HEC-RPT Tutorial

Using HEC-RPT typically consists of two phases: 1) preparing the application for use in workshops like the small group exercise we did this morning and 2) actually using the application in a workshop setting to facilitate communications about river management.

This tutorial will guide you through both phases of this process. The Green River in Utah, USA, is used as an example. This is the same river used in the small group exercise. If you participated in that workshop, please have your notes about those environmental flows ready for use in this workshop.

Background about Green River

The Green River watershed begins high in the Rocky Mountains at an elevation of nearly 14,000-ft (4,270-m). Downstream, at an elevation of 5,500-ft (1,680-m) and a watershed area of around 15,000-sq. mi. (39,000-sq. km), there's a large dam called Flaming Gorge that is operated for water supply and hydropower. Construction was completed in 1964. Until the late 1990's, release patterns from the dam were dominated by the effects of hydropower generation. Since that time, there has been a gradual change in operations to protect endangered fish species like the razorback sucker and to improve riparian habitat.

Phase 1 – Setting up an HEC-RPT project

1) Begin by opening HEC-RPT. There may be a shortcut on your computer desktop or double-click on the executable file called "HEC-RPT.exe".
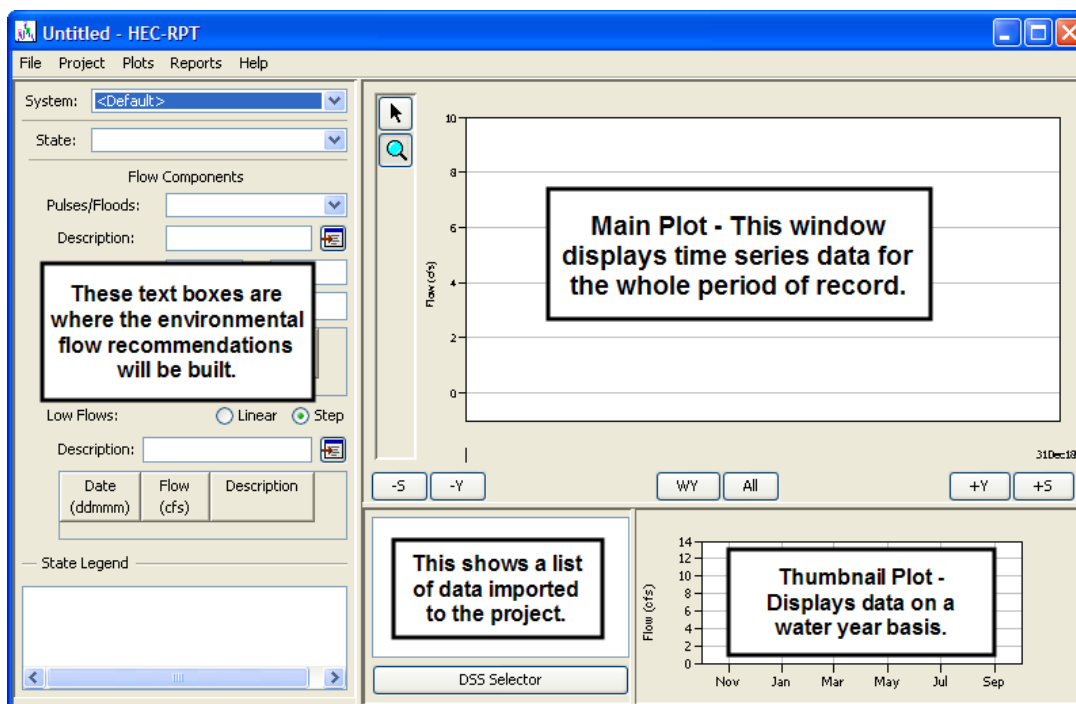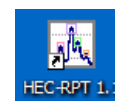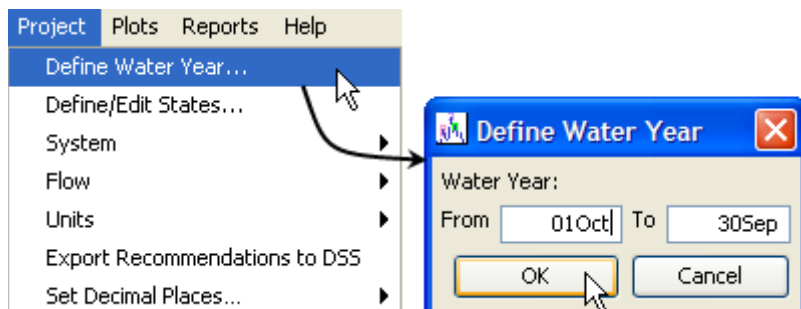

Figure. Key features of the main interface.

2) The options in the "Project" menu are listed in the typical order of use for an HEC-RPT application. The first option is for "Project – Define Water Year". Select this and make sure that it is set to 01Oct to 30Sep, which is the standard water year in the USA. Click OK.


