

US Army Corps of Engineers Hydrologic Engineering Center

# HEC-WAT Watershed Analysis Tool

**Quick Start Guide** 

Version 1.0 September 2017

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**Quick Start Guide** 

September 2017

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#### Watershed Analysis Tool, HEC-WAT, Quick Start Guide

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## Chapter 1

### **HEC-WAT (Watershed Analysis Tool)**

#### 1.1 Introduction

The U.S. Army Corps of Engineers (USACE) conducts water resources management studies. These studies begin with the definition of problems, issues, and opportunities and continue through the planning process by formulating, evaluating, and comparing alternatives with various analyses to determine impacts so that appropriate decisions may be made. The studies often require hydrologic, hydraulic, economic, and social impact analyses. In most cases, varying sections within a USACE office or through a Project Delivery Team (PDT) perform these impact analyses independently with the reporting and visualization of modeling results through independent models. For the project study, coordination, file/data sharing, logistics, reporting of modeling results, and status reporting are often a problem for the modeling teams as well as project management.

The Institute for Water Resources, Hydrologic Engineering Center (CEIWR-HEC) developed the Watershed Analysis Tool (HEC-WAT) to meet the USACE requirements of performing water resources studies in a comprehensive, systems based approach. Modeling teams will benefit because teams will be able to develop models in a closely coordinated manner using a shared schematic; track progress of other models; and, automatically retrieve results from previous model runs through the shared schematic, thus assuring a more efficient and coordinated result. A graphical user interface (GUI) would allow data and results sharing, common schematic assembly, definition and representation of alternatives, model setup, editing and implementation, and direct data and results visualization. The management team would benefit through the use of a tool that employs a common interface by being able to track project status through each modeling component and being able to display results during public and project status meetings.

For over two decades, USACE has required that all USACE planning processes address the Nation's water resources needs in a systems context while using risk analysis. From within USACE there is very little guidance and few tools to support this requirement. For this reason, HEC has added an option to HEC-WAT that will analyze complex riverine systems while implementing the flood risk management and systems requirements. The new compute option, Flood Risk Analysis (FRA), will allow a user to perform plan formulation or system performance analyses while incorporating risk analysis.

HEC-WAT provides a framework that streamlines and integrates tools commonly applied by USACE District and Division offices used when performing a water resources management study. The basic building block of the HEC-WAT framework is an HEC developed concept labeled "plug-in". By using the plug-in concept HEC-WAT incorporates individual pieces of software such as:

HEC-RAS - River Analysis System HEC-HMS - Hydrologic Modeling System HEC-ResSim - Reservoir Simulation HEC-FIA - Flood Impact Analysis HEC-SSP - Statistical Software Package HEC-DSSVue -HEC Data Storage System (DSS) Visual Utility Engine

The plug-in allows the software to work together in a coordinated fashion so that water resources, and economic decisions can be made from the same interface.

### 1.2 Purpose

The purpose of the HEC-WAT software is to help USACE study teams perform the necessary hydrologic, hydraulic, and consequence planning analyses that is required for water resource studies. The HEC-WAT framework allows a multi-disciplinary PDT to perform water resources studies in a comprehensive, systems based approach by building, editing and running models commonly applied by multi-disciplinary teams and saving and displaying data and results in a coordinated fashion.

The terminology, analysis procedures, and output used by HEC-WAT are consistent with the requirements of USACE guidance and policy. HEC-WAT is designed to facilitate:

- The entry of the appropriate data into each of the individual modeling programs.
- Trade-off analyses as all study alternatives will eventually be created within the HEC-WAT using consistent schematics, data, and tools. Their results will be easier to compare and contrast thus making the trade-off analysis easier to perform.
- The analytical process and enhanced coordination among study team members, while producing more consistent results, and shared displays.
- The definition of alternatives through schematic representations, model identification and sequencing, and tabular formats.
- The study status by reviewing reports in the HEC-WAT. During any given study, the manager or any other member of the project delivery team (PDT) will be able to determine the study status.
- The reviewing of modeling results at all modeled locations without the direct knowledge of how any of the individual models develop those results. Those attending meetings will be able to see the results directly rather than reading the results from a few locations in a hard copy report or poster.

## Chapter 2

### **Installing HEC-WAT**

#### 2.1 Requirements

- Installation about 3 GB of hard disk space for HEC-RAS 5.0.3 and HEC-WAT; Russian River watershed data about 10 GB; HEC-WAT Russian River watershed about 3 GB
- Memory 6 GB
- Operating System Windows XP 64-bit, Windows 7, and Windows 10.
- Java HEC-WAT runs Java 8, which is included and run under the HEC-WAT installation folder

#### 2.2 Installation

- Install HEC-WAT using the self-extracting exe file (i.e., C:\Programs) "*HEC-WAT\_10\_Portable.exe*".
- HEC- RAS Install If HEC-RAS Version 5.0.3 has not been installed on your computer, located in *C:\Programs\....\HEC-WAT-10\_Portable\apps*) is a shortcut. Double-click on the shortcut and the user will be directed to the HEC-RAS download webpage.
- Install the Russian River Watershed using the zip file "Russian\_WAT.7z".



- Install the Russian River folder using the zip file "*RussianRiver\_Data.7z*".
- To create an HEC-WAT shortcut, from the HEC-WAT directory, right click on "*wat.exe*" and drag to the desktop. Release, and from the shortcut menu click **Create shortcuts here**, an HEC-WAT shortcut will appear.

### 2.3 Starting HEC-WAT

When starting HEC-WAT, double-click the HEC-WAT icon (shortcut) on your desktop. The splash dialog box (Figure 2.1) for HEC-WAT will open and will appear for a few seconds, and then the main window of HEC-WAT will appear (Figure 2.2). HEC-WAT is now ready for use.

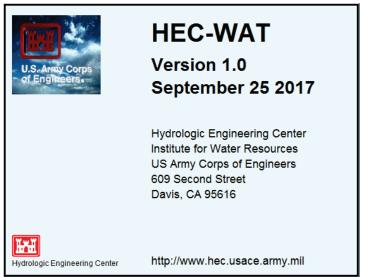


Figure 2.1 HEC-WAT Splash Dialog Box

¥ HEC-WAT - No Study	
File Edit View Maps Compute Results Tools Window Help	
The No Study	
Display Unit System set to English           Plugin HMS loaded           Plugin ResSim loaded           Starting Plugin Server for resim           RAS Plugin Server stated           Plugin RAS loaded           Starting Plugin Server for fla           Starting Plugin Server for hec-sap           INFC: Heclib Ver.Sub Minor. 70.407.4.7	
Study Maps Schematic Messages	
	34M of 193M

Figure 2.2 HEC-WAT Main Window

#### 2.4 About the Quick Start Guide

Chapters 3 thru 5 provide the user with an overview of the HEC-WAT framework. Chapter 6 introduces the user to creating an HEC-WAT study from scratch. Chapters 7 thru 9 are standalone chapters that lead a user thru creating an HEC-WAT study by importing individual models (Chapter 7); importing a CWMS watershed (Chapter 8); and, creating an HEC-WAT study that incorporates a simple flood FRA compute.

## Chapter 3

### **HEC-WAT Overview**

HEC-WAT is software that orchestrates the building, editing, and running of a series of models to help perform water resources studies and address the requirements found in USACE guidance. The software provides flexibility to offices in the performance of water resources studies (Figure 3.1). The software can be used to perform small CAP (Continuing Authorities Program) studies or large comprehensive studies. The HEC-WAT interface streamlines and integrates the analytical process of water resource studies by using the tools commonly applied by multi-disciplinary teams. These tools include hydrologic, hydraulic, economic, and social impact assessments.

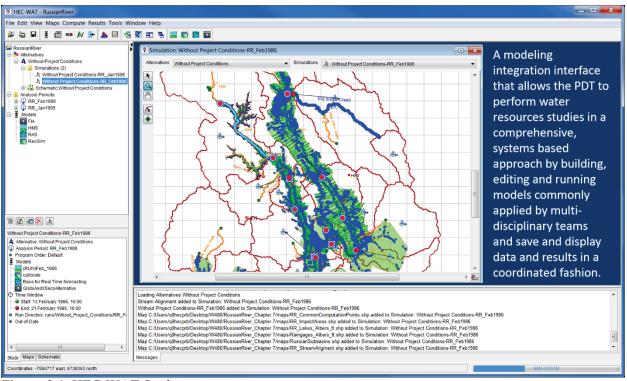


Figure 3.1 HEC-WAT Study

The HEC-WAT tool allows USACE and its partners and stakeholders to conduct their studies in a coordinated fashion. Coordination begins as each model uses the common schematic that is built within the HEC-WAT interface. The common schematic demands that each team use the same nomenclature for each of their models and alternatives. The individual models can be built and edited inside or outside the HEC-WAT and model results are viewed from HEC-WAT by selecting the elements found on the schematic. Once the models are located within HEC-WAT, the models can be run in sequence. The storage of data is organized by DSS and a simple DSS linking device is used to connect the models. The models themselves, the input data, and the results are all stored in the HEC-WAT's directory structure.

Therefore, all data and files used to make decisions are easily retrieved. Alternative analyses can be performed, and output from multiple alternatives can be viewed at the same time making alternative analyses and selection easier.

### 3.1 Identifying a Study

An issue at the beginning of any project study (i.e., reconnaissance, or feasibility) is the definition, study extent, and representation of alternatives, initially the without project, base year alternative. HEC-WAT helps to address this issue by allowing the project study team to jointly define alternatives through schematic representations, model identification and sequencing, and tabular formats.

The study team, under the direction of a Project Manager (PM), will start by meeting to acquaint the team with the location of the study to be conducted, and, then defining the problems and looking for opportunities. A typical study team could be composed of a PM, GIS (Geographic Information System) specialist, hydrologist, hydraulic engineer, water manager (reservoir), economist (flood damage and other consequence such as life loss), biologist (water quality), and planner.

After the location of the watershed, and the problems and opportunities of the study have been identified, the team will start the analytical process by determining what data or models already exist and what data and models will need to be built. Unlike the CWMS (Corps Water Management System) software that automatically extracts or copies data for a DSS file before a simulation is computed, HEC-WAT has no such requirements. Therefore, if the study requires the use of observed data, historical, or other model data, this data needs to be stored in DSS files. This requirement is based on the way HEC-WAT links model alternatives together and simulations are computed.

With a map in hand, the PM would lead the study team on choosing the study boundaries, identifying gage locations, sub-basin delineations, points where models would share data (common computation points), damage area centers, and location of measures (reservoirs, levees, etc.). Once this information has been identified then someone from the study team would be chosen to set up the base alternative (Without Project Conditions). This person should be someone with knowledge of the study area.

With the study area defined, the study team needs to identify any models that may already exist, what data is available, and what is the time window (analysis period) for the base alternative (Without Project Conditions). Once the base alternative is set the study team could identify, name, and gather information for additional alternatives. These alternatives could include the use of additional flood risk management measures, environmental features, or represent future conditions. The benefit of HEC-WAT is that each of the modeling teams will be able to use the identical schematic to perform their modeling and naming will be consistent across all models.

Each alternative will be tied to a given schematic. Therefore, the alternative definitions will be fully coordinated making for more consistent modeling and results.

#### 3.2 Creating a Study

After the study team has identified the study area, an HEC-WAT study can be created (Figure 3.1). A **study**, in HEC-WAT is a combination of the data and models and events required to analyze a specific geographic area. The first step is to define the schematic for the base alternative, and then schematics for other defined alternatives.

A **schematic** is a physical representation of a stream alignment, and the flood risk management and environmental measures that will be modeled. One individual from the study team will build the schematic for the base alternative. The first basic item of an HEC-WAT schematic is the stream alignment; this is usually created from importing information from a map layer (shapefile). Once a stream alignment has been built, then using the drawing tools available from within HEC-WAT, common computation points, and existing flood control or restoration measures, can be added to the schematic that will be shared across all models. To aid in the placement of elements on the schematic, background maps of gage locations, reservoir locations, sub-basin delineations, study boundary areas, etc. could be added to the study.

By default, HEC-WAT creates the base alternative – Without Project Conditions first. The study team has probably defined other alternatives that can be created, as well. An **alternative** in HEC-WAT is a way to group a schematic with different operations and model parameters. Once an alternative is created, the next step is to create analysis periods. **Analysis periods** define the time window and events that could be associated with an alternative are generated using time window modifiers. An **event** is an occurrence of precipitation/snowmelt that leads to some sort of hydrologic response normally associated with a specific time period. The event can be historical or hypothetical or represent the upper limit of a precipitation runoff response.

Now that alternatives and analysis periods have been defined, existing models that have been identified can be brought into the HEC-WAT study either by importing or copying the files into the HEC-WAT directory structure. If models are to be built, the HEC-WAT provides two options. One is that the models can be created through HEC-WAT by accessing the individual pieces of software directly from the framework. The other option is to copy the files created by HEC-WAT to a computer, and then return the files to the HEC-WAT study (Chapter 4, Section 4.6) once the models are calibrated. For example, if the HEC-RAS model for a study needs to be built, from the HEC-WAT directory structure there is a HEC-RAS folder which contains the default HEC-RAS files for the study. Copy these files to a computer, create the HEC-RAS model, and then copy the files back to the HEC-WAT study.

Once all the models have been added to the HEC-WAT study, simulations can be created. A **simulation** is a combination of an analysis period and event(s) associated with an alternative. For each of these combinations, models will need to be selected, the simulation will be computed, and results will be reviewed. The process is then repeated for the other identified alternatives, and after several HEC-WAT simulations, alternative result comparisons can be reviewed.

### 3.3 Opening a Study

1. From the HEC-WAT main window (Figure 3.1), from the **File** menu, click **Open Study**. The **Open Study** Browser (Figure 3.2) will open.

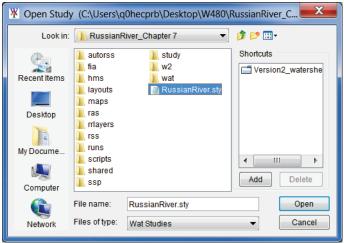


Figure 3.2 HEC-WAT - Open Study Browser

- 2. Browse to the location of the provided HEC-WAT study (i.e., *C:\Users\xxxxxx\ Desktop\Russian\_WAT*). The **Look in** list will show the location that is being chosen. Click on the .sty file *RussianRiver.sty*. The **File Name** box will now contain the .sty file name. The **Files of Type** list should display *Wat Studies*.
- 3. Click **Open**, the **Open Study** Browser will close (Figure 3.2) and the HEC-WAT main window (Figure 3.3) will now display the selected study *RussianRiver*.

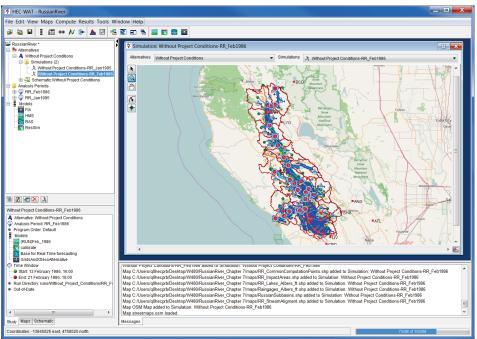


Figure 3.3 HEC-WAT Main Window - RussianRiver Study

## Chapter 4

### **HEC-WAT Interface**

The HEC-WAT main window (Figure 4.1) displays the framework for the HEC-WAT software that allows users to enter data, review data, create alternatives, run simulations, and view results. The **Title Bar** (Figure 4.1) displays the HEC-WAT study title. After a study is opened, the name of the study will appear here.

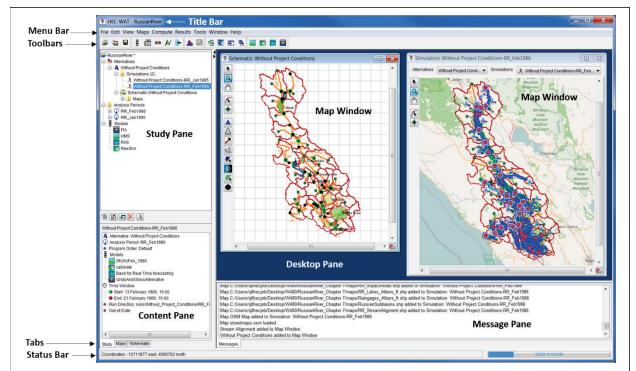


Figure 4.1 HEC-WAT Main Window

### 4.1 Panes

The HEC-WAT main window (Figure 4.1) is laid out in panes that allow the user to view HEC-WAT study data at the same time or to display different, yet simultaneous, views of the study data. The HEC-WAT main window has four main panes. The panes are:

**Study Pane** Provides an overview of items that have been defined for an HEC-WAT study (Figure 4.2). Based on the view (Section 4.2), the **Study Pane** can display information about alternatives; simulations; analysis periods; models that have been defined for the study; what map windows are actively open; the available schematics; stream alignments; measures; common computation points; and, impact areas.

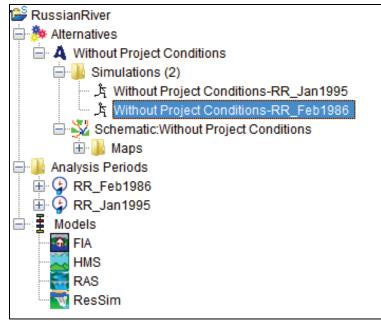


Figure 4.2 Study Pane - Study View

Content Pane This pane provides details on selected HEC-WAT components (Figure 4.3) in the Study Pane (available in the study, maps, and schematic views; see Section 4.2). For example, in Figure 4.3, for a study view, an HEC-WAT simulation has been selected – *Without Project Conditions-RR\_Feb\_1986*. The Content Pane displays the elements of the selected simulation. Information includes the alternative, the analysis period, the program order being used, the model alternatives that were run, the time window, the directory where the results from the simulation were written, and the status of the simulation. For a map view, the Content Pane displays the layers (map layers, primary layers) associated with the selected map windows listed in the Study Pane.

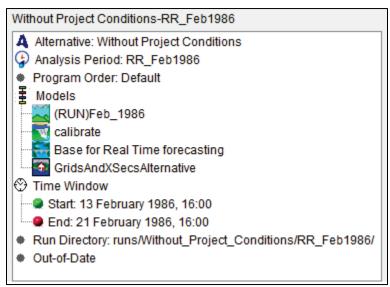


Figure 4.3 Content Pane - Study View

**Desktop Pane** The **Desktop Pane** (Figure 4.4) is where the different map windows available from HEC-WAT will display. For example, in Figure 4.4, the **Desktop Pane** contains a map window of a selected simulation and a map window of a selected schematic. These two map windows provide the user with a graphical representation of a simulation and a schematic, respectively.

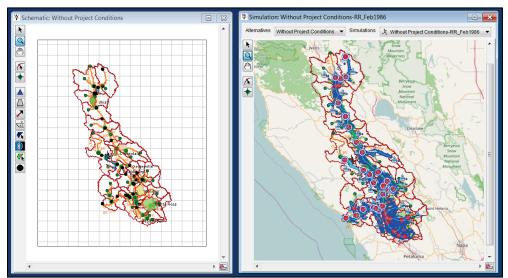


Figure 4.4 Desktop Pane

Message Pane The Message Pane (Figure 4.5) contains messages that the HEC-WAT software is providing for informational purposes. The information in the Message Pane is a record of HEC-WAT software activities, recording the opening of a study, opening map windows, accessing DSS, and many other HEC-WAT activities.

Without Project Conditions -1 eb\_1300 added to Map Window Without Project Conditions added to Map Window Stream Alignment added to Map Window Map OSM Map added to Simulation: Without Project Conditions-Feb\_1986 Map OSM Map added to Schematic: Without Project Conditions Map streetmaps.osm loaded.

Figure 4.5 Message Pane

### 4.2 Tabs

HEC-WAT tabs provide different views of the available data in a study and users can perform certain operations for a study from the

Study Maps Schematic

tabs. The tabs can change the layout of the menu bar; and, available information in the **Study** and **Content** panes can change. There are three tabs:

Study The default tab (Figure 4. 2) which provides a view of the study data in a tree (study tree) in the Study Pane. Also, from the Study Tree a user can create, edit, and delete alternatives, analysis periods, and simulations. From the Content Pane (Figure 4.3) the user can view detailed information about items

listed in the **Study Tree**. Also, this view affects the HEC-WAT menu bar (Section 4.3)

MapsThis tab (Figure 4.6) provides a view (Maps View) of the map windows<br/>currently active in the Desktop Pane (Figure 4.4). The maps windows are<br/>displayed by type in the Study Pane portion. In the Content Pane portion<br/>(Figure 4.6) information about the layers for a selected map window are<br/>displayed. Also, from the Content Pane in the Maps View the user can turn<br/>layers on/off, adjust properties of the layers, and order the layers for viewing in<br/>the associated map window. When the user switches to the Maps View the<br/>HEC-WAT menu bar options will change.

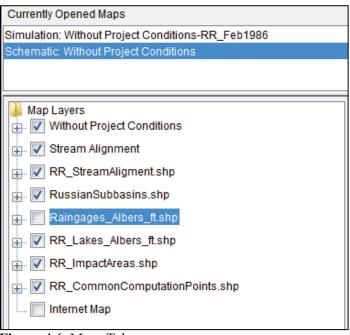


Figure 4.6 Maps Tab

Schematic From this tab (Figure 4.7), the user is provided with a view (a tree) in the Study Pane of the map layers that are available in the study, schematics that have been defined for the study, and, available components - stream alignments, measures (levees, reservoirs), common computation points, and impact areas that have been defined for the study. Also, from the study tree, the user can create, edit, delete, and modify the elements in the Schematic View. In the Content Pane further information is provided about elements in the Schematic View. When the user switches to the Schematic View the HEC-WAT menu bar options will change.

#### 4.3 Menu Bar

The menu bar of HEC-WAT provides the user with many commands to perform various functions. For further details on each command for the available menus, review the HEC-WAT User's Manual. For this manual, an overview of each menu that is available in the HEC-WAT software is provided.

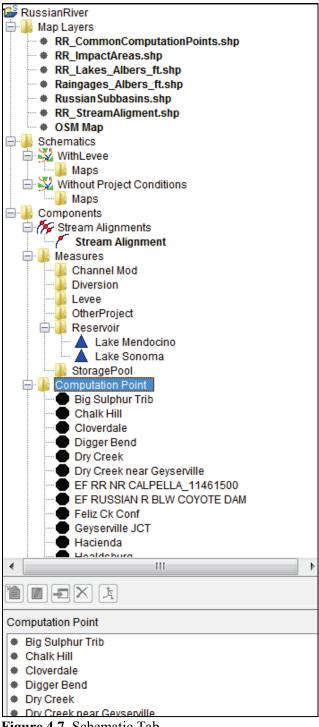


Figure 4.7 Schematic Tab

The **File** menu allows the user to perform study management functions such as creating, opening, closing, and saving an HEC-WAT study. Also, provides commands that will allow users to provide information about the study team; select the software applications or tools (plug-ins) that are needed for the study; import a CWMS watershed; import other HEC software application's model alternatives (HEC-HMS, HEC-ResSim, HEC-RAS, HEC-ResSim); open recently viewed HEC-WAT studies; and, exit the HEC-WAT software. This menu is available in all HEC-WAT views.

From the **Edit** menu, the HEC-WAT users can create/modify/edit items that are the building blocks of an HEC-WAT study. A user can manipulate alternatives and simulations; establish the program order for a study; link the individual models of a study; modify the look and feel of the common computation point layers (CCPs); provide aliases for defined stream segments in the HEC-WAT study; access available FRA editors; and, access editors from the individual application software and tools that are part of a study. This menu is available in all HEC-WAT views.

The **View** menu is where an HEC-WAT user can setup the HEC-WAT main window. The user can select which toolbars and panes to display and not display; set display units for plotting and tabulating; save layouts of the HEC-WAT framework; select which common computation point layer to view; and, review a report of the CCPs by common computation point layer in the HEC-WAT study. This menu is available in all HEC-WAT views.

From the **Maps** menu the user can setup map layers and map windows for the HEC-WAT study. Commands include setting up spatial properties; adding and removing map layers; manipulate map windows; add an Internet map; print a copy of the active map window in the **Desktop Pane** (Figure 4.4); and, import and export schematic elements (i.e., stream alignment, common computation points). This menu is available in all HEC-WAT views.

The **Compute** menu is used to compute individual simulations; compute multiple simulations; view a list of simulations for the watershed that have been computed; compute the active simulation or compute the individual models of the active simulation; and, view the compute log for the active simulation. This menu is only available in the **Study View**.

From the **Results** menu the user can view the simulation DSS file which contains data from a simulation; and, results from the software applications that are part of the active study. This menu is only available in the **Study View**.

The **Tools menu** provides access to DSS data (HEC-DSSVue); access to the Statistical Software Package (HEC-SSP); provides options for HEC-WAT startup, setting system properties, viewing threads, setup simulation and compute color, and plug-in information; view the log for HEC-WAT; view the logs that display DSS file activity and the logs of the applications software; monitor memory usage; what graphic elements HEC-WAT knows about from the other applications; information on how the different model alternatives are used for the study; and, setup for Distributed Computing. This menu is available in all HEC-WAT views.

From the **Window** menu the HEC-WAT user can control the appearance of the map windows in the **Desktop Pane** (Figure 3.1) of the HEC-WAT main window. This menu is available in all HEC-WAT views.

From the **Help** menu the user can access HEC-WAT documentation (i.e., HEC-WAT User's Manual, HEC-WAT Quick Start Guide), install the example study, connect to the HEC-WAT webpage, connect to the HEC website, and display current version information about HEC-WAT.

#### 4.4 Map Windows

Map windows (Figure 4.4) in HEC-WAT provide a way to graphically display HEC-WAT components. Map windows are displayed in the **Desktop Pane** of the HEC-WAT interface. There are three types of map windows available in HEC-WAT - schematic, alternative, and simulation. The HEC-WAT User's Manual provides more detailed information on map windows.

### 4.5 Plug-Ins

The primary purpose of HEC-WAT is to streamline and integrate a water resources study using software commonly applied by multi-disciplinary teams. The integration of the models is accomplished through the use of a concept called a "**plug-in**". By using plug-ins, HEC-WAT can incorporate individual pieces of software (HEC-RAS, HEC-HMS, HEC-ResSim, HEC-FIA) into the HEC-WAT framework which allows the individual software applications to work together in a coordinated fashion so that water resources, and economic decisions can be made from the same interface. For further details on plug-ins, review the HEC-WAT Technical Reference Manual which will be available after the release of Version 1.0.

To view the HEC-WAT default plug-ins:

- 1. From the HEC-WAT main window (Figure 4.1), from the **Tools** menu, click **Options**.
- 2. The **Options** dialog box (Figure 4.8) will open. Click on the **Plug-ins** tab. The table that is displayed provides information on all of the current plug-ins that are available in HEC-WAT.

General System Properties Threads Plug-	ins Compute Colors De	bug Model Directories	WAT Plug-ins DSS Timing Log HMS RAS Plugin
Enable/Disable Plugins for all Studies			
Plugin	Enabled	Started	Jar File
CeQualW2Plugin			jar/ext/ceQualW2.jar
EccPlugin			jar\ext\crt.jar
UrcPlugin			jar/ext/crt.jar
CwmsImporter		Image: A start and a start	jar\ext\cwmsImport.jar
ResultsMergeToolPlugin			jar\ext\dcmerge.jar
FragilityCurvePlugin		Image: A start and a start	jar/ext/fcPlugin.jar
HydrologicSamplingPlugin		V	jar\ext\hsPlugin.jar
PMPlugin		$\checkmark$	jar\ext\pm.jar
EadUncertPlugin		V	jar\ext\pm.jar
AepPlugin		V	jar\ext\pm.jar
HmsWatAdapter		V	jar\ext\S10HMSPlugin.jar
ResSimPluginClient		$\checkmark$	jar/ext/S15ResSimPlugin.jar
RasPluginClient		V	jar\ext\S20RASPlugin.jar
FiaPluginClient		$\checkmark$	jar/ext/S25FIAPlugin.jar
SspPluginClient		Image: A start and a start	jar/ext/S30SSPPlugin.jar
SimulationComputeEngineManagerPlugin		Image: A start and a start	jar/ext/simulationcomputePlugin.jar
GridGainComputePlugin	<b>v</b>	<b>V</b>	jar\ext\gridgaincompute.jar
TimeWindowModPlugin		Image: A start and a start	jar\ext\timewindowmod.jar
TwiPlugin		$\checkmark$	jar/ext/twiPlugin.jar
	St	art Plugin	

Figure 4.8 HEC-WAT - Options Dialog Box - Plug-ins Tab

4. Click **OK**, the **Options** dialog box will close (Figure 4.8).

To select the plug-ins for a study:

- 1. From the HEC-WAT main window (Figure 4.1), from the File menu, click Study **Details**.
- 2. The **Study Details** dialog box (Figure 4.9) will open. This dialog box provides information about the active study, allows the user to manipulate map windows; contact information for the study team; information on the model alternatives that make up the study; information about study simulations, and the plug-ins that are used by the study

X Study Details					x
Study Name:	RussianRiver				
Study Description:	This is an WAT study of the Ru	ssian River.			
Study File:	rb\Desktop\W480\RussianRive	er_Chapter 7	\Russiar	River.sty	
Unit System:	English				
Coordinate System:	USA_Contiguous_Albers_Equ	al_Area_Co	nic_USG	S_versior	n
Created By:	q0hecprb				
Created At:	Tue Nov 03 09:20:57 PST 2015	5			
Map Properties Co	ontacts Model Info Simulation	B Plugins			
Plugin	E	nabled			
FIA			~		
Fragility Curve					
HEC-SSP			<b>V</b>		
HMS			1		
Hydrologic Samplir	-				
Performance Metric	S				
RAS			1		
ResSim			~		
Simulation Comput					
Time-Window Inter					
TimeWindowModifi	er				
	Ок		Cancel		Apply

Figure 4.9 Study Details Dialog Box – Plugins Tab

- 3. Click on the **Plug-ins** tab. By enabling or disabling the plug-ins listed, the user will define what plug-ins will be used for the active study.
- 4. Click OK, the Study Details dialog box (Figure 4.9) will close.

#### 4.6 Directory Structure

Once an HEC-WAT study has been created, a directory structure has been created at a location the user selected when creating a HEC-WAT study. Figure 4.10 is a snapshot that represents the HEC-WAT directory structure for the *RussianRiver* study. More information on this directory structure and the individual files is provided in Chapter 4 of the HEC-WAT User's Manual.

