# 6. Output Canvas

An Output Canvas is an output device which shows various data visualization tools. Currently, you can create Teacups that shows the value (often storage) against some full value for that object (full reservoir). You can show multiple teacups in a group to display the relative fullness of many different items. As mentioned, often these are used to show the reservoir storage against some user specified "full" reservoir. An example is shown in the screenshot.

Following are some features of Output Canvases:

- You can show multiple groups of teacups that each contain multiple teacups. Within a group, consistent scaling is maintained for comparison.
- Data shown on a canvas is typically based on multiple objects (E.g. all the reservoirs in a basin); the data can be on the object itself or on an accompanying data object.



\* Sample data only

• On a Teacup, you can show marker lines and text values representing key levels.

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- All colors and text fonts are user settings so they can be changed as desired.
- Bounding boxed and the Legend are optional components that you can configure.
- Images can be added to the canvas as Background or Foreground Images.
- The data shown is typically for a specific timestep. Controls at the bottom of the device allow you to scroll through the timesteps or even animate the time range.
- The Output canvas can be exported as an image for use in other applications.
- Additional data visualizations will be made available on the Output Canvas in future releases.

The remainder of this section describes how to create, configure, and view Output Canvasses. For a stepped guide to creating a teacup diagram, go **HERE (Section 6.5)**.

## 6.1 Creating a new Output Canvas

**Output Canvas** configurations are **Output Devices** (like Plot Pages or RiverWare Data Files, etc...). Output Canvasses are created within the Output Manager dialog. To create a new Output Canvas:

- From the RiverWare workspace menu, select the Utilities 
   — Output Management.
- From the Output Manager dialog menu, select the New → New Output Canvas...

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## 6.2 Configuring Output Canvas

The **Output Canvas** configuration dialog allows you to create or change a canvas. It consists of the following panels as shown in the screenshot on the next page:

- **General Settings**: aspects of the configuration which apply to the entire Canvas, e.g., the name of the Canvas, the height and width, and the background color.
- Canvas Layout: specification of the content to be included in the Canvas.
- Selected Item Settings: control of the Canvas formatting as specified on a per-item basis.
- **Canvas Preview**: view the Canvas to quickly see what it will look like and arrange the items as desired.

In the remainder of this section, each of these panels is described in more detail.



The following sections describe all the pieces of the Output Canvas.

### 6.2.1 General Settings

The **General Settings** item display settings apply to the entire Output Canvas. To change a setting's value, click in the appropriate value cell, enter the new value and hit return (or click outside of the editing window). For more information, see the first section of the table HERE (Canvas Item Settings).

## 6.2.2 Canvas Content

You control the content of the Canvas in the **Canvas Layout** panel. This content is organized by items, and you specify the Canvas contents by indicating which items should be included. The following table gives a description of each item.

Item	Description
General Settings	Settings which apply to the entire canvas. This is always shown and cannot be deleted.
Teacup Group	Teacups are shown in groups so that all data is consistent across the group. The Teacup Group defines the slots to use, where they are located, the size of the bars in the teacup, and the fonts for the label and axis.
Teacup Legend	A Teacup Legend is part of a Teacup Group and provides a key to the teacups. The maximum value, the current value, markers, text and the units are shown in the legend.
Теасир	A teacup is shown for each object selected. You can modify the name and change the corresponding data object, if necessary.
Marker	Markers, representing a slot value, are horizontal lines shown on each teacup. Markers are added to the Teacup Group. You specify the line color, style and the slots to use.
Text Item	Text items are shown on each teacup to represent static text, one slot value, or the relationship of two slot values. You specify the type of text you want and the corresponding slots. Also specify the color and any prefix or suffix text.
Bounding Box	For better appearance, you may wish to add Bounding Boxes to the Teacup Group so that a box is drawn around each teacup. You can specify the color of the background and its opacity and the border color.
Image Group	Image Groups are containers for Images.
Image	You can add any jpg or png image to an image group. The image is then embedded in the output device. Also specify if it is on the foreground layer or background layer.

The following operations allow you to create the Canvas layout and arrange its items as desired:

 The Add Item button: Use the drop-down menu to chose an item to add to the layout. Use the plus button to add the selected item. The button is only valid when the



- item can be added. For example, Teacups must be added when a Teacup Group is selected.
- Use the 📃 button to delete an item from the list.
- The Move arrows: These buttons can be used to move the selected item up or down when possible.
- Edit operations: The following standard edit operations can be accessed via the right-click popup menu or the Edit Layout menu: Cut, Copy, Paste, Delete.