3) In HEC-RPT, _State_ refers to the prevailing hydrologic condition or season. States can be defined by one of two methods: by name and year or by scripting with time series. We are going to use the by name and year method for water years 1990-2004. For this tutorial, let's use two states: "Wet" and "Dry". Consider the following mean annual flow rates for the Green River. How would you separate them into categories for Wet and Dry? Trace a horizontal line through both plots to show your split between Wet and Dry.
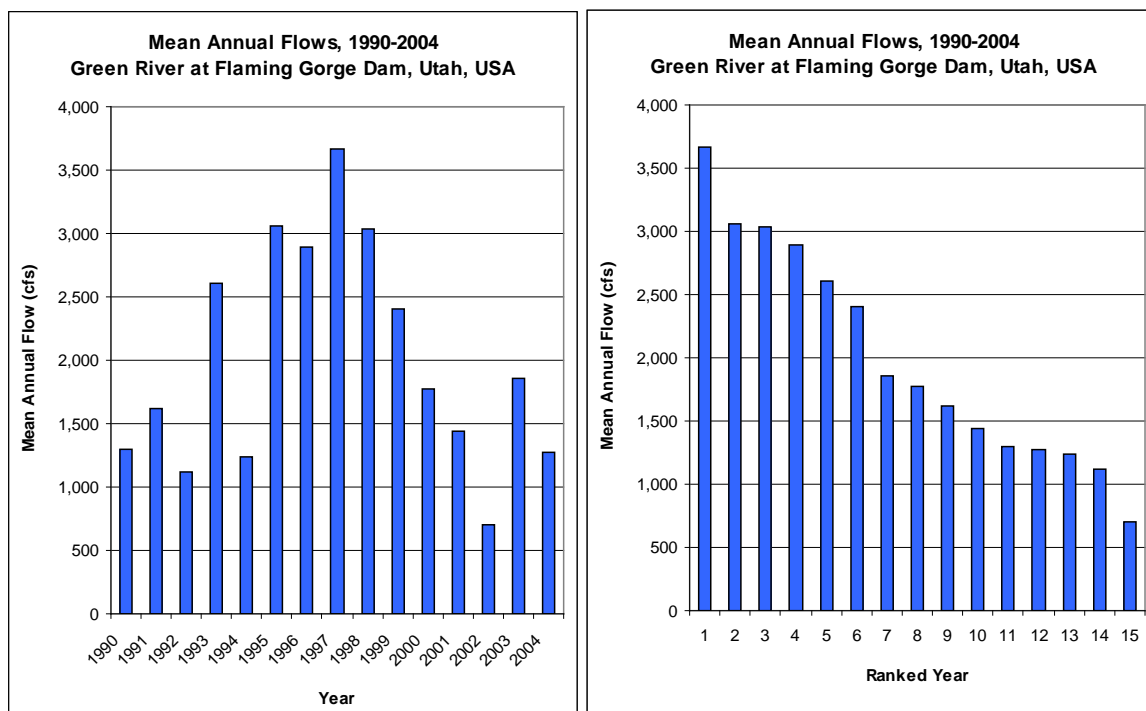

Note: Using the by name and year method labels each water year with a single hydrologic condition. This is usually not the case in actual river management where conditions can change from month to month, week to week, or even day to day. The

define state by scripting with time series option uses other time series (for example, precipitation or reservoir storage) as a basis for determining hydrologic conditions. With this method, State can change by whatever time step is specified in the script.