Name	Date modified	Туре	Size	
🐌 autorss	2/22/2016 5:37 PM	File folder		
👢 fia	8/4/2016 9:05 AM	File folder		
👢 hms	8/4/2016 9:05 AM	File folder		
🐌 layouts	8/4/2016 9:03 AM	File folder		
👢 maps	8/3/2016 2:01 PM	File folder		
🐌 ras	5/2/2016 7:52 PM	File folder		
👢 rrlayers	11/3/2015 9:34 AM	File folder		
👢 rss	8/4/2016 9:03 AM	File folder		
👢 runs	8/3/2016 8:20 AM	File folder		
👢 scripts	11/3/2015 9:22 AM	File folder		
👢 shared	6/27/2016 5:10 PM	File folder		
👢 ssp	11/3/2015 9:48 AM	File folder		
👢 study	7/8/2016 1:46 PM	File folder		
👢 w2	7/17/2016 8:51 AM	File folder		
👢 wat	5/13/2016 4:09 PM	File folder		
Iforecast	11/3/2015 9:22 AM	FORECAST File	2 KB	
Iforecast.bak	11/3/2015 9:22 AM	BAK File	0 KB	
contacts.xml	6/24/2016 6:23 PM	XML Document	1 KB	
contacts.xml.bak	4/16/2016 8:31 PM	BAK File	1 KB	
Correct_stream.align	11/3/2015 9:22 AM	ALIGN File	775 KB	
Default.ag	11/3/2015 9:23 AM	AG File	1 KB	
Default.ag.bak	11/3/2015 9:22 AM	BAK File	1 KB	
modelAltInfo.xml	6/24/2016 6:23 PM	XML Document	3 KB	
modelAltInfo.xml.bak	4/16/2016 8:31 PM	BAK File	2 KB	
PrecipGrids.xml	11/3/2015 9:22 AM	XML Document	2 KB	
PrecipGrids.xml.bak	11/3/2015 9:22 AM	BAK File	2 KB	
RR_PrecipGrids.xml	11/3/2015 9:22 AM	XML Document	2 KB	
RR_PrecipGrids.xml.bak	11/3/2015 9:22 AM	BAK File	2 KB	
RR_ResSim_Model.wksp	11/3/2015 9:22 AM	WKSP File	4 KB	
RR_ResSim_Model.wksp.bak	11/3/2015 9:22 AM	BAK File	4 KB	
Russian_River.wksp	11/3/2015 9:22 AM	WKSP File	4 KB	
Russian_River.wksp.bak	11/3/2015 9:22 AM	BAK File	4 KB	
RussianRiver.log	8/4/2016 9:05 AM	Text Document	380 KB	
RussianRiver.log.bak	8/4/2016 9:05 AM	BAK File	380 KB	
RussianRiver.projection	8/3/2016 2:01 PM	PROJECTION File	1 KB	
RussianRiver.projection.bak	8/3/2016 12:50 PM	BAK File	1 KB	
RussianRiver.sty	8/3/2016 2:01 PM	STY File	9 KB	
RussianRiver.sty.bak	8/3/2016 12:50 PM	BAK File	9 KB	
RussianRiver.sty.projection	6/24/2016 5:52 PM	PROJECTION File	1 KB	
RussianRiver.sty.projection.bak	6/24/2016 5:52 PM	BAK File	0 KB	
RussianRiver.sty.sa.bak	6/24/2016 5:52 PM	BAK File	0 KB	
RussianRiver.wksp	8/4/2016 9:03 AM	WKSP File	5 KB	

Figure 4.10 HEC-WAT Example Directory Structure

## Chapter 5

### **Reviewing Results**

To view model results in HEC-WAT, at least one simulation map window should be open in the **Desktop Pane**. Results will display for the active simulation map window by the model alternatives that are associated with the simulation. Results are available either from the HEC-WAT main window (Figure 4.1), from the **Study Tree** by simulation, from the **Content Pane**, or interactively from the schematic of the current simulation map window.

#### 5.1 Results Menu

From the HEC-WAT **Results** menu the user can access reports from the different models. From the HEC-WAT main window (Figure 4.1), from the **Results** menu, the user will point to the model from which the user wants to view results for. For example, if the user points to **HMS**, points to the HEC-HMS model alternative (that is part of selected simulation), click on **Global Summary Table**, the **Global Summary Results for** report for that particular HEC-HMS run will display (Figure 5.1).

Project: RussianRiver Simulation Run: Feb_1986									
Start of Run:13Feb1986, 16:00Basin Model:Russian River 86End of Run:21Feb1986, 16:00Meteorologic Model:gageinterpCompute Time:25Apr2017, 16:58:32Control Specifications:Feb_1986									
Show Elements: All Ele	ements 🔹	Volume Units	: 🖲 IN 🔾 AC-FT 🛛 Sortin	ng: Hydrologic 💌					
Hydrologic	Drainage Area	Peak Discharge	Time of Peak	Volume					
Element	(MI2)	(CFS)		(IN)					
Potter Valley	Not Specified	1.0	13Feb1986, 16:00	n/a 🔺					
Calpella	92.2470	11528.8	17Feb1986, 17:15	9.39					
Lake Mendocino	12.6220	2334.9	17Feb1986, 11:45	15.78					
Coyote	Not Specified	503.3	21Feb1986, 16:00	n/a					
Ukiah 100.5200		14683.3	17Feb1986, 15:45	11.63					
Ukiah Confluence	Not Specified	14683.3	17Feb1986, 15:45	n/a					
Ukiah-Talmage	Jkiah-Talmage Not Specified		17Feb1986, 18:15	n/a					
Talmage Loc	84.7330	11112.3	17Feb1986, 15:30	11.33					
Talmage	mage Not Specified		17Feb1986, 17:00	n/a					
Talmage-Hopland	Not Specified	24108.6	17Feb1986, 19:15	n/a					
lopland Loc 72.3280		8330.3	17Feb1986, 18:15	10.46					

Figure 5.1 HMS - Global Summary Report

For HEC-RAS, from the **Results** menu, point to **RAS**, click **Plot XYZ 3-D**, the **X-Y-Z Perspective Plot** dialog box will open (Figure 5.2).

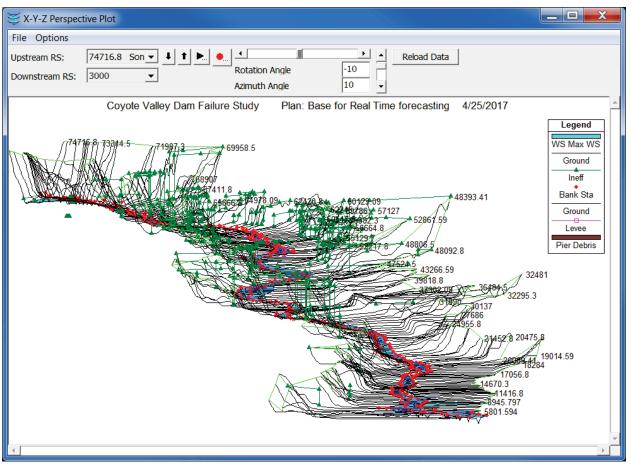


Figure 5.2 RAS - X-Y-Z Perspective Plot

### 5.2 Content Pane

Once a simulation has been computed, the user can also get the same reports that are available from the **Results** menu from the **Content Pane**. From the **Content Pane** right-click on one of the available models, from the shortcut menu (Figure 5.3), point to **Results**, click on the results that are available.

For example, in Figure 5.3, from the **Content Pane** right-click on the HEC-ResSim *calibrate* model, from the shortcut menu point to **Results**, click **Flow Summary**. The HEC-ResSim **Flow Summary Report** dialog box will open (Figure 5.4).

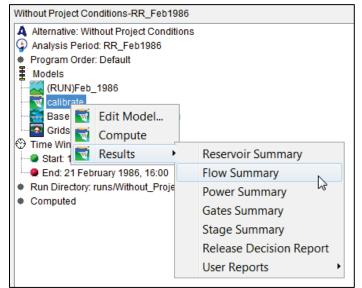


Figure 5.3 Content Pane - Shortcut Menu - Results

T Flow Summary Report									
File									
Alternative: Without Pr:RR_Feb1986:ResSim-calibrate Alternative:Without Pr:RR_Feb1986:ResSim-calibrate Lookback: 13 Feb 1986 16:00 Start Time: 13 Feb 1986 22:00 End Time: 21 Feb 1986 16:00									
Location/Parameter	Average	Maximum	Minimum						
Big Sulphur Trib									
Regulated Flow (cfs)	16868.45	53745.20	251.22						
Unregulated Flow (cfs)	20007.17	64856.47	303.65						
Cumulative Local Flow (cfs)	16501.24	53722.38	251.22						
Big Sulphur Trib to Geyserville JCT									
Regulated Flow (cfs)	16713.84	52264.52	254.29						
Unregulated Flow (cfs)	19890.08	63221.28	306.73						
Cumulative Local Flow (cfs)	16418.16	52241.01	254.29						
Chalk Hill									
Regulated Flow (cfs)	24112.67	74782.39	339.96						
Unregulated Flow (cfs)	27314.72	84578.26	392.39						
Cumulative Local Flow (cfs) 23865.67 74755.33 339.96									

Figure 5.4 ResSim - Flow Summary Report - Russian River

For HEC-FIA results, right-click on the HEC-FIA *GridsAndXSecsAlternative* model, from the shortcut menu point to **Results**, click **Individual Structure Damage Report**. The HEC-FIA **Individual Structure Damage Report** will open (Figure 5.5).

Individual Structure Damage Report										
		for alter	native GridsAnd	IXSecsAlternat	ive					
			for even							
		for time v	vindow GridsAr	ndXSecsAlterna	ative					
Structure	,	Dama	ige		Total	Depth of	Population At Risk	PC		
Name	Struct	Cont	Car	Other	Damage	Flooding	(Day)			
	Damage	Damage	Damage	Damage						
RES1-1SNB 06097 64222	0.0	0.0	0.0	0.0	0.0	-3.81	0.0			
RES1-1SNB 06097 64216	0.0	0.0	0.0	0.0	0.0	-3.34	0.0			
RES1-2SWB 06097 64250	7651.58	3952.89	0.0	0.0	11604.47	-2.59	3.0			
RES2 06097 64263	0.0	0.0	0.0	0.0	0.0	-2.41	3.0			
RES2 06097 64256	1892.75	258.1	0.0	0.0	2150.86	-0.55	2.0			
RES1-1SNB 06097 64218	0.0	0.0	0.0	0.0	0.0	-2.62	2.0			
RES1-2SNB 06097 64248	15524.34	6286.51	490.56	0.0	22301.4	0.41	4.0			
RES1-1SNB 06097 64217	0.0	0.0	0.0	0.0	0.0	-3.94	0.0			
RES1-1SNB 06097 47282	0.0	0.0	0.0	0.0	0.0	-1.65	1.0			
IND3 06097 24724	0.0	0.0	0.0	0.0	0.0	-2.89	0.0			
RES1-1SNB 06097 47281	0.0	0.0	0.0	0.0	0.0	-2.61	1.0			
RES2 06097 47260	30874.93	14867.47	11256.62	0.0	56999.01	6.25	1.0			
RES1-2SNB 06097 47251	32786.22	26702.77	11256.62	0.0	70745.61	6.05	3.0			
RES1-1SWB 06097 47249	68000.0	30939.24	11256.62	0.0	110195.85	6.25	1.0			
RES1-1SNB 06097 47244	46676.37	28883.64	8794.23	0.0	84354.23	5.37	1.0			
RES1-1SWB 06097 47248	61992.73	27774.54	11256.62	0.0	101023.89	5.37	1.0			
RES1-1SNB 06097 47247	54608.12	30773.43	11256.62	0.0	96638.17	6.05	1.0			
RES1-2SNB 06097 47252	33137.02	27141.28	11256.62	0.0	71534.91	6.18	3.0			
COM1 06007 133/15	26162.85	02005.22	2027/ 56	0.0	1/03/2 6/	6.05	0.0			

Figure 5.5 FIA - Individual Structure Damage Report

#### 5.3 Schematic

Results from the schematic are available by right-clicking on schematic elements and from the shortcut menu select result items (zooming in on an area is a good idea). From the map window click the **Pointer Tool**, right-click on a schematic element, a shortcut menu will appear (Figure 5.6). For example (Figure 5.6), right-click on a junction, the shortcut menu (Figure 5.6), besides providing information about the junction, HEC-WAT also provides information on schematic elements that are around the junction, like impact area, routing reaches, and cross sections.



Figure 5.6 HEC-WAT Schematic Shortcut Menu

In the example (Figure 5.6), if the user right-clicks on a junction from the shortcut menu, point to **Impact Area**, click **Aggregated Consequence Report**, the HEC-FIA **Aggregated Consequence Report** will open (Figure 5.7). Click the **Life Loss** tab to get a **Life Loss Report** by impact areas.

Aggregated Consequence Report for RR_Feb1986\fia\GridsAndXSecsAlternative										
							View E	By: Impact Areas 🔻		
Economic Struc	Economic Structure Agriculture Life Loss Summary									
	Life Loss Report by Impact Areas									
	for alternative GridsAndXSecsAlternative for event fia									
	,	,	,	for time window Gri	dsAndXSecsAlternative					
Impact Areas	Life Loss Day	Life Loss Day	Life Loss Night	Life Loss Night	Total Population Day	Total Population Day	Total Population Night	Total Population Night		
	Under 65	Over 65	Under 65	Over 65	Under 65	Over 65	Under 65	Over 65		
Russian River	24.51	4.52	26.17	6.51	3,755.00	613.00	3,796.00	596.00		
Total	24.51	4.52	26.17	6.51	3,755.00	613.00	3,796.00	596.00		
	Print Save To File Close									

Figure 5.7 FIA - Aggregated Consequence Report - Life Loss Report

From the same location in Figure 5.6, from the shortcut menu point to **Reach**, click **Profile Plot**, and the HEC-RAS **Profile Plot** (Figure 5.8) is displayed.

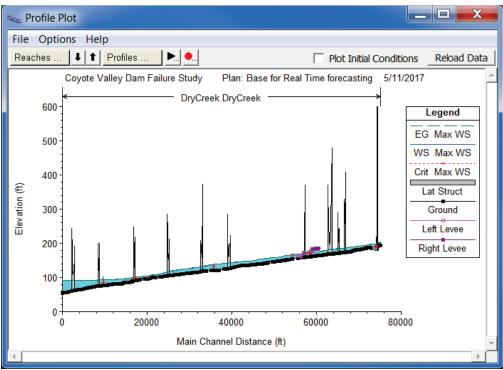


Figure 5.8 RAS - Profile Plot

Also at that location (Figure 5.6), from the shortcut point to **Reach**, click **Graph**, and the HMS graph for that HMS routing reach (Figure 5.9) is displayed.

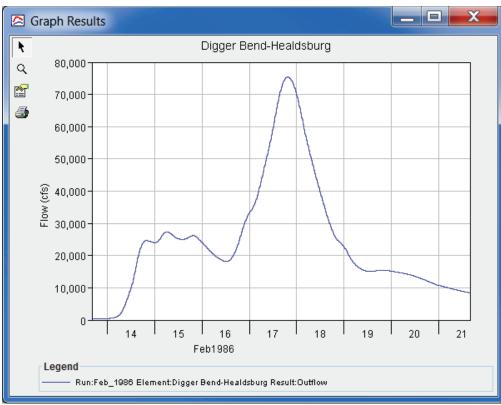


Figure 5.9 HMS - Graph of HEC-HMS Routing Reach

# **Chapter 6**

# **Create an HEC-WAT Study from Scratch**

Chapters 3 - 5 provided the user with an overview of the HEC-WAT framework. This chapter provides the user with instructions on creating an HEC-WAT study from scratch.

#### 6.1 Create an HEC-WAT Study

To create a new study:

1. From the HEC-WAT main window (Figure 6.1), on the File menu, click New Study. The Create New Study dialog box (Figure 6.2) will open.

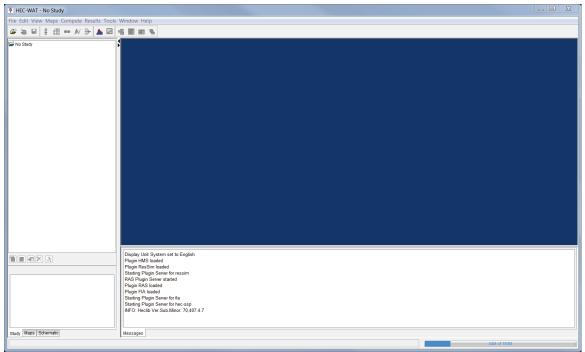


Figure 6.1 HEC-WAT Main Window

- 2. In the **Study Name** box (Figure 6.2), enter a name (*RussianRiver*), and in the **Description** box, enter a description (*Russian River water resources study*) for the new study.
- 3. In the **Directory** box (Figure 6.2), either enter the name of the directory where to store the HEC-WAT study, or click , and an **Open** browser (Figure 6.3) will open. Navigate to the directory where the HEC-WAT study will be stored, click **Open**. The **Open** browser (Figure 6.3) will close. On the **Create New Study** dialog box (Figure 6.2) in the **Directory** box the location will display.

🔆 Create New Stu	ıdy	<b>X</b>
Study Name:		
Description:		
Directory:	C:\Users\xxxxxxxx\Desktop\New_WAT_Study\	•
Unit System:	English	•
Coordinate System:		Edit
Create Default /	Alternative	Add Map Layers
Select Default Alte	rnative Name	
Existing Cond		
Without Project Conditions		
Alternative 1		
Other:		
		OK Cancel

Figure 6.2 Create New Study Dialog Box

¥ Open			X
Look in:	My Documents		▼ 🤌 📂 🛄 -
Recent Items	autorss BlackBerry CIRT_Materials ColumbiaRiverTreaty_Studies	My Music My Pictures My Shapes My Videos My Web Sites	temp     Virtual Machines     Visual Studio 2010     Visual Studio 2015     Visual Studio 2015     Walkthrough
Desktop	Custom Office Templates  dated  Downloads	MyFiles     Natomas     Natomas_FRM_Study     Optimized Nationals	Watershed WebEx
My Docume	dssmapgui     Fragments     Guadalupe     HEC Data	OneNote Notebooks     PDF Favorites     PenniBB     preferences	
Computer	IISExpress Iogs G My Data Sources	SME_Resumes Snagit Snagit Stamps	
Natuork	My Meetings Folder name: C:\Users\q0hecpr Files of type:	ssh b\Documents	Open Cancel

Figure 6.3 Open Browser

4. The **Unit System** (Figure 6.2) for the study defaults to **English** (which is correct for the *RussianRiver* study). The other choice from the list is **SI** (metric).

5. Next, the projected coordinate system of the study needs to be set. From the **Create New Study** dialog box (Figure 6.2), click **Edit** (by the **Coordinate System** box), the **Map Coordinate Information** dialog box will open (Figure 6.4).

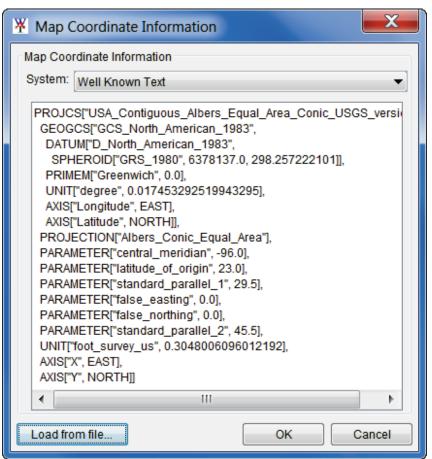


Figure 6.4 Map Coordinate Information Dialog Box with Study Projection Information

- 6. For the *RussianRiver* study the associated map layers have the correct projected coordinate system. So, one of those map layers can be used to set the projected coordinate system for the study. From the **Map Coordinate Information** dialog box (Figure 6.4), click **Load from file** (lower left corner of dialog box); an **Open** browser (Figure 6.3) will open. The map layers for the *RussianRiver* study are located in a folder titled *RussianRiver\_Data* (double-click). In that folder, is a *MapLayers* (double click) folder, from that folder, click on *RR\_StreamAlignment.prj* (any of the map layers will work). Click **Open**, now the **Map Coordinate Information** dialog box will contain information about the projected coordinate system (Figure 6.4). Click **OK**, the **Map Coordinate Information** dialog box will close (Figure 6.4). Now on the **Create New Study** dialog box the **Coordinate System** box (Figure 6.2) contains the name of the projected coordinate system (i.e., *USA\_Continguous\_Albers\_Equal\_Area\_Conic\_USGS\_version*) for the study.
- 7. When creating the *RussianRiver* study the user can add map layers that the PDT team has gathered for defining the study area. From the **Create New Study** dialog box (Figure 6.2), click **Add Map Layers**. The **Select Map to Add** browser will open (Figure 6.5).

X Select Map	to Add			X
Look in:	My Documents			
Recent Items	autorss BlackBerry	My Data Sources My Meetings My Music My Pictures	SIME_Resumes Crea	ite Copy
Desktop	Den l	My Videos My Web Sites MyFiles Natomas Natomas Natomas FRM Study	Virtual Machine Visual Studio 2 Visual Studio 2 Walkthrough Watershed	
My Docume	Guadalupe HEC Data	OneNote Notebooks PDF Favorites PenniBB	WebEx	
Computer	logs	preferences	4	
Network	File name: Files of type: All Maps			Open Cancel

Figure 6.5 Select Map to Add Browser

To copy the map layers to the study directory area, from the **Select Map to Add** browser (Figure 6.5), select **Create Copy**. Browse to where the map layers are located (in the folder titled *RussianRiver\_Data*, double-click on *Map Layers*). Select the following map layers:

- Find the map layer that represents the stream alignment RR StreamAlignment.shp
- Find the map layer the represents the subbasins RussianSubbasins.shp
- Find the map layer which represents the stream gages Raingages Albers ft.shp
- Find the map layer which represents the reservoirs *RR Lakes Albers ft.shp*
- Find the map layer which represents the impact areas RR ImpactAreas.shp
- Find the map layer which represents the CCPs RR CommonComputationPoints.shp

Click **Open**, the **Select Map to Add** browser will close (Figure 6.5). The **Create New Study** dialog box (Figure 6.6) appears.

- 8. HEC-WAT creates a default alternative *Without Project Conditions*. If the user wants the default alternative to have a different name, several choices are available, including **Other** which allows the user to name the default alternative. For the *RussianRiver* study the default alternative is used.
- Click OK, the Create New Study dialog box will close (Figure 6.6). The HEC-WAT main window will now have the name of the study (*RussianRiver*) on the title bar (Figure 6.7). A Schematic Map Window opens, which contains the map layers that were added to the study in Step 7.

X Create New Stu	ldy	X
Study Name:	RussianRiver	
Description:	Russian River water resources study	
Directory:	C:\Users\xxxxxxx\Desktop\New_WAT_Study\RussianRiver	-
Unit System:	English	▼
Coordinate System:	USA_Contiguous_Albers_Equal_Area_Conic_USGS_version	Edit
🔽 Create Default A	Alternative	Add Map Layers
Select Default Alternative Name		
Cond		
Without Project Conditions		
Alternative 1		
Other:		]
		OK Cancel

Figure 6.6 Create New Study Dialog Box - Completed

HEC-WAT - RussianRiver	
File Edit View Maps Compute Result	
≝ਙ∎ ፤⊞⇔∧ ⋺ ,	🔺 🖉 😤 ED 🕾 📓 🖬 🗃 🛃 🕍
	Schematic: Without Project Conditions
Alternatives	
A Without Project Conditions	
Simulations     Schematic:Without Project Conv	
Analysis Periods	
⊞ E Models	K
<	
1 🖉 🖅 🗡 Ja	
No Additional Content	
	1 Contraction of the second se
	Contend +
	• 🐱
	Project Loaded for ResSim
	Plugin FIA created RussianRiver
	Project Loaded for FIA Plugin HEC-SSP failed to save its Project.
	Plugn HECSSP failed to save its Project. Study RussianRiver saved.
	Plugin HEC-SSP failed to save its Project.
	Map RR_CommonComputationPoints shp loaded. Map C:/Users/q0hecprb/Desktop/New_WAT_Study/RussianRiver/maps/RR_ImpactAreas.shp added to Map Window
	Map C/Josens/durector/Desktop/new_VVX1_Study/Kussianik/wei/maps/kk_impact/veals.shp.added.to.wap Vvindow Map RR_Impact/reas.shp.loaded. T
	Man Cullinaralalhaanshillaashikan WAT. StuduilluunianDivarimanariDD. Lakan. Alhara A. aha addad ta Man Window
Study Maps Schematic	Messages 2
Coordinates: -7960637 east, 6597346 north	145M of 430M

Figure 6.7 HEC-WAT Main Window - RussianRiver Study - Maps Tab

#### 6.2 Building the Without Project Conditions Schematic

HEC-WAT by default will create a default alternative *Without Project Conditions* (see Section 6.1, step 8). From the HEC-WAT main widow (Figure 6.8), the **Schematic Map Window**, will contain the initial schematic for the *Without Project Conditions*. The next step is to build the schematic for the default alternative.

## 6.2.1 Adjust Map Layers

Once a map layer is in the HEC-WAT framework the user can make adjustments to the layer. Since the map layer that represents the subbasins for the *RussianRiver* study is a little bit in everyone's face, let's adjust that file - *RussianSubbasins.shp*.

From the HEC-WAT main window, click the **Maps** tab (Figure 6.7). Now the user can see which **Map Window** is currently active and what layers make up that **Map Window**. To change the color and the fill aspects of the *RussianSubbasins.shp* do the following:

- From the Map Layers tree (Figure 6.8), right click on *RussianSubbasins.shp*. This is the shapefile shortcut menu. This shortcut menu allows the user to expand/collapse the *RussianSubbasins.shp* leaf; move the shapefile to different positions in the tree (Move To Top/Move To Bottom, Move up/Move Down); show the legend of the shapefile; change the label of the shapefile; edit the properties of the shapefile; set/remove scale factors; copy the map layer to another location; and open the attribute table of the shapefile.
- From the shapefile shortcut menu (Figure 6.8), click **Properties**, the **Edit Polygon Properties** dialog box will open (Figure 6.9). The *RussianSubbasins.shp* file is a polygon shapefile. To edit the fill of the active map layer, from the **Fill** tab, change the color or not have a fill. For the

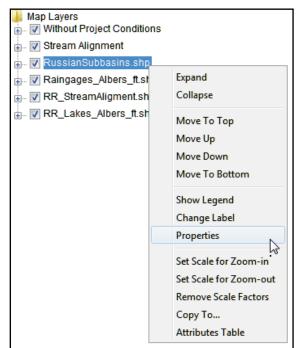


Figure 6.8 Map Layers Tree - Shortcut Menu

example in Figure 6.9, fill will be turned off. So click **Display Fill**, the check mark will clear, meaning that fill is turned off.

To change the outline color of the subbasin layer, from the **Edit Polygon Properties** dialog box (Figure 6.9), click the **Border** tab. From the **Color** list, select a color ("darkred"). Click **OK**, the **Edit Polygon Properties** dialog box will close and the changes will appear in dark red in the **Map Window**.

¥ Edit Polygon Properties
b/Desktop/New_WAT_Study/RussianRiver/maps/RussianSubbasins.
Fill Border Labels
Draw Features using:
One Fill 👻
Display Fill
Color darkred
Style
Transparency
25
OK Cancel Apply

Figure 6.9 Edit Polygon Properties Dialog Box

- 3. To turn off a map layer click in the checkbox by *Raingages\_Albers\_ft.shp*, the rain gages no longer appear on the map window.
- 4. To display the map window zoomed in, select the **Zoom Tool Q**. Draw a box around the map layers that are displayed in the **Map Window**. From the **Maps** menu, click **Default Map Properties**, the **Default Map Properties for** dialog box will open (Figure 6.10). Click **Set Map Extents to Display**, click **OK**. The **Default Map Properties for** dialog box will close.

* Default Map Properties for RussianRiver
Map Extents Default Map Layers
Coordinate System: USA_Contiguous_Alb View Extents: Easting: Minimum: 399177.724 Maximum: 114412.865 Max: 156685.746
Set Map Extents to Display
OK Cancel Apply

Figure 6.10 Default Map Properties for Dialog Box

This sets the extents for the **Map Window** so that when the study is opened the next time the **Map Window** will be zoomed in to the tighter area.

#### 6.2.2 Create a Stream Alignment

The backbone of any schematic is the **stream alignment**, and is the starting point in creating a schematic. A stream alignment is a one-dimensional river coordinate system, which defines the natural downstream flow network. Also, from the stream centerline, stationing will be provided

relative to its global location and specific to the study. The alignment indicates where confluences and bifurcations occur and provides a sense of distance and scale. Stream alignments are composed of a series of streams, stream nodes, and stream junctions.

The PDT has discussed the extents of the main stem for the study and has included all of the tributaries that will be considered by all of the models in the study. The PDT has created a shapefile that contains all of the pertinent streams - *RR\_StreamAlignment.shp* 

To import a stream alignment:

1. From the **Map Layers** tree (Figure 6.8), right-click on *Stream Alignment*. From the shortcut menu, click **Import**. The **Import Stream Alignment** dialog box will open (Figure 6.11). The **Shapefile Name** list defaults to the first line shapefile it can find in the *maps* directory; which happens to be the shapefile that represents the stream alignment for the *RussianRiver* study - *RR\_StreamAlignment.shp*.

¥ Import Stream Alignment ■						
File Edit						
Shapefile Name: RR_StreamAligment.shp 🔹 🛄						
Shapefile Information:						
Database Field Name: Na			_			
Database Field Marrie. Na	ame					
Name	Import	Reverse Direction				
Austin Creek	✓	<b>v</b>				
Bellevue-Wilfred	✓	<b>v</b>				
Big Sulfur Creek	✓	<b>v</b>				
Cold Creek	✓	<b>v</b>				
Copeland Creek	✓	<b>v</b>				
Dry Creek	<b>v</b>	✓				
EF Russian River	<b>v</b>	<b>V</b>				
East Austin Creek	<b>v</b>	<b>V</b>	=			
Feliz Creek	✓	<b>v</b>				
Forsythe Creek	✓	✓				
Franz Creek	<b>v</b>	<b>V</b>				
Green Valley Creek	<b>v</b>	✓				
Laguna de Santa Rosa	<b>v</b>	✓				
Little Sulfur Creek	<b>v</b>	✓				
Maacama Creek	<b>V</b>	✓				
Mark West Creek	<b>V</b>	✓				
Morrison Creek	✓ ✓	✓				
Orrs Creek		✓ ✓				
Pena Creek						
Pieta Creek		V V				
R150			-			
	Import All Reverse Direction					
Gap Tolerance:	0					
Replace Existing Stream	m Alignment					
Import						

Figure 6.11 Import Stream Alignment Dialog Box

2. From the **Database Field Name** list (Figure 6.11), the user needs to select the field name in the attribute file that contains the names of the streams - *Name*. Once a field name is selected, the table below will populate with the streams contained in the shapefile. If there is an issue with any of the stream segments the checkbox in the **Import** column

(Figure 6.11) will not be selected. This means the stream segment is not continuous and will not be imported.

