Technical Documentation Version 8.1

Release Notes

Center for Advanced Decision Support for
Water and Environmental Systems (CADSWES)
UNIVERSITY OF COLORADO **BOULDER**

Contents

Chapter 1
What's New in Version 8.1

This document describes new features, enhancements, and changes in RiverWare Version 8.1.

Topics

Special Attention Notes

The section describes special attention notes, which indicate changes in functionality that require you to update models, cause model results to differ, or display a warning message when you first load a model in RiverWare 8.1.

If you have any questions, contact RiverWare Support:

RiverWare-Support@colorado.edu

Groundwater and Aquifer modeling

The following changes were made to the groundwater and aquifer objects that could impact results.

Convergence on Groundwater Elevations and Aquifer Heads

Due to the modification of the convergence criteria on groundwater elevation and aquifer head slots, groundwater and aquifer results may differ in RiverWare Version 8.1. See "Aquifer and Groundwater Slot Convergence" on page 7 for details. The elevation/head should now track directly with the storage slot. That is, any change in storage results in a change in elevation/head.

Aquifer Conductance Checking

The aquifer object now checks that conductance values on adjacent objects have the same value. See "Aquifer: Conductance Checking" on page 8 for details. This could lead to a new error if your adjacent aquifers do not have consistent values.

Groundwater Slot Name Changes

The groundwater slots have been assigned shorter, more consistent names. See "Groundwater Slot Name Changes" on page 8 for details.

Existing model files, including links and SCTs, are automatically updated with the new names. A warning message is posted to diagnostics alerting you to the change.

You must update all RPL expressions and DMIs that reference these slots.

Issues With Peak and Base and Peak Power

The following issues have been addressed on power reservoirs that use Peak Power or Peak and Base power methods.

- The GetMaxReleaseGivenInflow RPL predefined function was incorrect when used with the Peak and Base and Peak Power methods. Previously, the value returned was the max release for a single unit. Now, the total max release is the single unit max release multiplied by the number of units and the Power Plant Cap Fraction. This issue was filed as RW-6420.

- The GetMaxReleaseGivenInflow RPL predefined function was setting Tailwater Elevation and Operating Head slots within the call to the RPL function, which should not happen.

- Peak power methods were incorrectly using slot values. Within the Peak and Base and Peak Power methods, the peak power calculation was incorrectly accessing a slot value, when it should have been using an internally computed pool elevation value. This issue was filed as RW-6472.

The fixes to these issues could change results for models with power reservoirs that use Peak Power or Peak and Base power methods.

Representation of RPL Slot Units

The default internal representation of slot values in RPL has been changed from "mixed" to "std". See "Representation of RPL Slot Values" on page 12 for details. In rare circumstances, this change could lead to different numeric results. In testing done by CADSWES, the only differences were insignificant.

Series Slots With Periodic Input Recomputation When Units Change

When a Series Slot with Periodic Input in periodic mode has its display units changed to or from a non-constant time unit (for example, acre-feet/month), the series values are recomputed. See "Recomputation When Units Change" on page 16 for details, This could lead to different results in the series values.

Accounting

The following changes have been made to RiverWare accounting functionality.

Rio Grande-specific Object-level Accounting Methods (OLAMs)

Elephant Butte Gain Loss Method Changes

In the Reservoir Account Gain Loss category, the Elephant Butte Gain Loss method has been modified as follows.

- Evaporation and precipitation are now charged to all accounts with positive previous storage. Seepage is charged to the account named "RioGrande".

- The Gain Loss is computed to reconcile the reservoir based on the following:

  – The RioGrande account storage, whether positive or negative

  – Any other account of water type RioGrande that has positive storage

  This change modifies the accounting results when the Elephant Butte Gain Loss method is used.

See "Elephant Butte and El Vado Gain Loss" in *Accounting* for details.

Elephant Butte with RG Compact Method Removal

The Elephant Butte Loss with RG Compact method is no longer supported because it should not be used and could cause confusion if selected inadvertently. This method has been removed from the user interface and can no longer be selected. Models using this method are automatically switched to the Elephant Butte Gain Loss method, and a warning message is posted to diagnostics.

Water Rights Solver: Diagnostic

A water rights subbasin warning has been changed to a diagnostic message. The message indicates supplies were not cloned because one end is out of the subbasin.

Following is the old message:

"Cloning for rule: One end of supply is not in subbasin: River^River.Return Flow.River_Excess River to River River Div__dot__Supply"

The new diagnostic message is as follows:

"During cloning, one end of a supply was found to not be in the subbasin and will not be cloned. The supply is: River_Excess River to River River Div__dot__Supply"

You can now see these messages by selecting the **Run Management**, then **Sim Obj** diagnostic category with the computational subbasin object context selected.

Diagnostics

The following changes have been made to diagnostics.

User Method Diagnostics

The User Method diagnostic category has been modified to include the category name. Following is an example of the old message:

24:00 January 31, 2012; OBJECT: Mohave; "Executing user method ("Peak and Base").

An example of the new message is as follows:

24:00 January 31, 2012; OBJECT: Mohave; "Executing the user method "Peak and Base" in the category "Power".

Installation

The following installation upgrades have been implemented in RiverWare 8.1.

Code Signing Certificates

The RiverWare installation files and associated executables are now digitally signed using a certificate issued by DigiCert. This should prevent warning messages at installation and startup.

Model Comparison Tool

The following changes have been made to the model comparison tool.

See "Model Comparison Tool" in *User Interface* for details on this tool.

Control Comparisons of Series Values

The Model Comparison Tool now allows you to specify that series values should not be included in the comparison. In the Models to Compare dialog, you can select the Do Not Compare Series Values option.