3 cnt) Select the "Project – Define/Edit States" menu option. For the define by name and year option, enter the period of record (1990-2004) and names of states (Wet and Dry) in the interface. Then click on the Assign Year States button to open an interface for selecting state for each year in the period of record. Do this for all years and click OK.
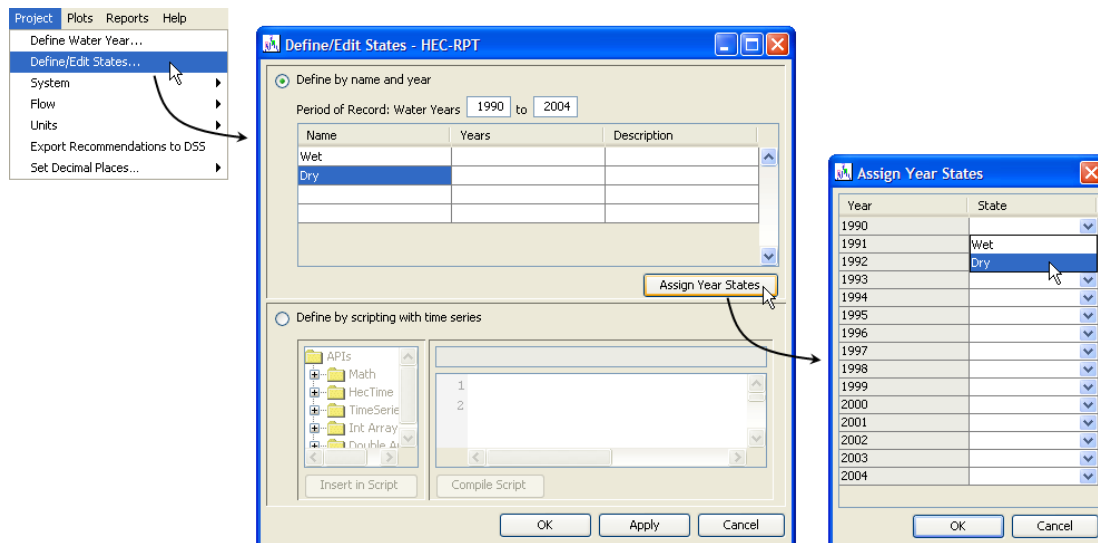
4) The Define/Edit States interface should have a list of years for each state. Click Apply. The years in the period of record will be assigned a color based on state.
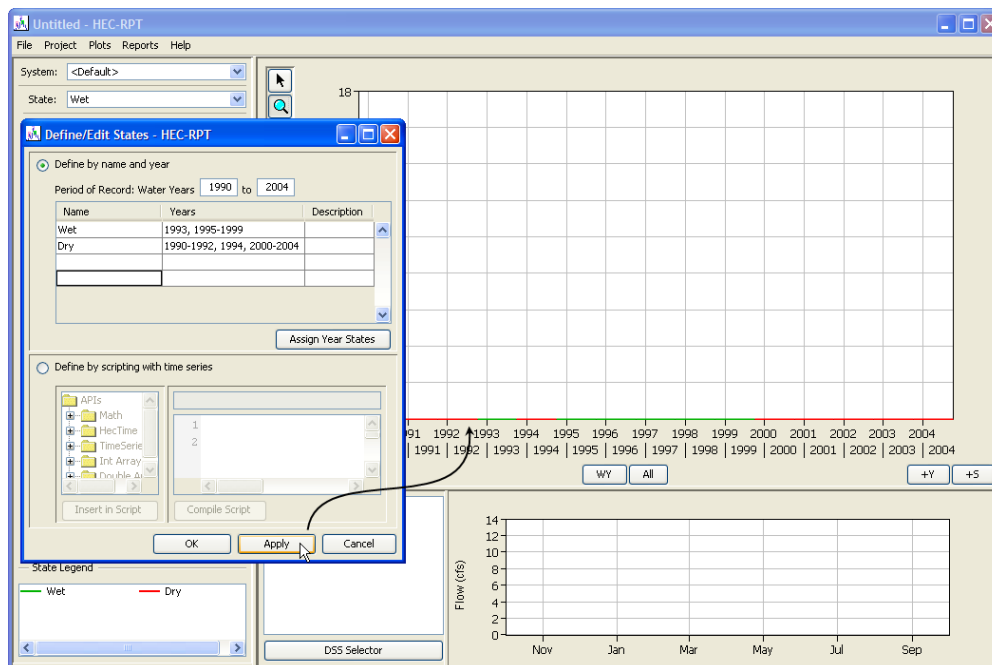
5) Click OK in the Define/Edit States interface to close that window. Use the "Project – System – New" menu option to create a system for the "Riparian Ecosystem". Repeat this process for the Razorback Sucker.
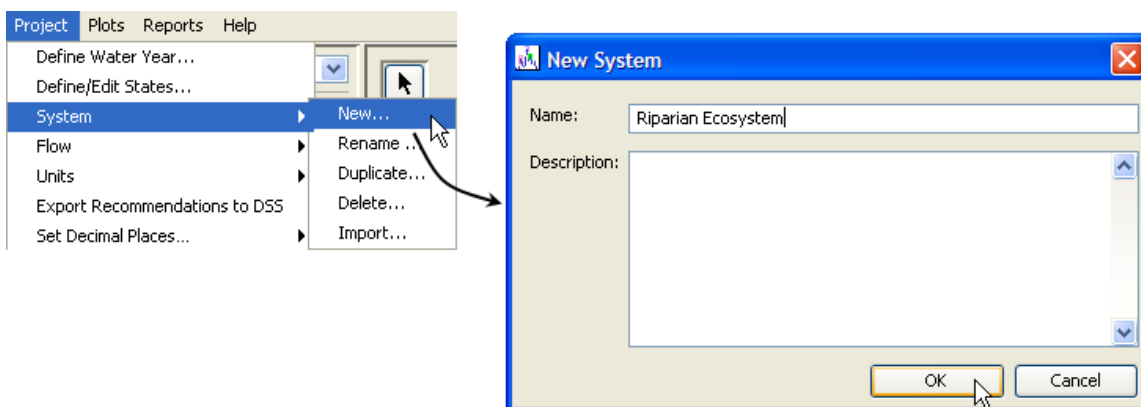
Note: "System" is the term used to describe a subject of interest for which flows will be recommended. A system may refer to a location on a river, an important ecosystem connected to the river, a guild of creatures, or to different points of view for river management. The same set of states is used for all systems in a project.

6) Now let's import some hydrologic data. Make sure the Razorback Sucker system is selected and then click on the DSS Selector button. This will open a window entitled Select Time Series Path. From this window, click on the file open button and browse to a file named "Green River Flows.dss". Open that file.
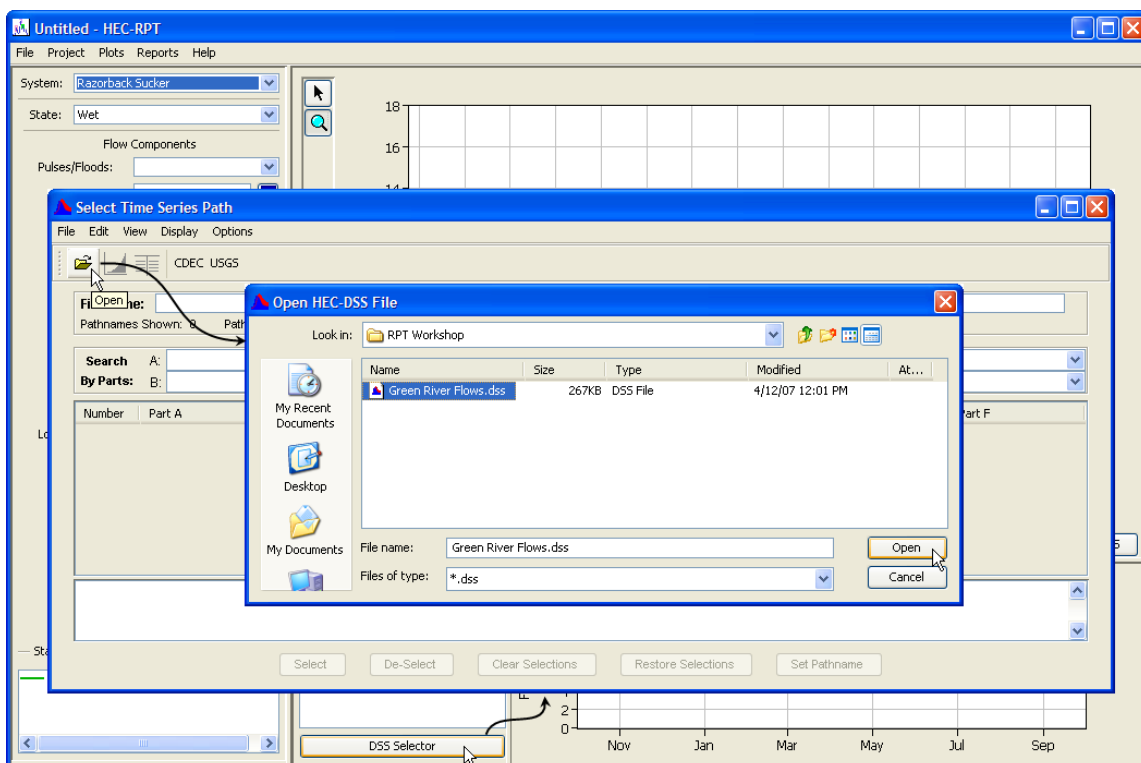
Note: DSS stands for Data Storage System - it is the database for all HEC software. The basic naming convention for data stored in DSS is:

/river name/location/data type/time range/time step/user specified name/

7) The DSS file contains two time series, natural flows and regulated flows released from Flaming Gorge Dam. Double click on the FLOW-NAT record and then on the FLOW-RES OUT. This selects the data to be imported. Click the Set Pathname button to import the data.
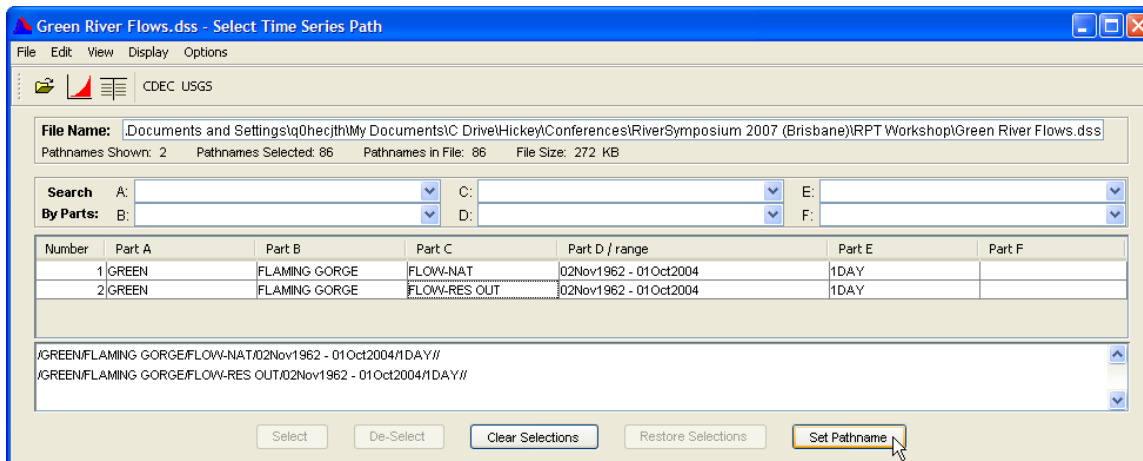
The main plot should now display the data…
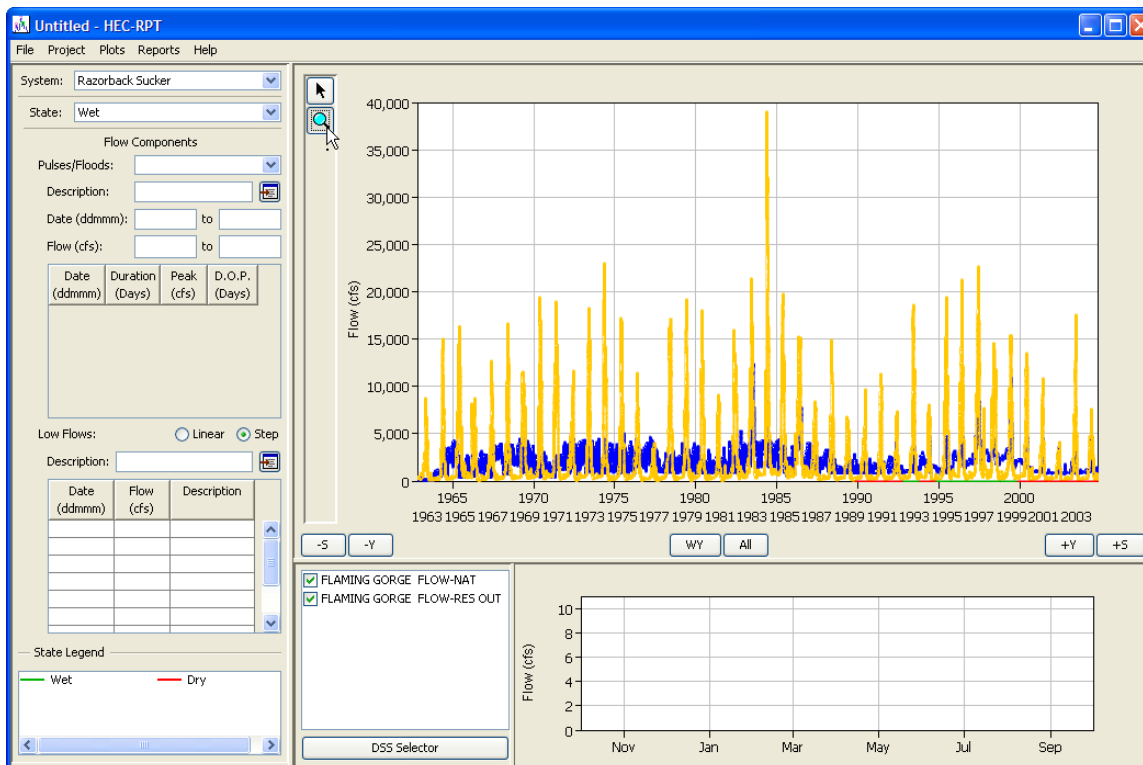
Select the zoom tool (shown by the magnifying glass icon) and experiment with zooming in by holding a left mouse button click and framing the area to be magnified. Zoom out with a right mouse button click. Also try the WY, All, +/- Year, and +/- State buttons. Imported time series can also be turned on and off by clicking on the boxes in the data list.