- 3. Click **Reverse Direction** (Figure 6.11). The flow direction in the *RR\_StreamAlignment*. *shp* shapefile is not correct. So instead of fixing the issue with ArcMap® (ESRI GIS software), by performing the **Reserve Direction** procedure the system of streams will have the correct flow direction.
- 4. Click **Import**, a message window will appear letting the user know that the stream alignment imported successfully. Click **OK**, the **Import Stream Alignment** dialog box will close (Figure 6.11). In the active **Map Window** the stream alignment appears (orange stream segments; green stream nodes and stream junctions).

#### 6.2.3 Add the Background Internet Map

Knowing where the watershed is located in reference to known locations can be quite helpful when communicating with the PDT and stakeholders. From the **Maps** menu (Figure 6.12), point to **Add Internet Map**, from the available list select which internet map that would be a good background (i.e., *Open Street Map*) map for the watershed. The selected internet map will load and appear in the active **Map Window**.

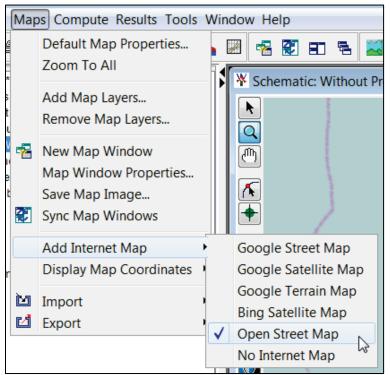


Figure 6.12 Maps Menu - Add Internet Map

This layer in the background might help with adding additional streams to the stream alignment; locations of reservoirs, levees, other projects, impact areas, and common computation points (CCPs). Based on the known extents of the study area, the layer provides a view of the watershed and surrounding area.

## 6.2.4 Adding CCPs

**Common computation points** (CCPs) are locations where one model can transfer data to another model, a location where results are needed for model development or alternative analysis, or locations where input boundary conditions are to be defined. CCPs need to be consistent for all models and should be placed on the stream alignment based on knowledge of possible study alternatives. The entire study team should be involved in the definition of the common computation points.

To import CCPs from a shapefile:

1. From Maps menu (Figure 6.12), point to Import, click Computation Points. The Import Computation Points dialog box will open (Figure 6.13). The Shapefile Name list defaults to the first point shapefile it can find in the *maps* directory; which happens to be the shapefile that represents the common computation points for the *Russian River* study - *RR\_CommonComputationPoints.shp*.

hapefile Name: RR_Commo	nComputatio	nPoints.shp			▼ [	
Shapefile Information:						
Database Field Name: D_N	IAME					<b>-</b> ]
ID_NAME	Import	Stream	On Stream	At Junction	Stream Station	
Austin Ck Conf	<b>v</b>	Russian River	-	<b>V</b>	37,792.116	
Big Sulphur Trib	<b>v</b>	Big Sulfur Creek	▼		98.144	
Chalk Hill	<b>v</b>	Russian River	▼		231,806.669	
Cloverdale	<b>v</b>	Russian River	▼		353,246.615	
Digger Bend	$\checkmark$	Russian River	<b>-</b>		201,087.524	
Dry Creek	$\checkmark$	Dry Creek	-		1,212.939	
Dry Creek Conf	1	Russian River	▼	<b>v</b>	170,045.663	-
Dry Creek near Geyserville	$\checkmark$	Dry Creek	<b>-</b>		50,613.101	=
Feliz Ck Conf	<b>v</b>	Russian River	<b>-</b>	<b>V</b>	439,006.715	
Geyserville	1	Russian River	▼] ✓		293,286.724	
Green Valley Ck Conf	1	Russian River	▼	<b>v</b>	118,994.035	
Guerneville	<b>v</b>	Russian River	<b>-</b>		83,863.523	
Hacienda	<b>v</b>	Russian River	<b>-</b>		114,358.942	
Healdsburg	1	Russian River	<b>-</b>		186,887.607	
Hopland	<b>v</b>	Russian River	<b>-</b>		470,474.070	
Jimtown	1	Russian River	<b>-</b>		256,223.664	
Johnsons Beach	1	Russian River	▼		83,066.729	
Lambert Bridge	<b>v</b>	Dry Creek	✓		36,934.906	Ŧ
Computation Points:24						
					Import	

Figure 6.13 Import Computation Points Dialog Box

- From the Database Field Name list (Figure 6.13), select the field name in the attribute file that contains the names of the CCPs *ID\_Name*. Once a field name is selected, the table below will populate with the CCPs contained in the shapefile. If there is an issue with any of the CCPs the checkbox in the Import column will not be selected.
- 3. Click **Import**, the **Import Computation Points** dialog box will close (Figure 6.13). Once the import of the CCPs is completed, a message window will appear letting you

know that the CCPs have been imported successfully. In the active **Map Window** the CCPs appear as black circles.

A user can also add CCPs to the schematic manually by performing the following steps:

- 1. From the **Schematic Map Window**, find the location where a CCP needs to be added, press the **Computation Point Tool**.
- 2. Hold down the **CTRL** key and click on the stream alignment to place the common computation point.
- 3. The Name New Computation Point dialog box will open (Figure 6.14). Enter the new Name (required) and Description (optional, but recommended). Click OK, the Name New Computation Point dialog box will close.

💥 Name N	ew Computation Point
Name:	Santa Rosa
Description:	•
	-
5	Select Computation Point Layer:
[	Default 🔹
	OK Cancel Help

Figure 6.14 Name New Computation Point Dialog Box

- 4. The common computation point will now appear in the map window as a black circle.
- 5. If a CCP is added at a stream junction, a slightly different **Name New Computation Point** dialog box will open (Figure 6.15). Enter the new **Name** (required) and **Description** (optional, but recommended).
- 6. From the **Select the Placement of the Computation Point** list (Figure 6.15), determine exactly where the common computation point will be placed. Choices are to have the common computation point placed on the stream junction, along one of the streams that form the stream junction, or none of the above. For example, in Figure 6.15, the common computation point will be placed on the stream junction.
- 7. Click **OK**, the **Name New Computation Point** dialog box (Figure 6.15) will close. The common computation point will now appear in the display area as a black circle.

#### 6.2.5 Adding a Reservoir

A **reservoir** is the impoundment created behind dams, or behind navigation locks and dams. For HEC-WAT a reservoir also includes the dam built on a stream to store water for uses such as flood risk management, hydroelectric power generation, recreation use, and water supply, etc.

🕌 Name ne	ew Computation Point	X
Name:	Mark West Ck Conf	
Description:		
		-
:	Select Computation Point Layer:	
	Default	<b>-</b>
:	Select the placement of the Computation Point:	
		•
	At the Stream Junction	
	Laguna de Santa Rosa 🔊 🔊 Mark West Creek	
	None of the above	

Figure 6.15 Name new Computation Point Dialog Box at a Stream Junction

To add a reservoir:

- 1. From the Schematic Map Window, find the location where a reservoir needs to be added, press the Reservoir Tool .
- 2. Hold down the **CTRL** key and click on the stream alignment to place the upstream end of the reservoir. Release the **CTRL** key; drag the mouse to the downstream end of the reservoir and click.
- 3. The Name New Reservoir dialog box will open (Figure 6.16). Enter the new Name (*Lake Mendocino*) and Description (optional, but recommended). Click OK, the Name New Reservoir dialog box will close.

X Name Ne	ew Reservoir	
Name:	Lake Mendocino	
Description:	Coyote Valley Dam	1
	OK Cancel Help	]

Figure 6.16 Name New Reservoir Dialog Box

4. The reservoir will now appear on the schematic as a cyan triangle (reservoir pool), a blue line (storage reach), a gray rectangle (dam), and two common computation points that represent the upstream and downstream ends of the reservoir.

5. The default representation of the reservoir pool is a triangle; the user can edit this triangle if a more detailed representation of the pool is desired. With the **Reservoir Tool** pressed, double-click on the reservoir. The triangle (Figure 6.17) will now be green with a blue outline color. Also, there are three vertex points (blue), and at the apex of the triangle is the reservoir label, which is represented by a yellow circle.

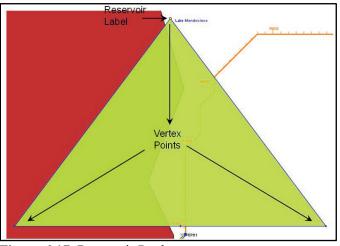


Figure 6.17 Reservoir Pool

- 6. When a reservoir is created there are two common computation points that are created with default names. It is recommended that the names of the two common computation points be changed. These two common computations points represent the inflow and outflow junctions of the reservoir and should be renamed accordingly.
- 7. To change the name of a common computation point, press the Computation Point Tool , right-click on one of the common computation points. From the shortcut menu, click Rename Computation Point; the Rename Computation Point dialog box will open (Figure 6.18). In the Name box, enter the new name, and in the Description box enter a description (optional, but recommended). For example, in Figure 6.18, the inflow junction for *Lake Mendocino* has been labeled *Lake Mendocino Inflow Jct*, and the outflow junction should be labeled *Lake Mendocino Outflow Jct*.

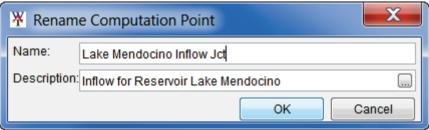


Figure 6.18 Rename Computation Point Dialog Box

8. Click **OK**, a **Confirm Rename** window will open, asking the user to be sure that the CCP is to be renamed. Click **Yes**, the **Rename Computation Point** dialog box will close (Figure 6.18) and the new name for the CCP will appear in the map window.

Repeat the steps above for the Lake Sonoma reservoir.

#### 6.2.6 Adding Impact Areas

An **impact area** is any distinct portion of a study that is affected by rising or falling stage in a stream, river, lake, or reservoir. Impact areas are an optional element, and are only required when the user wants to compute impacts at damage area centers in the study area

To import impact areas from a shapefile:

1. From the **Maps** menu (Figure 6.12), point to **Import**, click **Impact Areas**. The **Import Impact Areas** dialog box will open (Figure 6.19). The **Shapefile Name** list figures out whether there are any polygon shapefiles available in the **maps** directory; from the list the shapefile that represents the impact areas for the *RussianRiver* study -*RR\_ImpactAreas.shp*.

Shapefile Name: RR_Im		The second seco
Database Field Name:	ID_NAME	<ul> <li>Map Fields</li> </ul>
ID_NAME	Import	Stream Element
Cloverdale	<b>V</b>	Russian River 👻
Geyserville	V	Russian River 💌
Healdsburg	V	Russian River 🔻
Santa Rosa	V	R2310 🔻
Sebastopol	V	Laguna de Santa Rosa 🛛 🔻
Ukiah	V	Russian River 💌
Windsor		Windsor Creek 👻
	Replace Existing	

Figure 6.19 Import Impact Areas Dialog Box

- 2. From the **Database Field Name** list (Figure 6.19), the user needs to select the field name in the attribute file that contains the names of the impact areas *ID\_Name*. Once a field name is selected, the table below will populate with the impact areas contained in the shapefile. If there is an issue with any of the impact areas the checkbox in the **Import** column will not be selected.
- 3. Click **Import**, the **Import Impact Areas** dialog box will close (Figure 6.19). Once the import of the impact areas is completed, a message window will appear letting the user know that the impact areas have been imported successfully. In the active **Map Window** the impact areas appear as green polygons.

A user can also add impact areas to the schematic manually by performing the following steps:

- 1. From the Schematic Map Window, find the location where an impact area needs to be added, press the Impact Area Tool 🔨.
- 2. Hold down the **CTRL** key while clicking the mouse button. Each click creates a vertex point (Figure 6.20), which is the boundary of the polygon. When reaching the end point, release the **CTRL** key and click.



Figure 6.20 Draw an Impact Area

3. The Name New Impact Area dialog box will open (Figure 6.21). Enter a name (*Guerneville*), and if needed, enter a description. Click OK, the Name New Impact Area dialog box will close.

X Name Ne	ew Impact Area	X
Name:	Guerneville	
Description:		•
	OK Cancel Help	•

Figure 6.21 Name New Impact Area Dialog Box

4. The impact area will now appear in the display area as a green polygon with a name.

Following the steps in this chapter creates the basic schematic elements for an HEC-WAT watershed - stream alignment, common computation points, impact areas, and projects (reservoirs, levees). Now this basic schematic can be used by the models that are required for the watershed. The user will have choices at this point - to either build the individual models in

HEC-WAT or build individual models outside of HEC-WAT. If models are built outside of HEC-WAT, the user can import the individual models (Chapter 7) or if the models are the result of a Corps Water Management System (CWMS) watershed being available (Chapter 8).

Either choice using the basic schematic built in HEC-WAT promotes collaboration with customers, partners and stakeholders involved in water resource studies. Users will be able to perform studies in an integrated and systems based approach.

# Chapter 7

# Create an HEC-WAT Study from Existing Models

If the HEC-WAT study the user is building has existing model files, the user can build an HEC-WAT study from those models. For the *Russian River* example, the user can create an HEC-WAT study by importing individual model files (i.e., HEC-HMS, HEC-ResSim, HEC-RAS, HEC-FIA) that are available.

#### 7.1 Create an HEC-WAT Study

To create a new study:

1. From the HEC-WAT main window (Figure 7.1), on the **File** menu, click **New Study**. The **Create New Study** dialog box (Figure 7.2) will open.

File Edit View Maps Compute Results Tools Window Help         Image: Status         Image:	HEC-WAT - No Study		_ 0
Dipley Us System set to Englah     Pign Mix Staded     Pign Mix Staded   Pign Mix Staded   Pign Mix Staded   Pign Mix Staded   Pign Mix Staded   Pign Mix Staded   Pign Mix Staded   Pign Mix Staded   Pign Mix Staded   Pign Pign Start for sam   Pign Pign Start for sam		s Window Help	
Image: State of the State			
Image: Section of residue         Page: Page Section of residue         Page Page Section of residue         Page Page Page Section of residue         Page Page Page Section of residue			
Image: Control of the state         Pugin HMS loaded           Pugin Resim loaded         Pugin Resim loaded           Stating Pugin Reserve stated         Pugin RAS loaded           Pugin RAS loaded         Pugin RAS loaded           Pugin RAS loaded         Pugin RAS loaded	Ge No Study		
		Pugin HMS loaded Pugin Restin loaded Stating Pugin Server for ressim RAS Pugin Server stated Pugin RAS loaded Pugin RAS loaded	

Figure 7.1 HEC-WAT Main Window

2. In the **Study Name** box (Figure 7.2), enter a name (*RussianRiver*), and in the **Description** box, enter a description (*Russian River water resources study*) for the new study.

X Create New Stu	dy	×
Study Name: Description: Directory: Unit System: Coordinate System:	C:\Users\xxxxxxxx\Desktop\New_WAT_Study\ English	
Coordinate System: Coordinate System: Create Default Alternative Select Default Alternative Name Existing Conditions Without Project Conditions Alternative 1 Other:		Add Map Layers
		OK Cancel

Figure 7.2 Create New Study Dialog Box

3. In the **Directory** box (Figure 7.1), either enter the name of the directory where the HEC-WAT study will be stored, or click , and an **Open** browser (Figure 7.3) will open. Navigate to the directory where the HEC-WAT study will be stored, click **Open**. The **Open** browser (Figure 7.3) will close. On the **Create New Study** dialog box (Figure 7.2) in the **Directory** box the location will display.

X Open	and the second se		X
Look in:	My Documents		▼ 🥬 📂 🖽 -
Recent Items	ArcGIS autorss BlackBerry CIRT_Materials ColumbiaRiverTreaty_Studies	My Music My Pictures My Shapes My Videos My Web Sites	<ul> <li>temp</li> <li>Virtual Machines</li> <li>Visual Studio 2010</li> <li>Visual Studio 2015</li> <li>Walkthrough</li> </ul>
Desktop	Custom Office Templates	MyFiles Natomas Natomas_FRM_Study	Watershed
My Docume Computer	dssmapgui     Fragments     Guadalupe     HEC Data	OneNote Notebooks  PDF Favorites  PenniBB  preferences	
	IISExpress logs Wy Data Sources	SME_Resumes Snagit Snagit Stamps	
() Network	My Meetings Folder name: C:\Users\q0hecp Files of type:	with the second	Open     Cancel

Figure 7.3 Open Browser

4. The **Unit System** (Figure 7.2) for the study defaults to **English** (which is correct for the *RussianRiver* study). The other choice from the list is **SI** (metric).

5. Next, the projected coordinate system of the study needs to be set. From the **Create New Study** dialog box (Figure 7.2), click **Edit** (by the **Coordinate System** box), the **Map Coordinate Information** dialog box will open (Figure 7.4).

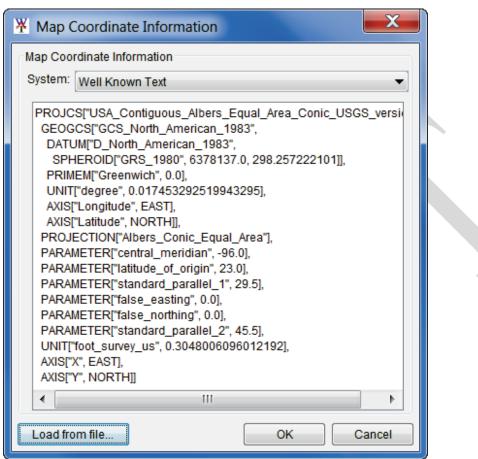


Figure 7.4 Map Coordinate Information Dialog Box with Study Projection Information

- 6. For the *RussianRiver* study, the associated map layers have the correct projected coordinate system. So, use one of those map layers to set the projected coordinate system for the study. From the **Map Coordinate Information** dialog box (Figure 7.4), click **Load from file** (lower left corner of dialog box); an **Open** browser (Figure 7.3) will open. The map layers for the *RussianRiver* study are located in a folder titled *RussianRiver\_Data* (double-click). In that folder, is a *MapLayers* (double click) folder, from that folder, click on *RR\_StreamAlignment.prj* (any of the map layers will work). Click **Open**, now the **Map Coordinate Information** dialog box will contain information about the projected coordinate system (Figure 7.4). Click **OK**, the **Map Coordinate Information** dialog box will contain information box the **Coordinate System** box (Figure 7.4). Now on the **Create New Study** dialog box the **Coordinate System** box (Figure 7.2) contains the name of the projected coordinate system (i.e., *USA\_Continguous\_Albers\_Equal\_Area\_Conic\_USGS\_version*) for the study.
- 7. Click **OK**; the **Create New Study** dialog box will close (Figure 7.2). The HEC-WAT main window will now have the name of the study (*RussianRiver*) on the title bar (Figure 7.5). A blank **Schematic Map Window** opens.

HEC-WAT - RussianRiver		_ 🗆 💌 X
File Edit View Maps Compute Resul	ts Tools Window Help	
🛎 🔄 🖬 🗄 🕶 № 🎐 .	🔺 🖾 😪 ED 🐁 🔛 🐭 🔛 🦉 🗃 🖬	
1-0	¥ Schematic: Without Project Conditions	
۰ III ۲		▶ 🛃
No Additional Content	Project Loaded for RAS         Plugin ResSim created RussianRiver         Project Loaded for ResSim         Plugin FIA created RussianRiver         Plugin FIA created RussianRiver         Plugin FIA SSP failed to save its Project.         Study RussianRiver saved.         Plugin HC-SSP failed to save its Project.         Stream Alignment added to Map Window	▲ Ⅲ ↓
Study Maps Schematic	Messages	
Coordinates: 737 east, -983 north	112M of 2 <mark>19M</mark>	

Figure 7.5 HEC-WAT Main Window - RussianRiver Study

# 7.2 Define Plug-Ins for a Study

To define the plug-ins for the *RussianRiver* study:

- 1. From the HEC-WAT main window (Figure 7.5), from the File menu, click Study **Details**.
- 2. The **Study Details** dialog box (Figure 7.6) will open. Click on the **Plug-ins** tab. The table that is displayed provides information on the plug-ins that are available in for the study.
- 3. For the *RussianRiver* study the following plug-ins should be enabled *FIA*, *HEC-SSP*, *HMS*, *RAS*, and, *ResSim*.
- 4. Click **OK**, the **Study Details** dialog box will close (Figure 7.6), and the plug-ins for the study have been defined.

#### 7.3 Import an HEC-ResSim Model

If there is an HEC-ResSim model available, the user should import that model first. Why? Because the HEC-ResSim model will contain a stream alignment, all of the common computation points (CCPs), and the reservoirs necessary to model the study area.

X Study Details			X	
Study Name:	RussianRiver			
Study Description:	Russian River water resou	urces study		
Study File:	b\Desktop\New_WAT_Stu	dy/RussianRiver/RussianRiver.sty		
Unit System:	English			
Coordinate System:	USA_Contiguous_Albers_	Equal_Area_Conic_USGS_versio	n	
Created By:	q0hecprb			
Created At:	Wed May 31 20:02:59 PDT	2017		
Map Properties Co	ontacts Model Info Simula	ations Plugins		
Plugin		Enabled		
FIA				
Fragility Curve		V		
HEC-SSP		V		
HMS		<b>v</b>		
Hydrologic Samplin	ng	<b>v</b>		
Performance Metric	CS	<b>v</b>		
RAS		V		
ResSim		V		
	te Engine Manager	×		Ŧ
Time-Window Inter		V		
TimeWindowModifi	ler	✓		
		OK Cancel	Apply	

Figure 7.6 Study Details Dialog Box - Plugins Tab

1. From the HEC-WAT main window (Figure 7.5), from the File menu, point to Import, and click ResSim. An Import Type window (Figure 7.7) will open, click Watershed.

I	mport	Туре
	?	Do you want to import a ResSim alternative or the entire Watershed?          Alternative       Watershed         Cancel

Figure 7.7 Import Type Window

- The Select Watershed File to Import From (Figure 7.8) browser will open. Browse to the folder *RR\_Models*; double click on the *base* folder; double-click on the *RR\_ResSim\_Model* folder. The Files of Type list should display ResSim Watershed Files; click *RR\_ResSim\_Model.wksp*; and, then click Open.
- 3. A **ResSim Import** window will open (Figure 7.9) showing the progress of the HEC-ResSim import.
- 4. The HEC-WAT Schematic Editor will open (Figure 7.10), from the Measures area of the Schematic Editor, click Select All. All of the reservoirs listed in the table are now selected. Click OK, the Schematic Editor will close (Figure 7.10).

X Select Wat	ershed File to	Import From	×
Look in	RR_Res	Sim_Model 🔹 🔊 📂 🖽 🗸	
Recent Items	autorss dssmapge maps rss	JÌ	
Desktop	scripts shared study suppleme	ntal	
My Docume		im_Model.wksp River.wksp iver.wksp	
Computer			
Network	File name: Files of type:	RR_ResSim_Model.wksp       ResSim Watershed Files	Open Cancel

Figure 7.8 Select Watershed File to Import From Browser

¥ ResSim Import	X	
Importing Watershed	Cancel	

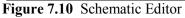
Figure 7.9 ResSim Import Window

- 5. The imported stream alignment, common computation points, reservoirs, and any available map layers from the HEC-ResSim model display in the HEC-WAT Schematic Map Window (Figure 7.11). For all of the map layers to appear, close the Schematic Map Window, from the message window click Yes. To re-open the Schematic Map Window, from the Study Tree, double-click on Schematic: Without Project Conditions, the Schematic Map Window will appear in the Desktop Area of the HEC-WAT main window (Figure 7.11).
- 6. The user has now completed the import of the RussianRiver HEC-ResSim model.

#### 7.4 Import an HEC-HMS Model

1. From the HEC-WAT main window (Figure 7.5), from the **File** menu, point to **Import**, and click **HMS**. The HEC-HMS application will open with the **Select Project File** browser already open (Figure 7.12).

X Schematic Edit	tor			×
Name: Withou Description:	ut Project Con	ditions		
Stream Alignment:	Stream Align	ment		
Maps: Measures:				
	Selected	Measure	Туре	Stream
Select All	<b>v</b>	Lake Sonoma	Reservoir	N/A
	Image: A start of the start	Lake Mendocino	Reservoir	N/A
		[	ОК	Cancel Apply



HEC-WAT - RussianRiver		
File Edit View Maps Compute Results	Tools Window Help	
🛯 🛎 🖬 📑 🏥 🚥 N 🎐 🔺	22 🕾 22 80 8 25 8 25 25 25 25 25 25 25 25 25 25 25 25 25	
RussianRiver *		•
A Without Project Conditions		
		•
	Map C:\Users\q0hecptb\Desktop\New_VAT_Study\RussianRiver\maps\RussianRivers.shp added to Schematic: Without Project Conditions	
	Map RussianRivers shp loaded. Map C: Users\q0hecptbDesktopNew_WAT_Study\RussianRiver\maps\RussianRiverSA shp added to Schematic: Without Project Conditions Map RussianRiverSA shp loaded. Map C: Users\q0hecptbDesktopNew_WAT_Study\RussianRiver\maps\RussianRiver\S shp added to Schematic: Without Project Conditions Map RussianRiverS, shp loaded. Map C: Users\q0hecptbDesktopNew_WAT_Study\RussianRiver\maps\RussianSins.shp added to Schematic: Without Project Conditions Map RussianSubbasins.shp loaded. Without Project Conditions swed successfully to C: Users\q0hecptbDesktopNew_WAT_Study\RussianRiver\Wathout_Project Conditions sch	
Study Maps Schematic	Messages	
Coordinates: -7042872 east, 6600031 north	109M of 321M	

Figure 7.11 HEC-WAT Schematic Map Window After HEC-ResSim Import

Figure 7.12 HEC-HMS Main Window and Select Project File Browser

- 2. Browse to the folder *RR\_Models*; double click on the *RR\_HMS\_Model* folder, select *Russian\_River.hms* and, then click **Select.**
- 3. When the HEC-WAT study is created an *hms* subfolder is created. In that subfolder are the default files that are generated when creating an HEC-HMS project. When the HEC-HMS import process finds that a project already exists, a warning window will appear (Figure 7.13). Click **Yes**, the warning window will close.

Replac	re Existing HEC-HMS Project
?	Project "RussianRiver" already exists in directory C:\Users\q0hecprb\Desktop\New_WAT_Study\RussianRiver\hms.
	Replace existing project with HMS project in "C:\Users\q0hecprb\Desktop\RussianRiver_Data\RR_Models\RR_HMS_Model\Russian_River.hms"?
	Yes No

Figure 7.13 HEC-HMS Warning Window about HEC-HMS Project

- 4. The import process begins (patience this could take a few seconds), the import is finished when the study pane in the HEC-HMS main window contains a study tree. From the HEC-HMS main window (Figure 7.12), from the **File** menu, click **Exit**.
- 5. The user has now completed the import of the RussianRiver HEC-HMS model.

#### 7.5 Import an HEC-RAS Model

1. From the HEC-WAT main window (Figure 7.5), from the File menu, point to Import, and click RAS. The Select RAS project to import from browser will open (Figure 7.14).

X Select RAS	project to im	port from	_	X
Look in:	RR_RAS_	Model	💌 🤌 📂	<b>.</b>
Recent Items	📄 RussianR	ver.prj		
Desktop				
My Docume				
Computer				
	File name:	RussianRiver.prj		Open
Network	Files of type:	RAS Project Files	-	Cancel

7.14 Select RAS project to import from Browser

- 2. Browse to the folder *RR\_Models*; double click on the *RR\_RAS\_Model* folder, select *RussianRiver.prj* and, then click **Open.**
- 3. The **Select RAS project to import from** browser will close (Figure 7.15). An **Importing** window (Figure 7.15) will open; when the HEC-RAS model import is complete this window will close.

Importing RAS	×	

Figure 7.15 HEC-RAS Importing Window

4. The user has now completed the import of the RussianRiver HEC-RAS model.

#### 7.6 Import an HEC-FIA Model

1. From the HEC-WAT main window (Figure 7.5), from the **File** menu, point to **Import**, and click **FIA**. The **Import Alternatives** dialog box will open (Figure 7.16).

Import Alternatives		X
Select/Add Project Please Select Your Alte	native For Each Project	
Project	Alternative	Progress
	Edit Alte	ernative Specifications
	Import Alternatives	Close

Figure 7.16 Import Alternatives Dialog Box

- 2. Click **Select/Add Project**, an **Open** browser will open (Figure 7.3). Browse to the folder *RR\_Models*; double click on the *RR\_FIA\_Model* folder, select *Russian\_River.prj* and, then click **Open.**
- 3. The table will now contain the name of the **Project** (*RussianRiver*). From the **Alternative** column (Figure 7.17), from the list, select the HEC-FIA alternative that will be imported (*GridsAndXSecsAlternative*).

Iternative For Each Project					
Project Alternative Progress					
GridsAndXSecsAlter	ſ <b>+</b>				
	Alternative				

Figure 7.17 HEC-FIA Import Alternative Table

- 4. Click Edit Alternative Specifications, the Alternative Specification dialog box will open. Select Copy Projection from project, and click OK.
- 5. Click **Import Alternatives**, in the **Progress** column of the table (Figure 7.17) the cell will display the progress of the import with a green bar. When the import is complete an **Information** window will open, click **OK**.
- 6. From the **Import Alternatives** dialog box (Figure 7.17) click **Close**. A *RussianRiver* HEC-FIA model alternative has been imported.