When the Models to Compare dialog is first opened, the top-level items in the "Types of model content that will be compared" list are now collapsed by default.
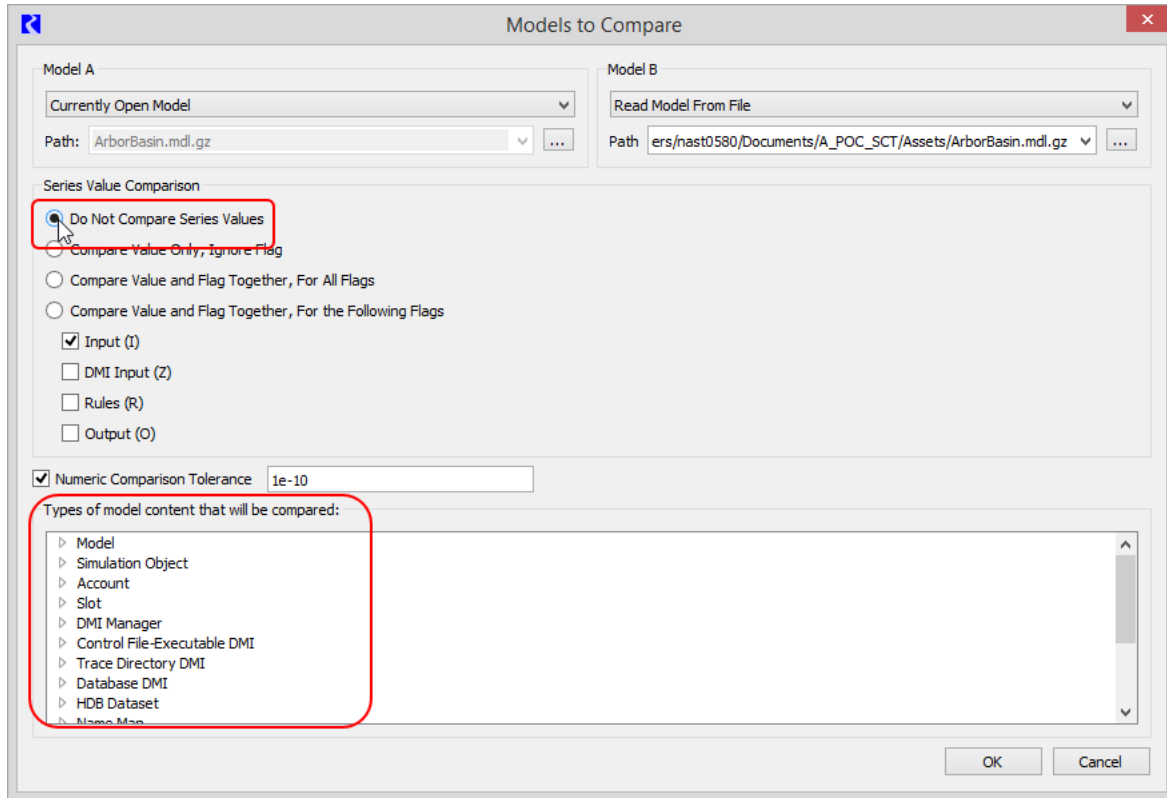
Copy Properties

A Copy Property operation has been added to the Model Comparison Tool. This operation makes a given property for the currently open model identical to that property for the comparison model. This is useful when merging two models. The operation is initially available (enabled) for only a few of the property types supported by the tool, primarily RPL item bodies, slot names, and slot values.

See *"Copy Property" in User Interface* for details.
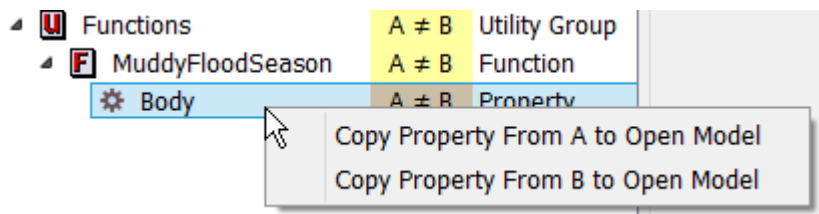
Script and MRM Configuration Comparisons

The Model Comparison Tool now compares script information and MRM configurations. For scripts, the tool compares script groups, script actions, and all action settings. For MRM configurations, all named MRM configurations and their settings are compared.

See "Description of content and properties compared by the Model Comparison Utility" in *User Interface* for details.

Multiple Run Management

The following changes have been made to multiple run management (MRM).

Continue Concurrent MRM After Stop

The concurrent multiple run feature has been enhanced to allow you to configure how many traces can stop before the entire multiple run stops. This can be useful for debugging, or when you are able to backfill results for the stopped traces after the multiple run finishes. The enhancement is available in RiverWare and RiverSMART for non-distributed and distributed concurrent multiple runs.

See "Control to Abort all Multiple Runs after Abort" in *Solution Approaches* for details.

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Revised: 8/4/20
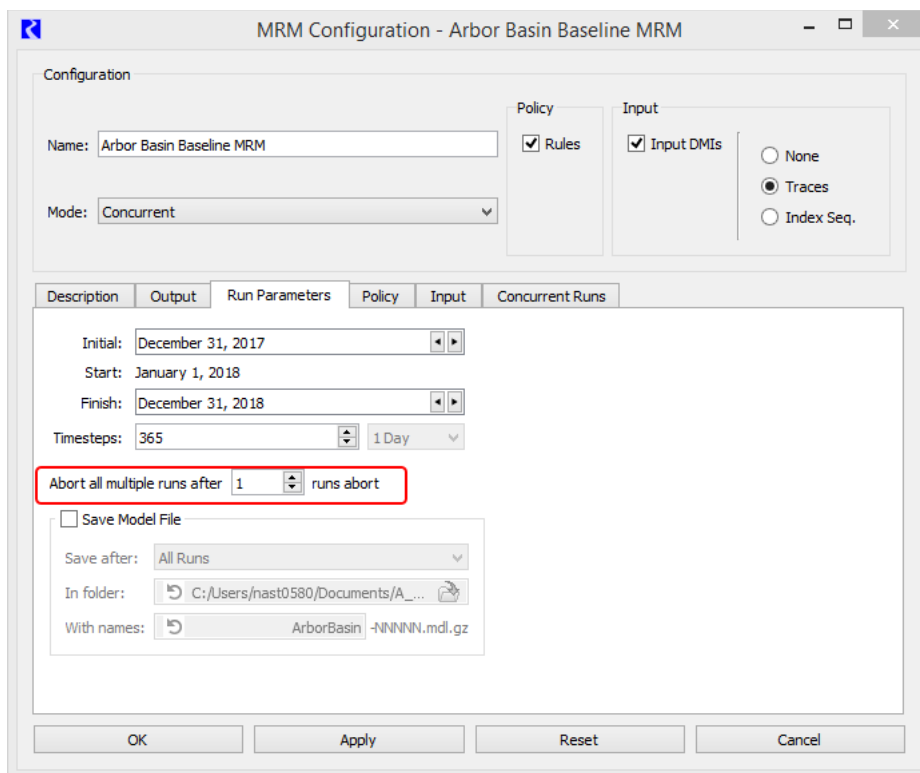
Save File per MRM Trace

The RiverWare MRM Run Parameters tab now provides configuration options for automatically saving the model after each run. The options are as follows:

- Successful Runs—save the model after runs that complete successfully.