Look at regulated outflows (FLOW-RES OUT) for 1990 through 2004. Can you see any changes in how the reservoir was managed?

8) This concludes Phase 1 of the workshop. Please save your project by using the "File – Save As" menu option – any file name and location is fine. If you would like to switch to metric units, select the "Project – Units – SI" menu option. Units can be changed at any time.

Phase 2 – Using HEC-RPT to help facilitate the definition of ecosystem flows

1) Let's learn how the flow component features work by entering the flows defined in this morning's workshop. Zoom to a few years in the early 1990's. Try to get a view that includes a few wet and dry years.
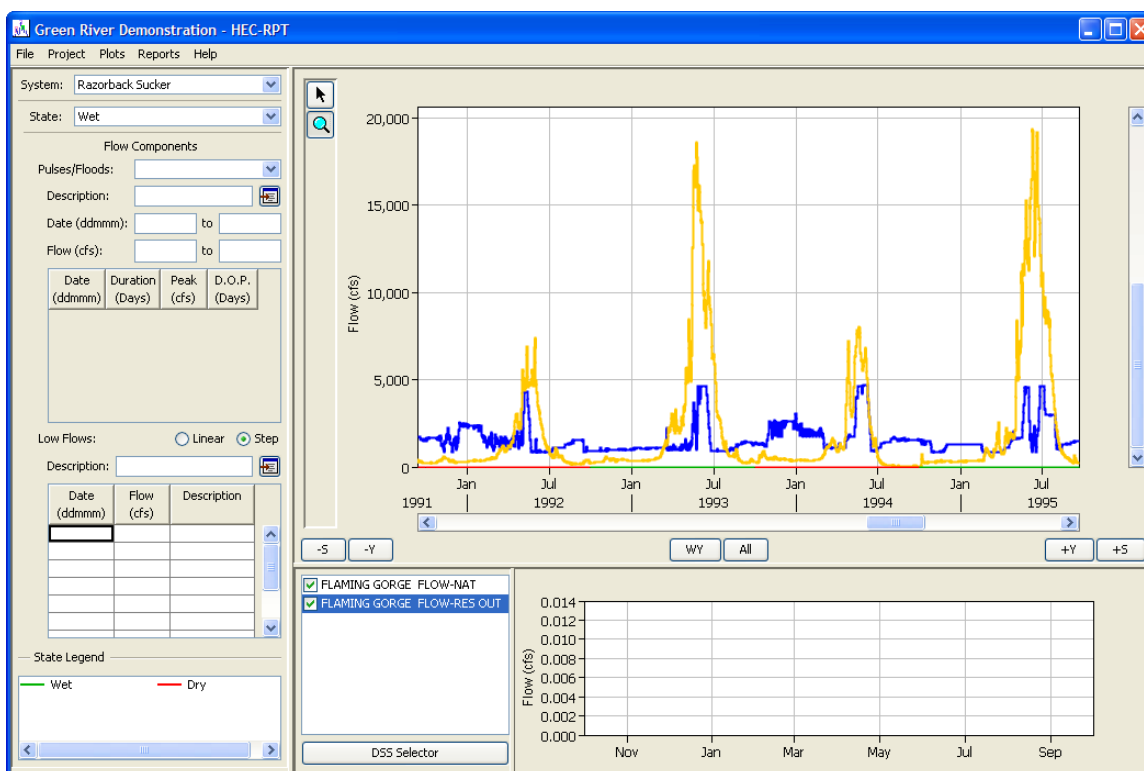

It might be easier to see the recommendations if the other data are hidden. For now, turn off the two import data series.

Start with the low flows. Enter dates and flows and try both the step and linear options. If you do not have results handy from the last workshop, enter values from this table:

| Green River – Low Flows (cfs)		
Date	Dry State	Wet State
01Oct	400	800
01Nov	300	600
01Mar	300	600
01Apr	800	1600
01May	1000	2000
01Jul	1000	2000
15Aug	800	1600
01Sep	400	800
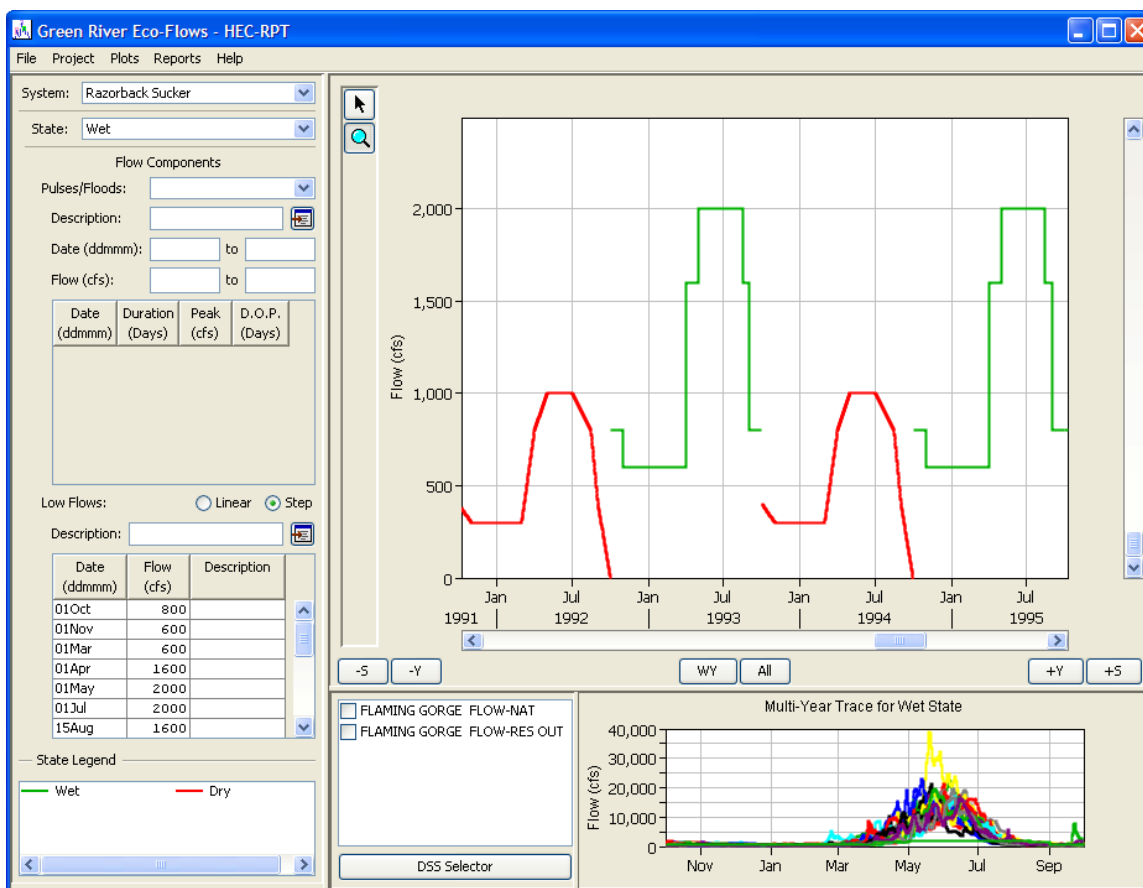
This figure displays low flows for wet and dry years. Low flows entered for wet years are exactly twice as much as those for dry years, but there is also a notable difference in pattern. That difference is related to the method selected to trace the low flows. Wet years use the step method, which "steps" the low flows to the value in the table on the date specified. Dry years use the linear method, which connects the points in the table with straight lines.

Note: Both methods start at zero on the first day of the water year unless a value for that day is entered by the user. The linear method also ends the water year at zero, unless a value for that day is specified by the user (which is not done here).