#### 7.7 Add Map Layers

Now that the base models are in the watershed lets add some map layers:

 From the HEC-WAT main window (Figure 7.5), from the Maps menu, click Add Map Layers, the Select Map to Add browser will open (Figure 7.18). Click Create Copy. Browse to the folder *RussianRiver\_Data*; double click on the *MapLayers* folder, select the following map layers:

X Select Map	to Add	×
Look in:	1 MapLayers	▼ 🤣 📂 🖽 -
Recent Items Desktop My Docume	Raingages_Albers_ft.shp         RR_commonComputationPoints.shp         RR_lmpactAreas.shp         RR_Lakes_Albers_ft.shp         RR_ReservoirFool.shp         RR_StreamAligment.shp         RussianRivers.shp         RussianSubbasins.shp         streetmaps.osm	Create Copy
Network	File name: "RR_CommonComputationPoints.shp" "RR_ImpactAreas.s Files of type: All Maps	shp" Open Cancel

Figure 7.18 Select Map to Add Browser

- Find the map layer which represents the impact areas RR\_ImpactAreas.shp
- Find the map layer which represents the CCPs *RR\_CommonComputationPoints.shp*
- 2. Click **Open**, the **Select Map to Add** browser will close (Figure 7.18). The HEC-WAT **Schematic Map Window** (Figure 7.19) will now display the added map layers.
- 3. The user can now make adjustments to the map layers. From the HEC-WAT main window (Figure 7.5), click the Maps tab. From the Map Layers tree:
  - Right-click on the Stream Alignment layer, from the shortcut menu, click Move to Top.
  - Right-click on the Without Project Conditions layer, from the shortcut menu, click Move to Top.
  - Un-check the *Raingages\_Albers\_ft.shp* map layer (this will cause the map layer to no longer display in the active map window).
  - Right-click on the *RR\_ImpactAreas.shp* map layer, from the shortcut menu, click **Properties**. The Edit **Polygon Properties** Editor will open (Figure 7.20). From the Fill tab, change the color to "lightgreen", click OK. The impact areas on the second content of the second

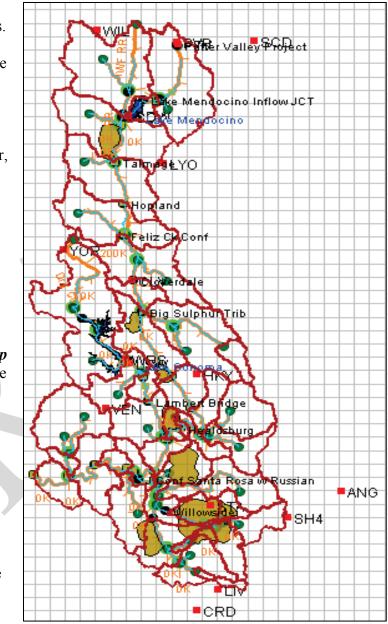


Figure 7.19 Map Layers Added to Watershed

active map window will now display in "lightgreen".

4. The user can adjust the view of the study area in the active map window. Using the **Magnifier Tool**, zoom the study area in the active map window to the appropriate area that the user would like displayed. From the HEC-WAT main window (Figure 7.5), from the **Maps** menu, click **Default Map Properties**, the **Default Map Properties for** dialog

¥ Edit Polygon Properties	×
WAT_Study/RussianRiver/maps/RR_Impac	tAreas.shp
Fill Border Labels	
Draw Features using:	
One Fill	• •
🔽 Display Fill	
Color lightgreen	
Style	
Transparency	
	25
OK Cancel	Apply
Figure 7.20 Edit Polygon Properties	Editor

box will open (Figure 7.21). Click Set Map Extents to Display, click OK. The Default Map Properties for dialog box will close.

Default Map Properties for RussianRiver					
Map Extents Default Map Layers					
Coordinate System: USA_Contiguous_Alb View Extents: Easting: Northing: Minimum: 399177.724 Min: 527787.249					
Maximum: 114412.865 Max: 156685.746					
Grow to Map Extents					
OK Cancel Apply					

Figure 7.21 Default Map Properties for Dialog Box

This sets the extents for the **Map Window** so that when the study is opened the next time the **Map Window** will be zoomed in to the tighter area.

#### 7.8 Create an Analysis Period

An HEC-WAT compute requires an HEC-WAT alternative, an analysis period, a program order, and model alternatives.

To create an analysis period:

1. From the HEC-WAT main window (Figure 7.5), from the **Study Tree**, right-click on the **Analysis Periods** folder (Figure 7.22). From the shortcut menu click **New**.

😂 RussianRiver				
- · · · · · · · · · · · · · · · · · · ·				
📄 🔺 Without Pro	oject C	Conditions		
🕀 🌗 Simulati	ions			
🖃 💑 Schem	atic:W	ithout Project Conditions		
🕀 퉲 Map	s			
🗄 🌗 Analysis Period		1		
Models	9	New		
- 🚮 FIA	$\mathbf{X}$	Delete from Study		
- KINS		,		
RAS				
ResSim				

Figure 7.22 Analysis Period Shortcut Menu

2. The **Create New Analysis Periods** dialog box will open (Figure 7.23). In the **Name** box enter a name (*RR\_Feb1986*). In the **Time Window** box enter the information required for the time window.

X Create N	ew Analysis	Periods	x	
Name:	RR_Feb1986	3		
Description:				
Time Windo	w			
Start Date:		13Feb1986 Start Time:	1400	
End Date:		21Feb1986 End Time:	1600	
Years in Tir	me Window:		1	
		ОК	Cancel	

Figure 7.23 Create New Analysis Periods Dialog Box

- 3. For the **Start Date** and **End Date**, enter in the format ddmmmyyyy. The **Start Time** and **End Time** should be entered as military time e.g. 0000, 0600, 1300 (1 p.m.), 2400 (midnight).
- 4. Click **OK**, the **Create New Analysis Periods** dialog box will close (Figure 7.23). On the HEC-WAT main window (Figure 7.6), from the **Study Pane**, under the **Analysis Periods** folder, the new analysis period name will appear.

#### 7.9 Setup Lookback Window – HEC-ResSim

The time window for an HEC-ResSim simulation has two parts, a "lookback period" and a "simulation or forecast period". The lookback period is used by HEC-ResSim to "warm up" a HEC-ResSim model alternative. During this period, routing of flows through the river and

reservoir network are performed but no release decisions are made nor are any mass balance computations evaluated. The user should think of the lookback period as the time to establish the state of the river network and the starting conditions of the reservoirs. The simulation period is the portion of the time window during which HEC-ResSim simulates reservoir operations, and makes release decisions based on the operation scheme defined by the user. Releases are then routed through the river network, combining with local inflows along the way.

Since HEC-WAT and most of the models treat the analysis period as a single, continuous time window, a setup step is required for each HEC-ResSim alternative in an HEC-WAT study. The setup step lets each HEC-ResSim model alternative know how much of the analysis period to use for the lookback period.

To setup the lookback period:

1. From the HEC-WAT main window (Figure 7.5), from the Edit menu, point to ResSim, click Lookback Window (Figure 7.24).

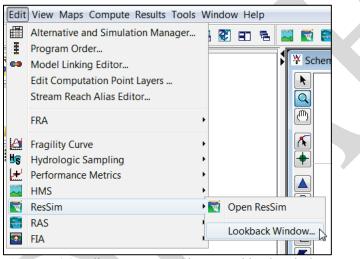


Figure 7.24 Edit Menu – ResSim – Lookback Window

2. The Lookback Window dialog box (Figure 7.25) will open.

¥ Lookback \	Window		X
Alternative	Description	TimeStep	Lookback Steps
calibrate		1 Hour	- 6
C:calibrate		5 Minutes	•
B:calibrate		10 Minutes	
		15 Minutes 30 Minutes	=
		1 Hour	
		2 Hour	
		3 Hour	
		4 Hour OK Car	Apply

Figure 7.25 Lookback Window Dialog Box

- 3. The table displays the HEC-ResSim alternatives that are available in the HEC-WAT study. Each alternative that is being used in an HEC-WAT simulation will need to have a lookback window set. For example, in Figure 7.25, the HEC-ResSim alternative *calibrate* has a **TimeStep** of 1 hour and **Lookback Steps** of 6.
- 4. The time step can be selected from the TimeStep column, in each cell there is a list of available time steps for the user to choose from. The selected time step has to match the time step that was specified for the HEC-ResSim alternative as part of the alternative's original run control data (which is located in the HEC-ResSim Alternative Editor). The number of lookback steps must be entered in a cell in the Lookback Steps column. At least one lookback time step is required for a HEC-ResSim alternative to compute, however more lookback steps may be needed, depending on a variety of factors in the HEC-ResSim alternative's operating scheme. The HEC-ResSim modeler should be consulted to determine the minimum lookback window needed by each alternative.
- 5. Click OK, a Missing Lookback Info window (Figure 7.26) will open. This message window is letting the user know that lookback information for the other HEC-ResSim alternatives have not been set. For this example, the user is only using the *calibrate* alternative, click OK. The Missing Lookback Info window (Figure 7.26) and the Lookback Window dialog box (Figure 7.25) will both close.

Missing	Lookback Info
1	The following ResSim alternatives do not have their lookback information set: calibrate C:calibrate B:calibrate
	ОК

Figure 7.26 Missing Lookback Info Window

## 7.10 Program Order

HEC-WAT allows for a flexible set of programs, computation order, and data flow through the establishment of a program order. Once a program order has been chosen for an HEC-WAT study, changes should not be made to the program order as this could cause a disruption in the flow of data and invalidate any existing work.

Currently in HEC-WAT Version 1.0 the default program order is - HMS, ResSim, RAS, FIA. This is the correct program order for the example watershed that is being used, so no adjustment is necessary. For further details on **Program Order**, review Chapter 11 (Section 11.1) of the HEC-WAT User's Manual.

## 7.11 Create an HEC-WAT Simulation

Now that all of the building blocks have been configured (alternative, analysis period, program order, models), the user can now create an HEC-WAT simulation. To create an HEC-WAT simulation:

- 1. From the HEC-WAT main window (Figure 7.5), from the **WAT Tools** toolbar, click the **Alternative and Simulation Manager** button **m**.
- 2. The **Alternative and Simulation Manager** will open (Figure 7.27). From this dialog box the user can create/modify alternatives, analysis periods, simulations, program orders, link models, and make runs.

X Alternative and Sim	ulation Manager	
File Edit View		
A 🤪 🧏 🗄 😁	<u>A</u>	
Alternatives	Analysis Periods	
Alternatives	RR_Feb1986	
Without Project Conditions	Create Simulation Create Simulation From	
Need to create a Simulation	OK Cancel Apply	Ť

Figure 7.27 Alternative and Simulation Manager

3. To create a simulation, from the table right-click on the intersection of an alternative and analysis period. From the shortcut menu click **Create Simulation**. The **Create New Simulation** dialog box will open (Figure 7.28).

	lame:		it Proje	ect Conditions-RR_Feb1986				
	Description							
Run FRA								
	Alternative: Witho			out Project Conditions				
	Analysis Period: RR_Feb1986							
	Program Order: Default							▼ New
F Part: Without Pr:RR_Feb1986								
	Models	Prog	ram	Alternative	Simulation Time Window		Time Window Adjustment	Needs To Compute
		HMS		Ҳ (RUN)Feb_1986 🔹		-	Edit	
		ResSim	ı	🛃 calibrate 🔹	Simulation Window	•	Edit	
		RAS		🔚 Base for Real Time forecasting 🔻	Simulation Window	-	Edit	
		FIA		GridsAndXSecsAlternative 🔹	Simulation Window	•	Edit	

Figure 7.28 Create New Simulation Dialog Box

- 4. HEC-WAT has defined a default name for the simulation (*Without Project Conditions-RR\_Feb1986*) in the **Name** box (Figure 7.28). The name is a combination of the HEC-WAT alternative name and analysis period name, where the intersection was in the table (name can be changed). Also, in the **Alternative** and **Analysis Period** lists (Figure 7.28) the selections have already been made based on the intersection in the table. The selected **Alternative** cannot be changed, but the selected **Analysis Period** can be changed.
- 5. The program order is *Default*.
- 6. In the **F Part** box (Figure 7.28), a default **F Part** is displayed that was generated by HEC-WAT based once again on the alternative and analysis period names. The user can edit the item, but it is not advised.
- 7. In the **Programs** table (Figure 7.28), the software applications that were defined in the program order appear in the order they were selected. Now the user must select the appropriate model alternatives (plan, run) for each software application. From the **Alternative** column, from the list for **HMS** (Figure 7.29), select the appropriate HMS model alternative (*(RUN)Feb\_1986*). Repeat the process for the other software applications. Below is the list of the appropriate model alternatives for the *RussianRiver* study:

HMS - (RUN)Feb\_1986 ResSim - calibrate RAS - Base for Real Time forecasting FIA – GridsAndXSecsAlternative

Models	Program	Alternative	Simulation	Time Window	Needs To
			Time Window	Adjustment	Compute
	HMS	🔀 (RUN)Feb_1986	Simulation Window 🖪	Edit	
	ResSim	🔽 calibrate 🔹	Simulation Window 🖪	Edit	
	RAS	🔚 Base for Real Time forecasting 🕚	Simulation Window 🖪	Edit	
	FIA	GridsAndXSecsAlternative	Simulation Window 🔹	Edit	

Figure 7.29 Selection of Model Alternatives - Create New Simulation Dialog Box

- 8. Now that all of the model alternatives have been selected, click **OK**. The **Create New Simulation** dialog box will close (Figure 7.29). On the **Alternative and Simulation Manager** (Figure 7.30), the intersection of an HEC-WAT alternative and analysis period now provides information about the simulation.
- 9. Click **OK**; the **Alternative and Simulation Manager** will close (Figure 7.30). From the HEC-WAT main window (Figure 7.5), the created simulation appears on the **Study Tree**, under the **Simulations** folder (Figure 7.31).
- 10. The **Content Pane** (Figure 7.32) displays information about the selected simulation.

X Alternative and Simulation Manager								
File Edit View								
🗛 😳 大   🧵 👄   🦣								
Alternatives	Analysis Periods							
Alternatives		RR_Feb1986						
	HMS	(RUN)Feb 1986						
Without Project Conditions	ResSim	calibrate						
without Project Conditions	RAS	Base for Real Time forecasting						
	FIA	GridsAndXSecsAlternative						
		OK Cancel A	Apply					



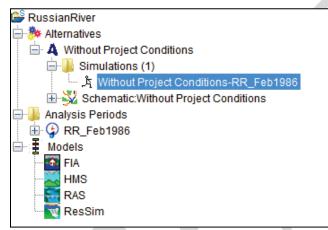


Figure 7.31 Study Tree with Created Simulation

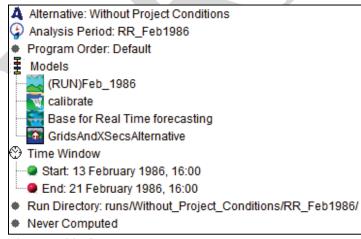


Figure 7.32 Content Pane

11. Double click on the simulation name (*Without Project Conditions-RR\_Feb1986*), a Select Map dialog box will open. Click New Map Window, click OK. The Select Map dialog box will close. The new map window will contain the schematic elements that represent the simulation (Figure 7.33).

¥ HEC-WAT - RussianRiver	
File Edit View Maps Compute Results Tools Wind	low Help
🛎 🔄 🖬 🗐 🕶 N 🅞 🔺 🗷 🖷 🕯	2 ED 🗣 🔤 🗑 🗃
RussianRiver *	Simulation: Without Project Conditions-RR_Feb1986  Iternatives Without Project Conditions  Simulations  Simulations  Simulations  Simulations  Simulations  The operation of th
	set of the
<	Without Project Conditions saved successfully to C:Users\q0hecprb/Desktop/Wew_WAT_Study/RussianRiver/Without_Project_Conditions.sch Without Project Conditions saved successfully to C:Users\q0hecprb/Desktop/Wew_WAT_Study/RussianRiver/Without_Project_Conditions.sch Plugin HEC-SSP failed to save its Project. Study RussianRiver saved.
Study Maps Schematic	Messages Simulation Map Errors ×
Coordinates: -13930451 east, 4671593 north	464M of 763/M

Figure 7.33 Map Window - Schematic of Current HEC-WAT Simulation

# 7.12 Linking

The next step is to have the models of a simulation communicate with each other. This is accomplished by linking (DSS mapping) the models thru DSS and using a simulation name. From HEC-WAT, the **Model Linking Editor** (Figure 7.34) provides an easy way to link models including observed data, and provides a mechanism where the linking will have to be done once per alternative.

ile Edit Vie					
Simulation:	Without Project Condit	ions-RR_Feb1986			( I
lodel To Link: Default Mode	l To Link:				
Doldan mode	Location	Parameter	Input From Model	Location/Parameter	Dynamically Linked
			I		

Figure 7.34 Model Linking Editor

- 1. From the HEC-WAT main window (Figure 7.33), from the **WAT Tools** toolbar, click the **Model Linking Editor** button •••.
- 2. The **Model Linking Editor** will open (Figure 7.34). From the **Simulation** list the user will need to select a simulation. For this example the user will be selecting the *Without Project Conditions-RR\_Feb1986* (default) simulation.
- 3. Now let's link the individual model alternatives that are part of the selected simulation.

# 7.12.1 Linking the HMS Model Alternative

 From the Model Linking Editor, from the Model to Link list select *HMS-*(*RUN*)*FEB\_1986* (Figure 7.34). The Model Linking Editor table (Figure 7.35) will now contain all of the locations for the HMS model alternative.

Y Model Lin	-									
File Edit Vie	W									
🖬 🚳 🎺										
Simulation: Without Project Conditions-RR_Feb1986										
Default Model To Link:										
Lo	ocation	Parameter	Input From Model	Location/Parameter	Dynamically Linked					
GageInterp		Precipitation	DSS File 🔻	precip_Russian.dss:/SHG/RUSSIAN/PRECIP/13		1				
EF RUSSIAN at	t CALPELLA 1d	Flow	DSS File 🗸	FlowData.dss:/EF RUSSIAN R/CALPELLA CA/FL						
Coyote		Flow	DSS File 🗸	FlowData.dss:/EF RUSSIAN/COYOTE, NR UKIAH						
RUSSIAN at UP	KIAH 1d	Flow	DSS File 🗸	FlowData.dss:/RUSSIAN R/UKIAH CA/FLOW/01J						
RUSSIAN at HO	DPLAND_1d	Flow	DSS File 🗸	FlowData.dss:/RUSSIAN R/HOPLAND CA/FLOW/						
RUSSIAN AT C	LOVERDALE_1d	Flow	DSS File 🗸 🔻	FlowData.dss:/RUSSIAN R/CLOVERDALE CA/FL						
RUSSIAN at GE	EYSERVILLE_1d	Flow	DSS File 🗸 🔻	FlowData.dss:/DRY C BL WARM SPRINGS DAM/						
RUSSIAN at HE	EALDSBURG_1d	Flow	DSS File 🔹	FlowData.dss:/RUSSIAN R/HEALDSBURG CA/F						
DRY C at GEYS	BERVILLE	Flow	DSS File 🔹	FlowData.dss:/DRY CR/NR GEYSERVILLE/FLO						
RUSSIAN at GU	JERNEVILLE_1d	Flow	DSS File 🔻	FlowData.dss:/RUSSIAN R/GUERNEVILLE CA/F						
Dynamicall	Select Source Data									

Figure 7.35 Model Linking Editor – HMS Model Alternative

- 2. Since HEC-HMS wants precipitation and flow data that is not provided by another software application, HEC-WAT reads the linking from the HMS model alternative and displays that linking in the **Model Linking Editor** table (Figure 7.35).
- 3. The table displays the linking from a DSS file for the HMS model alternative which is the correct linking.

#### 7.12.2 Linking the ResSim Model Alternative

1. From the **Model Linking Editor**, from the **Model to Link** list select *ResSim-calibrate* (Figure 7.35). The **Model Linking Editor** table (Figure 7.36) will now contain all of the locations for the ResSim model alternative that need to be linked.

X Model Linking Editor									
File Edit View									
	onditions-RR_Feb1	986							
Model To Link: 📉 ResSim-calib	rate								
Default Model To Link:									
Location	Parameter	Input From Model	Location/Parameter	Dynamically Linked					
WF Russian	Known Flow	HMS-(RUN)Feb_1986 -	Ukiah - Flow	•					
Russian 10	Known Flow	HMS-(RUN)Feb_1986 -	Lake Mendocino - Flow	<b>•</b>					
Austin Ck Local	Known Flow	HMS-(RUN)Feb_1986 -	Austin Ck Loc - Flow	<b>•</b>					
Guerneville Local (Russian 20)	Known Flow	HMS-(RUN)Feb_1986 -	Hacienda Loc - Flow	<b>-</b>					
Green Valley	Known Flow	HMS-(RUN)Feb_1986 -	Green Valley - Flow	<b>-</b>					
Santa Rosa Cr	Known Flow	HMS-(RUN)Feb_1986 -	Mirabel Heights-Mirabel Park - Flow	<b>-</b>					
Dry Creek Local	Known Flow	HMS-(RUN)Feb_1986 -	Dry Ck Lower - Flow	<b>•</b>					
Geyserville Dry Creek Local	Known Flow	HMS-(RUN)Feb_1986 -	Yoakim Loc - Flow	<b>•</b>					
Lake Sonoma Inflow	Known Flow	HMS-(RUN)Feb_1986 -	Lake Sonoma - Flow	<b>•</b>					
Healdsburg Local	Known Flow	HMS-(RUN)Feb_1986 -	Healdsburg Loc - Flow	<b>•</b>					
Geyserville Local	Known Flow	HMS-(RUN)Feb_1986 -	Geyserville Loc - Flow	<b>-</b>					
Dia Sulabur Cr	Known Flow	UMQ (DUNI)EAN 1006 -	Dia Sulabur Ck. Elow	-					
	Linked In Differ	Select Source Data	a						
Dynamically Linked Locations	Linked in Dille	enconnulation							

Figure 7.36 Model Linking Editor – ResSim Model Alternative

2. The current linking (Figure 7.37) that is displayed for the ResSim model alternative is correct, so the linking does not need to be done.

#### 7.12.3 Linking the RAS Model Alternative

1. From the **Modeling Linking Editor**, from the **Model to Link** list select *RAS-Base for Real Time forecasting* (Figure 7.36). The **Model Linking Editor** table (Figure 7.37) contains all of the locations for the RAS model alternative that need to be linked. The current linking (Figure 7.37) that is displayed is the HEC-RAS linking for the standalone model.

File Edit View				
Simulation: Without Project Conditions-RR_Feb1986				▼ ◀
Model To Link: 🔚 RAS-Base for Real Time forecasting				▼ ◀
Default Model To Link:				
Location	Parameter	Input From Model	Location/Parameter	Dynamically Linked
SA: 365	Flow	DSS File 🗸	forecast.dss://Ukiah/FLOW//15MIN/C:00	
SA: 923	Flow	DSS File 🗸	forecast.dss://Ducans Mills/FLOW//15MI	
SA: 928	Flow	DSS File 🗸	forecast.dss://Green Valley/FLOW//15MI	
SA: 929	Flow	DSS File 🗸	forecast.dss://Mirabel Heights-Mirabel P	
DryCreek DryCreek RS 58953.5	Flow	DSS File 🔻	forecast.dss://Yoakim Loc/FLOW//15MI	
DryCreek DryCreek RS 37302.09	Flow	DSS File 🔻	forecast.dss://Lambert Loc/FLOW//15MI	
DryCreek DryCreek RS 3499	Flow	DSS File 🗸	forecast.dss://Dry Ck Lower/FLOW//15M	
Russian CoyoteToDC RS 527387.7 (Lake Mendocino O)	Flow	DSS File 🔻	forecast.dss://Lake Mendocino-Pool/Flo	
Russian CoyoteToDC RS 418492.2	Flow	DSS File 🗸	forecast.dss://Feliz Ck/FLOW//15MIN/C:	
Russian CoyoteToDC RS 348180.3	Flow	DSS File 🗸	forecast.dss://Oat Valley Ck/FLOW//15MI	
Russian CoyoteToDC RS 347412.9	Flow	DSS File 🔻	forecast.dss://Big Sulphur Ck/FLOW//15	
Puesian CovataTaDC PS 250290.6	Flow		forecast des://limtownLac/ELOW//15MI	
	Select Sour	ce Data		

Figure 7.37 Model Linking Editor - RAS Model Alternative Unlinked

- 2. RAS model alternative linking will be the results from the HMS and ResSim model alternatives.
- From the Model Linking Editor (Figure 7.37), click Default Model to Link. The Select Default Model to Link dialog box will open (Figure 7.38). From the Default Model to Link list, select *HMS-(RUN)Feb\_1986*. Click OK, the Select Default Model to Link dialog box will close (Figure 7.38).

X Select Default N	lodel To L	ink X					
Default Model To Link: HMS-(RUN)Feb_1986 🔻							
	ОК	Cancel					

Figure 7.38 Select Default Model to Link Dialog Box

4. A Confirm Input from the "Input From Model" changing to window (Figure 7.39) will appear. Basically the window is asking the user to be sure before proceeding, click **Yes**. The Confirm Input from the "Input From Model" changing to window closes, and the Model Linking Editor now displays the linking for the RAS model alternative (Figure 7.40).

Confirm Input From Model changing to HMS-(RUN)Feb_1986
This will override the "Input From Model" column with HMS-(RUN)Feb_1986 in rows where the entry is "DSS File", and also in rows where the Location/Parameter entry is empty Are you sure?           Yes         No

Figure 7.39 Confirm Input from Model changing to Window

ile Edit View		Č.			
Simulation: Without Project Conditions-RR_Feb1986				━ ◀	וה
Nodel To Link: 📑 RAS-Base for Real Time forecasting				I	ה ח ה
					JU
Default Model To Link:					
Location	Parameter	Input From Model	Location/Parameter	Dynamically	6
				Linked	
SA: 365	Flow	HMS-(RUN)Feb_1986	Ukiah - Flow 🔻		
SA: 923	Flow	HMS-(RUN)Feb_1986	Ducans Mills - Flow 🔻		
SA: 928	Flow	HMS-(RUN)Feb_1986	Green Valley - Flow 🔻		
SA: 929	Flow	HMS-(RUN)Feb_1986	Mirabel Heights-Mirabel Park - Flow 🔻		
DryCreek DryCreek RS 58953.5	Flow	HMS-(RUN)Feb_1986	Yoakim Loc - Flow 🔻		
DryCreek DryCreek RS 37302.09	Flow	HMS-(RUN)Feb_1986	Lambert Loc - Flow 🔻		
DryCreek DryCreek RS 3499	Flow	HMS-(RUN)Feb_1986	Dry Ck Lower - Flow 🔻		
Russian CoyoteToDC RS 527387.7 (Lake Mendocino O)	Flow	HMS-(RUN)Feb_1986	Lake Mendocino - Flow 🔻		
Russian CoyoteToDC RS 418492.2	Flow	HMS-(RUN)Feb_1986	Feliz Ck - Flow 🔻		
Russian CoyoteToDC RS 348180.3	Flow	HMS-(RUN)Feb_1986	Oat Valley Ck - Flow 🔻		
Russian CoyoteToDC RS 347412.9	Flow	HMS-(RUN)Feb_1986	Big Sulphur Ck - Flow 🔻		
Puccian CovataTaDC DQ 250200.6	Flow	LIMO (DUNIEAN 1006	limtown Loc Flow	1	

Figure 7.40 Model Linking Editor - RAS Model Alternative Linking to an HMS Model Alternative

- 5. There are two locations in the RAS linking that need to be linked to the ResSim model alternative. From the Model Linking Editor table (Figure 7.40) for the DryCreek DryCreek RS 74716.8 (Sonoma Outflow J) row, from the Input Model column (Figure 7.40), select ResSim-calibrate. HEC-WAT tries to find a match, Lake Sonoma-Pool Outflow. From the Location/Parameter column list, select Lake Sonoma Outflow JCT Flow.
- 6. Repeat Step 5 for the *Russian CoyoteToDC RS 527387.7 (Lake Mendocino O)* row (*Lake Mendocino-Pool Outflow*) from the **Location/Parameter** column list, select *Lake Mendocino Outflow JCT Flow*.
- 7. Refer to the printout (*RussianRiverLinking.pdf*; located in a folder titled *RussianRiver\_Data*) for the linking for each of the model alternatives. Once the linking is finished for the RAS model alternative, from the **Model Linking Editor** (Figure 7.41) click , this will save the linking.

File Edit View					
🖬 🖨 🥠					
					а с
Simulation: Without Project Conditions-RR_Feb1986				▼ ◀	IJU
Model To Link: 🔚 RAS-Base for Real Time forecasting				━━ ◀	ן ה
Default Model To Link:					
Location	Parameter	Input From Model	Location/Parameter	Dynamically Linked	<
SA: 365	Flow	HMS-(RUN)Feb_1986	Ukiah - Flow	▼	
SA: 923	Flow	HMS-(RUN)Feb_1986 -	Ducans Mills - Flow	-	
SA: 928	Flow	HMS-(RUN)Feb_1986	Green Valley - Flow	-	
SA: 929	Flow	HMS-(RUN)Feb_1986 -	Mirabel Heights-Mirabel Park - Flow	-	
DryCreek DryCreek RS 58953.5	Flow	HMS-(RUN)Feb_1986	Yoakim Loc - Flow	-	
DryCreek DryCreek RS 37302.09	Flow	HMS-(RUN)Feb_1986 -	Lambert Loc - Flow	-	ŀ
DryCreek DryCreek RS 3499	Flow	HMS-(RUN)Feb_1986 -	Dry Ck Lower - Flow	-	
Russian CoyoteToDC RS 527387.7 (Lake Mendocino O)	Flow	ResSim-calibrate 🔹	Lake Mendocino Outflow JCT - Flow	-	
Russian CoyoteToDC RS 418492.2	Flow	HMS-(RUN)Feb_1986 -	Feliz Ck - Flow	-	
Russian CoyoteToDC RS 348180.3	Flow	HMS-(RUN)Feb_1986 -	Oat Valley Ck - Flow	-	٦
Russian CoyoteToDC RS 347412.9	Flow	HMS-(RUN)Feb_1986	Big Sulphur Ck - Flow	-	
Ruccian CovataTaDC RS 250200.6	Flow	LUMO / DUINIEAN 1006	Limtown Loc Flow	-	
	Select So	urce Data			

Figure 7.41 Model Linking Editor - Completed RAS Model Alternative Linking

8. That completes the linking for the RAS model alternative.

# 7.12.4 Linking the FIA Model Alternative

- 1. From the **Model Lining Editor**, from the **Model to Link** list select *FIA-GridsAndXSecsAlternative* (Figure 7.41). The **Model Linking Editor** table (Figure 7.42) will now contain all of the locations for the FIA model alternative that need to be linked.
- 2. For the FIA model alternative, the linking will be results from the RAS model alternative.
- 3. From the **Model Linking Editor** (Figure 7.42), click **Default Model to Link**. The **Select Default Model to Link** dialog box will open (Figure 7.38). From the **Default**

Y Model Linking Editor					X
File Edit View					
🖬 🖨 🥠					
Simulation: Without Project Conditions-RR	Feb1086			▼ ◀	₽
					5
Model To Link: FIA-GridsAndXSecsAlternati	ve			▼ ◀	₽
Default Model To Link:					
Location	Parameter	Input From Model	Location/Parameter	Dynamically Linked	Q
DryCreek DryCreek 74716.8	STAGE	<b>_</b>	*		
DryCreek DryCreek 74403	STAGE	<b>•</b>	*		Ξ
DryCreek DryCreek 74016.5	STAGE	<b>•</b>	<b>.</b>		
DryCreek DryCreek 73802.3	STAGE	<b>•</b>	*		1
DryCreek DryCreek 73608.59	STAGE	<b>•</b>	*		1
DryCreek DryCreek 73461*	STAGE	<b>•</b>	*		1
DryCreek DryCreek 73314.5	STAGE	<b>•</b>	*		1
DryCreek DryCreek 73158*	STAGE	•	*		1
DryCreek DryCreek 73002.8	STAGE	<b>*</b>	*		1
DryCreek DryCreek 72747.59	STAGE	-	*		1
DryCreek DryCreek 72399.5	STAGE		*		1
DryCrook DryCrook 71097 2	RTACE				
Dynamically Linked Locations	Select Sour	ce Data			

Figure 7.42 Model Linking Editor - FIA Model Alternative Unlinked

Model to Link list, select *RAS-Base for Real Time forecasting*. Click **OK**, the **Select Default Model to Link** dialog box will close (Figure 7.38).

