



**Technical Documentation Version 5.1**

---

# **Model Building**

---



**C A D S W E S**

**Center for Advanced Decision Support for Water and Environmental Systems**

These documents are copyrighted by the Regents of the University of Colorado. No part of this document may be reproduced, stored in a retrieval system, or transmitted in any form or by any means electronic, mechanical, recording or otherwise without the prior written consent of The University of Colorado. All rights are reserved by The University of Colorado.

The University of Colorado makes no warranty of any kind with respect to the completeness or accuracy of this document. The University of Colorado may make improvements and/or changes in the product(s) and/or programs described within this document at any time and without notice.

# Model Building Table of Contents

<b>Defining Default Units .....</b>	<b>1</b>
<b>Selecting the Controller and setting Run Times .....</b>	<b>1</b>
<b>Objects on the Workspace .....</b>	<b>2</b>
The Object Palette .....	2
Pulling Objects Off The Palette .....	3
<b>Configuring Objects .....</b>	<b>3</b>
<b>Importing/Entering Data into slots .....</b>	<b>4</b>
<b>Linking Slots on Objects .....</b>	<b>4</b>
Quick Links .....	4
Viewing Links .....	4
Creating Links .....	4
Deleting Links .....	5
Link Editor .....	5
Existing Links - Viewing and deleting.....	5
Link Creation.....	6
Moving the Destination Object to become the Source Object.....	6

# Model Building

**Introduction:** In general, building a RiverWare model consists of the following steps. Some models require additional steps and others do not require all of these steps. This document describes these steps and provides links to documents with more information:

1. Use the RiverWare Resource Database to define default units in model construction.
2. Select the Simulation Controller and set Run Times for a simulation run.
3. Pull objects off the Palette.
4. Select user methods on the objects.
5. Set timeseries ranges, enter, import, and export slot data.
6. Link objects together to define the basin topology.

---

## 1. Defining Default Units

RiverWare stores all slot values in RiverWare internal units and performs calculations in these units (except where the algorithms do explicit conversions). When an object is first instantiated, the slots default to displaying the internal units, unless the Resource Database has been configured for a different default. The riverwareDB file is the Resource Database file which allows you to define the default user units to any unit of the specified unit type.


The riverwareDB file must be created and placed in the correct directory before RiverWare is started to take effect. As a result, this is the very first step in creating a model. More information on features and the syntax of the riverwareDB file may be found in the reference located [HERE \(Units.pdf, Section 3\)](#).

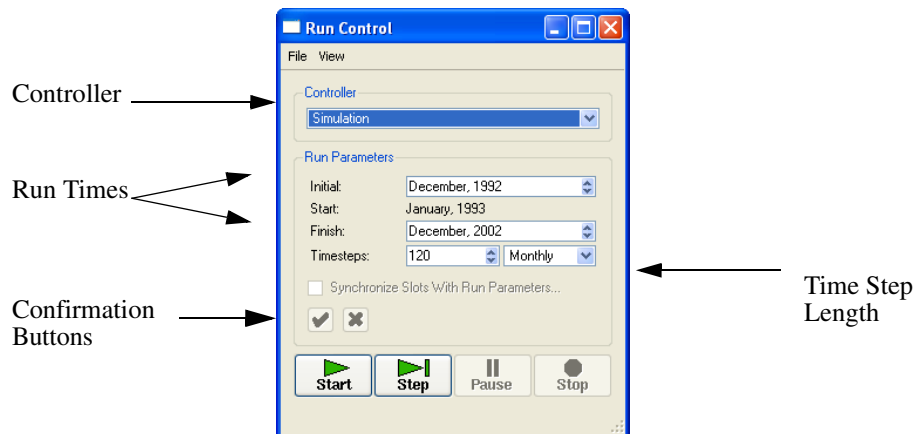
If the user has created a model and forgot to define the default units in the riverwareDB file, the **Configure Existing Slots** dialog can be used to configure some or all of the existing slots in a model. Click [HERE \(Slots.pdf, Section 2\)](#) for more information on the **Configure Existing Slots** utility.

---

## 2. Selecting the Controller and setting Run Times

The next step in building a model is to select the controller and specify the run times and timestep for the run. These actions are performed from the **Run Control** dialog.

- Selecting **Control** ➔ **Run Control Panel** or clicking the Run Control toolbar icon,  brings up the **Run Control** dialog.



- From this dialog, the user should specify:
  - Controller
  - Timestep length
  - Initial date
  - Finish date or number of timesteps.


For a detailed description of this dialog and the various pieces click [HERE \(RunControl.pdf, Section 1\)](#) to go to the Run Control documentation.