2) Next, add a pulse flow through the "Project – Flow – New" menu.
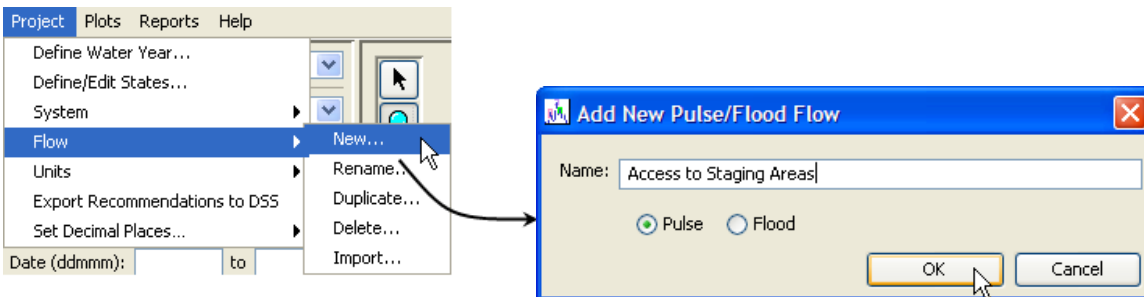
Enter the season and flow range from your flow recommendations or as shown below. This defines a window that shows when and how high flows should get to achieve the environmental purpose of that pulse or flood flow.
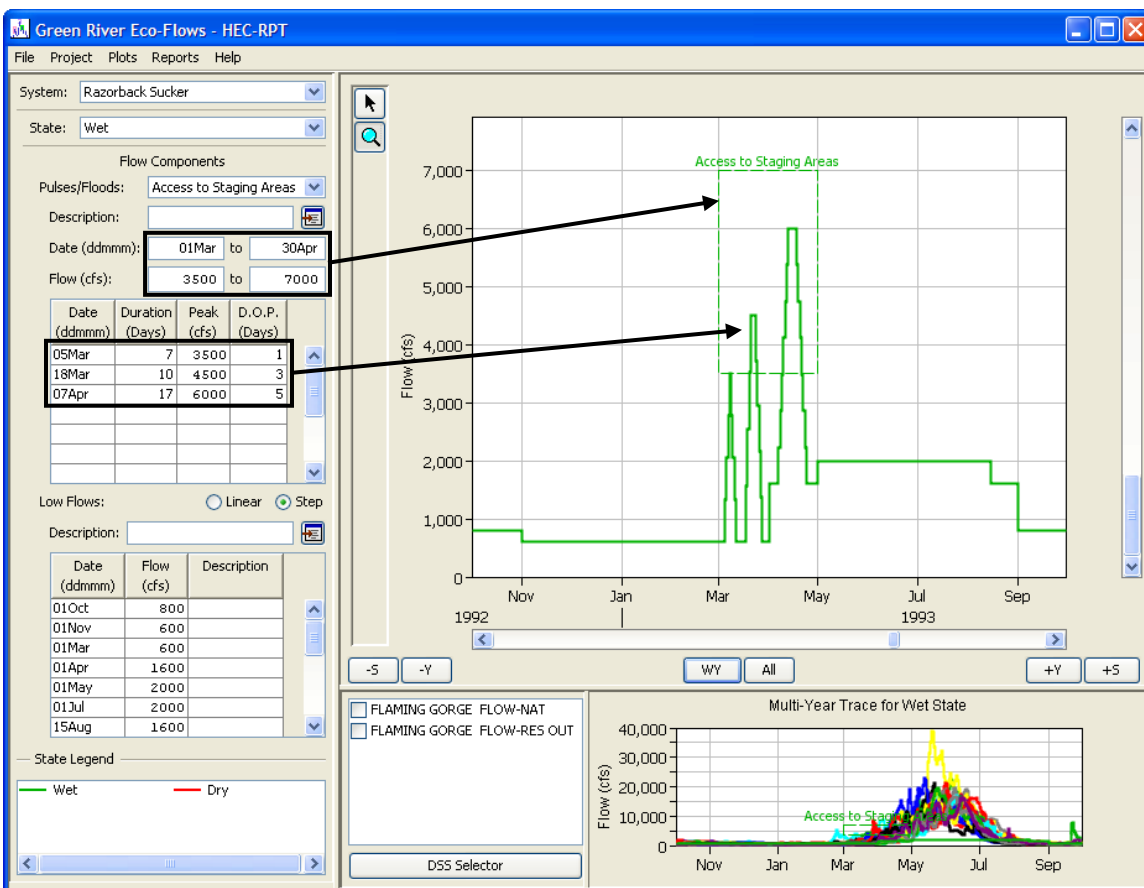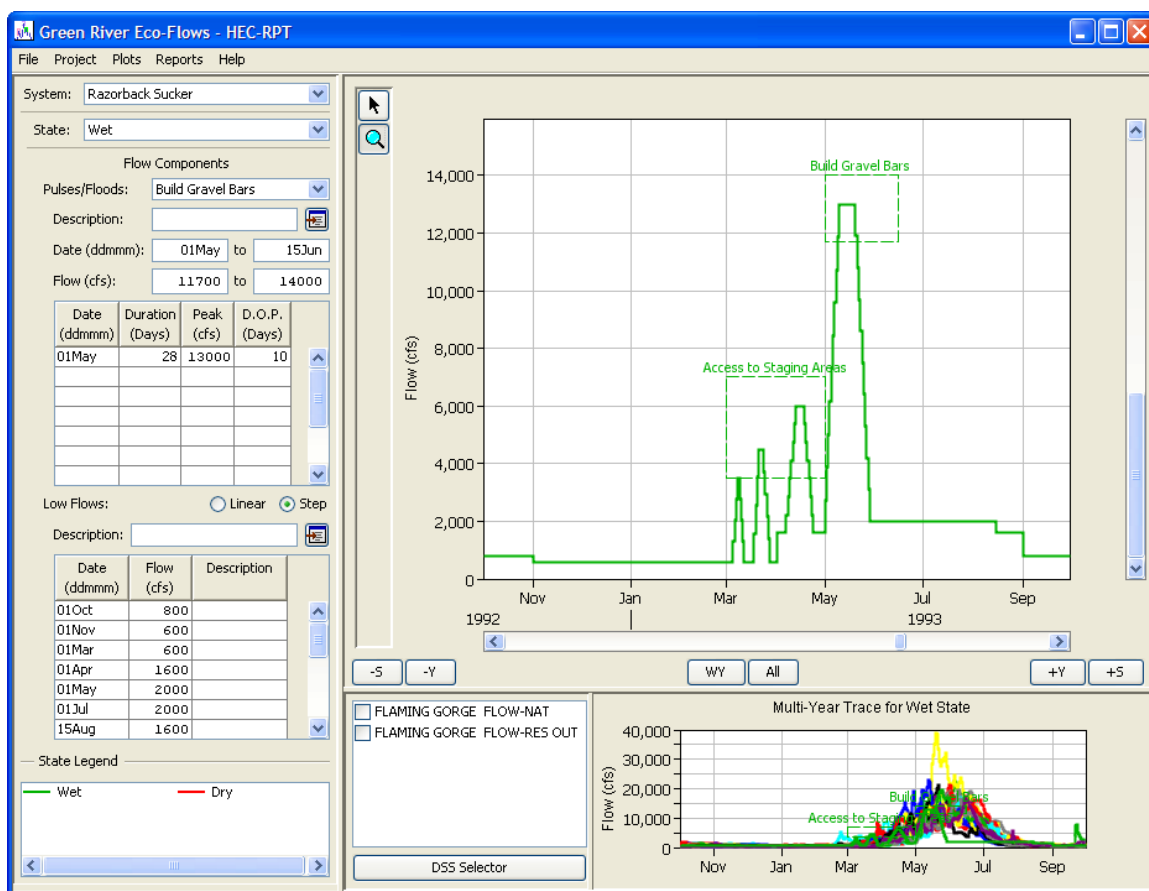

Pulses and floods can be traced by entering a start date, duration, peak flow, and duration of peak (D.O.P.). There can be more than one peak flow per window.