4. A Confirm Input from the "Input From Model" changing to window (Figure 7.39) will appear. Basically the window is asking the user to be sure before proceeding, click Yes. The Confirm Input from the "Input From Model" changing to window closes, and the Model Linking Editor now displays the linking for the RAS model alternative (Figure 7.43).

File Edit View	N				
Simulation:	Without Project Condition	DR DR Fab10	06		_
onnulation.	without Project Condition	IS-RR_FEDIS	80		▼
Model To Link:	FIA-GridsAndXSecsA	Iternative			▼
Default Mode	To Link:				
	Location	Parameter	Input From Model	Location/Parameter	Dynamically Linked
DryCreek DryCr	eek 74716.8	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 34616.8 - Stage	-
DryCreek DryCr	eek 74403	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 74403 - Stage	-
DryCreek DryCr	eek 74016.5	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 74016.5 - Stage	-
DryCreek DryCr	eek 73802.3	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 73802.3 - Stage	-
DryCreek DryCr	eek 73608.59	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 73608.59 - Stage	-
DryCreek DryCr	eek 73461*	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 73461* - Stage	-
DryCreek DryCr	eek 73314.5	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 73314.5 - Stage	-
DryCreek DryCr	eek 73158*	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 73158* - Stage	-
DryCreek DryCr	eek 73002.8	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 73002.8 - Stage	-
DryCreek DryCr	eek 72747.59	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 72747.59 - Stage	-
DryCreek DryCr	eek 72399.5	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 72399.5 - Stage	-
DryCrook DryCr	nak 71007 2	QTACE	PAS Pace for Peal Time forecasting -	DerCrook DerCrook 71097 2 Stage	
			Select Source Data		

Figure 7.43 Model Linking Editor - FIA Model Alternative Linking to RAS Model Alternative

- 5. The user will need to adjust two rows for the FIA linking; HEC-WAT did not choose the correct locations. In Figure 7.43, for the first row (*DryCreek DryCreek 74716.8*), change the Location/Parameter column to *DryCreek Dry Creek 74716.8* (Sonoma Outflow J) Stage. Repeat for the row Russian CoyoteToDC 527387.7 and change the Location/Parameter column to Russian CoyoteToDC 527387.7 (Lake Mendocino O) Stage.
- 6. Refer to the printout (*RussianRiverLinking.pdf*; located in a folder titled *RussianRiver\_Data*) for the linking for each of the model alternatives. Once the linking is finished for the RAS model alternative, from the **Model Linking Editor** (Figure 7.44) click , this will save the linking.
- 7. That completes the linking for the FIA model alternative.

X Model Linking Editor*				
File Edit View				
8 4				
Simulation: Without Project Cond	ditions-RR_Feb198	36		
Model To Link: Model To Link: FIA-GridsAndXS	ecsAlternative			
Default Model To Link:				
Location	Parameter	Input From Model	Location/Parameter	Dynamically Linked
DryCreek DryCreek 74716.8	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 34616.8 - Stage	•
DryCreek DryCreek 74403	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 74403 - Stage	•
DryCreek DryCreek 74016.5	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 74016.5 - Stage	<b>•</b>
DryCreek DryCreek 73802.3	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 73802.3 - Stage	•
DryCreek DryCreek 73608.59	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 73608.59 - Stage	•
DryCreek DryCreek 73461*	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 73461* - Stage	•
DryCreek DryCreek 73314.5	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 73314.5 - Stage	•
DryCreek DryCreek 73158*	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 73158* - Stage	•
DryCreek DryCreek 73002.8	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 73002.8 - Stage	•
DryCreek DryCreek 72747.59	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 72747.59 - Stage	•
DryCreek DryCreek 72399.5	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 72399.5 - Stage	•
DerCrook DerCrook 71097 2	STACE	PAS Base for Peal Time forecasting 📼	Dr/Crook Dr/Crook 71097 2 Stago	-
		Select Source Data		
Dynamically Linked Locations	Linked In Differe	nt Simulation		

Figure 7.44 Model Linking Editor – Completed FIA Model Alternative Linking

# 7.13 Compute and Results

Now that a simulation has been defined, the linking of model alternatives has been completed for the simulations, and model alternatives have been imported into HEC-WAT, the user is now ready to compute the Russian River watershed.

- From the HEC-WAT main window (Figure 7.45), from the Study Tree, from the Simulations folder, right-click Without Project Conditions-RR\_Feb1986. From the shortcut menu (Figure 7.45) point to Compute, hold down the Ctrl key, click Simulation.
- 2. The **Compute Progress** dialog box will open (Figure 7.46). The compute for the Russian River study takes about 20 minutes.

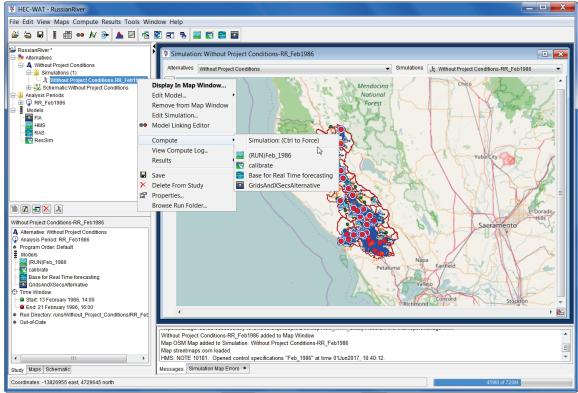


Figure 7.45 HEC-WAT Main Window - Compute

3. When the compute is finished, click **Close**, the **Compute Progress** dialog box will close (Figure 7.46).

Compute Progress - Without Project Conditions-RR_Feb1986	×
Run Time Window for ResSim-calibrate is Start Time 13 February 1986, 14:00 End Time: 16:00 Lookback for calibrate set to 12 Hours Compute Directory now C:\Users\q0hecprb\Desktop\New_WAT_Study\RussianRiverYuns\Without_Project_Condit ResSim Runtime Window: Lookback time:13Feb1986 1400 Civit for 415-6100	
Start time:14Feb1986 0200 End time:21Feb1986 1600 Computing ResSim alternative calibrate Copying ResSim alternative files to simulation Extracting DSS data Copying DSS data to Simulation DSS file Copying Network to compute area	III
•	•
Computing calibrate	
100%	
Overall	
Cancel	

Figure 7.46 Compute Progress Dialog Box

# **Chapter 8**

# Create an HEC-WAT Study from a CWMS Watershed

If the HEC-WAT study the user is building already has been built in the Corps Water Management System (CWMS) software, an HEC-WAT study can be created from the CWMS watershed. For the *Russian River* example, the user can create an HEC-WAT study by importing the available CWMS watershed.

## 8.1 Create an HEC-WAT Study

To create a new study:

1. From the HEC-WAT main window (Figure 8.1), on the **File** menu, click **New Study**. The **Create New Study** dialog box (Figure 8.2) will open.

HEC-WAT - No Study		
File Edit View Maps Compute Results Tools V	/indow Help	
≝ 늘 ⊟ ፤ @ ⊷ ∧ ⋺ 🔺 🗷 🕈		
Taŭ No Sludy		
		1
	Display fund System set to English Plugin HKS loaded Plugin HKS loaded Stating Plugin Server for ressim RAS Plugin Server for tasted Plugin FIX loaded Stating Plugin Server for fa Stating Plugin Server for fa	
Study Maps Schematic	Messages	
		34M of 193M

Figure 8.1 HEC-WAT Main Window

2. In the **Study Name** box (Figure 8.2), enter a name (*RussianRiver*), and in the **Description** box, enter a description (*Russian River water resources study*) for the new study.

🔆 Create New Stu	ıdy	X
Study Name: Description:		
Directory: Unit System:	C:\Users\xxxxxxxx\Desktop\New_WAT_Study\	
Coordinate System: Edit Edit  Create Default Alternative Add Map Layers		
Select Default Alternative Name © Existing Conditions		
<ul> <li>Without Project Conditions</li> <li>Alternative 1</li> </ul>		
Other:		OK Cancel

Figure 8.2 Create New Study Dialog Box

3. In the **Directory** box (Figure 8.1), either enter the name of the directory where the HEC-WAT study will be stored, or click , and an **Open** browser (Figure 8.3) will open. Navigate to the directory where the HEC-WAT study will be stored, click **Open**. The **Open** browser (Figure 8.3) will close. On the **Create New Study** dialog box (Figure 8.2) in the **Directory** box the location will display.

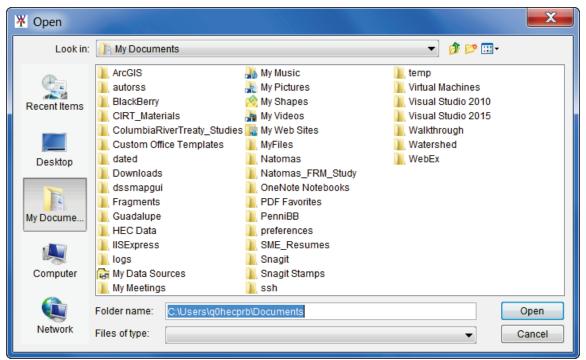


Figure 8.3 Open Browser

- 4. The **Unit System** (Figure 8.2) for the study defaults to **English** (which is correct for the *RussianRiver* study). The other choice from the list is **SI** (metric).
- 5. Next, the projected coordinate system of the study needs to be set. From the **Create New Study** dialog Box (Figure 8.2), click **Edit** (by the **Coordinate System** box), the **Map Coordinate Information** dialog box will open (Figure 8.4).

Map Coordinate Information			
Map Coordinate Information			
System: Well Known Text 👻			
PROJCS["USA_Contiguous_Albers_Equal_Area_Conic_USGS_versiv GEOGCS["GCS_North_American_1983", DATUM["D_North_American_1983", SPHEROID["GRS_1980", 6378137.0, 298.257222101]], PRIMEM["Greenwich", 0.0], UNIT["degree", 0.017453292519943295], AXIS["Longitude", EAST], AXIS["Latitude", NORTH]], PROJECTION["Albers_Conic_Equal_Area"], PARAMETER["central_meridian", -96.0], PARAMETER["central_meridian", -96.0], PARAMETER["latitude_of_origin", 23.0], PARAMETER["standard_parallel_1", 29.5], PARAMETER["false_easting", 0.0], PARAMETER["false_northing", 0.0], PARAMETER["standard_parallel_2", 45.5], UNIT["foot_survey_us", 0.3048006096012192], AXIS["X", EAST], AXIS["Y", NORTH]]			
4 111			
Load from file OK Cancel			

Figure 8.4 Map Coordinate Information Dialog Box with Study Projection Information

- 6. For the *RussianRiver* study, the associated map layers have the correct projected coordinate system. So, use one of those map layers to set the projected coordinate system for the study. From the **Map Coordinate Information** dialog box (Figure 8.4), click **Load from file** (lower left corner of dialog box); an **Open** browser (Figure 8.3) will open. The map layers for the *RussianRiver* study are located in a folder titled *RussianRiver\_Data* (double-click). In that folder, is a *MapLayers* (double-click) folder, from that folder, click on *RR\_StreamAlignment.prj* (any of the map layers will work). Click **Open**, now the **Map Coordinate Information** dialog box will contain information about the projected coordinate system (Figure 8.4). Click **OK**, the **Map Coordinate Information** dialog box will contain information about the projected coordinate system (Figure 8.4). Now on the **Create New Study** dialog box the **Coordinate System** box (Figure 8.2) contains the name of the projected coordinate system (i.e., *USA\_Continguous\_Albers\_Equal\_Area\_Conic\_USGS\_version*) for the study.
- Click OK; the Create New Study dialog box will close (Figure 8.1). The HEC-WAT main window will now have the name of the study (*RussianRiver*) on the title bar (Figure 8.5). A blank Schematic Map Window opens.

HEC-WAT - RussianRiver		x
File Edit View Maps Compute Result	Its Tools Window Help	
😂 🖬 🖬 🗐 🕶 N 🎐 /	🔺 🖾 📲 🕾 🔛 🥦 🔛 🗱 🔛 🧱 🖬	
RussianRiver *	Schematic: Without Project Conditions	
Alternatives		^
		Ŧ
	•	
	Project Loaded for RAS	
No Additional Content	Plugin ResSim created RussianRiver Project Loaded for ResSim Plugin FIA created RussianRiver Project Loaded for FIA	
	Puign HECSSP failed to save its Project. Study RussianRiver saved. Puign HECSSP failed to save its Project.	=
Study Maps Schematic	Stream Alignment added to Map Window Messages	~
Coordinates: 737 east, -983 north	112M of 2 <mark>18M</mark>	

Figure 8.5 HEC-WAT Main Window - RussianRiver Study

#### 8.2 Import a CWMS Watershed

To import a CWMS watershed:

1. From the File menu, point to Import, click CWMS Watershed. The Import CWMS Watershed dialog box will open (Figure 8.6).

X Import CWMS Wat	tershed	<b>—</b> X	
CWMS Watershed File:		(	)
Import Progress			
			_
Success	Watershed Component	# Model Alternatives Imported	
	I	1	
		Close	

Figure 8.6 Import CWMS Watershed Dialog Box

 Now select the RussianRiver CWMS watershed file. From the CWMS Watershed File box, click , and the Select Workspace File browser (Figure 8.7) will open. Browse to the directory (C \Desktop\RussianRiver\_Data\CWMS\_Watershed/RussianRiver) and select RussianRiver.wtrshd. Click Import, the Select Workspace File browser will close (Figure 8.7).

X Select Worl	kspace File		×
Look in:	<u>]</u> RussianR	iver 👻 🍺 📂 🛄 -	
Recent Items	L autorss Cavi dssmapgu	📗 supplemental	
Desktop	hms hms_old layouts maps	<b>I</b> RussianRiver.wtrshd	
My Docume	MetVue mfp ras reports		
Computer	riverware rrlayers rss runs		
Network	File name: Files of type:	RussianRiver.wtrshd 3.x Workspace Files	Import Cancel

Figure 8.7 Select Workspace File Browser

3. A Continue Import? window will open (Figure 8.8). This window is warning the user that the import process will overwrite any existing data in the watershed. Click Yes, the Continue Import? window will close (Figure 8.8)

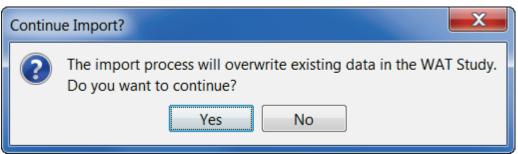


Figure 8.8 Continue Import? Window

4. The Import CWMS Watershed dialog box (Figure 8.9) will now display the name of the CWMS watershed file in the CWMS Watershed File box (Figure 8.9). As the import proceeds, the Import Progress box on the Import CWMS Watershed dialog box (Figure 8.9) will display what is happening during the import. The table on the Import CWMS Watershed dialog box (Figure 8.9) will display which CWMS watershed components have finished, whether the import was successful or not, and the number of model alternatives that were imported.

¥ Import CWMS Watershed				
CWMS Watershed File:	RussianRiver_Data\CWMS_Watershed\RussianRiver\RussianRiver.wtrst			
Import Progress				
Importing RAS			•	
RAS import complete				
Importing FIA				
FIA import complete				
Updating Maps			E	
Adding 9 Maps to watershed				
Done updating maps. Saving watershed			Ŧ	
•	111		4	
Success	Watershed Component	# Model Alte	ernatives Imported	
$\checkmark$	ResSim		3	
<b>↓</b>	HMS		4	
<b>↓</b>	RAS		4	
¥	FIA		1	
¥	Maps			
			Close	

Figure 8.9 Importing RussianRiver CWMS Watershed

5. When the HEC-WAT study is created an *hms* subfolder is created. In that subfolder are the default files that are generated when creating an HEC-HMS project. When the HEC-HMS import process finds that a project already exists, a warning window will appear (Figure 8.10; this warning window can open behind the HEC-WAT main window). Click **Yes**, the warning window will close.

Replace	e Existing HEC-HMS Project
?	Project "RussianRiver" already exists in directory C:\Users\q0hecprb\Desktop\New_WAT_Study\RussianRiver\hms.
	Replace existing project with HMS project in "C:\Users\q0hecprb\Desktop\RussianRiver_Data\CWMS_Watershed\RussianRiver\hms\Russian_River.hms"?
	<u>Y</u> es <u>N</u> o

Figure 8.10 HEC-HMS Warning Window about HEC-HMS Project

6. If the HEC-HMS model was created using Version 4.0/4.1, a Convert HEC-HMS Project window (Figure 8.11) will open. This window is letting the user know that the HEC-HMS model will be converted to a Version 4.2 HEC-HMS model. Click Convert Project, the Convert HEC-HMS Project window (Figure 8.11) will close, and the import of the watershed will continue.

Convert	t HEC-HMS Project	x
?	The selected project is from HEC-HMS Version 4.0 and will be converted to Version You will not be able to use the project in HEC-HMS Version 4.0 after conversion. Do you wish to convert the project?	4.1.
-	Convert Project Cancel	

Figure 8.11 Convert HEC-HMS Project Window

7. Once the import process is finished from the **Import CWMS Watershed** dialog box (Figure 8.9) click **Close**. The **Import CWMS Watershed** dialog box (Figure 8.9) will close, and the HEC-WAT main window (Figure 8.12) will display the map layers and the stream alignment of the imported CWMS watershed.

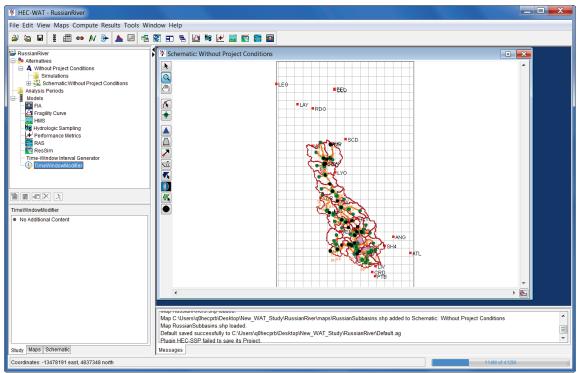


Figure 8.12 HEC-WAT Main Window - RussianRiver Study - Map Layers & Stream Alignment

7. From the File menu, click Save Study.

#### 8.3 Adjust Schematic - Reservoir Displays

The reservoir elements from the HEC-ResSim model, do not automatically display on the HEC-WAT Schematic Map Window. From the Study Pane, from the Study Tree under the Simulations folder, right-click *on Schematic:Without Project Conditions*. From the shortcut men, click Edit. The Schematic Editor (Figure 8.13) will open, under Measures, click Select All. Click OK, the Schematic Editor will close, and the HEC-ResSim reservoir elements will appear on the HEC-WAT Schematic Map Window.

#### 8.4 Adjust Map Layers

Part of the CWMS import, includes importing map layers for the HEC-WAT study. Now the user can make adjustments to the map layers.

1. From the HEC-WAT main window, click the **Maps** tab (Figure 8.12). Now the user can see which **Map Window** is currently active and what layers make up that **Map Window**. The user can now make adjustments to the map layers, from the **Map Layers** tree:

X Schematic Edit	tor			X
Name: Without Project Conditions				
Description:				
Stream Alignment:	Stream Alignn	nent		
Maps:	RR_Com	monComputationPoi	nts.shp	
	RR_Impa	ctAreas.shp		=
	RR_Lake	RR_Lakes_Albers_ft.shp		
	RR_Strea	RR_StreamAligment.shp		
	Raingage	s_Albers_ft.shp		~
Measures:	Selected	Measure	Туре	Stream
Select All	<b>v</b>	Lake Sonoma	Reservoir	Dry Ck
	✓	Lake Mendocino	Reservoir	EFRR
		[	OK Ca	ncel Apply

Figure 8.13 Schematic Editor

- Un-check the *Raingages\_Albers\_ft.shp* map layer (this will cause the map layer to no longer display in the active map window).
- Right-click on the *RR\_ImpactAreas.shp* map layer, from the shortcut menu, click **Properties**. The **Edit Polygon Properties Editor** will open (Figure 8.14). From the **Fill Tab**, change the color to "lightgreen", click **OK**. The impact areas on the active map window will now display in "lightgreen".

¥ Edit Polygon Properties			
WAT_Study/RussianRiver/maps/RR_ImpactAreas.sl	np		
Fill Border Labels	_		
Draw Features using:			
One Fill 🗸			
✓ Display Fill			
Color lightgreen			
Style 🖉			
Transparency			
25			
OK Cancel Apply			

Figure 8.14 Edit Polygon Properties Editor

2. The user can adjust the view of the study area in the active map window. Using the **Magnifier Tool**, zoom the study area in the active map window to the appropriate area that the user would like displayed. From the HEC-WAT main window (Figure 8.12),

from the Maps menu, click Default Map Properties, the Default Map Properties for dialog box will open (Figure 8.15). Click Set Map Extents to Display, click OK. The Default Map Properties for dialog box will close.

X Default Ma	Default Map Properties for RussianRiver								
Map Extents D	efault Map Layers								
	Coordinate System: USA_Contiguous_Alb View								
	Extents:								
	Easting: Northing:								
	Minimum: 399177.724 Min: 527787.249								
	Maximum: 114412.865 Max: 156685.746								
	Set Map Extents to Display								
Grow to Map Extents									
	OK Cancel Apply								

Figure 8.15 Default Map Properties for Dialog Box

This sets the extents for the **Map Window** so that when the study is opened the next time the **Map Window** will be zoomed in to the tighter area.

#### 8.5 Define Plug-Ins for Study

To define the plug-ins for the *RussianRiver* study:

- 1. From the HEC-WAT main window (Figure 8.12), from the File menu, click Study **Details**.
- 2. The **Study Details** dialog box (Figure 8.16) will open. Click on the **Plug-ins** tab. The table that is displayed provides information on the plug-ins that are available for the study.
- 3. For the *RussianRiver* study the following plug-ins should be enabled *FIA*, *HEC-SSP*, *HMS*, *RAS*, and, *ResSim*.
- 4. Click **OK**, the **Study Details** dialog box will close (Figure 8.16), and the plug-ins for the study have been defined

#### 8.6 Create an Analysis Period

An HEC-WAT compute requires an HEC-WAT alternative, an analysis period, a program order, and model alternatives.

X Study Details			X			
Study Name:	RussianRiver					
Study Description:	Russian River water re	sources study				
Study File:	b\Desktop\New_WAT_	Study/RussianRiver/	RussianRiver.sty			
Unit System:	English					
Coordinate System:	USA_Contiguous_Albe	rs_Equal_Area_Con	ic_USGS_version			
Created By:	q0hecprb					
Created At: Wed May 31 20:02:59 PDT 2017						
Map Properties Co	ontacts   Model Info   Sin	nulations Plugins				
Plugin		Enabled				
FIA			V			
Fragility Curve			V			
HEC-SSP			<b>v</b>			
HMS			<b>V</b>			
Hydrologic Samplin			✓			
Performance Metric	:S		✓			
RAS		4	V			
ResSim			V			
Simulation Compu			V			
	Time-Window Interval Generator TimeWindowModifier					
TimewindowModifi	ei					
		ок	Cancel Apply			

Figure 8.16 HEC-WAT – Study Details Dialog Box - Plugins Tab

To create an analysis period:

1. From the HEC-WAT main window (Figure 8.12), from the **Study Tree**, right-click on the **Analysis Period** folder (Figure 8.17). From the shortcut menu click **New**.

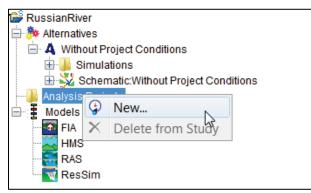


Figure 8.17 Analysis Periods Shortcut Menu

- 2. The **Create New Analysis Periods** dialog box will open (Figure 8.18). In the **Name** box enter a name (*RR\_Feb1986*). In the **Time Window** box enter the information required for the time window.
- 3. For the **Start Date** and **End Date**, enter in the format ddmmmyyyy. The **Start Time** and **End Time** should be entered as military time e.g. 0000, 0600, 1300 (1 p.m.), 2400 (midnight).

Y Create New Analysis	Periods	X
Name: RR_Feb198	6	
Description: Time Window		
Start Date: End Date:	13Feb1986 Start Time: 21Feb1986 End Time:	1400 1600
Years in Time Window:		1
	ОК	Cancel

Figure 8.18 Create New Analysis Periods Dialog Box

4. Click **OK**, the **Create New Analysis Periods** dialog box will close (Figure 8.18). On the HEC-WAT main window (Figure 8.12), from the **Study Pane**, under the **Analysis Periods** folder, the new analysis period name will appear.

#### 8.7 Setup Lookback Window – HEC-ResSim

The time window for an HEC-ResSim run has two parts, a "lookback period" and a "simulation or forecast period". The lookback period is used by HEC-ResSim to "warm up" a ResSim model alternative. During this period, routing of flows through the river and reservoir network are performed but no release decisions are made nor are any mass balance computations evaluated. The user should think of the lookback period as the time to establish the state of the river network and the starting conditions of the reservoirs. The simulation period is the portion of the time window during which HEC-ResSim simulates reservoir operations, and makes release decisions based on the operation scheme defined by the user. Releases are then routed through the river network, combining with local inflows along the way.

Since HEC-WAT and most of the models treat the analysis period as a single, continuous time window. For this reason a setup step is required for each HEC-ResSim alternative in an HEC-WAT study. The setup step lets each HEC-ResSim alternative know how much of the analysis period to use for the lookback period.

To setup the lookback period:

- 1. From the HEC-WAT main window (Figure 8.12), from the **Edit** menu, point to **ResSim**, click **Lookback Window** (Figure 8.19).
- 2. The Lookback Window dialog box (Figure 8.20) will open.
- 3. The table displays the ResSim model alternatives that are available in the HEC-WAT study. Each model alternative that is being used in an HEC-WAT simulation will need to have a lookback window set. For example, in Figure 8.20, the ResSim model alternative *calibrate* has a **TimeStep** of 1 hour and **Lookback Steps** of 6.

Edit	View Maps Compute Results Tools	Win	dow	Help	)			
	Alternative and Simulation Manager			<b>1</b> 4		~~	W	F
HHH	Program Order						W -	
•	Model Linking Editor						¥ Sci	hen
	Edit Computation Point Layers							
	Stream Reach Alias Editor						Q	
	FRA	•					۳	
	Fragility Curve	•					~	
Us	Hydrologic Sampling	•						
H	Performance Metrics	•						
~	HMS	•						_
V	ResSim	• 1	Ор	en Re	esSi	m		
<b>F</b>	RAS	1	Loc	kha	ck V	Vinc	low	
-	FIA		LUC	KDa				3

Figure 8.19 Edit Menu – ResSim – Lookback Window

K Lookback V	Vindow		X
Alternative	Description	TimeStep	Lookback Steps
calibrate		1 Hour	- 6
C:calibrate		5 Minutes 🔺	
B:calibrate		10 Minutes	
		15 Minutes 30 Minutes	
		1 Hour	
		2 Hour	
		3 Hour	
		4 Hour OK Canc	

Figure 8.20 Lookback Window Dialog Box

- 4. The time step can be selected from the TimeStep column, in each cell there is a list of available time steps for the user to choose from. The selected time step has to match the time step that was specified for the ResSim model alternative as part of the alternative's original run control data (which is located in the HEC-ResSim Alternative Editor). The number of lookback steps must be entered in a cell in the Lookback Steps column. At least one lookback time step is required for a ResSim model alternative to compute, however more lookback steps may be needed, depending on a variety of factors in the ResSim model alternative's operating scheme. The HEC-ResSim modeler should be consulted to determine the minimum lookback window needed by each alternative.
- 5. Click OK, a Missing Lookback Info window (Figure 8.21) will open. This message window is letting the user know that lookback information for the other ResSim model alternatives have not been set. For this example, the user is only using the *calibrate* model alternative, click OK. The Missing Lookback Info window (Figure 8.21) and the Lookback Window dialog box (Figure 8.20) will both close.

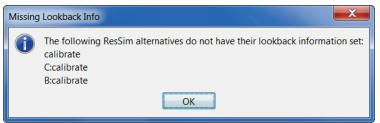


Figure 8.21 Missing Lookback Info Window

# 8.8 Program Order

HEC-WAT allows for a flexible set of programs, computation order, and data flow through the establishment of a program order. Once a program order has been chosen for an HEC-WAT study, changes should not be made to the program order as this could cause a disruption in the flow of data and invalidate any existing work.

Currently in HEC-WAT Version 1.0 the default program order is - HMS, ResSim, RAS, FIA. This is the correct program order for the example watershed that is being used, so no adjustment is necessary. For further details on **Program Order**, review Chapter 11 (Section 11.1) of the HEC-WAT User's Manual.