- Unsuccessful Runs—save the model after runs stop unsuccessfully.

- All Runs—save the model after successful and unsuccessful runs.

In addition, you can specify the folder and base name for the saved files.

See *"Save Model File" in Solution Approaches* for details.
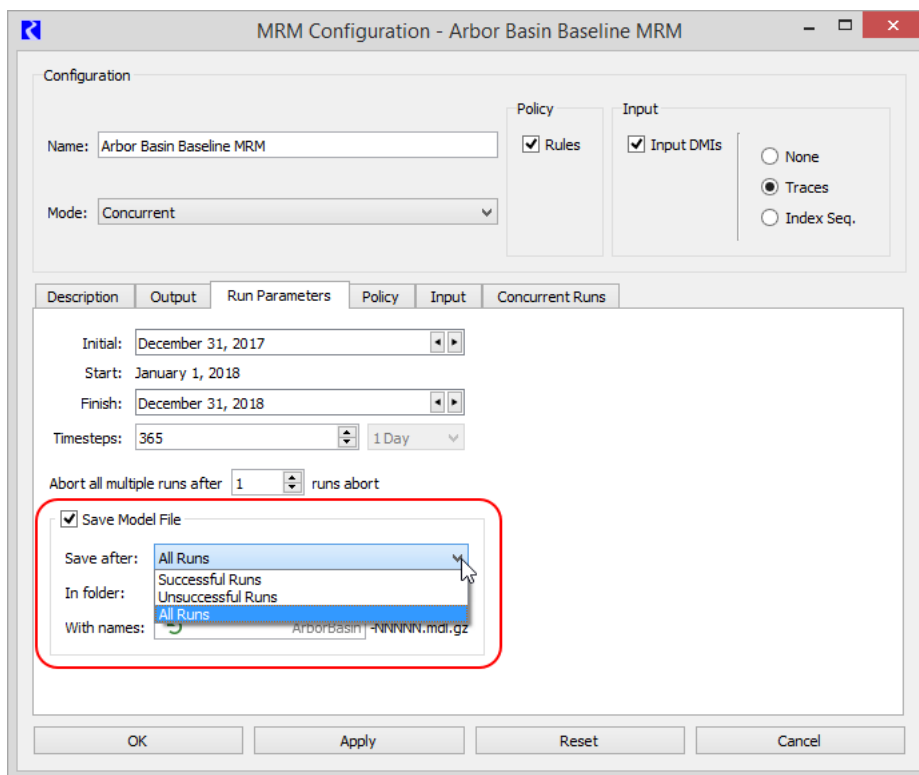
Note: The RiverSMART MRM event has been updated with similar functionality.

Objects

The following changes have been made to RiverWare simulation objects.

Aquifer and Groundwater Slot Convergence

On the following slots, the convergence criteria was changed within the code to "None" and cannot be changed by the user:

- Aquifer.Head

- Aquifer.Head Previous

- Groundwater.Elevation

- Groundwater.Elevation Previous

The criteria to reset these slots is now based on the convergence criteria of the Storage slot. If Storage changes such that it will be reset, then the Head/Elevation slots will be reset as well. If Storage is within convergence and not reset, then no attempt is made to reset the Head/Elevation slots

The Head/Elevation results should now track directly with the Storage slot. That is, any change in Storage, results in a change in Head/Elevation. Because of this new approach, groundwater and aquifer objects that redispatch could produce different, corrected, results.

See "General Slots" in *Objects and Methods* and "Head Based Groundwater Grid" in *Objects and Methods*for details.

Aquifer: Conductance Checking

The Aquifer object now checks that conductance values on adjacent objects have the same value. This ensures that mass is neither lost nor gained as water flows from one object to the next.

See "Aquifer" in *Objects and Methods* for details.

Groundwater Slot Name Changes

Within the Compute Conductance method, the following groundwater slots have been assigned shorter, more consistent names, as follows:

- Aquifer Area changed to Area

- Aquifer Length changed to Length

- Aquifer Width changed to Width

- Aquifer Thickness changed to Thickness

Existing model files, including links and SCTs, are automatically updated with the new names. A warning message is posted to diagnostics alerting you to the change. You must update all RPL expressions and DMIs that reference these slots.

See "Compute Conductance" in *Objects and Methods* for details.

Computational Subbasin: Changes to Initialize Flow Slots for Routing

The Initialize Flow Slots for Routing computational subbasin method has been improved to work with five additional reach routing methods, as follows:

- Modified Puls and Muskigum with Segments—this method works like No routing; no additional timesteps are initialized.

- Kinematic, Kinematic Improved, and Muskingum—these methods dispatch only during the run range. The initialization now treats these as boundary conditions, in that the Outflow slot has values set by the subbasin method.

See "Initialize Flow Slots for Routing" in *Objects and Methods* for details.

Generator: Specified Adjusted Capacity

The Specified Adjusted Capacity slot has been added to the Generator object. You can optionally specify this value as a reduced power request for the generator.

See "Generator" in *Objects and Methods* for details.

Reach, Distribution Canal, and Water User

Changed Warning Messages to Diagnostic

Previously, warnings were posted for Impulse and Step Response routing methods when the routed flow was not known. For consistency with other RiverWare operations that do not issue a warning message when there is no value, these messages have been modified from Warnings to Diagnostics, using the User Method diagnostic category.

RiverSMART

The RiverSMART release cycle is now synchronized with RiverWare. Go to the following site for the RiverSMART installer download:

https://cadswes2.colorado.edu/downloads/riverware/releases/index.html

RiverWISE

The following changes have been made to RiverWISE.

Input Periodic Slots

RiverWISE now supports input data sets based on exported RiverWare periodic slots. These data sets are treated much like ordinary table data sets based on exported RiverWare table slots; the main difference is that the tabular display of data sets based on periodic slots includes special row and header text. These data sets cannot be plotted in RiverWISE.

See "Periodic and Table Slots" in *RiverWISE Model Developer's Guide* for details.

