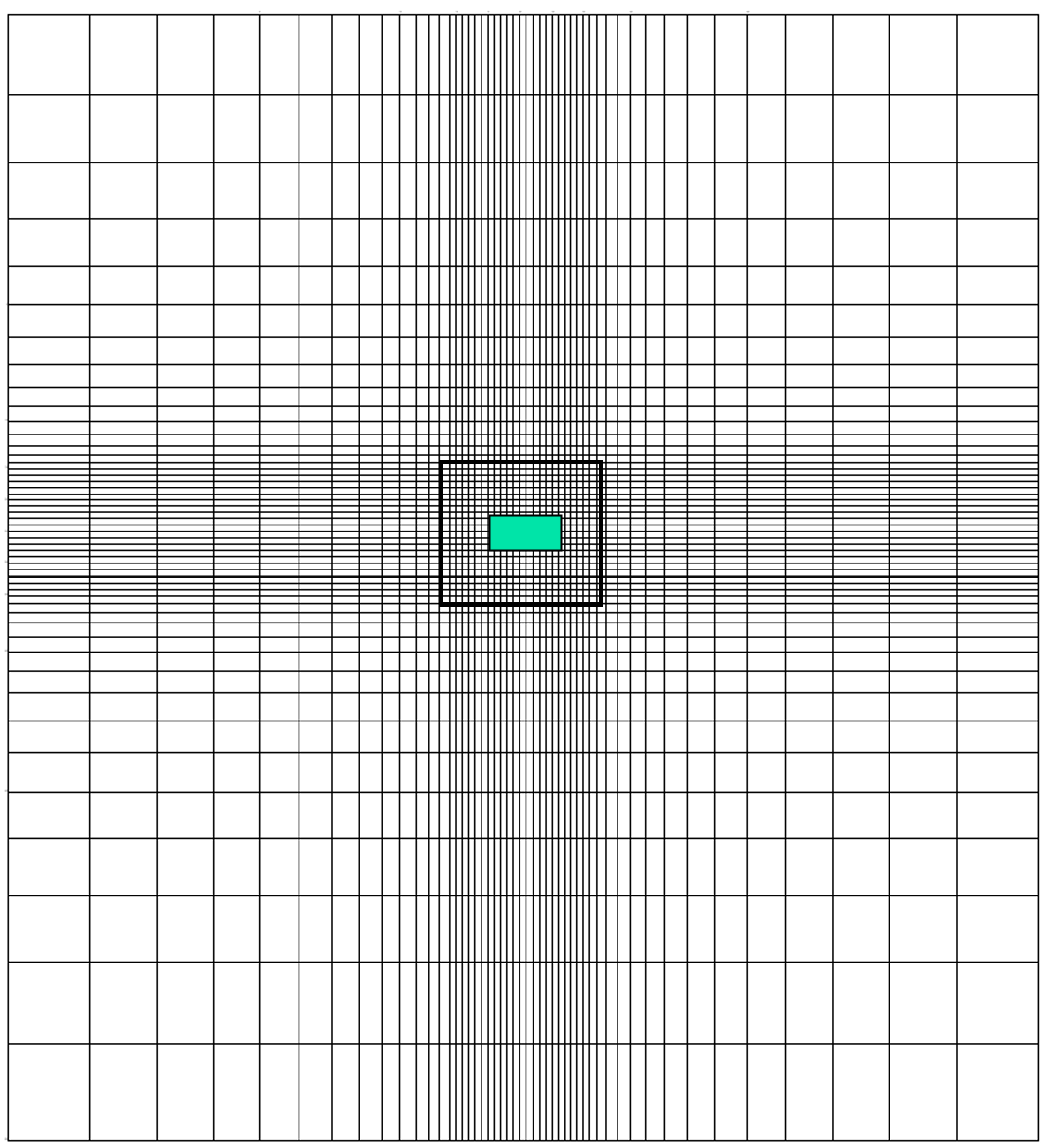
Description automatically generated

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 enter the well information at the top of the dialog box. Since the 3rd stress period is steadystate, you should keep the default period length (365 days) and number of time steps. 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 take more time 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.

A screenshot of a computer

Description automatically generated

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.

A screenshot of a computer

Description automatically generated

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 (“3117” 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 three 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. The head and flux changes are computed for the scenarios listed in Table 2.

A table of text with black text

Description automatically generated with medium confidence  
Table 2. Impact Scenarios to Evaluate with CSM Regulatory Tool.

* + 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\_CSM\_cp\_permit.csv, where “permit” is the permit number entered on the setup dialog. Also note that CP will be replaced by EOP for End of Permit evaluations.
  + 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\_CSM\_cp\_permit.csv. Also note that cp will be replaced by EOP for End of Permit evaluations.
  + 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\_CSM\_cp\_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. Also note that cp will be replaced by EOP for End of Permit evaluations.
  + Shapefile of grid cell polygons showing head in layers 1 (SAS) and 3 (UFA), 4 (UFA) and 6 (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\_CSM\_cp\_Permit.shp, where “permit” is the permit number entered on the setup dialog. Also note that cp will be replaced by EOP for End of Permit evaluations.
  + Note that all shapefiles are exported in UTM meters, as defined in the project file: *C:\SJRWMDmodels\CSM\_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 for a Permit Evaluation**

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 Option**

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 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 ECFT for stress period 3 (where the applicant’s new pumpingn rate is active). The Focus TMR dialog has been modified to add a button for this feature, as shown below.

A screenshot of a computer

Description automatically generated

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.

Graphical user interface, application

Description automatically generated

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.

Graphical user interface, application

Description automatically generated

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 CSM Simulations**

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

A screenshot of a computer

Description automatically generated

The template file is called c:\SJRWMDmodels\CSM\_FTMR\Reports\StandardReport\_CSM.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 CSM 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.