3) Next, add a flood flow through the "Project – Flow – New" menu.
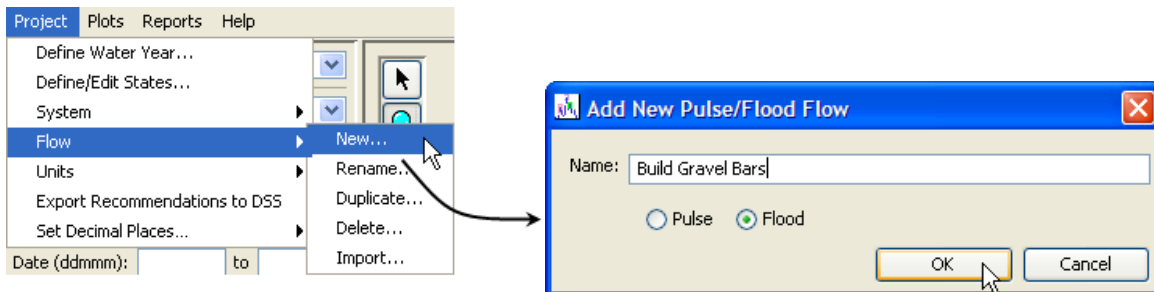
Enter the season and flow range from your flow recommendations or as shown below.

4) Use your notes from this morning to continue building environmental flows for the Razorback Sucker, the Riparian Ecosystem, or both.

5) Reactivate the natural flow data. Click the WY button and then use the +/-S buttons to navigate the period of record. Are there any parts of the recommendations that consistently deviate from natural patterns?
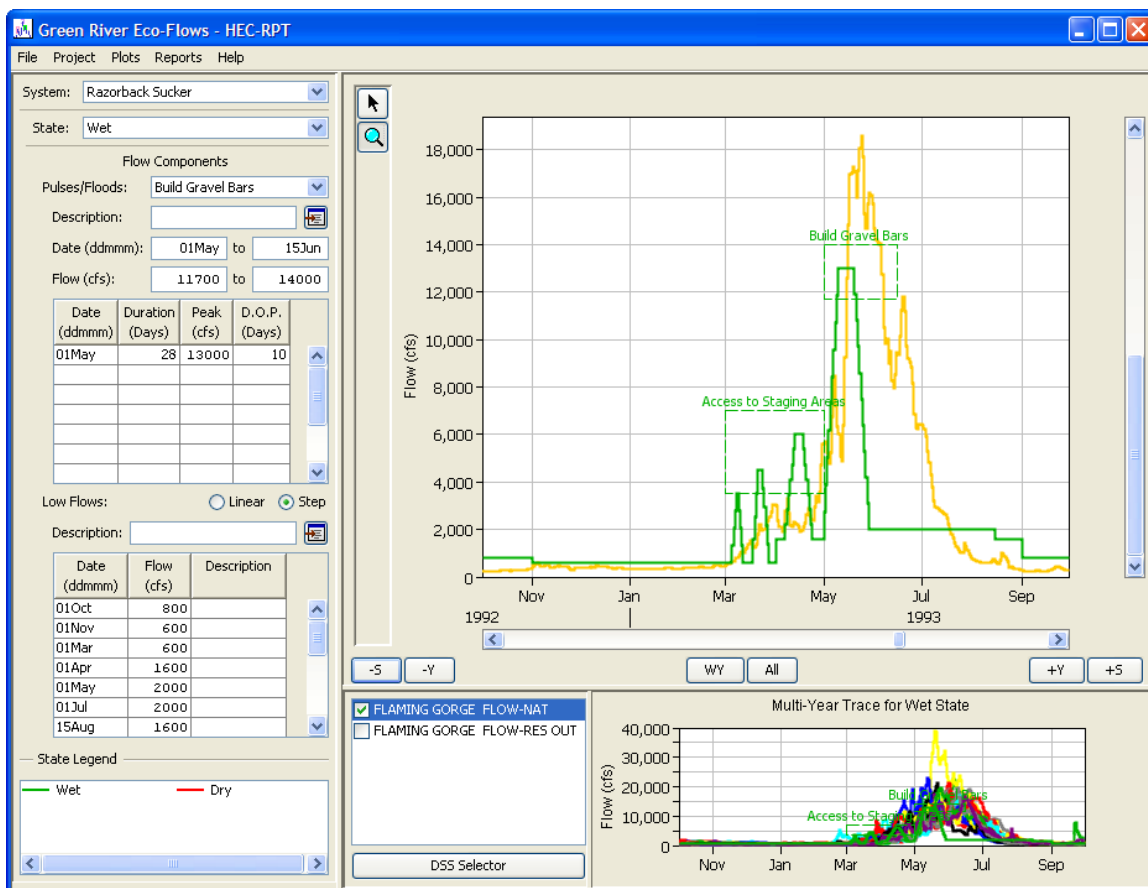
6) As time allows, please explore some other features of the software, including the thumbnail plot and XY Markers.

The thumbnail plot displays data based on a calendar year. Several plot options can be found under the "Plots – Predefined Plots" menu option.

XY Markers are graphical features that can be added to the plot windows. XY Markers are created by right clicking on a plot window and selecting the "Add/Edit Markers" option. This menu also has a command called "Open in new window" that replicates the current plot in a new window.

CTRL-T is also a useful command.

Please don't hesitate to ask questions. This may seem like an abrupt end to the workshop, but remember HEC-RPT is primarily a visualization tool. It is not intended to perform detailed quantitative analyses. Users should see the plot windows automatically respond to changes made to things like flow components, XY markers, and predefined plot selection, which makes HEC-RPT easy to experiment with and to learn.