Radio Buttons for Scalar Values

RiverWare modelers creating a WISE file can now enumerate the permissible values for a scalar input data set.
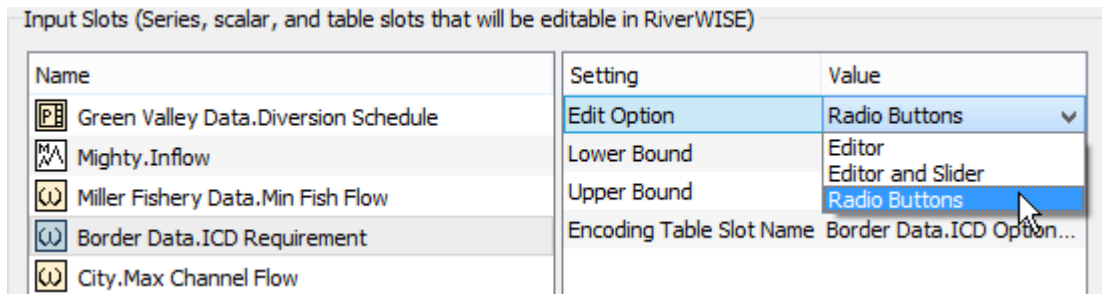
These data sets are then edited in RiverWISE using radio button controls.
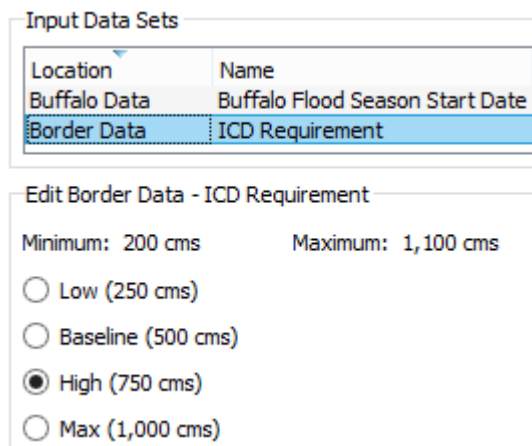
See "Scalar Slots" in *RiverWISE Model Developer's Guide* for details.

Export DateTime Slots

In the Export to RiverWISE dialog, the input or output slot sets can now include slots with values of unit type DateTime. These values are displayed in RiverWISE as they are in RiverWare—for example, "January 1" for a value with unit MonthAndDay and "12:00 February 17, 2020" for a value with unit FullDateTime. The Edit panel of the Edit and Run Scenarios tab now provides options for specifying a date/time value when any of the displayed values have the DateTime unit type.

See "DateTime Values" in *RiverWISE Model Developer's Guide* for details.

Export Results From RiverWISE

RiverWISE now allows you to export result data sets to an Excel workbook. Data for all data sets and scenarios are exported, with each data set written to a different worksheet. Within a worksheet, the first column includes the series date and times, and each subsequent column includes the data for a different scenario.

See "Export Results to Excel" in *RiverWISE Stakeholder's Guide* for details.

RPL

The following changes have been made to the RiverWare Policy Language (RPL).

New or Modified RPL Predefined Functions

GetTraceNumber

The GetTraceNumber() RPL predefined function has been added. This function is similar to GetRunIndex, but differs as follows.

A multiple run is configured to simulate N traces, and GetRunIndex() always returns 1..N. If the multiple run is configured to begin with trace 1, GetTraceNumber() also returns traces 1..N. If the multiple run is configured to begin with trace M, GetTraceNumber() returns traces M..(M+N-1).

See "GetTraceNumber" in *RiverWare Policy Language (RPL)* for details.

Hypothetical Target Simulation

Previously, a run would stop due to a table interpolation error during hypothetical target simulation.

The RPL predefined functions for hypothetical target simulation, HypTargetSim and HypTargetSimWith-Status, attempt to find a control slot value that leads to a desired target slot value. Two numeric parameters to these functions provide minimum and maximum control slot values, and these bounds constrain the search for a satisfying control slot value. The search algorithm first computes the target value associated with each of these values by conducting a hypothetical simulation using each of these values on the control slot. If dispatching fails during either of these simulations, an error is issued and the run stops. This behavior is problematic when the dispatch failure is due to a control slot bound that is too extreme, leading to a table interpolation error. This was the case with the model run analyzed, and in this situation it is preferable to continue the search instead of stopping the run.

The hypothetical target simulation has been modified to achieve this increased flexibility for the input control slot by relaxing the internal search algorithm requirement that the target interval be unbounded. That is, if either the minimum or maximum control values fails to lead to a valid target value—because the simulation failed to dispatch successfully with that control value—the search algorithm effectively treats that bound as infinite and continues the search until either the interval becomes bounded and a satisfying control value is found, or the maximum iteration limit is reached.

See "Hypothetical Simulations" in *RiverWare Policy Language (RPL)* for details.

RPL Set Comparison Tool

The RPL Set Comparison Tool has been reimplemented to be more consistent with the Model Comparison Tool. The search, filter, and other usability features have been improved, and many of the RiverWare 8.1 Model

Comparison Tool improvements have also been applied, including the new Copy Properties feature. See "Copy Properties" on page 5 for details.
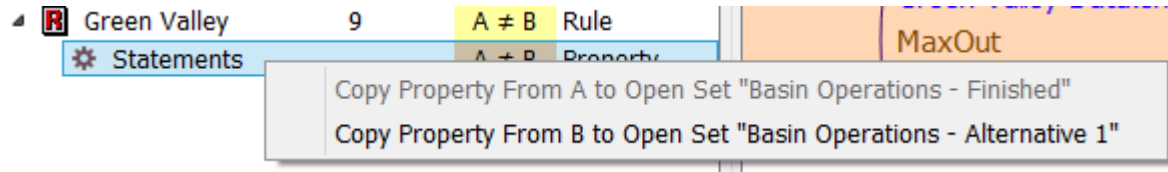
RPL Slot Viewer Buttons

New RPL Slot Viewer buttons have been added to the workspace to allow you to more easily access open RPL Viewers. See "Slot Viewers and RPL Viewers Workspace Buttons" on page 18 for details.

Representation of RPL Slot Values

When slot values are accessed in RPL, a standard number, scale, and unit are used. There were previously three ways to represent a slot value as a RPL numeric value:

• std—uses a scale of 1.0 and the slot's internal unit.

• user—uses the slot's user scale and user unit.

• mixed—uses the slot's user scale and standard unit.

The mixed approach was used exclusively through RiverWare 5.2, but it was not ideal because of the use of user scale. As a result, the other two options were added in RiverWare 6.0, and the --rplslotvalunits command line argument was added to allow users to control this behavior. The user option provided some benefit, but the results of a run could change if user units changed. For these reasons, the std scheme is preferred.

In RiverWare 8.1, the user and mixed options have been removed; the std approach is the only one available. With this change, RPL evaluation should not be affected by changing slot units.

In rare circumstances, this change could lead to different numerical results. In testing performed by CADSWES, the only differences were insignificant.

Scripts

The following changes have been made to RiverWare scripts.

New Actions

The following script action types have been added for use with Series Slots With Periodic Input.