#### 6.2.3 Selected Item Settings

The **Selected Item Settings** panel allows you to control the appearance of individual Canvas items. This panel lists the settings which apply to the item currently selected in the **Output Canvas Content** panel, and allows editing by clicking on the current setting value. The following table gives the settings which apply to each type of Canvas item:

Teacup Group: Teacups:	
Setting	Value
Name	Teacups
Show	Yes
Unit Type	Volume
Maximum Entity Name	Total capacity
Maximum Entity Color	#ac6262
Maximum Slot Reference Type	Data Object / Slot
Maximum Slot Name	Max Storage
Current Entity Name	Current storage
Current Entity Color	#5c5cd6
Current Slot Reference Type	Object / Slot Name
Current Slot Name	Storage
Maximum Bar Height	100
Bar Width	61
Show Vertical Axis	Yes
Teacup Label Font	font-family: "MS S
Teacup Axis Font	font-family: "MS S
Teacup Text Font	font-family: "MS S

#### Canvas Item Settings

Item Type	Setting	Туре	Notes
	Name	Single line text	
	Canvas Width	Value in pixels	
General	Canvas Height	Value in pixels	
Settings	Background Color	Color Chooser	Click HERE (Color Chooser) for more info.
	Timestep	Datetime Text	Usually the date shown is controlled by the date controls in the preview or on the canvas itself

Item Type	Setting	Туре	Notes
	Name	Text	
	Show	Yes/No	
	Unit Type	Menu Selection	
	Maximum Entity Name	Text	
	Maximum Entity Color	Color Chooser	Click HERE (Color Chooser) for more info.
	Maximum Slot Reference Type	Object/Slot Name or Data Object/ Slot Name	Choose whether the specified Maximum slot is on the object itself or an accompanying data object. Click HERE (Slot Reference Type) for details.
	Maximum Slot Name	Slot Selection	The slot used for the larger bar on the teacup. Click HERE (Slot Selections) for details on this selection.
	Current Entity Name	Text	
Teacup	Current Entity Color Current Slot Reference Type Current Slot Name	Color Chooser	Click HERE (Color Chooser) for more info.
Group		Object/Slot Name or Data Object/ Slot Name	Choose whether the specified current slot is on the object itself or an accompanying data object. Click HERE (Slot Reference Type) for details.
		Slot Selection	The slot used for the smaller (current) bar on the teacup. Click HERE (Slot Selections) for details on this selection.
	Maximum Bar Height	Number	Height (in pixels) of the largest bar in the teacup group.
	Bar Width	Number	Width of all the teacup bars in the group.
	Show Vertical Axis	Yes/No	
	Teacup Label Font	Font Selector	The font used for the teacup labels.
	Teacup Axis Font	Font Selector	The font used for the teacup axis.
	Teacup Text Font	Font Selector	The font used for all text items in the group.
Teesure	Label	Text	The text used for the label on the legend.
Legend	X Position	Number	Click HERE (Position) for more info.
	Y Position	Number	Click HERE (Position) for more info.

Item Type	Setting	Туре	Notes
	Label	Text	The text used for the label on the teacup.
	Reference Object	Object Selection	Use the selector to choose the object for this teacup. Usually this is a Reservoir object.
Теасир	Reference Data Object	Object Selection	Use the selector to choose the data object related to the reference object. This is usually located automatically if available.
	X Position	Number	Click HERE (Position) for more info.
	Y Position	Number	Click HERE (Position) for more info.
	Label	Text	The text used for the marker on the legend.
	Line Color	Color Chooser	Click HERE (Color Chooser) for more info.
	Line Style	Menu	
Marker	Slot Reference Type	Object/Slot Name or Data Object/ Slot Name	Location of the slot to use for the marker. Click HERE (Slot Reference Type) for details.
	Slot Name	Slot Selection	The slot used for marker. Click HERE (Slot Selections) for details on this selection.
	Text Type	Menu Choice	Choose one of the types of text LINK
	Text Color ( Prefix Text	Color Chooser	Click HERE (Color Chooser) for more info.
		Text	String to include before the Text Item
	Suffix Text	Text	String to include after the Text item
	Slot 1 Reference Type	Object/Slot Name or Data Object/ Slot Name	Location of the slot to use for the text item. Click HERE (Slot Reference Type) for details.
Text Item	Slot 1 Name	Slot Selections	Click HERE (Slot Selections) for details.
	Slot 2 Reference Type	Object/Slot Name or Data Object/ Slot Name	Location of the slot to use for the marker. Click HERE (Slot Reference Type) for details.
	Slot 2 Name	Slot Selections	For Text items that show or use two values, this is the second slot. It is only shown for Text items with two slots.
	Legend Text	Text	The text that is displayed on the legend.
	Show	Yes/No	
Bounding	Opacity	Number	This value must be between 0 and 100, inclusive.
Box	Background Color	Color Chooser	Click HERE (Color Chooser) for more info.
	Show Border	Yes/No	
	Border Color	Color Chooser	Click HERE (Color Chooser) for more info.