## 3. Objects on the Workspace

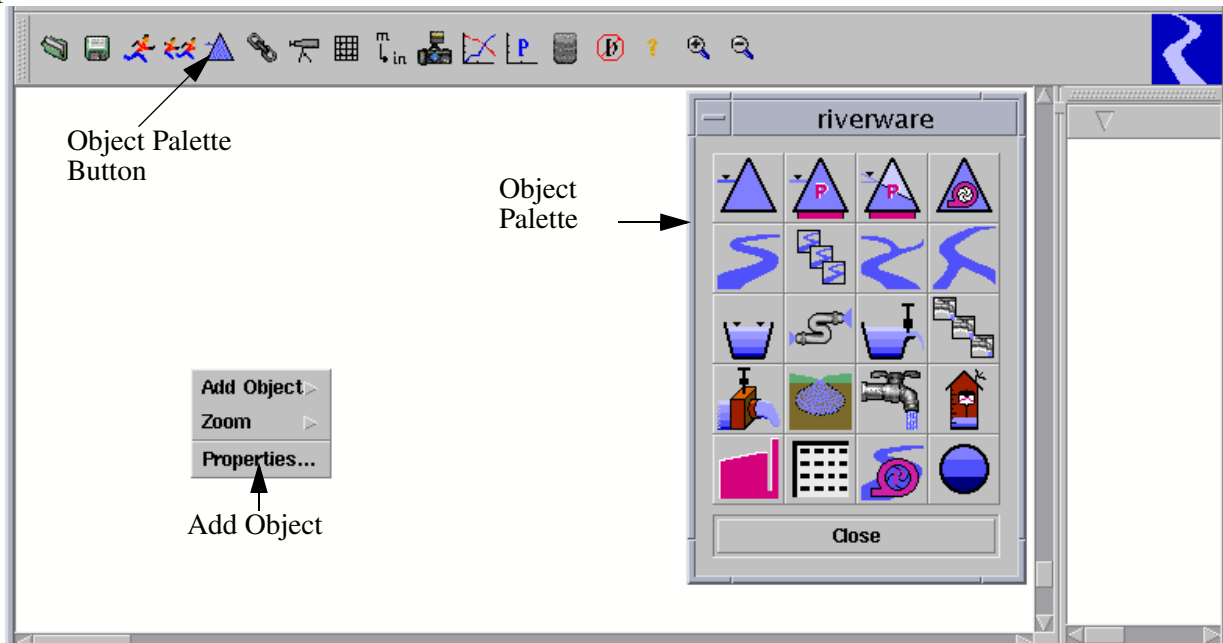
A model can be created on a blank workspace by selecting desired objects from the object palette and placing them on the workspace. The object icons are a convenient way to visualize the physical layout of a modeled system. These objects also contain the data and the physical process algorithms that drive the simulation.

### 3.1 The Object Palette

Objects are added to the workspace using the object palette. The **Palette** contains all of the available object types used to represent features of a river basin. It is the source from which objects are instantiated on the workspace. To place objects on the workspace, drag them off the object palette and place them in the desired location on the workspace. The object palette is accessed:

- by clicking on the object palette selector button on the main toolbar. 
- selecting **Workspace** ➔ **Objects** ➔ **Object Palette from the menu bar**.
- by right clicking with the mouse on the workspace. This will bring up a small window with the option to **Add Object**. Selecting the “add object” option opens a list of all objects. Clicking on the desired object will place it on the workspace.

The coordinates of the objects on the workspace are saved with the model so that objects will remain in position.



### 3.2 Pulling Objects Off The Palette

An object is created by clicking on its icon and dragging it off the **Palette** onto the workspace. At the time an object is created, default attributes are defined by several sources. The first timestep and timestep size in SeriesSlots are matched to the **Run Control** run time settings. Display units and other slot configurations default to internal RiverWare units and configurations, unless other settings are specified in the RiverWare Resource Database (RiverWareDB) file. Default user methods are also selected for new objects. Slots associated with the selected controller and Methods are allocated in memory. For more information on each type of object, click [HERE \(Objects.pdf\)](#)

For more information on managing objects including, selecting, importing, exporting, deleting, and clearing the workspace, click [HERE \(Workspace.pdf, Section 4\)](#) to view the workspace documentation.

## 4. Configuring Objects

Objects are configured from the Open Object dialog. More information on this dialog is presented [HERE \(ObjectUserInterface.pdf, Section 1\)](#). The general steps to necessary to configure the objects are as follows:

- Name the object: [HERE \(ObjectUserInterface.pdf, Section 1.1\)](#)
- Select User Methods: [HERE \(ObjectUserInterface.pdf, Section 1.3.1\)](#) Note, the **Multi-Object Method Selector** can be used to select methods on multiple objects in one action. This feature is described in detail [HERE \(ObjectUserInterface.pdf, Section 2\)](#).