• Set Series Slot Input Mode—actions with this type set the periodic input *mode* of one or more series slots with periodic input. See "Set Series Input Mode" in *Automation Tools* for details.

• Set Series Slot Periodic Values—actions with this type set a periodic input *value* of one or more series slots with periodic input. See "Set Series Slot Periodic Values" in *Automation Tools* for details.

Modified Set Table Slot Value Actions

The Set Table Slot Value action type has been extended to allow you to specify rows by interval label for periodic slots.

Run Scripts Automatically When a Model is Loaded

A new check box and menu have been added to the Script Manager dialog, allowing you to specify the name of a script group to run when the model loads. The check box enables and disables the automatic script run functionality, and the menu provides a list of valid script groups. To configure a series of scripts to run on model load, you can create a script group that includes the ordered list of scripts, select the check box, and select the name of the group in the menu.

See "Tour of the Script Manager" in *Automation Tools* for details.
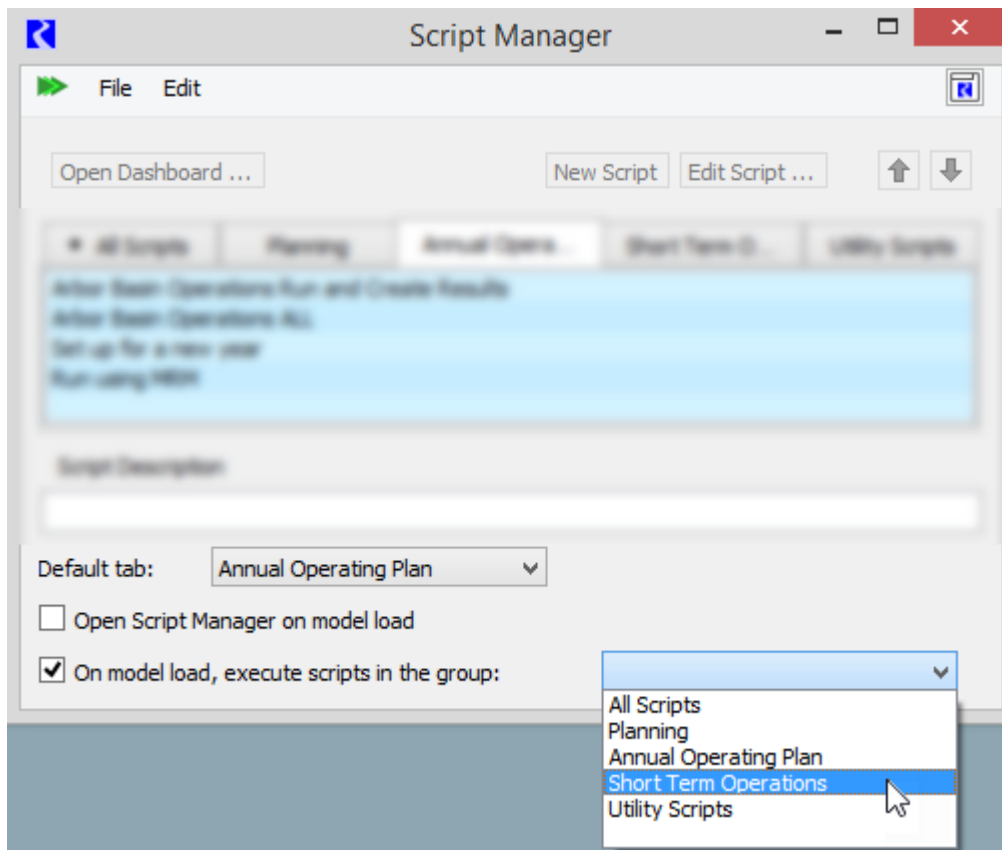
Slots

The following changes have been made to RiverWare slots.

Expression Slots

Expression slots now always initially open in their own slot dialog, not the Slot Viewer. To view an expression slot in the Slot Viewer, you must first open it in its own dialog, then dock it in the Slot Viewer. When displayed in the Slot Viewer, the expression slot includes a button in the column header, which you can select to open the dialog for the associated slot.
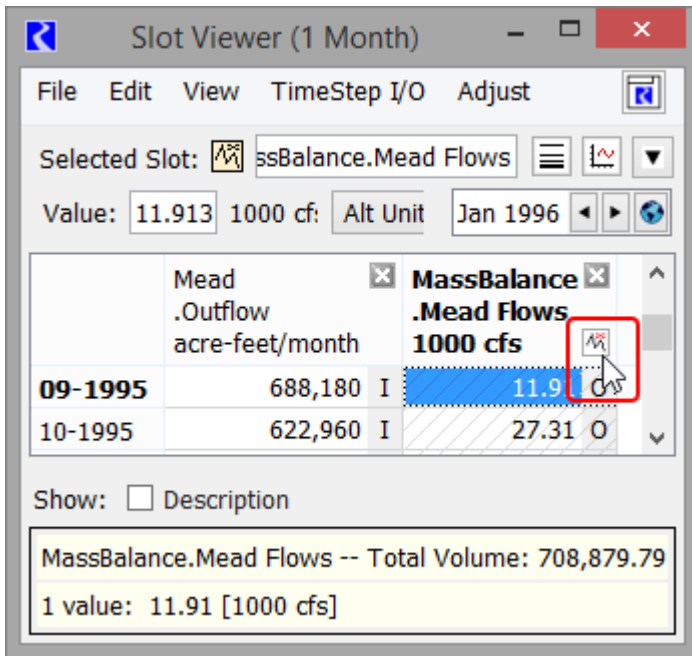
Slot Viewers

Previously, you could open only one Slot Viewer at a time, and it only displayed series data with the same timestep size as that of the model. Now, you can have one Slot Viewer for each timestep size in RiverWare. Each Slot

Viewer is associated with a specific timestep size, which is identified in the window title bar—for example, "Slot Viewer (1 Month)" and "Slot Viewer (1 Day)". The Slot Viewer displays series data with that timestep size only.
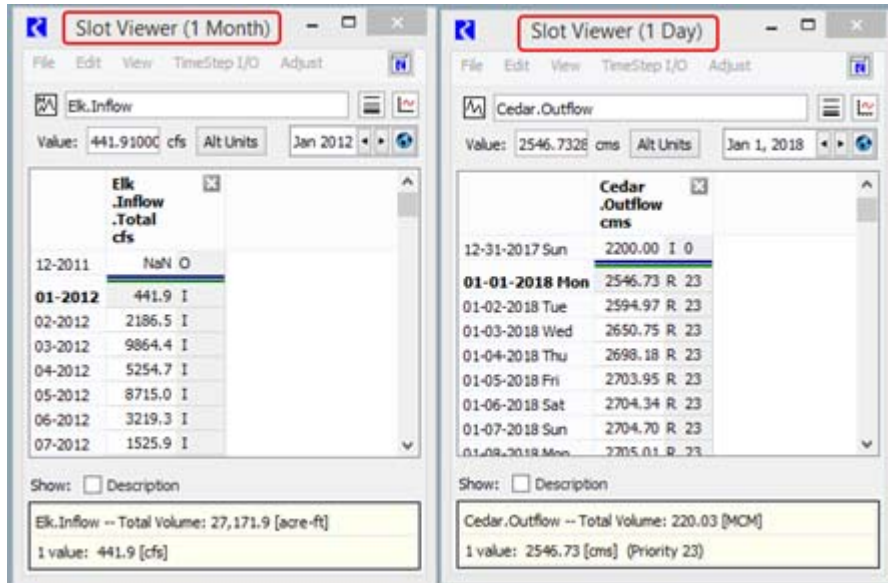
New Slot Viewer buttons have also been added to the workspace to allow you to more easily access open Slot Viewers. See "Slot Viewers and RPL Viewers Workspace Buttons" on page 18 for more information.

Series Slots with Periodic Input

Series Slots with Periodic Input allow you to specify a series of data as either a time series or a periodic relationship. When in periodic mode, the series values are computed for each timestep. Following are changes to these types of slots.

Visual Indicator on Slot Viewer

The Slot Viewer now has a button that identifies Series Slot with Periodic Input slots and provides quick access to open the slot dialog. The indicator appears in the column header, and you can select it to open the slot dialog for the

associated slot. Note that if the column associated with the slot is selected, its slot dialog can also be opened by selecting the slot icon in the upper section of the Slot Viewer.
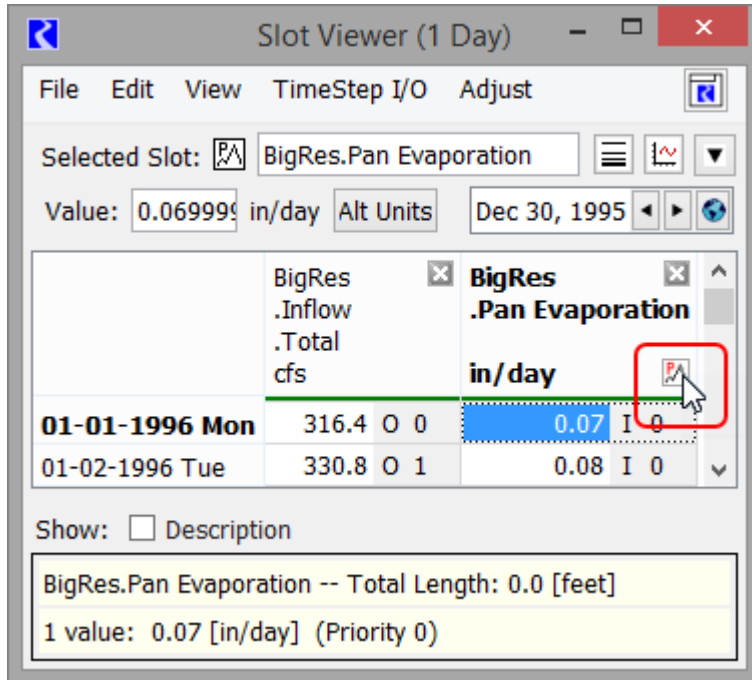
Recomputation When Units Change

When a Series Slot with Periodic Input in periodic mode has its display units changed to or from a non-constant unit, the series values are recomputed—for example, when the units are changed from cms to acre-feet/month. This is necessary because the display units influence the series values. A warning is issued to diagnostics when this occurs.

Undo and Redo Slot Data Edits

RiverWare now supports Undo and Redo operations for slot data edits, allowing you to easily reverse and reapply these types of edits. Initially, this functionality is provided for the following dialogs:

• Slot Viewer

• Slot (for Series, Table, Table Series, Agg Series, Multi-, Periodic, and Scalar Slots)

• Object Account Summary

• Edit Account

• Exchange Balance

In these dialogs, all data editing operations that change values without changing the structure of the data are tracked by Undo and Redo. This includes entering, pasting, clearing, filling, importing, and interpolating values, adjusting values by factor or offset, and changing value flags.

Structural changes, which change a slot's rows, columns, and configuration—such as removing a row from a table slot—are *not* tracked and are therefore not eligible for Undo and Redo.

External changes, which are initiated outside the dialog—for example from an SCT or a script action—are also *not* tracked.

If you execute an Undo or Redo and there has been an intervening untracked change to any of the values affected by the edit, a confirmation dialog is displayed, allowing you to confirm or cancel the operation. If you confirm, it undoes the value that was *last tracked by the dialog*, not the external change.

See "Undo and Redo" in *User Interface* for details.
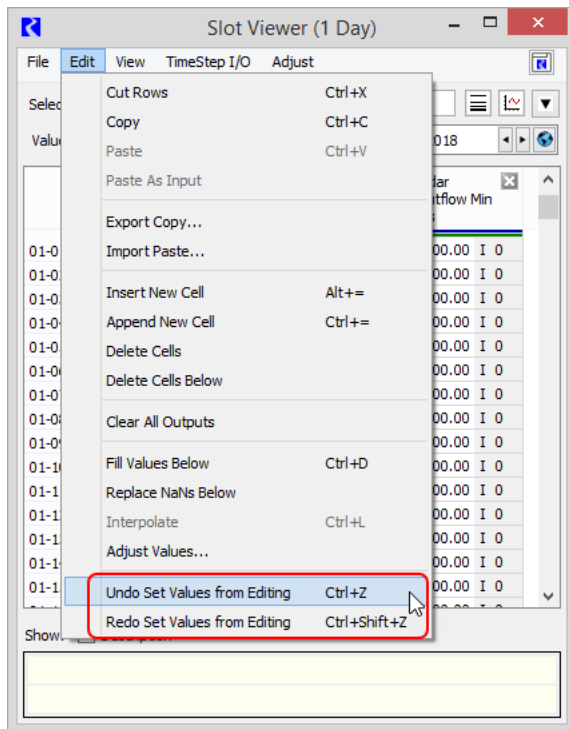
System Control Table (SCT)

The following changes have been made to the SCT.