Item Type	Setting	Туре	Notes
Image	Name	Text	
Group	Show	Yes/No	
	Name	Text	By default, this is the original image file name.
Image	Layer	Foreground/ Background	Choose the layer on which the image lives. Background images can be separately locked into position on the Canvas Preview.
J	Image Opacity	Number	This value must be between 0 and 100, inclusive.
	X Position	Number	Click HERE (Position) for more info.
	Y Position	Number	Click HERE (Position) for more info.

**Color Chooser:** For all of the colors settings on the canvas, the settings allow you to specify the color in a number of ways. Usually you should use the color selector to specify the desired color. You can choose the color from the palette, specify RGB values, or specify Hue/Sat/Val from the dialog. From the text setting, you can also type the hexidecimal color or type in an html color name.

**Position:** For all of the X and Y Position Settings, you can:

- Specify the coordinates on the canvas as the number of pixels from the bottom left. This provides a fine level of control over the positions.
- Drag the item on the canvas. (preferred)



**Slot Reference Type:** For all of the Slot Reference Type settings, choose whether the slot is on the reference object or its accompanying data object. **Object/Slot Name** is for the specific object. **Data Object/Slot Name** is for the accompanying data object. The Output Canvas will try to find an accompanying data object by searching for the object's name and the string "Data". You can modify the data object to use if it is not correctly found.



**Slot Selections:** Specify the slot name or use the selector to choose a representative slot. For these, you are choosing the slot only, but to do this, you must select a specific object first. The Object part is removed and only the Slot Name is used.

Show Slots on: 💿 Objects 🔘	Accounts 🔘 Supplies 🔘 Other: 🛛	xchanges	•	
Object Types: 1 (of 16)       All     Invert       Obj Type     AggregateObj       AggDistributionCanal     AggDistributionCanal       AggReach     Confluence       DataObj     DistributionCanal       DistributionCanal     DiversionObject       GroundWaterStorage     Reach       Reservoir     PowerReservoir       StorageReservoir     StorageReservoir       StorageReservoir     StorageReservoir       StreamGage     WaterUser	Objects: 1 (of 8)       All     Invert       Type     Object       LevelPow     Abiquiu       LevelPow     ElephantButte       LevelPow     Elvado       StorageR     Caballo       StorageR     Cochiti       StorageR     Alemez       StorageR     Nambe		Slot   Slot   Reservoir Summary   Reservoir Summary Totals   Return Flow   No Grande Ratio   Seepage   Besepage Coefficients   Surface Area   Surface Ice Coverage   Total Inflows   Jurregulated Spill Capacity Fraction   Ok Cancel	

You must select a representative Object, but it is not used in the setting.

#### 6.2.4 Canvas Preview

The first tab of the panel on the right side of the dialog provides a live preview of what the output Canvas will look like when generated. In fact, this Canvas Preview should be used to define the layout of all of the items added to the canvas. Drag teacups, legends, and Images to their desired location. The X and Y Positions will update automatically in the settings.

You can lock items using the toggles at the bottom right. Those images that are set to be "Background" layer are controlled by the first toggle. All other items are locked by clicking on the Other Items toggle.

### 6.2.5 Log

This tab provides a textual description of the Canvas generation process. The log contains details such as whether slots were found or not and image size and position. When a problem occurs during generation, the details will be reported here.



Output Canvas Canvas Viewer

#### 6.3 Canvas Viewer

The Canvas Viewer is the output device that is shown when the Canvas is generated. On the Viewer, the position of all items is locked and cannot be changed. The only controls are the animation controls at the bottom. These are described in the next section.

The canvas image can be exported or copied to the clipboard using the File menu.

Note: In the initial implementation, the Viewer and Preview are essentially two views of the same dialog. Changes in one are immediately reflected in the other. This may change in the future.