## 5. Importing/Entering Data into slots

The next step in model building is to enter data into slots. This topic is described in detail in the Slots section of the online help [HERE \(Slots.pdf, Section 1.2.1\)](#).

## 6. Linking Slots on Objects

Links are the connections between slots on objects which pass information during a simulation run. They propagate a value from a slot on one object to a slot on a different object. Links are bidirectional in general, but in a pure simulation run, if values propagate in both directions during a single timestep, the model is overdetermined, and the run aborts.


A slot may be linked to more than one other slot. Also, several links may exist between different slots on two objects, but only one line is represented on the workspace. There are two methods for viewing, creating and deleting links in RiverWare: “Quick Links” and the **Edit Links** dialog.

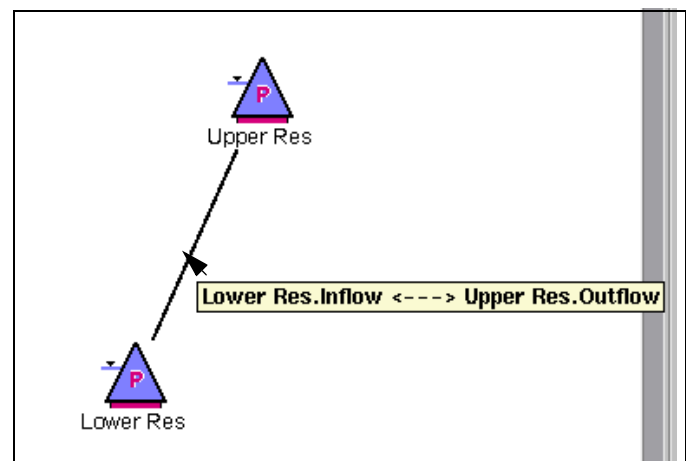
### 6.1 Quick Links

Using quick links is typically the easiest way to view, create, and delete links. Quick links consist of using the right-mouse button and the resulting context menus.

#### 6.1.1 Viewing Links

In models with many links, it can be difficult to determine which objects and slots a particular link is connecting. By hovering over the link with the mouse cursor, all the connected objects and slots associated with that link are displayed in a tool-tip pop-up window as shown.

Also, in the **Open Object, Slots** tab, linked slots are marked with a . Right clicking on a linked slot brings up a context menu. Highlighting **Linked Slots** displays a list of all slots linked to the selected slot. Clicking a slot on this context menu will open that slot.



#### 6.1.2 Creating Links

Quick links can be used to create links by first clicking on an object with the right mouse button. A context menu dialog appears. Selecting **Link** then prompts the user to select a slot to start a new link. A

link is started. Then, the user selects another object to which the link will end, again starting with the right mouse button. The user then clicks **Link** and is prompted to select a slot on that object. After a slot is selected, the link appears on the workspace connecting the two objects.

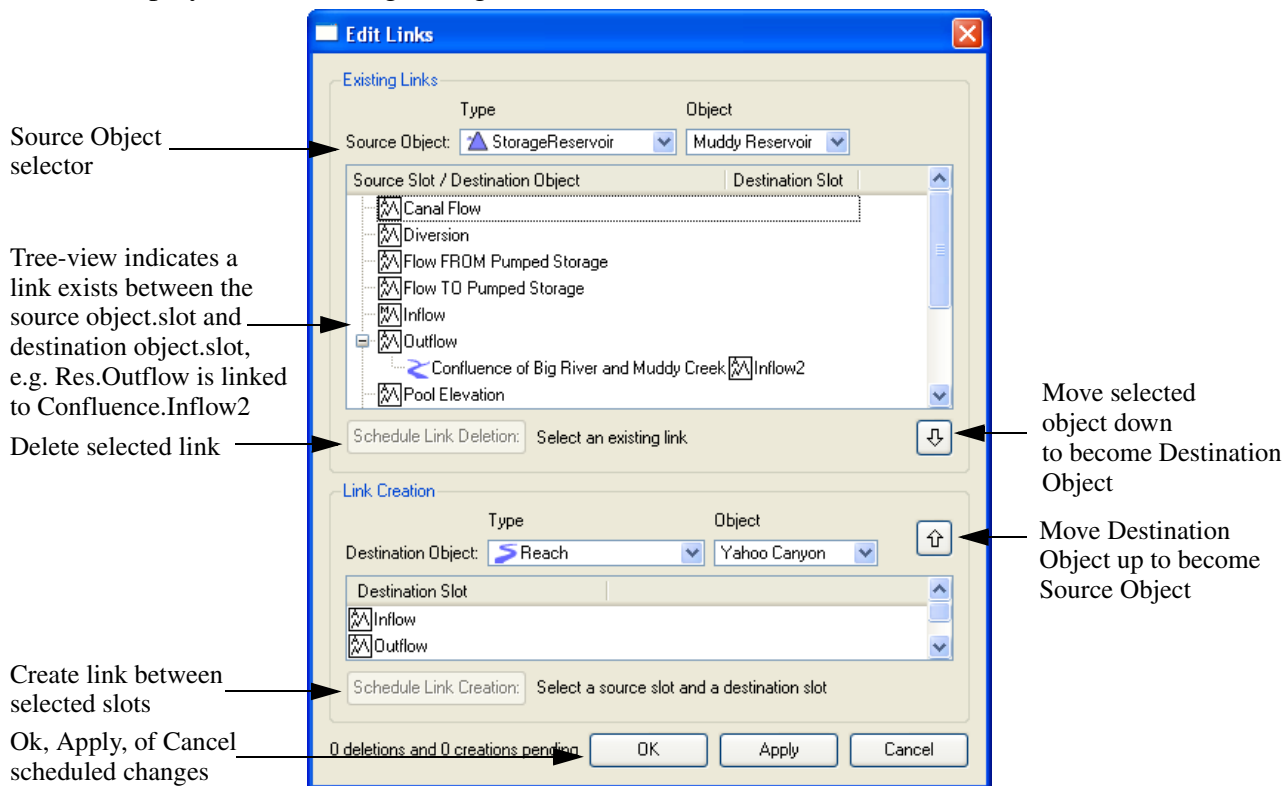
### 6.1.3 Deleting Links

Links can be deleted between objects by hovering over the link with the cursor and right clicking. This brings up a context menu with the option to **Delete Link**. Mousing over the **Delete Link** menu will bring up a list of all the links in that location. Selecting a link from the list will cause that link to be deleted.

## 6.2 Link Editor

Sometimes the quick links operations do not provide enough flexibility to view, create or edit links. In this situation the **Edit Links** dialog provides a comprehensive location to view, create, and delete links.

From the workspace, selecting **Workspace** ➔ **Edit Links...** or clicking on the Link Editor toolbar icon, displays the following dialog.



The **Edit Links** dialog is divided into two areas, one for Existing Links and one for Link Creation.

### 6.2.1 Existing Links - Viewing and deleting

The upper portion of the dialog is used to view and delete existing links. A list of slots is generated by selecting a **Source Object: Type** and an **Object**. The list of all linkable slots on that object appears in

the **Source Slots** tree-view list. Aggregate Objects show the upper level aggregate and each element with a “+” symbol to display the member slots, similar to the Open Object dialog.

A slot in this dialog has a link if it has a “+” symbol to the left of its name. Clicking on the “+” expands the tree view and shows all of the slots linked to the given slot by displaying the **Destination Object** and **Destination Slot**.

When the user highlights a row containing a **Destination Object** and **Destination Slot**, the **Schedule Link Deletion** button becomes active. Clicking this button will “schedule” the link for deletion; the link is actually deleted when the Ok or Apply button is clicked. When a link is scheduled for deletion, the text is displayed with a strike through its name and a note next to the button.



Note, a user can create a link between two slots, then change methods on one or both of the objects such that the linked slots are no longer visible or in use. The link will remain on the workspace and in the **Edit Links** dialog, the **Source Slot** will be shown in *italics* to indicate that it is not currently visible in the model. The user is prevented from creating links between non-visible slots, but links between non-visible slots can be deleted and viewed.

## 6.2.2 Link Creation

Both the upper and lower portion of the dialog are used to create new links. First select a **Source Object: Type** and **Object** in the upper portion of the dialog. Then select a **Destination Object: Type** and **Object** in the lower portion. Highlight the desired slot in the upper and lower lists and click the **Schedule Link Creation** button to “schedule” the link for creation; the link will actually be created when the OK or Apply button is clicked. A link scheduled for creation is shown as green text and the tree view is automatically expanded.

Links can be created between any pair of slots when one slot is listed in the top half and the other slot is listed in the bottom half. These links may not all make physical sense, but any combination can be defined.

## 6.2.3 Moving the Destination Object to become the Source Object

Often when using this dialog, the user is creating a series of links in a specified order, say upstream to downstream. To accommodate this, the up arrow button  can move the **Destination Object** in the link creation area up to become the **Source Object**. Similarly, the down arrow  can be used to move the **Source Object** down to become the **Destination Object**. When using this button, the object in the selected row is moved down; thus, you can either select a slot (or make no selection) and the **Source Object** will move down. Or, you can highlight the linked **Destination Object** and **Destination Slot** row (via the tree-view) and clicking the down arrow will move the selected destination object down to become the object selected in the link creation area.