#### 8.9 Create an HEC-WAT Simulation

Now that all of the building blocks have been configured (alternative, analysis period, program order, models), the user can now create an HEC-WAT simulation. To create an HEC-WAT simulation:

- 1. From the HEC-WAT main window (Figure 8.12), from the **WAT Tools** toolbar, click the **Alternative and Simulation Manager** button **m**.
- 2. The Alternative and Simulation Manager dialog box will open (Figure 8.22). From this dialog box the user can create/modify alternatives, analysis periods, simulations, program orders, link models, and make runs.

X Alternative and Sim	ulation Manager
File Edit View	
🗛 🤪 초 🗄 👄	<b>A</b>
A 14	Analysis Periods
Alternatives	RR_Feb1986
Without Project Conditions	Create Simulation Create Simulation From
Need to create a Simulation	OK Cancel Apply

Figure 8.22 Alternative and Simulation Manager Dialog Box

3. To create a simulation, from the table right-click on the intersection of an alternative and analysis period. From the shortcut menu click **Create Simulation**. The **Create New Simulation** dialog box will open (Figure 8.23).

¥ Create	New S	imula	tion			X			
Name:	Withou	ıt Proje	ect Conditions-RR_Feb1986						
Description									
Run	FRA								
Alternative: Without Project Conditions									
Analysis	Analysis Period: RR_Feb1986								
Program	Program Order: Default   New								
F Part:	Without	Pr:RR	_Feb1986						
Models	Prog	am	Alternative	Simulation Time Window	Time Window Adjustment	Needs To Compute			
	HMS		🔀 (RUN)Feb_1986 🛛 🔻	Simulation Window 🔹	Edit				
	ResSim	ı	📷 calibrate 🛛 🔻	Simulation Window 🔹 🔻	Edit				
	RAS		🚼 Base for Real Time forecasting 🔻	Simulation Window 🔹 🔻	Edit				
	FIA GridsAndXSecsAlternative  Simulation Window  Edit								
				C	K Canc	el Apply			

Figure 8.23 Create New Simulation Dialog Box

- 4. HEC-WAT has defined a default name for the simulation (*Without Project Conditions-RR\_Feb1986*) in the **Name** box (Figure 8.23). The name is a combination of the HEC-WAT alternative name and analysis period name, where the intersection was in the table (name can be changed).
- 5. A program order needs to be selected. From the **Program Order** list (Figure 8.23) make sure *Default* is selected as the program order.
- 6. In the **F Part** box (Figure 8.23), a default **F Part** is displayed that was generated by HEC-WAT based once again on the alternative and analysis period names. The user can edit the item, but it is not advised.
- 7. In the **Programs** table (Figure 8.23), the software applications that were defined in the program order appear in the order the software applications were selected. Now the user must select the appropriate alternative (plan, run) for each software application. From the **Alternative** column, from the list for **HMS** (Figure 8.24), select the appropriate HMS run (*(RUN)Feb\_1986*). Repeat the process for the other software applications. Below is the list of the appropriate alternatives for the *RussianRiver* study:

HMS - (RUN)Feb\_1986 ResSim - calibrate RAS - Base for Real Time forecasting FIA - GridsAndXSecsAlternative

Models	Program	Alternative	Simulation		Time Window	Needs To
			Time Window		Adjustment	Compute
	HMS	🔀 (RUN)Feb_1986 🔹	Simulation Window	•	Edit	
	ResSim	🔽 calibrate 🔹	Simulation Window	•	Edit	
	RAS	🔚 Base for Real Time forecasting 🖪	Simulation Window	-	Edit	
	FIA	GridsAndXSecsAlternative	Simulation Window	-	Edit	

Figure 8.24 Selection of Model Alternatives - Create New Simulation Dialog Box

 Now that all of the model alternatives have been selected, click OK. The Create New Simulation dialog box will close (Figure 8.23). On the Alternative and Simulation Manager (Figure 8.25) dialog box, the intersection of the WAT alternative and analysis period now provides information about the simulation.

X Alternative and Sim	ulation Manage	er	X	
File Edit View				
🗛 🤤 🏂 📑 👄	<b>A</b>			
Alternatives		Analysis Periods		
Alternatives	RR_Feb1986			
	HMS ((RUN)Feb 1986 🗸			
Without Project Conditions	ResSim	calibrate	<b></b>	
without Project Conditions	RAS	Base for Real Time forecasting	<b></b>	
	FIA	GridsAndXSecsAlternative	<b></b>	
		OK Cancel A	pply	

Figure 8.25 Alternative and Simulation Manager - Completed Simulation

9. Click **OK**; the **Alternative and Simulation Manager** dialog box will close (Figure 8.25). From the HEC-WAT main window (Figure 8.12), the created simulation appears on the **Study Tree**, under the **Simulations** folder (Figure 8.26), click on the simulation.

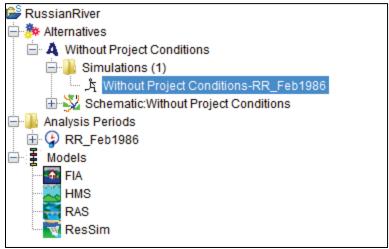
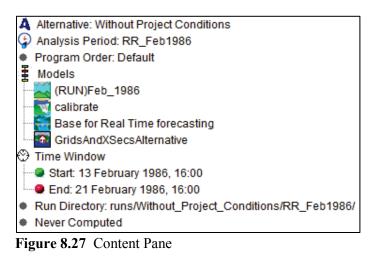


Figure 8.26 Study Tree with Created Simulation

10. The Content Pane (Figure 8.27) displays information about the selected simulation.



11. Double click on the simulation name (*Without Project Conditions-RR\_Feb1986*), a Select Map dialog box will open. Click New Map Window, click OK. The Select Map dialog box will close. The new map window will contain the schematic elements that represent the simulation (Figure 8.28).

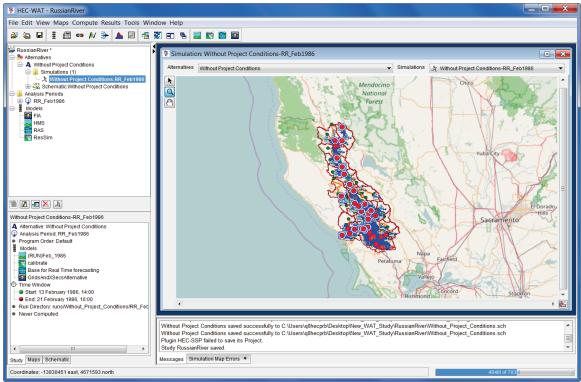


Figure 8.28 Map Window - Schematic of Current HEC-WAT Simulation

# 8.10 Linking

The next step is to have the models of a simulation communicate with each other. This is accomplished by linking (DSS mapping) the models thru DSS and using a simulation name.

From HEC-WAT, the **Model Linking Editor** (Figure 8.29) provides an easy way to link models including observed data, and provides a mechanism where the linking will have to be done once per alternative.

X Model Lin	king Editor								
File Edit Vie	w								
84									
Simulation:	Simulation: Without Project Conditions-RR_Feb1986								
Model To Link:									
Default Mode	I To Link:								
Default Mode	ocation	Parameter	Input From Model	Location/Parameter	Dynamically Linked				
					<b>T</b>				
		Selec	t Source Data						
Dynamically	y Linked Locations	Linked In Different Sir	nulation						

Figure 8.29 Model Linking Editor

- 1. From the HEC-WAT main window (Figure 8.28), from the **WAT Tools** toolbar, click the **Model Linking Editor** button —.
- 2. The **Model Linking Editor** will open (Figure 8.29). From the **Simulation** list the user will need to select a simulation. For this example the user will be selecting the *Without Project Conditions-RR\_Feb1986* (default) simulation.
- 3. Now let's link the individual model alternatives that are part of the selected simulation.

#### 8.10.1 Linking the HMS Model Alternative

- 1. From the **Model Linking Editor**, from the **Model to Link** list select *HMS-(RUN)FEB* \_1986 (Figure 8.29). The **Model Linking Editor** table (Figure 8.30) will now contain all of the locations for the HMS model alternative.
- 2. Since HEC-HMS wants precipitation and flow data that is not provided by another software application, HEC-WAT reads the linking from the HMS model alternative and displays that linking in the **Model Linking Editor** table (Figure 8.30).
- 3. The table displays the linking from a DSS file for the HMS model alternative which is the correct linking.
- 4. That completes the linking for the HMS model alternative.

File Edit Vie	w					
🖬 🖨 🎺						
Simulation:	Without Project C	onditions-RR_Fe	b1986			
Model To Link: KUN)Feb_1986						
Default Mode	To Link:					
Lo	cation	Parameter	Input From Model	Location/Parameter	Dynamically Linked	
GageInterp		Precipitation	DSS File 🔻	precip_Russian.dss:/SHG/RUSSIAN/PRECIP/13		
EF RUSSIAN at	CALPELLA 1d	Flow	DSS File 🗸	FlowData.dss:/EF RUSSIAN R/CALPELLA CA/FL		
Coyote		Flow	DSS File 🗸	FlowData.dss:/EF RUSSIAN/COYOTE, NR UKIAH		
RUSSIAN at UK	(IAH 1d	Flow	DSS File 🗸	FlowData.dss:/RUSSIAN R/UKIAH CA/FLOW/01J		
RUSSIAN at HO	PLAND_1d	Flow	DSS File 🗸	FlowData.dss:/RUSSIAN R/HOPLAND CA/FLOW/		
RUSSIAN AT CI	LOVERDALE_1d	Flow	DSS File 🗸	FlowData.dss:/RUSSIAN R/CLOVERDALE CA/FL		
RUSSIAN at GE	YSERVILLE_1d	Flow	DSS File 🗸	FlowData.dss:/DRY C BL WARM SPRINGS DAM/		
RUSSIAN at HE	ALDSBURG_1d	Flow	DSS File 🗸	FlowData.dss:/RUSSIAN R/HEALDSBURG CA/F		
DRY C at GEYS	ERVILLE	Flow	DSS File 🗸	FlowData.dss:/DRY CR/NR GEYSERVILLE/FLO		
RUSSIAN at GL	JERNEVILLE_1d	Flow	DSS File 🗸	FlowData.dss:/RUSSIAN R/GUERNEVILLE CA/F		
	/ Linked Locations	Linked In D	Select Sourc	e Data		

Figure 8.30 Model Linking Editor – HMS Model Alternative

#### 8.10.2 Linking the ResSim Model Alternative

1. From the **Model Linking Editor**, from the **Model to Link** list select *ResSim-calibrate* (Figure 8.30). The **Model Linking Editor** table (Figure 8.31) will now contain all of the locations for the ResSim model alternative that needs to be linked.

Model Linking Editor					X
File Edit View					
🖬 🖨 🥠					
Simulation: Without Project Co	onditions-RR_Feb1	986			
Default Model To Link:					
Location	Parameter	Input From Model	Location/Parameter	Dynamically Linked	C
WF Russian	Known Flow	HMS-(RUN)Feb_1986 -	Ukiah - Flow	•	-
Russian 10	Known Flow	HMS-(RUN)Feb_1986 -	Lake Mendocino - Flow	<b>•</b>	
Austin Ck Local	Known Flow	HMS-(RUN)Feb_1986 -	Austin Ck Loc - Flow	<b>▼</b>	:
Guerneville Local (Russian 20)	Known Flow	HMS-(RUN)Feb_1986 -	Hacienda Loc - Flow	•	
Green Valley	Known Flow	HMS-(RUN)Feb_1986 -	Green Valley - Flow	<b>•</b>	_
Santa Rosa Cr	Known Flow	HMS-(RUN)Feb_1986 -	Mirabel Heights-Mirabel Park - Flow	<b>•</b>	
Dry Creek Local	Known Flow	HMS-(RUN)Feb_1986 -	Dry Ck Lower - Flow	•	
Geyserville Dry Creek Local	Known Flow	HMS-(RUN)Feb_1986 -	Yoakim Loc - Flow	•	
Lake Sonoma Inflow	Known Flow	HMS-(RUN)Feb_1986 🔻	Lake Sonoma - Flow	<b>•</b>	
Healdsburg Local	Known Flow	HMS-(RUN)Feb_1986 -	Healdsburg Loc - Flow	•	
Geyserville Local	Known Flow	HMS-(RUN)Feb_1986 -	Geyserville Loc - Flow	•	
Pia Sulabur Cr	Known Flow	LIME (DUN)Eab 1006	Big Sulphur Ck Elow	I	
Dynamically Linked Locations	Linked In Differ	Select Source Data	a		

Figure 8.31 Model Linking Editor – ResSim Model Alternative

2. The current linking (Figure 8.31) that is displayed for the ResSim model alternative is correct, so the linking for the ResSim model alternative does not need to be done.

#### 8.10.3 Linking the RAS Model Alternative

1. From the **Model Linking Editor**, from the **Model to Link** list select *RAS-Base for Real Time forecasting* (Figure 8.31). The **Model Linking Editor** table (Figure 8.32) will now contain all of the locations for the RAS model alternative that need to be linked. The current linking (Figure 8.32) that is displayed for the RAS model alternative is the linking for the standalone model.

₩ Model Linking Editor				
File Edit View				
🖬 🚑 🤣				
Simulation: Without Project Conditions-RR_Feb1986				• •
Model To Link: 📑 RAS-Base for Real Time forecasting				<b>▼ 4</b>
Default Model To Link:				
Location	Parameter	Input From Model	Location/Parameter	Dynamically Linked
SA: 365	Flow	DSS File 🗸	forecast.dss://Ukiah/FLOW//15MIN/C:00	
SA: 923	Flow	DSS File 🗸	forecast.dss://Ducans Mills/FLOW//15MI	
SA: 928	Flow	DSS File 🔻	forecast.dss://Green Valley/FLOW//15MI	
SA: 929	Flow	DSS File 🗸	forecast.dss://Mirabel Heights-Mirabel P	
DryCreek DryCreek RS 58953.5	Flow	DSS File 🗸	forecast.dss://Yoakim Loc/FLOW//15MI	
DryCreek DryCreek RS 37302.09	Flow	DSS File 🔻	forecast.dss://Lambert Loc/FLOW//15MI	
DryCreek DryCreek RS 3499	Flow	DSS File 🗸	forecast.dss://Dry Ck Lower/FLOW//15M	
Russian CoyoteToDC RS 527387.7 (Lake Mendocino O)	Flow	DSS File 🗸	forecast.dss://Lake Mendocino-Pool/Flo	
Russian CoyoteToDC RS 418492.2	Flow	DSS File 🗸	forecast.dss://Feliz.Ck/FLOW//15MIN/C:	
Russian CoyoteToDC RS 348180.3	Flow	DSS File 🗸	forecast.dss://Oat Valley Ck/FLOW//15MI	
Russian CoyoteToDC RS 347412.9	Flow	DSS File 🗸	forecast.dss://Big Sulphur Ck/FLOW//15	
Russian CovataTaDC RS 250290.6	Flow		forecast des://limtown.Loc/ELOW//15MI	
Select Source Data  Dynamically Linked Locations Linked In Different Simulation				

Figure 8.32 Model Linking Editor - RAS Model Alternative Unlinked

- 2. RAS linking will be results from the HMS and ResSim model alternatives. The printout (*RussianRiverLinking.pdf*) of the linking for each of the model alternatives is located in a folder titled *RussianRiver\_Data*.
- From the Model Linking Editor (Figure 8.32), click Default Model to Link. The Select Default Model to Link dialog box will open (Figure 8.33). From the Default Model to Link list, select HMS-(RUN)Feb\_1986. Click OK, the Select Default Model to Link dialog box will close (Figure 8.33).

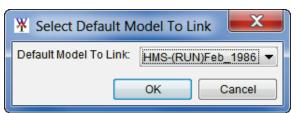


Figure 8.33 Select Default Model to Link Dialog Box

4. A Confirm Input From Model changing to window (Figure 8.34) will appear. Basically the window is asking the user to be sure before proceeding, click Yes. The Confirm Input From Model changing to window closes, and the Model Linking Editor now displays the linking for the RAS model alternative (Figure 8.35).

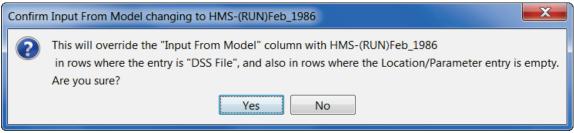


Figure 8.34 Confirm Input From Model changing to window

ile Edit View				
imulation: Without Project Conditions-RR_Feb1986				▼ ●
lodel To Link: 📑 RAS-Base for Real Time forecasting				▼ ◀
Default Model To Link:				
Location	Parameter	Input From Model	Location/Parameter	Dynamically
				Linked
SA: 365	Flow	HMS-(RUN)Feb_1986 -	Ukiah - Flow 🔻	·
SA: 923	Flow	HMS-(RUN)Feb_1986 -	Ducans Mills - Flow	•
SA: 928	Flow	HMS-(RUN)Feb_1986 -	Green Valley - Flow	•
SA: 929	Flow	HMS-(RUN)Feb_1986 -	Mirabel Heights-Mirabel Park - Flow 🔹	•
DryCreek DryCreek RS 58953.5	Flow	HMS-(RUN)Feb_1986 -	Yoakim Loc - Flow	r
DryCreek DryCreek RS 37302.09	Flow	HMS-(RUN)Feb_1986 -	Lambert Loc - Flow	r l
DryCreek DryCreek RS 3499	Flow	HMS-(RUN)Feb_1986 -	Dry Ck Lower - Flow	
Russian CoyoteToDC RS 527387.7 (Lake Mendocino O)	Flow	ResSim-calibrate 🔹	Lake Mendocino Outflow JCT - Flow 🔹	
Russian CoyoteToDC RS 418492.2	Flow	HMS-(RUN)Feb_1986 -	Feliz Ck - Flow	r
Russian CoyoteToDC RS 348180.3	Flow	HMS-(RUN)Feb_1986 -	Oat Valley Ck - Flow	r
Russian CoyoteToDC RS 347412.9	Flow	HMS-(RUN)Feb_1986 -	Big Sulphur Ck - Flow	r
Pussion CovataTaDC PS 250200.6	Flow	LIMO (DUNIEAN 1006	limtown Loc Flow	
	Select So	urce Data		

Figure 8.35 Model Linking Editor - Completed RAS Model Alternative Linking

- There are two locations in the RAS linking that need to be linked to the ResSim model alternative. From the Model Linking Editor table (Figure 8.35) for the DryCreek DryCreek RS 74716.8 (Sonoma Outflow J) row, from the Input Model column (Figure 8.35), select ResSim-calibrate. HEC-WAT tries to find a match, Lake Sonoma-Pool Net Inflow. So from the Location/Parameter column list, select Lake Sonoma Outflow JCT Flow.
- 6. Repeat Step 5 for the *Russian CoyoteToDC RS 527387.7 (Lake Mendocino O)* row (*Lake Mendocino Flow*) to *Lake Mendocino Outflow JCT Flow*.
- 7. The printout (*RussianRiverLinking.pdf*) of the linking for each of the model alternatives is located in a folder titled *RussianRiver\_Data*. Once the linking is finished for the RAS model alternative, from the **Model Linking Editor** (Figure 8.35) click , this will save the linking.
- 7. That completes the linking for the RAS model alternative.

## 8.10.4 Linking the FIA Model Alternative

1. From the **Model Linking Editor**, from the **Model to Link** list select *FIA-GridsAndXSecsAlternative* (Figure 8.35). The **Model Linking Editor** table (Figure 8.36) will now contain all of the locations for the FIA model alternative that needs to be linked.

File Edit View				
🖬 🖨 🎺				
Simulation: Without Project Con	ditions-RR Feb19	86		▼ ◀
	-			
Model To Link: Model To Link:	SecsAlternative			▼ ◀
Default Model To Link:				
Location	Parameter	Input From Model	Location/Parameter	Dynamically
Location	Parameter	input From Moder	Location/Parameter	Linked
DryCreek DryCreek 74716.8	STAGE	RAS-Base for Real Time forecasting 🔻	DryCreek DryCreek 34616.8 - Stage	▼
DryCreek DryCreek 74403	STAGE	RAS-Base for Real Time forecasting	<u> </u>	•
DryCreek DryCreek 74016.5	STAGE	RAS-Base for Real Time forecasting		•
DryCreek DryCreek 73802.3	STAGE	RAS-Base for Real Time forecasting	DryCreek DryCreek 73802.3 - Stage	•
DryCreek DryCreek 73608.59	STAGE	RAS-Base for Real Time forecasting	DryCreek DryCreek 73608.59 - Stage	▼
DryCreek DryCreek 73461*	STAGE	RAS-Base for Real Time forecasting	DryCreek DryCreek 73461* - Stage	▼
DryCreek DryCreek 73314.5	STAGE	RAS-Base for Real Time forecasting	<u> </u>	▼
DryCreek DryCreek 73158*	STAGE	RAS-Base for Real Time forecasting		•
DryCreek DryCreek 73002.8	STAGE	RAS-Base for Real Time forecasting	<u> </u>	•
DryCreek DryCreek 72747.59	STAGE	RAS-Base for Real Time forecasting		•
DryCreek DryCreek 72399.5	STAGE	RAS-Base for Real Time forecasting	<u> </u>	•
DryCreek DryCreek 72399.5	STAGE		DryCreek DryCreek 72399.5 - Stage	
				-
		Select Source Data		

Figure 8.36 Model Linking Editor - Completed FIA Model Alternative Linking

- 2. For FIA the linking will be results from the RAS model alternative. The printout (*RussianRiverLinking.pdf*) of the linking for each of the model alternatives is located in a folder titled *RussianRiver\_Data*.
- 3. As the user can see the linking for the FIA model alternative in this study is already completed. This is because the RAS and FIA model alternatives have already been linked in standalone mode.
- 4. For this example, the user will need to adjust two rows for the FIA linking; HEC-WAT did not choose the correct locations. In Figure 8.36, for the first row (*DryCreek DryCreek 74716.8*), change the Location/Parameter column to *DryCreek Dry Creek 74716.8* (Sonoma Outflow J) Stage. Repeat for the row Russian CoyoteToDC 527387.7 and change the Location/Parameter column to Russian CoyoteToDC 527387.7 (Lake Mendocino O) Stage.
- 5. Once the linking is finished for the FIA model alternative, from the **Model Linking** Editor (Figure 8.36) click 🖬, this will save the linking.
- 6. That completes the linking for the FIA model alternative.

# 8.11 Compute and Results

Now that a simulation has been defined, the linking of model alternatives has been completed for a simulation, and model alternatives have been imported into HEC-WAT, the user is now ready to compute the Russian River study.

 From the HEC-WAT main window (Figure 8.37), from the Study Tree, from the Simulations folder, right-click *Without Project Conditions-RR\_Feb1986*. From the shortcut menu (Figure 8.37) point to Compute, hold down the Ctrl key, click Simulation.

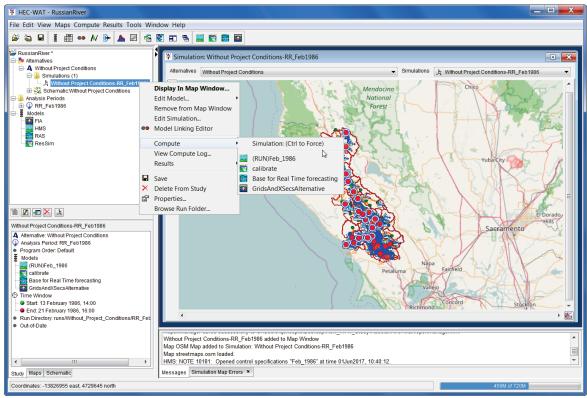


Figure 8.37 HEC-WAT Main Window - Compute

2. The **Compute Progress** dialog box will open (Figure 8.38) and the compute starts. Since the user is taking a watershed that was built for real-time forecasting (CWMS) and creating a planning study (HEC-WAT) from those models, the user may need to do some work on getting the models to compute successfully.

✗ Compute Progress - Without Project Conditions-RR_Feb1986				
Run Time Window for ResSim-calibrate is Start Time 13 February 1986, 14:00 End Time:21 February         16:00         Lookback for calibrate set to 12 Hours         Compute Directory now         C:\Users\q0hecprb\Desktop\New_WAT_Study\RussianRiverYruns\Without_Project_Conditions\RR_Fet         ResSim Runtime Window:         Lookback time:13Feb1986 1400         Start time:14Feb1986 0200         End time:21Feb1986 1600         Computing ResSim alternative calibrate         Copying ResSim alternative files to simulation         Extracting DSS data to Simulation DSS file         Copying Network to compute area				
4 III >				
Computing calibrate				
100%				
Overall				
Cancel				

Figure 8.38 Compute Progress Dialog Box

8-24

# Chapter 9 Flood Risk Analysis (FRA) Compute Option

USACE flood risk management (FRM) policy requires that USACE analytical processes include methods and tools that employ integrated, comprehensive, systems and life-cycle based approaches and risk-based concepts in planning, design, construction, operations and major maintenance. These USACE methods need to incorporate systems response of projects when considering load distribution and failure possibilities. USACE policy also states that project performance needs to consider the system reaction to flood loading and how those loadings are distributed across the watershed.

HEC-WAT includes an option that will analyze complex riverine systems while implementing the flood risk management and systems requirements. The compute option, Flood Risk Analysis (FRA), allows a user to perform plan formulation or system performance analyses while incorporating risk analysis.

# 9.1 Create an HEC-WAT Study

To create an HEC-WAT study by importing from individual models, the first step is to create an HEC-WAT study:

1. From the HEC-WAT main window (Figure 9.1), on the **File** menu, click **New Study**. The **Create New Study** dialog box (Figure 9.2) will open.

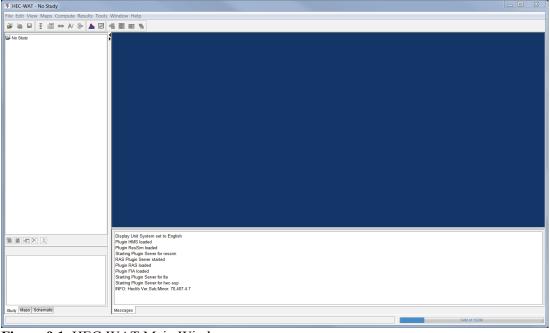


Figure 9.1 HEC-WAT Main Window

🔻 Create New Stu	ldy	X
Study Name: Description: Directory:	C:\Users\xxxxxxxxxxv\Desktop\New_WAT_Study\	
Unit System: Coordinate System:	English	▼ Edit
Create Default Attended Select Default Attended Concerning Concerning Concerning Concerning Concerning Atternative 1	rnative Name litions	Add Map Layers
		OK Cancel

Figure 9.2 Create New Study Dialog Box

- In the Study Name box (Figure 9.2), enter a name (*RussianRiver*), and in the Description box, enter a description (*Russian River water resources study - FRA*) for the new study.
- 3. In the **Directory** box (Figure 9.2), either enter the name of the directory where the HEC-WAT study will be stored, or click , and an **Open** browser (Figure 9.3) will open. Navigate to the directory where the HEC-WAT study will be stored.

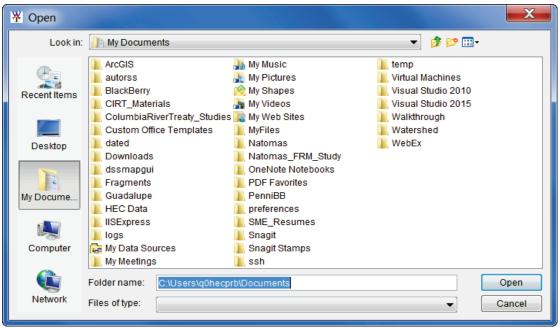


Figure 9.3 Open Browser

- 4. The **Unit System** for the study defaults to **English** (which is correct for the *RussianRiver* study). The other choice from the list is **SI** (metric).
- 5. Next, the projected coordinate system of the study needs to be set. From the **Create New Study** dialog box (Figure 9.1), click **Edit** (by the **Coordinate System** box), the **Map Coordinate Information** dialog box will open (Figure 9.4).

Wap Coordinate Information					
Map Coordinate Information					
System: Well Known Text 🔹					
PROJCS["USA_Contiguous_Albers_Equal_Area_Conic_USGS_versid GEOGCS["GCS_North_American_1983", DATUM["D_North_American_1983", SPHEROID["GRS_1980", 6378137.0, 298.257222101]], PRIMEM["Greenwich", 0.0], UNIT["degree", 0.017453292519943295], AXIS["Longitude", EAST], AXIS["Longitude", EAST], AXIS["Latitude", NORTH]], PROJECTION["Albers_Conic_Equal_Area"], PARAMETER["central_meridian", -96.0], PARAMETER["latitude_of_origin", 23.0], PARAMETER["standard_parallel_1", 29.5], PARAMETER["false_easting", 0.0], PARAMETER["false_northing", 0.0], PARAMETER["false_northing", 0.0], PARAMETER["standard_parallel_2", 45.5], UNIT["foot_survey_us", 0.3048006096012192], AXIS["X", EAST], AXIS["Y", NORTH]]					
Load from file OK Cancel					

Figure 9.4 Map Coordinate Information Dialog Box

- 6. For the *RussianRiver* study, the associated map layers have the correct projected coordinate system. So, use one of those map layers to set the projected coordinate system for the study. From the **Map Coordinate Information** dialog box (Figure 9.4), click **Load from file** (lower left corner of dialog box); an **Open** browser (Figure 9.3) will open. The map layers for the *RussianRiver* study are located in a folder titled *RussianRiver\_Data* (double-click). In that folder, is a *MapLayers* (double click) folder, from that folder, click on *RR\_StreamAlignment.prj* (any of the map layers will work). Click **Open**, now the **Map Coordinate Information** dialog box will contain information about the projected coordinate system (Figure 9.4). Click **OK**, the **Map Coordinate Information** dialog box will contain information about the projected coordinate system (Figure 9.4). Now on the **Create New Study** dialog box the **Coordinate System** box (Figure 9.2) contains the name of the projected coordinate system (i.e., *USA\_Continguous\_Albers\_Equal\_Area\_Conic\_USGS\_version*) for the study.
- 7. Click **OK**; the **Create New Study** dialog box will close (Figure 9.1). The HEC-WAT main window will now have the name of the study (*RussianRiver*) on the title bar (Figure 9.5). A blank **Schematic Map Window** opens.

HEC-WAT - RussianRiver		_ 🗆 🗙
File Edit View Maps Compute Result	ilts Tools Window Help	
≝ ≒ ⊟ ፤ ∰ ⇔ ∧ ۍ ,	🔺 💹 📲 🔁 🖬 🖶 🔛 🗱 📰 🖬	
🚊 🏇 Alternatives	Schematic: Without Project Conditions	
Without Project Conditions           Image: I		<b>^</b>
🗄 🕺 Schematic:Without Project Con		
Analysis Periods     Models		
<	$\left  \begin{array}{c} \\ \\ \end{array} \right  \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	•
		<u> </u>
	Project Loaded for RAS	
No Additional Content	Plugin ResSim created RussianRiver	
<ul> <li>No Additional Content</li> </ul>	Project Loaded for ResSim Plugin FIA created RussianRiver	
	Project Loaded for FIA	
	Plugin HEC-SSP failed to save its Project. Study RussianRiver saved.	
	Plugin HEC-SSP failed to save its Project.	
Study Maps Schematic	Stream Alignment added to Map Window Messages	•
Coordinates: 737 east, -983 north	wessayes 112M of 208M	
Coordinates. 757 east, -983 fioldi	112M 012 (33M	

Figure 9.5 HEC-WAT Main Window - RussianRiver Study

#### 9.2 Import an HEC-ResSim Model

If there is an HEC-ResSim model available, the user should import that model first. Why? Because the HEC-ResSim model will contain a stream alignment, all of the common computation points (CCPs), and the reservoirs necessary to model the watershed.

1. From the HEC-WAT main window (Figure 9.5), from the **File** menu, point to **Import**, and click **ResSim**. An **Import Type** window (Figure 9.6) will open. Since the *RussianRiver* study being built does not have any of the basic building blocks that are covered in Chapter 6, click **Watershed**.

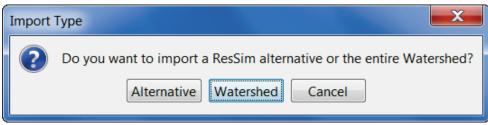


Figure 9.6 Import Type Window

2. The Select Watershed File to Import From (Figure 9.7) browser will open. Browse to the folder *FRA\_RR\_Models*; double click on the *base* folder; double-click on the *RR\_ResSim\_Model* folder. From the Files of Type list, select ResSim Watershed Files; click *RussianRiver.wksp*; and, then click Open.

X Select Wate	X Select Watershed File to Import From				
Look in: 🕕 RR_ResSim_Model 🔹 🔊 🗊 🗸			•		
Recent Items	autorss dssmapge maps rss scripts study				
My Docume	supplemental  w2 RR_ResSim_Model.wksp Russian_River.wksp RussianRiver.wksp				
Computer					
Network	File name: Files of type:	RR_ResSim_Model.wksp ResSim Watershed Files  v	Open Cancel		

Figure 9.7 Select Watershed File to Import From Browser

3. A **ResSim Import** window will open (Figure 9.8) showing the progress of the HEC-ResSim import.

* ResSim Import	<b>X</b>
Importing Watershed	Cancel

Figure 9.8 ResSim Import Window

- 4. The HEC-WAT Schematic Editor will open (Figure 9.9), from the Measures area of the Schematic Editor, click Select All. All of the reservoirs listed in the table are now selected. Click OK, the Schematic Editor will close (Figure 9.9).
- 5. The imported stream alignment, common computation points, reservoirs, and any available map layers from the HEC-ResSim model display in the HEC-WAT Schematic Map Window (Figure 9.10). For all of the map layers to appear, close the Schematic Map Window, from the message window click Yes. To re-open the Schematic Map Window, from the Study Tree, double-click on Schematic: Without Project Conditions, the Schematic Map Window will appear in the Desktop Area of the HEC-WAT main window (Figure 9.10).
- 6. The user has now completed the import of the RussianRiver HEC-ResSim model.

¥ Schematic Editor					
Name: Withou Description:	t Project Conditions				
Stream Alignment:	Stream Align	Stream Alignment			
Maps:					
Measures:	Selected	Measure	Туре	Stream	
Select All	<b>v</b>	Lake Sonoma	Reservoir	N/A	
	Lake Mendocino Reservoir N/A		N/A		
			ОК Са	ancel Apply	

Figure 9.9 Schematic Editor

HEC-WAT - RussianRiver				
File Edit View Maps Compute Results Tools Window Help				
≝ ≒ ⊌ ፤ ∰ ⇔ ∧ ۍ				
RussianRiver *	¥ Schematic: Without Project Conditions			
A Without Project Conditions Simulations Schematic Without Project Con- Analysis Periods Hodels Hus RAS ResSim				
	< · · · · · · · · · · · · · · · · · · ·			
No Additional Content	Map <c:usersiq0hecpt added="" conditions<="" desktop="" maps="" new_wat_study="" project="" russianriver="" russianrivers="" schematic:="" shp="" td="" to="" without="">           Map RussianRivers shp loaded           Map RussianRivers shp loaded.           Map RussianRivers shp loaded.           Map RussianRiverSa shp loaded.           Map RussianSubbasins shp loaded.           Without Project Conditions seed successfully to C:Userslq0hecptbDesktopNew, WAT_Study/RussianRiverMapsRussianRiverWathout_Project_Conditions sch</c:usersiq0hecpt>			
Study Maps Schematic	Messages			
Coordinates: -7042872 east, 6600031 north	109M of 321M			

Figure 9.10 HEC-WAT Schematic Map Window After HEC-ResSim Import

# 9.3 Import an HEC-HMS Model

1. From the HEC-WAT main window (Figure 9.5), from the **File** menu, point to **Import**, and click **HMS**. The HEC-HMS application will open along with the **Select Project File** browser (Figure 9.11).

🖀 HEC-HMS 4.2.1 [C:\Users\q0hecprb\Desktop\New_WAT_Study\RussianRiver\hms\RussianRiver.hms]				
File Edit View Components Parameters Compute Results Tools Help				
🗋 🖆 🖬 🍏 📐 🕂 🔍 🖆 🖬 🏺 💠 🧮 🏜None Selected 💌	None Selected 🔻 🕷 🔤 🔤 🧐			
RussianRiver	Z Select Project File			
Components Compute Results Project Name: RussianRiver Description: Output DSS File: C:\Users\q0hecprb\Desktop\New_WAT_Study\Russian	Image: Second laws       Image: Second laws         Image: Second			
	File name:         Russian_River.hms         Select           Hetwork         Files of type:         HEC-HMS Project Files (*.hms)         Cancel           Begin opening project         TrussianRiver * in directory *C: Users \g0hecprb/Desktop\View_WAT_Study\RussianRiver \vims* at time 33May2017, 20:03:00           Finished opening project         TrussianRiver* in directory *C: Users \g0hecprb/Desktop\View_WAT_Study\RussianRiver \vims* at time 33May2017, 20:03:00			

Figure 9.11 HEC-HMS Main Window and Select Project File Browser

- 2. Browse to the folder *FRA\_RR\_Models*; double click on the *RR\_HMS\_Model* folder, select *Russian\_River.hms* and, then click **Select.**
- 3. When the HEC-WAT study is created an *hms* subfolder is created. In that subfolder are the default files that are generated when creating an HEC-HMS project. When the HEC-HMS import process finds that a project already exists, a warning window will appear (Figure 9.12). Click **Yes**, the warning window will close.

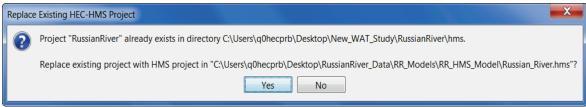


Figure 9.12 HEC-HMS Warning Window about HEC-HMS Project

4. The import process begins (patience this could take a few seconds), the import is finished when the study pane in the HEC-HMS main window contains a study tree. From the HEC-HMS main window (Figure 9.11), from the **File** menu, click **Exit**. The HEC-HMS model import is completed.

# 9.4 Import an HEC-RAS Model

1. From the HEC-WAT main window (Figure 9.5), from the File menu, point to Import, and click RAS. The Select RAS project to import from browser open (Figure 9.13).

¥ Select RAS	X Select RAS project to import from					
Look in: 🕕 RR_RAS_Model			- 🦻 📂 🖽	•		
Recent Items	📄 RussianR	ver.prj				
Desktop						
My Docume						
Computer						
	File name:	RussianRiver.prj		Open		
Network	Files of type:	RAS Project Files	▼	Cancel		

Figure 9.13 Select RAS project to import from Browser

- 2. Browse to the folder *FRA\_RR\_Models*; double click on the *RR\_RAS\_Model* folder, select *RussianRiver.prj* and, then click **Open.**
- 3. The **Select RAS project to import from** browser will close (Figure 9.13). An **Importing** window (Figure 9.14) will open; when the HEC-RAS model import is complete this window will close. The HEC-RAS model import is completed.

Importing RAS	<b>X</b>

Figure 9.14 HEC-RAS Importing Window

#### 9.5 Import an HEC-FIA Model

1. From the HEC-WAT main window (Figure 9.5), from the **File** menu, point to **Import**, and click **FIA**. The **Import** Alternatives dialog box will open (Figure 9.15); this dialog box can open behind the HEC-WAT main window.

<u>a</u> 1	Import Alternat	ives		٢		
	Select/Add Project Please Select Your Alternative For Each Project					
	Project	Alternative	Progress			
	Edit Alternative Specifications					
		Import Alternativ	Close			

Figure 9.15 Import Alternatives Dialog Box

- Click Select/Add Project, an Open Browser will open (Figure 9.3). Browse to the folder *FRA\_RR\_Models*; double click on the *RR\_FIA\_Model* folder, select *RussianRiver.prj* and, then click Open.
- 3. The table will now contain the name of the **Project** (*RussianRiver*). From the **Alternative** column (Figure 9.16), from the list select the HEC-FIA alternative that will be imported (*GridsAndXSecsAlternative*).

Р	Please Select Your Alternative For Each Project				
	Project Alternative Progress				
	RussianRiver	GridsAndXSecsAlter 👻			

Figure 9.16 HEC-FIA Import Alternative Table

- 4. Click Edit Alternative Specifications, the Alternative Specification dialog box will open. Select Copy Projection from project, and click OK.
- 5. Click **Import Alternatives**, in the **Progress** column of the table (Figure 9.16) the cell will display the progress of the import with a green bar. When the import is complete an **Information** window will open, click **OK**.
- 6. From the **Import Alternatives** dialog box (Figure 9.15) click **Close**. The HEC-FIA model alternative has been imported.

## 9.6 Add Map Layers

Now that the base models have been imported into the study lets add some map layers:

 From the HEC-WAT main window (Figure 9.5), from the Maps menu, click Add Map Layers, the Select Map to Add browser will open (Figure 9.17). Click Create Copy. Browse to the folder *RussianRiver\_Data*; double click on the *MapLayers* folder, select the following map layers:

🐺 Select Map	X Select Map to Add				
Look in:	<u> MapLayer</u>	s 🔻 🌶 🏓	<b>-</b>		
Recent Items	RR_Comr RR_Impace RR_Lakes	s_Albers_ft.shp monComputationPoints.shp ctAreas.shp s_Albers_ft.shp rvoirPool.shp	Create Copy		
Desktop	RR_Stream	mAligment.shp ivers.shp ubbasins.shp			
My Docume	Succurap	3.00m			
Computer					
	File name:	"RR_CommonComputationPoints.shp" "RR_ImpactAreas.shp"	Open		
Network	Files of type:	All Maps 🔹	Cancel		

Figure 9.17 Select Map to Add Browser

- Find the map layer which represents the impact areas RR\_ImpactAreas.shp
- Find the map layer which represents the CCPs *RR\_CommonComputationPoints.shp*
- 2. Click **Open**, the **Select Map to Add** browser will close (Figure 9.17). The HEC-WAT **Schematic Map Window** (Figure 9.18) will now display the added map layers.
- 3. The user can now make adjustments to the map layers. From the HEC-WAT main window (Figure 9.5), click the **Maps** tab. From the **Map Layers** tree:
  - Right-click on the **Stream Alignment** layer, from the shortcut menu, click **Move to Top**.
  - Right-click on the **Without Project Conditions** layer, from the shortcut menu, click **Move to Top**.
  - Un-check the *Raingages\_Albers\_ft.shp* map layer (this will cause the map layer to no longer display in the active map window).
  - Right-click on the *RR\_ImpactAreas.shp* map layer, from the shortcut menu, click **Properties**. The **Edit Polygon Properties Editor** will open (Figure 9.19). From the **Fill Tab**, change the color to "lightgreen", click **OK**. The impact areas on the active map window will now display in "lightgreen".
- 4. The user can adjust the view of the study area in the active map window. Using the Magnifier Tool, zoom the study area in the active map window the appropriate area that the user would like displayed. From the HEC-WAT main window (Figure 9.5), from the Maps menu, click Default Map Properties, the Default Map Properties for dialog box will open (Figure 9.20). Click Set Map Extents to Display, click OK. The Default Map Properties for dialog box will close.

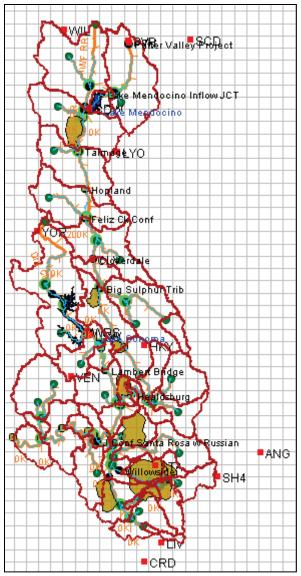


Figure 9.18 Map Layers Added to Watershed

¥ Edit Polygon Properties				
WAT_Study/RussianRiver/maps/RR_ImpactAreas.shp				
Fill Border Labels				
Draw Features using:				
One Fill 🔹				
📝 Display Fill				
Color lightgreen				
Style				
Transparency				
25				
OK Cancel Apply				

Figure 9.19 Edit Polygon Properties Editor

Default Map Properties for RussianRiver				
Map Extents D	efault Map Layers			
Coordinate System: USA_Contiguous_Alb View				
	Extents: Easting:	Northing:		
	Minimum: 899177.724	Min: 527787.249		
	Maximum: 114412.865	Max: 156685.746		
	Set Map Extents to Display			
Grow to Map Extents				
OK Cancel Apply				

Figure 9.20 Default Map Properties for Dialog Box

This sets the extents for the **Map Window** so that when the study is opened the next time the **Map Window** will be zoomed in to the tighter area.

## 9.7 Define Plug-Ins for an FRA Study

To define the plug-ins for the RussianRiver study:

- 1. From the HEC-WAT main window (Figure 9.5), from the **File** menu, click **Study Details**.
- 2. The **Study Details** dialog box (Figure 9.21) will open. Click on the **Plug-ins** tab. The table that is displayed provides information on the plug-ins that are available in for the study.
- 3. For an FRA study, all plug-ins should be selected. Click **OK**, the **Study Details** dialog box will close (Figure 9.21).

## 9.8 Hydrologic Sampling

The first step in an FRA compute (Monte Carlo analysis) is the sampling of the hydrology to create perhaps thousands of realizations of a hydrologic sequence. Because FRA is an eventbased model, the hydrology information is needed as time series of flow or precipitation to be routed through the system under study. Life-cycle analysis requires each realization of hydrology to consist of a full analysis period, for example fifty years, although a single year analysis period is also possible. Realizations may be formed as flow hydrographs, or may be formed as precipitation hyetographs, with hydrographs generated by HEC-HMS within each FRA sub-compute. Each realization of the analysis period will only be populated by the flood events, and not the low flow periods between flood events.

X Study Details					X
Study Name:	RussianRiver				
Study Description:	Russian River water	resources s	study		
Study File:	b\Desktop\New_WA	T_Study\Ru	ssianRiver	RussianRiver.sty	
Unit System:	English				
Coordinate System:	USA_Contiguous_Al	bers_Equal	_Area_Co	nic_USGS_versio	n
Created By:	q0hecprb				
Created At:	Wed May 31 20:02:59 PDT 2017				
Map Properties Co	ontacts Model Info	Simulations	Plugins		
Plugin		Ena	Enabled		
FIA				V	
Fragility Curve				1	
HEC-SSP		1		1	
HMS		1		1	
Hydrologic Samplin	ng			<b>v</b>	
Performance Metric	s			<b>v</b>	
RAS		1		✓	
ResSim				✓	
Simulation Compute Engine Manager				✓	
Time-Window Interval Generator				<b>v</b>	
TimeWindowModifi	er			$\checkmark$	
L		ОК		Cancel	Apply

Figure 9.21 HEC-WAT - Study Details Dialog Box - Plugins Tab

Hydrologic Sampling generates the hydrologic sequences required for the sampling of the hydrology. Then hydrologic information such as flow or precipitation frequency curves, cross correlations between curves, and hydrograph or hyetograph shapes, or historical and synthetic event hydrographs is stored. The Hydrologic Sampling then generates pseudo random numbers to sample the hydrology to generate as many realizations of the life-cycle hydrologic sequence as necessary. Each generated sequence is made available to the other software applications available in the HEC-WAT program sequence.

#### 9.8.1 Creating a Hydrologic Sampling Alternative

The following is for creating a simple hydrologic sampling alternative from a hydrologic sampling alternative that has already been created. For further details review the HEC-WAT User's Manual.

#### 9.8.2 Copying a Hydrologic Sampling Alternative

1. With the HEC-WAT software closed, from the user's computer, locate the HEC-WAT directory for the watershed. From the *FRA\_RR\_Models* folder, copy the *RR\_hs* folder to the HEC-WAT directory that contains the study. Rename that folder to *hs*.

- 2. Open HEC-WAT, and open the *RussianRiver* study.
- 3. From the **Study Pane** (Figure 9.22), expand **Models**. There should be a **Hydrologic Sampling** node, click on it. In the **Content Pane** (below the **Study Pane**), there should be a Hydrologic Sampling Alternative *RR\_Precip2*.

RussianRiver
🚍 🏇 Alternatives
🚊 🔺 Without Project Conditions
🗄 퉲 Simulations
🕀 😼 Schematic:Without Project Conditions
ianalysis Periods ianalysis Periods
i dels
FIA
Hydrologic Sampling
Performance Metrics
RAS
ResSim
Time-Window Interval Generator
W TimeWindowModifier
Hydrologic Sampling
SR_Precip2
-
Study Maps Schematic

Figure 9.22 Study and Content Panes

- 4. Right-click on *RR\_Precip2*, from the shortcut menu click **Edit**. The **Hydrologic Sampling Editor** will open (Figure 9.23).
- 5. RR\_Precip2 is a hydrologic sampling alternative that was previously built for the Russian River study. This alternative is setup to sample precipitation data. How do we know that (besides the name)? From the Data to be Sampled list on the Hydrologic Sampling Editor (Figure 9.23), Precipitation Sampling has been selected. The other choice is Flow Sampling. For Precipitation Sampling there is one sampling method available (Sampling Method list, Figure 9.23), Basin Average Frequency Curve.
- For Flow Sampling, there are two sampling choices (Sampling Method list, Figure 9.23) Basin Average Frequency Curve (which is the selection for *RR\_Precip2*) and Historical Basin-wide Events. Each of these choices are the mechanisms that generate a hydrologic sequence.
  - **Basin Average Frequency Curve** generates an event hydrograph for each location by sampling a peak flow from a flow frequency curve and combining that peak with a hydrograph shape (for further details see HEC-WAT User's Manual and Applications Guide).

<b>H</b> s Hydrolog	gic Sam	pling Editor				X			
Name: Description:	Name: RR_Precip2   K (1) 1 of 1 (b) H Description: RR_Precip with new GEV and extra shapes								
Data to be Sa	Data to be Sampled: Precipitation Sampling  Sampling Method: Basin Average Frequency Curve								
Event Samp	ling Fr	equency Curve	Hyetograph Locations	Shape Sets	Shape Summary				
Flood Sea Distributic Uniform Min (Sta Max (En	n Type rt): 1N	Uniform	▼ ate -DDMMM) ate -DDMMM)	Program y Program y Progra	Intribution Plot				
				PDF	CDF	Plot			
Data Ch	eck	]			ОК	Cancel Apply			

Figure 9.23 Hydrologic Sampling Editor - Event Sampling Tab

• **Historical Basin-wide Events** - the period-of-record of actual events plus an array of synthetic events are put into a "flood bucket" and repeatedly re-sampled to provide basin-wide sets of hydrographs (for further details see HEC-WAT User's Manual and Applications Guide).

#### 9.9 Create an Analysis Period

An FRA compute requires an HEC-WAT alternative, an analysis period, a program order, and model alternatives.

To create an analysis period:

1. From the HEC-WAT main window (Figure 9.5), from the **Study Tree**, right click on the **Analysis Periods** folder (Figure 9.24). From the shortcut menu click **New**.

💕 Ru	ssianRiv	er					
📄 💏	Alternativ	/es					
i i	A With	out Pi	oject Conditions				
	🗄 🚺 S	imula	tions				
	🗄 😼 s	chen	natic:Without Project Cond	itions			
	Analysis						
<u>⊢</u> <b>≣</b>	Models	9	New				
	🐨 FIA	$\times$	Delete from Study				
HMS HMS							
RAS							
	Res	Sim					

Figure 9.24 Analysis Period Shortcut Menu

2. The **Create New Analysis Periods** dialog box will open (Figure 9.25). In the **Name** box enter a name ( $FRA_TW$ ). In the **Time Window** box enter the information required for the time window.

✗ Create New Analysis Periods								
Name: Description:	FRA_TW							
Time Windo Start Date:	W	02Oct1950 Start Time:	0000					
End Date:		010ct2000 End Time:	2400					
Years in Tin	ne Window:		50					
		ОК	Cancel					

Figure 9.25 Create New Analysis Periods Dialog Box

- 3. For the **Start Date** and **End Date**, enter in the format ddmmmyyyy. The **Start Time** and **End Time** should be entered as military time e.g. 0000, 0600, 1300 (1 p.m.), 2400 (midnight)
- 4. Click **OK**, the **Create New Analysis Periods** dialog box will close (Figure 9.26). On the HEC-WAT main window (Figure 9.5), from the **Study Pane**, under the **Analysis Periods** folder, the new analysis period name will appear.

## 9.10 Setup Lookback Window – HEC-ResSim

The time window for an HEC-ResSim run has two parts, a "lookback period" and a "simulation or forecast period". The lookback period is used by HEC-ResSim to "warm up" a ResSim model alternative. During this period, routing of flows through the river and reservoir network are performed but no release decisions are made nor are any mass balance computations evaluated. The user should think of the lookback period as the time to establish the state of the river network and the starting conditions of the reservoirs. The simulation period is the portion of the time window during which HEC-ResSim simulates reservoir operations, and makes release decisions based on the operation scheme defined by the user. Releases are then routed through the river network, combining with local inflows along the way.

Since HEC-WAT and most of the models treat the analysis period as a single, continuous time window. For this reason a setup step is required for each HEC-ResSim alternative in an HEC-WAT study. The setup step lets each ResSim model alternative know how much of the analysis period to use for the lookback period.

To setup the lookback period:

1. From the HEC-WAT main window (Figure 9.5), from the Edit menu, point to ResSim, click Lookback Window (Figure 9.26).

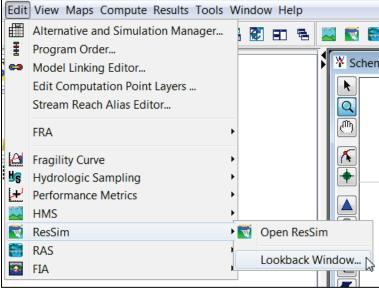


Figure 9.26 Edit Menu – ResSim – Lookback Window

2. The Lookback Window dialog box (Figure 9.27) will open.

Y Lookback Wir	dow		<b>X</b>
Alternative	Description	TimeStep	Lookback Steps
calibrate		1 Hour 🔻	6
		5 Minutes 10 Minutes 15 Minutes 30 Minutes 1 Hour 2 Hour 3 Hour 4 Hour OK Cance	Apply

Figure 9.27 Lookback Window Dialog Box

- 3. The table displays the ResSim model alternative that are available in the HEC-WAT study. Each model alternative that is being used in an HEC-WAT simulation will need to have a lookback window set. For example, in Figure 9.27, the HEC-ResSim alternative *calibrate* has a **TimeStep** of 1 hour and **Lookback Steps** of 6.
- 4. The time step can be selected from the **TimeStep** column, in each cell there is a list of available time steps for the user to choose from. The selected time step has to match the time step that was specified for the ResSim model alternative as part of the alternative's

original run control data (which is located in the HEC-ResSim Alternative Editor). The number of lookback steps must be entered in a cell in the **Lookback Steps** column. At least one lookback time step is required for a ResSim model alternative to compute, however more lookback steps may be needed, depending on a variety of factors in the ResSim model alternative's operating scheme. The HEC-ResSim modeler should be consulted to determine the minimum lookback window needed by each alternative.

# 9.11 Program Order

HEC-WAT allows for a flexible set of programs, computation order, and data flow through the establishment of a program order. Once a program order has been chosen for an HEC-WAT study, changes should not be made to the program order as this could cause a disruption in the flow of data and invalidate any existing work.

Currently in HEC-WAT Version 1.0 the default program order is - HMS, ResSim, RAS, FIA. This is the correct program order for the example watershed that is being used, so no adjustment is necessary. For further details on **Program Order**, review Chapter 11 (Section 11.1) of the HEC-WAT User's Manual.

# 9.12 Create an HEC-WAT FRA Simulation

Now that all of the building blocks have been configured, the user can now create an HEC-WAT FRA simulation. To create an HEC-WAT FRA simulation:

- 1. From the HEC-WAT main window (Figure 9.5), from the **WAT Tools** toolbar, click the **Alternative and Simulation Manager** button
- 2. The Alternative and Simulation Manager dialog box will open (Figure 9.28). From this dialog box the user can create/modify alternatives, analysis periods, simulations, program order, link models, and make runs.

⅔ Alternative and Simulation Manager								
File Edit View								
A 🖓 A 🗄 🖴 🎉								
Alternatives	Analysis Periods							
Alternatives	FRA_TW							
Without Project Conditions	Create Simulation Create Simulation From							
Need to create a Simulatio	n OK Cancel Apply							

Figure 9.28 Alternative and Simulation Manager Dialog Box

3. To create a simulation, from the table right-click on the intersection of an alternative and analysis period. From the shortcut menu click **Create Simulation**. The **Create New Simulation** dialog box will open (Figure 9.29).

¥ Create New Simulation									
Name: Description									
	Description:								
Alternativ	/e:	Without	Project Conditior	IS		•]			
Analysis	Period:	FRA_TV	٧			▼]			
Program	Order:	Default				▼ New			
F Part:	Without	Pr:FRA_	ſW						
Models	Prog	gram	Alternative	Simulation Time Window	Time Window Adjustment	Needs To Compute			
	HMS			Simulation 🔻	N/A				
	ResSim	I		Simulation 🔻	N/A				
	RAS			Simulation 🔻	N/A				
	FIA Simulation V/A								
				OK	Cancel	Apply			

Figure 9.29 Create New Simulation Dialog Box

- 4. HEC-WAT has defined a default name for the simulation (*Without Project Conditions-FRA\_TW*) in the **Name** box (Figure 9.29). The name is a combination of the HEC-WAT alternative name and analysis period name, where the intersection was in the table (name can be changed). Also, in the **Alternative** and **Analysis Period** lists (Figure 9.29) the selections have already been made based on the intersection in the table. The selected **Alternative** cannot be changed, but the selected **Analysis Period** can be changed.
- 5. In the **F Part** box (Figure 9.29), a default **F Part** is displayed that was generated by HEC-WAT based once again on the alternative and analysis period. The user can edit the item, but it is not advised.
- 6. To create an FRA simulation, select **Run FRA** (Figure 9.30). The options for setting up an FRA simulation are now available.

Run FRA	
Number of realizations to perform the flood risk management analysis:	10
Minimum number of realizations before checking for convergence:	1
Years per realization:	500
Hydrologic Event Alternative:	BR_Precip2 ▼

Figure 9.30 FRA Setup - Create New Simulation Dialog Box

- Number of realizations to perform the flood risk management analysis enter the maximum number of realizations (e.g., 10) that are needed to perform the FRA analysis; number must be equal to or larger than the simulation time window.
- Years per realization default is 500; number can be increased.
- 7. From the **Hydrologic Event Alternative** list (Figure 9.30) select the appropriate Hydrologic Sampling Alternative (*RR\_Precip2*).
- 6. A program order needs to be selected. From the **Program Order** list (Figure 9.30) select the *Default* program order.
- 8. In the **Programs** table (Figure 9.31), the software applications that were defined in the program order appear in the order the software applications were selected. Now the user must select the appropriate alternative (plan, run) for each software application. From the **Alternative** column, from the list for **HMS** (Figure 9.31), select the appropriate HMS run (*(MCA)DCL\_WAT*). Repeat the process for the other software applications. Below is the list of the appropriate alternatives for the *RussianRiver* study:

Models	Program	Alternative	Simulation Time Window	Time Window Adjustment	Needs To Compute
	HMS	(MCA)DCL_WAT	Simulation Window 🔻	Edit	Compute
	ResSim		Simulation Window	Edit	
	RAS	🔚 Base 🔻	Simulation Window 🔻	Edit	
	FIA	GridsAndXSecsAlt 🔻	Simulation Window 🔻	Edit	

Figure 9.31 Selection of Model Alternatives - Create New Simulation Dialog Box

HMS - (MCA)DCL\_WAT ResSim - calibrate RAS - Base FIA - GridsAndXSecsAlternative

- Now that all of the alternatives have been selected, click OK. The Create New Simulation dialog box will close (Figure 9.28). On the Alternative and Simulation Manager (Figure 9.32) dialog box, the intersection of the alternative and analysis period now provides information about the simulation.
- Click OK; the Alternative and Simulation Manager dialog box will close (Figure 9.32). From the HEC-WAT main window (Figure 9.5), the created simulation appears on the Study Tree, under the Simulations folder (Figure 9.33).
- 11. Click on the simulation in the **Study Tree** (Figure 9.33), the **Content Pane** (Figure 9.34) displays information about the selected simulation.
- 12. Double-click on the simulation name (*Without Project Conditions-FRA\_TW*), a Select Map dialog box will open. Click New Map Window, click OK. The Select Map dialog box will close. The new map window will contain the schematic elements that represent the simulation (Figure 9.35).

X Alternative and Simulation Manager							
File Edit View							
🗛 😳 🧏 🗄 👄 🚴							
Alternatives		Analysis Periods					
Alternatives		FRA_TW					
	HMS	(MCA)DCL WAT					
Without Project Conditions	ResSim	calibrate 🔹 🔻					
Wallout Toject Conditions	RAS	Base 🔻					
	FIA	GridsAndXSecsAlternative					
		OK Cancel Apply					

Figure 9.32 Alternative and Simulation Manager - Completed Simulation

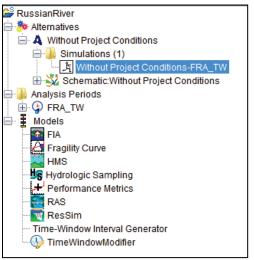


Figure 9.33 Study Tree with Created Simulation

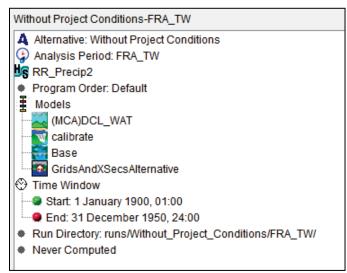


Figure 9.34 Content Pane

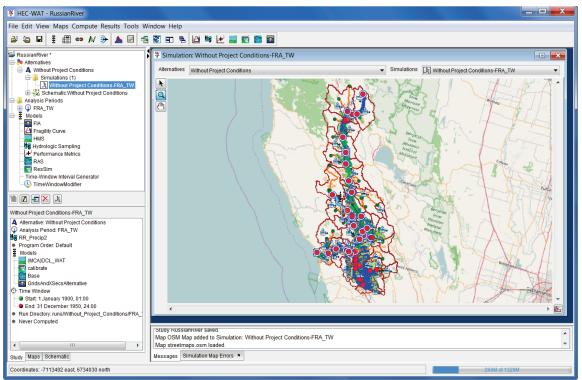


Figure 9.35 Map Window - Schematic of Current HEC-WAT Simulation

# 9.13 Linking

The next step is to have the models of a simulation communicate with each other. This is accomplished by linking (DSS mapping) the models thru DSS and using a simulation name. From HEC-WAT, the **Model Linking Editor** (Figure 9.36) provides an easy way to link models including observed data, and provides a mechanism where the linking will have to be done once per alternative.

Model Linking Editor								
File Edit View								
84								
Simulation: Without Project Condi	itions-FRA_TW			▼ ●				
Model To Link:								
Default Model To Link:								
Location	Parameter	Input From Model	Location/Parameter	Dynamically Linked				
				<b>^</b>				
	Solor	t Source Data						
	Select Source Data							
Dynamically Linked Locations	Linked In Different Sim	nulation						

Figure 9.36 Model Linking Editor

- 1. From the HEC-WAT main window (Figure 9.35), from the **WAT Tools** toolbar, click the **Model Linking Editor** button .
- 2. The **Model Linking Editor** will open (Figure 9.36). From the **Simulation** list the user will need to select a simulation. For this example the user will be selecting the *Without Project Conditions-FRA\_TW* (default) simulation.
- 3. Now let's link the individual model alternatives that are part of the selected simulation.

# 9.13.1 Linking the HMS Model Alternative

1. From the **Model Linking Editor** (Figure 9.36), from the **Model to Link** list select *HMS- (MCA)DCL\_WAT* (Figure 9.37). The **Model Linking Editor** table will now contain all of the locations for the HEC-HMS model that need to be linked.

Model Linking Editor				
File Edit View				
🖬 🖨 🥠				
Simulation: Without Project Co	nditions-FRA_TW			▼ ●
Model To Link: 🔀 HMS-(MCA)DC	L_WAT			Image: A state of the state
Default Model To Link:				
Location	Parameter	Input From Model	Location/Parameter	Dynamically Linked
Calpella	Precipitation	<b></b>		•
Lake Mendocino	Precipitation	<b></b>		
Ukiah	Precipitation	<b></b>		Ξ
Talmage Loc	Precipitation	<b></b>		
Hopland Loc	Precipitation	<b></b>		
Feliz Ck	Precipitation	<b></b>		
Cloverdale Loc	Precipitation	<b></b>		
Big Sulphur Loc	Precipitation	<b></b>		
AG Resort	Precipitation	<b></b>		
Oat Valley Ck	Precipitation	<b></b>		
Geyserville Loc	Precipitation	<b>•</b>		
limtown Loc	Procinitation			<b>v</b>
Dynamically Linked Locations	_	t Source Data		

Figure 9.37 Model Linking Editor - HMS Model Alternative Unlinked

- 2. For HEC-HMS the linking will be results from the Hydrologic Sampling alternative. The printout (*RussianRiverLinking.pdf*) of the linking for each of the model alternatives is located in a folder titled *RussianRiver\_Data*.
- Does every row in the table have to be done? Yes, but, since all of the linking will be to the Hydrologic Sampling alternative, click Default Model to Link. The Select Default Model to Link dialog box will open (Figure 9.38). From the Default Model to Link list, select HydrologicSampling-RR\_Precip2. Click OK, the Select Default Model to Link dialog box will close (Figure 9.38).

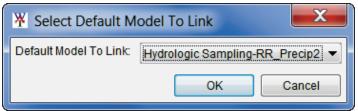


Figure 9.38 Select Default Model To Link Dialog Box

4. A Confirm Input From Model changing to window (Figure 9.39) will appear. Basically the window is asking the user to be sure before proceeding, click Yes. The Confirm Input From Model changing to window closes, and the Model Linking Editor now displays the linking for the HEC-HMS model (Figure 9.40).

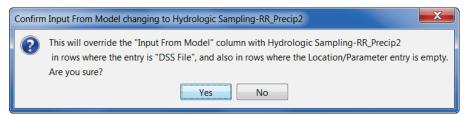


Figure 9.39 Confirm Input From Model changing to Window

Model Linking Editor							x
File Edit View							
6 4							
	t Project Conditions	-FRA TW				▼	
Model To Link: 🔀 HM	IS-(MCA)DCL_WAT					▼ ◀	
Default Model To Link	k:						
Location	Parameter	Input From Model		Location/Parameter		Dynamically Linked	9
Calpella	Precipitation	Hydrologic Sampling-RR_Precip2	◄	Calpella - PRECIP-INC	-		
Lake Mendocino	Precipitation	Hydrologic Sampling-RR_Precip2	◄	Lake Mendocino - PRECIP-INC	•		
Ukiah	Precipitation Hydrologic Sampling-RR_Precip2  Ukiah - PRECIP-INC		•		≡		
Talmage Loc	Precipitation	Hydrologic Sampling-RR_Precip2	◄	Talmage Local - PRECIP-INC	•		
Hopland Loc Precipitation		Hydrologic Sampling-RR_Precip2	•	Hopland Loc - PRECIP-INC	•		
Feliz Ck	Precipitation	Hydrologic Sampling-RR_Precip2	•	Feliz Creek - PRECIP-INC	•		
Cloverdale Loc	Precipitation	Hydrologic Sampling-RR_Precip2	•	Cloverdale - PRECIP-INC	•		
Big Sulphur Loc	Precipitation	Hydrologic Sampling-RR_Precip2	•	Big Sulphur Loc - PRECIP-INC	•		
AG Resort	Precipitation	Hydrologic Sampling-RR_Precip2	•	Ag Resort - PRECIP-INC	•		
Oat Valley Ck	Precipitation	Hydrologic Sampling-RR_Precip2	•	Oat Valley Creek - PRECIP-INC	•		
Geyserville Loc	Precipitation	Hydrologic Sampling-RR_Precip2	•	Geyserville Loc - PRECIP-INC	•		Ţ
limtown Loc	Procinitation	Hydrologic Sampling DD Procin?	-Ĩ	limtown Loc PRECIPINIC	-1		-
		Select Source Data					
Dynamically Linked	Locations 📃 Link	ed In Different Simulation					

Figure 9.40 Model Linking Editor - Completed HMS Model Alternative Linking

- 5. Once the linking is finished for the HMS model alternative, from the **Model Linking** Editor (Figure 9.40) click , this will save the linking.
- 6. That completes the linking for the HMS model alternative.

# 9.13.2 Linking the ResSim Model Alternative

1. From the **Model Linking Editor** (Figure 9.40), from the **Model to Link** list, select *ResSim-calibrate*. The **Model Linking Editor** table (Figure 9.41) will now contain all of the locations for the ResSim model alternative that needs to be linked.

ile Edit View				
🖬 🎒 🎺				
Simulation: Without	Project Conditions	S-FRA TW		▼
	-	_		
Re:	Sim-calibrate			▼ ◀
Default Model To Link	:			
Location	Parameter	Input From Model	Location/Parameter	Dynamically Linked
Ukiah	Known Flow	HMS-(RUN)Feb_1986	▼ Ukiah	•
Jenner	Known Flow	HMS-(RUN)Feb_1986	▼ Jenner	•
Austin Ck Local	Known Flow	HMS-(RUN)Feb_1986	✓ Austin Ck Loc	•
Hacienda Loc	Known Flow	HMS-(RUN)Feb_1986	▼ Hacienda Loc	•
Green Valley	Known Flow	HMS-(RUN)Feb_1986	▼ Green Valley	•
Santa Rosa Cr	Known Flow	HMS-(RUN)Feb_1986	<ul> <li>Mirabel Heights-Mirabel Park</li> </ul>	•
Dry Creek Local	Known Flow	HMS-(RUN)Feb_1986	Dry Ck Lower	•
Geyserville Dry Creek	Known Flow	HMS-(RUN)Feb_1986	▼ Yoakim Loc	•
Lake Sonoma Inflow	Known Flow	HMS-(RUN)Feb_1986	▼ Lake Sonoma	•
Healdsbug East	Known Flow	HMS-(RUN)Feb_1986	▼ Healdsbug East	•
Geyserville Local	Known Flow	HMS-(RUN)Feb_1986	▼ Geyserville Loc	•
Rig Sulphur Cr	Known Flow	LING (DUNIEAD 1006	Big Sulphur Ck	-

Figure 9.41 Model Linking Editor - ResSim Model Alternative Unlinked

- 2. For ResSim the linking will be the results from the HMS model alternative. Well, this looks like it is already linked. Well, yes and no. The HEC-ResSim model was already part of another HEC-WAT study. The model was modified to include parameter sampling. So the **Model Linking Editor** is reading the ResSim linking and it's reporting that this HEC-ResSim model alternative is already linked to an HMS model alternative that HEC-WAT knows about and it was linked to a different HEC-WAT simulation.
- Does every row in the table have to be done? Yes, but, since all of the linking will be to the HMS model alternative, click Default Model to Link. The Select Default Model to Link dialog box will open (Figure 9.38). From the Default Model to Link list, select HMS-(MCA)DCL\_WAT. Click OK, the Select Default Model to Link dialog box will close (Figure 9.38).
- 4. A Confirm Input From Model changing to window (Figure 9.39) will appear. Basically the window is asking the user to be sure before proceeding, click Yes. The Confirm Input From Model changing to window closes, and the Model Linking Editor now displays the linking for the ResSim model alternative (Figure 9.42).

File Edit View						
🔲 🖨 🥠						
Simulation: Withou	t Project Conditions	-FRA_TW		▼ ●		
Model To Link: [ 📆 Re						
Default Model To Lin	k:					
Location	Parameter	Input From Model	Location/Parameter	Dynamically Linked		
Ukiah	Known Flow	HMS-(MCA)DCL_WAT	▼Ukiah - Flow	•		
Jenner	Known Flow	HMS-(MCA)DCL_WAT	Jenner - Flow	•		
Austin Ck Local	Known Flow	HMS-(MCA)DCL_WAT	<ul> <li>Austin Ck Loc - Flow</li> </ul>	•		
Hacienda Loc	Known Flow	HMS-(MCA)DCL_WAT	<ul> <li>Hacienda Loc - Flow</li> </ul>	•		
Green Valley	Known Flow	HMS-(MCA)DCL_WAT	<ul> <li>Green Valley - Flow</li> </ul>	•		
Santa Rosa Cr	Known Flow	HMS-(MCA)DCL_WAT	<ul> <li>Mirabel Heights-Mirabel Park</li> </ul>	•		
Dry Creek Local	Known Flow	HMS-(MCA)DCL_WAT	<ul> <li>Dry Ck Lower - Flow</li> </ul>	•		
Geyserville Dry Creek	. Known Flow	HMS-(MCA)DCL_WAT	<ul> <li>Yoakim Loc - Flow</li> </ul>	•		
Lake Sonoma Inflow	Known Flow	HMS-(MCA)DCL_WAT	▼ Lake Sonoma - Flow	•		
Healdsbug East	Known Flow	HMS-(MCA)DCL_WAT	✓ Healdsbug East - Flow	•		
Geyserville Local	Known Flow	HMS-(MCA)DCL_WAT	<ul> <li>Geyserville Loc - Flow</li> </ul>	•		
Dia Quinhur Or	Known Flow		- Dia Sulphur Ck. Elow	<b>_</b> i		

Figure 9.42 Model Linking Editor - Completed ResSim Model Alternative Linking

- 5. Once the linking is finished for the ResSim model alternative, from the **Model Linking** Editor (Figure 9.42) click 🖬 , this will save the linking.
- 6. That completes the linking for the ResSim model alternative.

## 9.13.3 Linking the RAS Model Alternative

- 1. From the **Model Linking Editor** (Figure 9.42), from the **Model to Link** list, select *RAS-Base*. The **Model Linking Editor** table (Figure 9.43) will now contain all of the locations for the RAS model alternative that needs to be linked.
- 2. For the RAS linking, results from the HMS and ResSim model alternatives will be used. The printout (*RussianRiverLinking.pdf*) of the linking for each of the model alternatives is located in a folder titled *RussianRiver\_Data*.
- From the Model Linking Editor (Figure 9.43), click Default Model to Link. The Select Default Model to Link dialog box will open (Figure 9.38). From the Default Model to Link list, select HMS-(MCA)DCL\_WAT. Click OK, the Select Default Model to Link dialog box will close (Figure 9.38).
- 4. A Confirm Input From Model changing to window (Figure 9.39) will appear. Basically the window is asking the user to be sure before proceeding, click Yes. The Confirm Input From Model changing to window closes, and the Model Linking Editor now displays the linking for the RAS model alternative (Figure 9.44).

ile Edit View				
Simulation: Without Project Conditions-FRA_TW				• •
Model To Link: 📑 RAS-Base				▼ ◀
Default Model To Link:				
Location	Parameter	Input From Model	Location/Parameter	Dynamically Linked
SA: 365	Flow	DSS File 🔻	out.dss://UKIAH/FLOW//15MIN/WIT 🔻	
SA: 773	Flow	DSS File 🔹	out.dss://CHALK HILL LOC/FLOW// 🔻	
SA: 923	Flow	DSS File 🔹	out.dss://CAZADERO-AUSTIN/FLO 🔻	
SA: 928	Flow	DSS File 🗸	out.dss://GREEN VALLEY/FLOW//1 🔻	
SA: 929	Flow	DSS File 🔻	out.dss://MIRABEL HEIGHTS-MIRA 🔻	
DryCreek DryCreek RS 58953.5	Flow	DSS File 🔻	out.dss://YOAKIM LOC/FLOW//15MI 🔻	
DryCreek DryCreek RS 37302.09	Flow	DSS File 🔻	out.dss://LAMBERT LOC/FLOW//15 🔻	
DryCreek DryCreek RS 3499	Flow	DSS File 💌	out.dss://DRY CK LOWER/FLOW//1 🔻	
Russian CoyoteToDC RS 527387.7 (Lake Mendocino O)	Flow	DSS File	out.dss://LAKE MENDOCINO-POO 🔻	
Russian CoyoteToDC RS 418492.2	Flow	DSS File 🔻	out.dss://FELIZ CK/FLOW//15MIN/ 🔻	
Russian CoyoteToDC RS 348180.3	Flow	DSS File 🔻	out.dss://OAT VALLEY CK/FLOW//1 🔻	
Ruccian CovotoToDC RS 247412.0	Flow			
	Select Source I	Data		

Figure 9.43 Model Linking Editor - RAS Model Alternative Unlinked

				5 6
			▼ ◀	וו
Parameter	Input From Model	Location/Parameter	Dynamically Linked	6
Flow	HMS-(MCA)DCL_WAT	Ukiah - Flow	-	
Flow	HMS-(MCA)DCL_WAT	Chalk Hill Loc - Flow	-	
Flow	HMS-(MCA)DCL_WAT	Coyote - Flow	-	
Flow	HMS-(MCA)DCL_WAT	Green Valley - Flow	-	
Flow	HMS-(MCA)DCL_WAT	Mirabel Heights-Mirabel Park - Flow	-	
Flow	HMS-(MCA)DCL_WAT	Yoakim Loc - Flow	-	
Flow	HMS-(MCA)DCL_WAT	Lambert Loc - Flow	-	
Flow	HMS-(MCA)DCL_WAT	Dry Ck Lower - Flow	-	
Flow	ResSim-calibrate 🔹	Lake Mendocino Outflow JCT - Flow	-	
Flow	HMS-(MCA)DCL_WAT	Feliz Ck - Flow	-	
Flow	HMS-(MCA)DCL_WAT	Oat Valley Ck - Flow	-	٦
Flow		Big Sulphur Ck. Flow	_1	1
	Flow Flow Flow Flow Flow Flow Flow Flow	Flow     HMS-(MCA)DCL_WAT       Flow     HMS-(MCA)DCL_WAT	Flow     HMS-(MCA)DCL_WAT     Ukiah - Flow       Flow     HMS-(MCA)DCL_WAT     Chalk Hill Loc - Flow       Flow     HMS-(MCA)DCL_WAT     Coyote - Flow       Flow     HMS-(MCA)DCL_WAT     Green Valley - Flow       Flow     HMS-(MCA)DCL_WAT     Green Valley - Flow       Flow     HMS-(MCA)DCL_WAT     Mirabel Heights-Mirabel Park - Flow       Flow     HMS-(MCA)DCL_WAT     Yoakim Loc - Flow       Flow     HMS-(MCA)DCL_WAT     Yoakim Loc - Flow       Flow     HMS-(MCA)DCL_WAT     Dry Ck Lower - Flow       Flow     HMS-(MCA)DCL_WAT     Dry Ck Lower - Flow       Flow     HMS-(MCA)DCL_WAT     Dry Ck Lower - Flow       Flow     HMS-(MCA)DCL_WAT     Flow       Flow     HMS-(MCA)DCL_WAT     Dry Ck Lower - Flow       Flow     HMS-(MCA)DCL_WAT     Oat Valley Ck - Flow	Parameter       Input From Model       Location/Parameter       Dynamically Linked         Flow       HIMS-(MCA)DCL_WAT       Ukiah - Flow          Flow       HIMS-(MCA)DCL_WAT       Chalk Hill Loc - Flow          Flow       HIMS-(MCA)DCL_WAT       Coyote - Flow          Flow       HIMS-(MCA)DCL_WAT       Coyote - Flow          Flow       HIMS-(MCA)DCL_WAT       Green Valley - Flow          Flow       HIMS-(MCA)DCL_WAT       Mirabel Heights-Mirabel Park - Flow          Flow       HIMS-(MCA)DCL_WAT       Yoakim Loc - Flow          Flow       HIMS-(MCA)DCL_WAT       Dry Ck Lower - Flow          Flow       HIMS-(MCA)DCL_WAT       Feliz Ck - Flow          Flow       HIMS-(MCA)DCL_WAT       Foliz Ck - Flow          Flow       HIMS-(MCA)DCL_WAT       Foliz Ck - Flow

Figure 9.44 Model Linking Editor - Completed RAS Model Alternative Linking

- 5. There are two locations in the RAS linking that needs to be linked to the ResSim model alternative. From the Model Linking Editor table (Figure 9.43) for the DryCreek DryCreek RS 74716.8 (Sonoma Outflow J) row, from the Input Model column (Figure 9.43), select ResSim-calibrate, select Lake Sonoma Outflow JCT Flow.
- 6. Repeat Step 5 for the *Russian CoyoteToDC RS 527387.7 (Lake Mendocino Outflow JCT Flow)* row.

- 7. Once the linking is finished for the RAS model alternative, from the **Model Linking** Editor (Figure 9.44) click 🖬, this will save the linking.
- 8. That completes the linking for the RAS model alternative.

# 9.13.4 Linking the FIA Model Alternative

1. From the **Model Linking Editor**, from the **Model to Link** list select *FIA*-*GridsAndXSecsAlternative* (Figure 9.44). The **Model Linking Editor** table (Figure 9.45) will now contain all of the locations for the FIA alternative model that needs to be linked.

X Model Lini	king Editor					x
File Edit Vie	w					
86 🖗						
Simulation:	Without Project	t Conditio	ns-FRA_TW		▼ … ↓	I 🕨
Model To Link:	FIA-GridsA	AndXSecs	Alternative			
Default Mode	l To Link:					
Location	n Para	ameter	Input From Model	Location/Parameter	Dynamically Linked	Q
Grid From File	Depth	(Max)	RAS-Base 🔻	Depth (Max)1 - depth 🛛 🔻		
						Ŧ
			Select Source Data			
Dynamically	/ Linked Locatio	ons 📃 L	inked In Different Simulation			

Figure 9.45 Model Linking Editor - Completed FIA Model Alternative Linking

- 2. For FIA, the linking will be the results from the RAS model alternative. Specifically depth grids that have been created by the RAS Mapper Tool available from HEC-RAS.
- 3. From the **Model Linking Editor** (Figure 9.45), from the **Input From Model** column, from the model list, select *RAS-Base*. In the **Location/Parameter** column, HEC-WAT has identified what it thinks is the correct item *Depth (Max)1 depth* and HEC-WAT is correct.
- 4. Once the linking is finished for the FIA model alternative, from the **Model Linking** Editor (Figure 9.47) click 🔲, this will save the linking.
- 5. That completes the linking for the FIA model alternative.

## 9.14 Output Variables

The user must choose at least one output variable from the model alterantives in the compute sequence or tell the FRA simulation to compute without an output variable being chosen before computing an FRA simulation (Section 9.15). For a "production" simulation where output is

required, the user should choose all appropriate output variables before running the simulation. Why is it a good idea for the user to choose at least one output variable? In most cases, the desired type of output from a WAT/FRA simulation will include the maximum (or minimum) value from a time-series record. For example, the maximum stage from a reservoir time-series could be extracted to build a reservoir stage frequency curve. Saving time-series information from many thousands of events, at many locations, for many alternatives could overwhelm the available storage on a computer. However, maximum values (scalars) do not require much disk space. From the **Output Variable Editor** (Figure 9.46), a user can select any available output variables from the models that are part of the selected HEC-WAT simulation and get summary information (e.g., maximum flows, maximum stage, etc.) for each event in the FRA compute.

File Edit							
8							
Simulation:	Without Pro	ject Conditions-FRA_TW					
Model:	FIA						,
Alternative:	GridsAr	ndXSecsAlternative		•	Select Variables to Save	Extraction Time Windo	ow
			Selected Model Outp (select Frequency to generat				
RAS	Model	Alternative	Variable	Parameter Stage	Units	Frequency	
RAS		Base	DRYCREEK DRYCREEK	Stage	ft		- 1
RAS		Base	RUSSIAN COYOTETODC	Stage	ft		
RAS		Base	RUSSIAN COYOTETODC	Stage	ft		
RAS		Base	RUSSIAN COYOTETODC	Stage	ft	<b>V</b>	
RAS		Base	RUSSIAN COYOTETODC	Stage	ft	<b>v</b>	
RAS		Base	RUSSIAN COYOTETODC	Stage	ft	✓	
FIA		GridsAndXSecsAlternative	Total Damage	Currency	\$	✓	-
FIA		GridsAndXSecsAlternative	Total Structures Damaged	Count	Structure Count	✓	

Figure 9.46 Output Variable Editor

- The Output Variable Editor will open (Figure 9.46). From this editor, the user can select variables from the model alternatives that are part of a selected HEC-WAT simulation. Currently, the maximum value for each of the output variables selected will be saved to the *simulation.dss* file and if the user wants to generate a frequency curve for a selected output variable, the user must select Frequency from the Output Variable Editor (Figure 9.46).
- 3. From the **Simulation** list, select an HEC-WAT simulation (only FRA simulations will be available); next from the **Model** list select the appropriate software application; and, then from the **Alternative** list select the appropriate model alternative.
- 4. Next click **Select Variables to Save**, the **Select** *model alternative* selector will open (Figure 9.47).

Figure 9.47 Select model alternative Selector

- 5. A list of the model alternative's available output variables is listed in the Available Variables list. To select one, highlight, and then click Add. The selected variable is moved to the Selected Variables list. Click OK, the Select model alternative selector (Figure 9.47) closes and the selected output variables appear on the Output Variable Editor (Figure 9.46).
- 6. From the File menu, click Save. Close the Output Variable Editor (Figure 9.46).

## 9.15 Compute and View Results

Now that a simulation has been defined, the linking of model alternatives has been completed for a simulation, and model alternatives have been imported into HEC-WAT, the user is now ready to compute the Russian River study.

- 1. From the HEC-WAT main window (Figure 9.35), from the **Study Tree**, from the **Simulations** folder, right-click *Without Project Conditions-FRA\_TW*. From the shortcut menu (Figure 9.48) point to **Compute**, click **Simulation**.
- The Run FRA Simulation dialog box will open (Figure 9.49). In the Name box is the name of the simulation that will be computed (*Without Project Conditions-FRA\_TW*). The number of realizations (10) that will be computed is provided in the Max. Number of Realizations box. Other options are:
  - Start at Lifecycle 1 default starting point of an FRA compute
  - **Run specified** by selecting this option the user can choose whether to run from a specific lifecycle or realization. From the **Run Specified List** (Figure 9.49) the user can select lifecycle or realization. In the text box the user will then enter the number of the specific lifecycle or realization to start the FRA compute from.

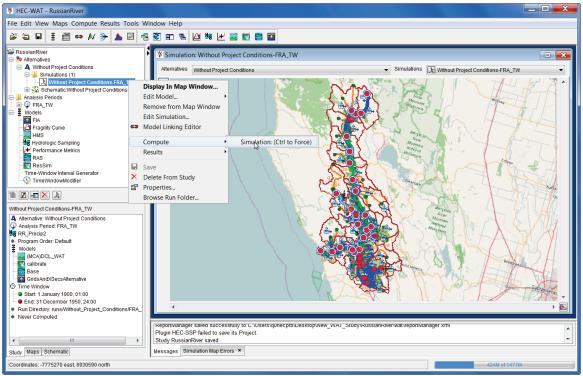


Figure 9.48 HEC-WAT Main Window - FRA Compute

₩ Run FRA Simulation - \	Without Project Conditions-FRA_TW	×
Name:	Without Project Conditions-FRA_TW	
Description:		
Max. Number of Realizations:		10
Compute Engine:	Single-Thread Sequential	Options
Start At Lifecycle 1	─ Run specified Lifecycle(s): ▼	
Save Lifecycle DSS Files	Save Model Folders	
Stop Simulation Compute	on Error	(
Output Variables Optional		
Restart WAT After Model E	rrors	
Consecutive Number of Er	rrors to Cause Restart: 3	
Maximum Number of Rest	tart Attempts: 3	
Restart Plugins		
MMS		
🔽 ResSim		
RAS		
<b>FIA</b>		
	<back next=""></back>	Cancel

Figure 9.49 Run FRA Simulation Dialog Box

- Save Lifecycle DSS Files when the user makes this choice all FRA results are saved. If the only results the user wants saved are by realization and lifecycle then the user should choose Delete Event Folders (Figure 9.49) to make sure results by events are not saved.
- Save Model Folders results by events are not saved by default; if the user wishes to save all information, Save Model Folders (Figure 9.49) must be selected
- Stop Simulation Compute on Error selecting this option will make the FRA compute stop when any kind of error is detected during the simulation (compute)
- **Output Variables Optional** by default an FRA compute requires that at least one output variable be selected; if **Output Variables Optional** is selected then output variables are not required for the FRA compute
- Restart WAT After Model Errors if Stop Simulation Compute on Error has not been selected, this option becomes available. If this option is selected, the user can set the consecutive number of errors that will make HEC-WAT restart and the maximum number of restarts.
- **Restart Plugins** this allows the user to decided which programs to stop and re-start during the FRA compute. This needs to be used when there are memory issues with the individual software applications during an FRA compute.
- 3. Click **Next**, the **Run FRA Simulation Information** dialog box (Figure 9.50) will open. This dialog box provides information about the FRA simulation that is about to be computed. Information includes the time window, when the simulation will be stopped, whether results will be saved, lifecycles that will be run, convergence information, model sequence information, variables for convergence, time window modifiers; and output variable time windows.
- 4. Click **Compute**, the **Compute Progress** dialog box will open (Figure 9.51). When the compute is finished, click **Close,** the **Compute Progress** dialog box will close (Figure 9.51).
- 5. Since the user is taking a study that was built for a non-flood risk analysis, the user may need to do some work on getting the models to compute successfully.

	RA Simulation - Without	t Project Conditi	ons-FRA_TW	X
	ie: 01Jan1900 0100 e: 31Dec1950 2400			•
Simulatio Simulatio	on will stop on first error. on will save all results. tion Information			
Lifecycle	s to Run:[1-100]	-		
	Model Sequence			
Model	Alternative			≡
HMS	(MCA)DCL_WAT			
ResSim	calibrate			
RAS	Base			
FIA	GridsAndXSecsAlternative			
		_		
	Time Wi	ndow Modifiers		
Model	Alternative	Time Window	Time Window	w Mod
HMS	(MCA)DCL_WAT	Simulation Windo	ow none	
DasCim	astibrata	<back< td=""><td>Compute</td><td>Cancel</td></back<>	Compute	Cancel

Figure 9.50 Run FRA Simulation Information Dialog Box

Compute Progress - Without Project Conditions-FRA_TW
Lifecycle 1 Event: 1
Event 1 time window is 23 January 1951, 13:00; 2 February 1951, 13:00
Computing Lifecycle 1
>>>Starting next Realization 1<<<
==> Computing HMS model (MCA)DCL_WAT
Run Time Window for HMS-(MCA)DCL_WAT is Start Time 23 January 1951, 13:00 End Time:2 Februa
Computing HMS run (MCA)DCL_WAT HMS: NOTE 16850: Event seed is 8009314025651226624 for Realization 0, Lifecycle 1, Event 1
HMS: NOTE 15901: Began computing sample DCL_WAT in uncertainty analysis "02Jun2017, 15:49:
HMS: NOTE 20364: Found no parameter problems in meteorologic model "Basin_Average". HMS: NOTE 40049: Found no parameter problems in basin model "Russian River BA".
Compute Failed
100%
Overall
Realization
Close

Figure 9.51 Compute Progress Dialog Box - FRA Compute