SCT Documentation

The SCT chapter of the *User Interface* book has been restructured into a standalone book. The content has been reorganized and improved using a topic-based approach designed to assist users in finding and applying information to answer a question, solve a problem, or perform a task. Each topic starts with a descriptive heading and includes content that is mostly conceptual, step-by-step procedure, or quick-reference type information. The text is supported by extensive screenshots, and each topic includes a section with links to related topics.

See *"System Control Table (SCT)"* for details.

Workspace

The following changes has been made to the RiverWare workspace.

Object Import Location

In previous RiverWare versions, imported objects retained the coordinates with which they were exported, in all workspace views (canvases). Now, when you import objects, you can selectively choose to locate the imported objects near an object already in the model.

When you initiate the import operation, by selecting **Workspace**, then **Objects**, then **Import Objects**, the Import RiverWare Simulation Object File dialog now includes the following radio buttons in the "Import Location" group:

• Use exported coordinates—imported objects retain their original coordinates.

• Near object (with controls for specifying the reference object)—imported objects are placed near the specified reference object, if the object is valid. Specifically, imported objects retain their positions relative to one another, and the lower-left corner of the bounding box around them is positioned just to the right of the reference object.

See "Import" in *User Interface* for details.
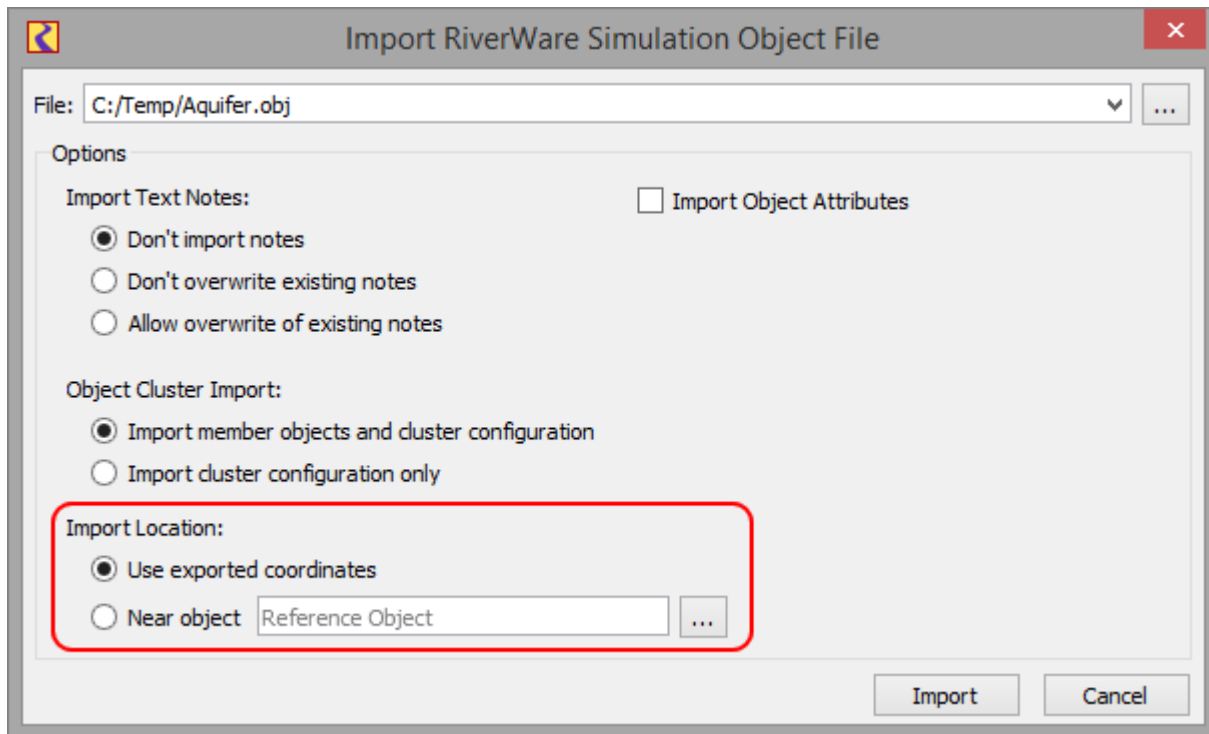
Slot Viewers and RPL Viewers Workspace Buttons

The following buttons have been added to the bottom button bar in the main workspace.

- Slot Viewers—displays a list of open Slot Viewer windows and allows you to select one to bring to the front.
- RPL Viewers—displays a list of open RPL Viewers and allows you to select one to bring to the front.

See "Viewer Buttons" in *User Interface* for details.
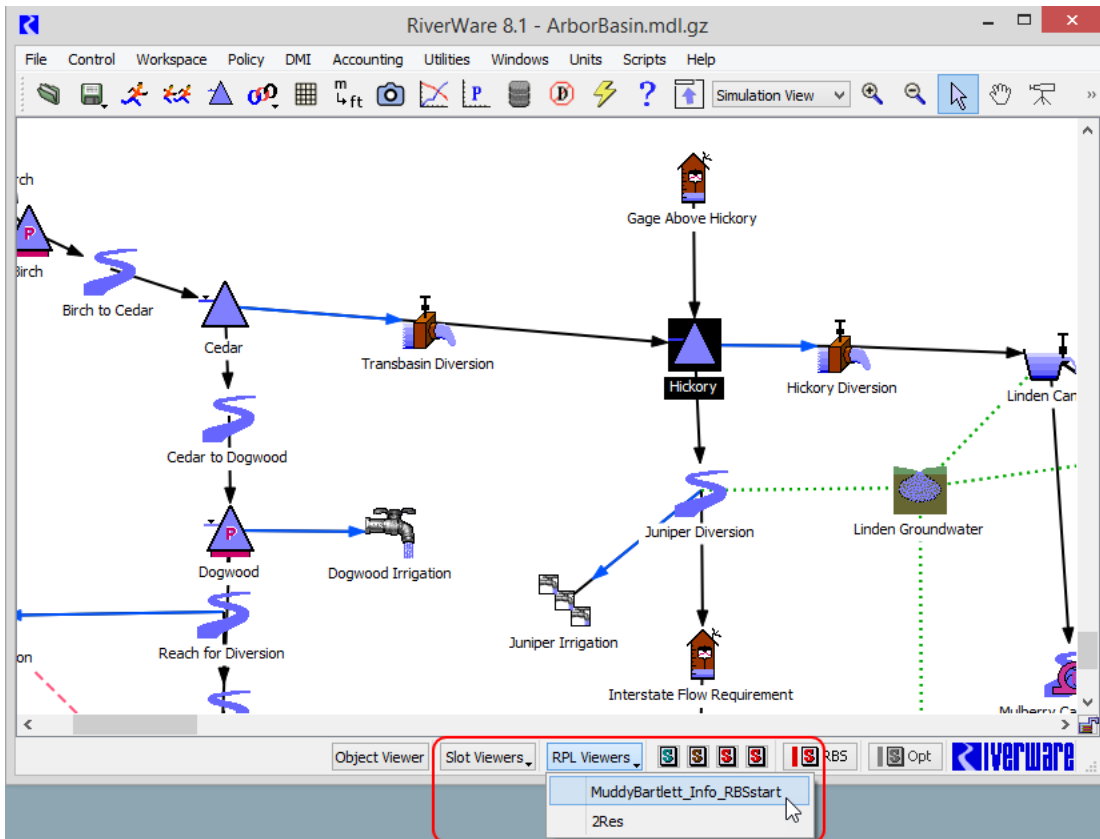
Show Workspace Button

The Show Workspace button has been added to the menu bar of many RiverWare windows and dialogs. Selecting the button allows you to bring the workspace window to the front, in its current Compact or Full Workspace display mode. Hovering over the button displays a tooltip with the model file name and full file path, allowing you to easily identify the model a window or dialog is associated with. Pressing Ctrl+Shift+B brings the workspace to the front, and Ctrl+B sends the workspace to the back.

See "Show Workspace" in *User Interface* for details.
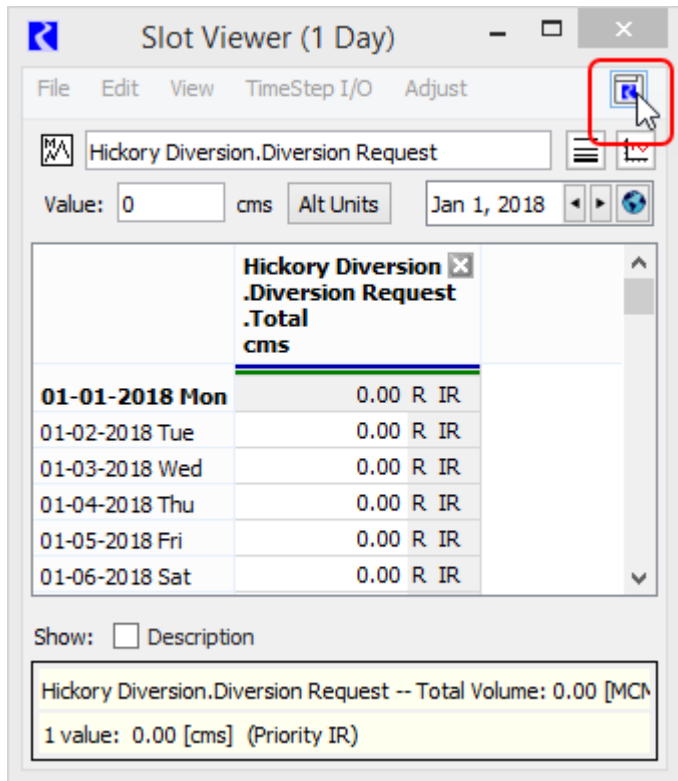
Chapter 2
Closed Issue Reports

Table 2.1 summarizes the issues that have been addressed or fixed since the last major release (Version 8.0). Issues are listed in bug number order. For more information on any bug, go to the RiverWare website:

www.riverware.org

Table 2.1 Issues addressed since Version 8.0

Number	Summary
6236	Can't select a Periodic Slot as Input for export to RiverWISE
6362	Incompatible Slot Message when switching between model files without closing SCT
6364	Read issues with new Excel DMI
6366	SCT Display NaN option does not work
6392	Simulations crash if any RPL expression is copied
6398	Changing Excel DMI Dataset name without applying leads to assertion failure
6401	RiverWISE can open the Script Manager
6402	WQ does not solve without closing and reopening RW
6403	Distributed MRM run using Script not supported
6404	Oracle connection code contains hard-coded reference to version 12c
6405	Set Difference does not remove all duplicates
6406	Unable to connect to HDB in RW 8.0
6407	RPL Won't Locate Newly Added Accounts Until Save/Reopen
6409	Reservoir dispatch method name typos
6411	Periodic Slot Plot Error
6415	Opening an object cluster causes a crash
6417	Slot Viewer can get Editable/Read-Only property wrong for some columns
6419	Open Object Cluster Kills RiverWare
6420	GetMaxReleaseGivenInflow() does not work correctly with Peak Power Method
6422	RDF Viewer has a unit conversion issue
6427	RW crashes when removing Dataset from Database DMI
6432	DIT not filtering water users as expected
6437	Model Comparison Not Seeing Difference in AggSeries Slot

Chapter 2
Closed Issue Reports

Table 2.1 Issues addressed since Version 8.0

Number	Summary
6441	Incorrect Error Statements in Diagnostic Output
6442	RW bug - unexpected error
6443	RW text size between laptop and dual monitors
6445	Opening Script Editor causes model to freeze on any subsequent runs
6456	Bug in MRM
6457	"Unexpected Error..." within SCT when "Alt Units - Volume" used
6458	RiverWare crashes when I try to dock a RiverWare window
6459	RW multislot error with MTOM
6462	Install wizard doesn't have option to install
6465	RPL Equality Comparison (==) Allowing Different Units
6469	"Pressing Stop soon after pressing Start run results in "Report to CADSWES" error message"
6472	Peak Power methods incorrectly using value on Pool Elevation slot
6473	Series Slots with Periodic Inputs units conversion issue
6474	Showing minimized workspace changes mode from Compact to Full
6475	Newly created accounts are not valid in auto passthrough creation
6476	Unable to find minimum spill in GetMinSpillGivenInflowRelease
6477	Error importing periodic_base to periodic slot
6479	Model Report plain text misapplying carriage returns
6481	Starting RiverWare over Remote Desktop causes an error and won't start
6484	Sometimes series expression slots open in a Slot Viewer
6487	Crash when running planning model
6488	Display inconsistencies on Object Viewer
6489	Model Report section number is incorrect for a RPL Group
6490	RPL can be edited while Debugger still active, can cause full crash
6491	In distrib MRM saving per-trace model files can fail
6492	In distrib MRM removing per-trace model files can fail
6494	RPL function diagnostic settings availability is inconsistent when run is paused
6495	Groundwater Object doesn't solve properly
6499	RPL set comparison failure - unequal number of properties
6500	RPL expression can have multiple comments, might be related to a crash
6502	Groundwater Object Storage not changing proportionally to Elevation
6503	Output Canvas is not showing datetime or text slot values correctly