### 6.4 Animation

A date spinner appears under the canvas in both the preview and generated canvas as shown above. It allows the display to be stepped forward and backward through the timesteps. Click the **Start** button to animate through time. Use the date slider to see where you are in time and the animation speed controls to change the speed (seconds per frame).



#### 6.5 Instructions to Create a Teacup Diagram

Following are instructions to create a teacup diagram from scratch. These are the bare minimum instructions; you'll want to modify fonts, colors and label text to make the diagram look great.

1. From the Output Manager dialog menu, select the New - New Output Canvas...

In general, to create a new Canvas, start with the **General Settings**, then use the **Canvas Layout** to define what you want to have in the Canvas. Use the **Selected Item Settings** to configure each item in the Canvas.

**2.** In the **General Settings**, specify the **Name**. See the screenshot to the right.

**3.** Add a **Teacup Group** by selecting it from the **Add Item** menu and clicking the + button.

Add Item:	Teacup Group	-	¢				
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4. Specify the slots to use for the Current Entity and Maximum Entity using the Maximum Slot Name, Reference Type, Current Slot Name, and Reference Type. See the screenshot to the right.

**5.** Add **Teacups** to the group. First select the Teacup Group, then select **Teacup** from the **Add Item** menu. Click the + button.

Add Item:	Teacup 🔹 🖨 🔳 🛊 🛡		
Output Ca	anvas Content		
General Settings: My New Teacup Diagram			
Teacup Group: Teacup Group (Volume)			

Output Canvas Content	

General Settings: My New Teacup Diagram

General Settings: My New Teacup Diagram:

. . .

Setting	Value
Name	My New Teacup Diagram
Canvas Width	500

	Teacup Group: Teacup Group:		
	Setting	Value	*
	Name	Teacup Group	
	Show	Yes	
	Unit Type	Volume	
	Maximum Entity Name	Total capacity	
	Maximum Entity Color	#ffe881	
	Maximum Slot Reference Type	Object / Slot Nam	-
	Maximum Slot Name	Elevation Volume .	=
	Current Entity Name	Current storage	
	Current Entity Color	#0000e0	
	Current Slot Reference Type	Object / Slot Nam	
	Current Slot Name	Storage	

6. Select the objects you wish to use. Make sure to select all the objects you want. One teacup will be created for each object.

7. This will create a set of teacups and show them on the preview canvas. The initial placement uses the positions of the objects on the Simulation Workspace.On the **Canvas Preview**, drag the teacups to the desired location.





**8.** Add Markers to the Teacup Group: First select the Teacup Group, then select **Marker** from the **Add Item** menu. Click the + button.

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**9.** Specify the Slot (series, scalar, periodic) to use for the marker and its location. Specify a better label if desired. This will be shown later on the legend.

**10.** Add a Text item. First select the Teacup Group, then select **Text Item** from the **Add Item** menu. Click the + button.

#### **11.** In the settings, specify the

type of text. For this example, we will add text showing the current storage. Choose **Value** for the **Text Type** setting. Specify the prefix, suffix, slot reference, slot name, and Legend Text as shown in the screenshot.

Marker: Dead Storage

Value

#ff0000

Solid Line

Slot Reference Type Data Object / Slot Name

Dead Storage

Dead Storage

Marker: Dead Storage:

Setting

Line Style

Slot Name

Label Line Color



**12.** If desired, add a **Bounding Box** to the Teacup Group to create a border around each teacup. Select the Teacup Group, then select **Bounding Box** from the **Add Item** menu. Click the + button. Modify the colors or opacity if desired.



**13.** Add a legend so all of the units, markers, and text values are clearly annotated. Select the Teacup Group, then select **Teacup Legend** from the **Add Item** menu. Click the + button.



**14.** Add background images and foreground images if desired. Select the **General Settings**, then select **Image Group** from the **Add Item** menu. Click the + button. Select **Image** from the **Add Item** menu. Click the + button. A file chooser opens. Select the desired jpg or png file.



**15.** At this point, your teacups and images may not fit on the canvas. Here are some possibilities to fix this:

- Enlarge the canvas using the **General Settings** for width and height.
- Shrink the teacups using the Maximum Bar Height in the Teacup Group settings.

Then drag the teacups and images to fit them on the canvas as desired.

**16.** Modify the colors and fonts to make the canvas look pretty.



**17.** Click **OK** to save the canvas and then generate the device from the Output Manager. Use the animation controls to watch the teacups change through time. Here is our result: