



**CADSWES**

University of Colorado

Center for Advanced Decision Support for Water and Environmental Systems

# Overview of New and Upcoming RiverWare Features

---

RiverWare User Group Meeting  
August 13-14, 2008

**CADSWES STAFF**

# Outline

---

- What's new in 5.0? – David
- Qt Port Status – Patrick
- Description and demonstration of new features
  - Import/Export of Objects – Patrick
  - Major User Interface Changes – Phil
  - Global Slot Configuration – Neil
- Linux and 64-bit status – Bill
- Upcoming Work – Edie

# What's New in RiverWare 5.0?

---

## ➤ General RiverWare

- Descriptions for data object and slots
- File loading menus
- Global slot configuration
- Import/export of links, accounts, supplies, and position
- Import paste
- Integer indexed slots
- Model file format

- Plotting date markers
- Plotting probability scale
- Selector enhancements
- Series display compression
- Statistical Slot methods

## ➤ Engineering Objects

- Initialization for routing
- New routing methods
- MODFLOW Link
- WQ docs

# What's New in RiverWare 5.0? (cont.)

---

- Re-implemented / enhanced dialogs:
  - Diagnostics
  - Exchange dialogs
  - Link manager
  - Multi-object method selector
  - Periodic slot
  - Snapshot manager
  - Subbasin manager
  - Unit converter
- Accounting water rights solver
- New database DMI editor
- MRM output and iterative mode
- Optimization – RPL based
- RPL interface changes
- RPL predefined functions
- SCT tabs for scalar and other slots
- **No more Galaxy!**

# Qt Port Status - Patrick

---

- GUI toolkits are great!
  - Less code
  - Fewer grungy details
  - More platform independence
  - Early 1990s: Galaxy is great!

# Qt Port Status

---

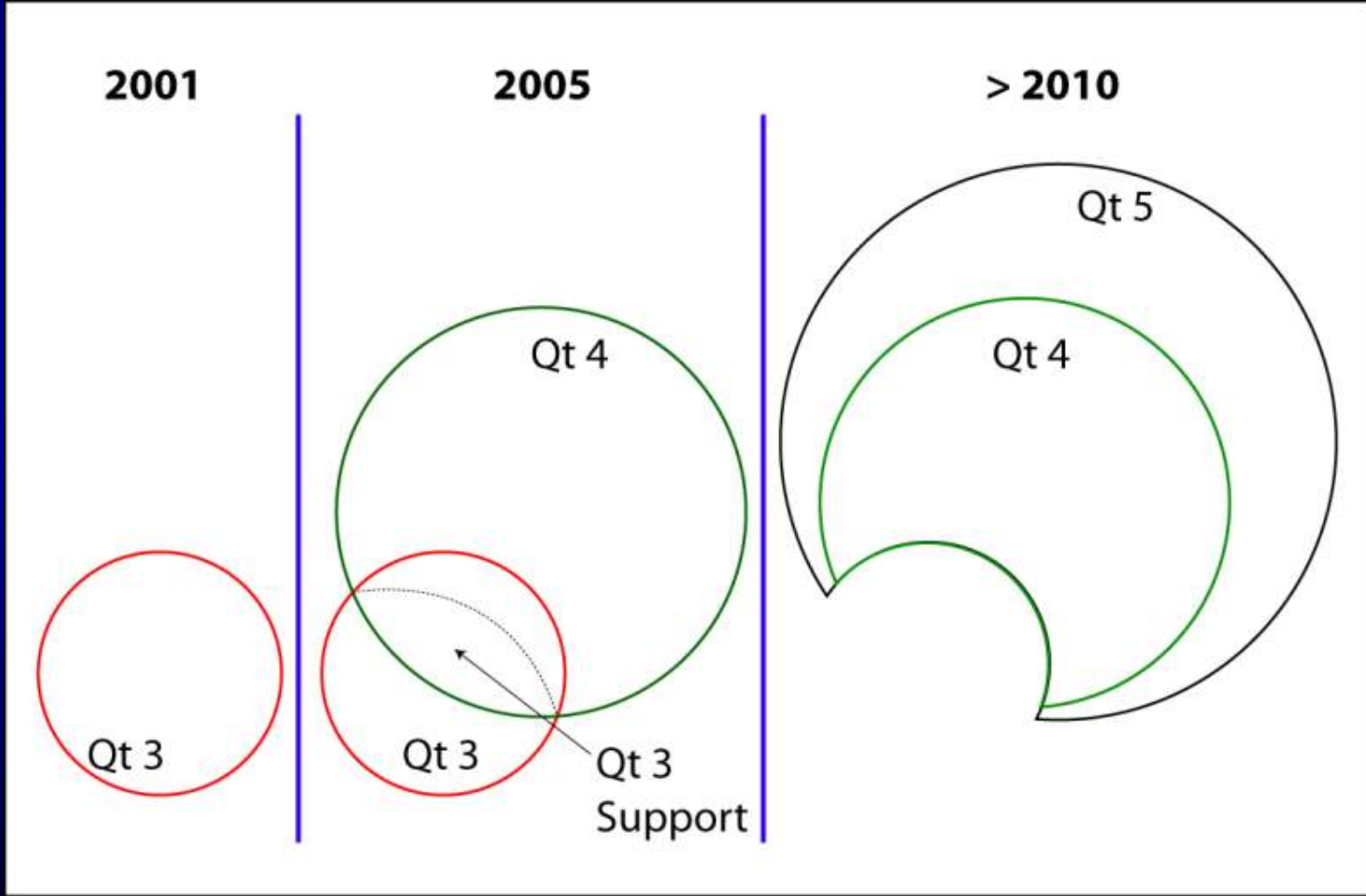
- GUI toolkits are great!
  - Less code
  - Fewer grungy details
  - More platform independence
  - Early 1990s: Galaxy is great!
- ... until the toolkit company fails
  - 2002: Qt application framework is great!
  - Began rewriting 100+ dialogs in Qt 3
  - Late 2007: RiverWare contains no Galaxy

# Summer 2005: Qt 4 released

---

- Bigger and better
  - 500 C++ classes, 9,000 functions
  - Some functionality changed
  - Much functionality deprecated (Qt 3 support layer)
- Migrating to Qt 4 was a major effort
  - 134 dialogs, most use deprecated functionality
- Future: replace use of Qt 3 support layer

# Qt versions





# Outline

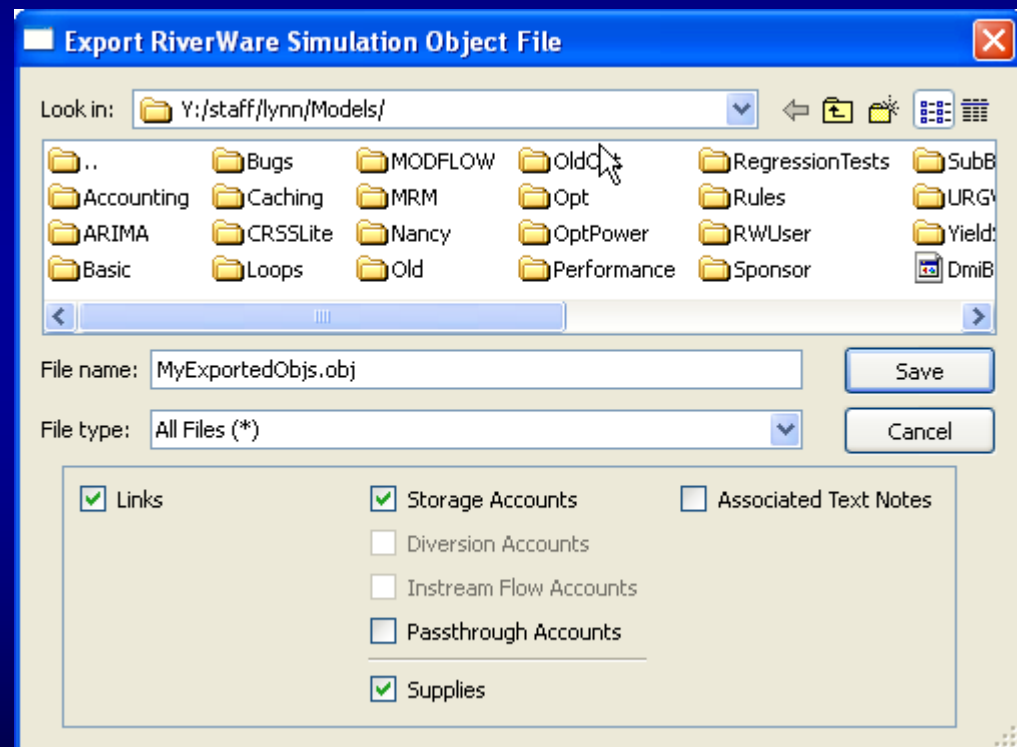
---

- What's new in 5.0? – David
- Qt Port Status – Patrick
- **Description and demonstration of new features**
  - Import/Export of Objects – Patrick
  - Major User Interface Changes – Phil
  - Global Slot Configuration – Neil
- Linux and 64-bit status – Bill
- Upcoming Work – Edie

# Export/Import of workspace objects- Patrick

New:

- Links
- Supplies
- Locations



# Major GUI Enhancements in RiverWare 5.0 - Phil

---

- Open Object
- Open Slot
- SCT
- “GUS” Selector
- Other Dialogs enhanced during Qt4 Port
- Misc. Usability Improvements
- *Several Demos*

# Open Object Dialog Enhancements

---

## *New in RiverWare 5.0:*

- User Descriptions (on Data Objects)
  - ... and on Data Object Slots
- Show Slots in SCT
  - Show All Slots in New SCT ...
  - Add All Slots to single Open SCT ...

# Open Slot Dialog Enhancements

---

## *New in RiverWare 5.0:*

- Series Display Compression
- Import Paste (e.g. from Excel)
- Periodic Slot Dialog Reimplementation
  - Multiple cell operations ... Fill values below ...  
Replace NaNs below ... Interpolate and Adjust ...  
Column Sum Row ... Export Copy / Import Paste  
... User Descriptions (on Data Objects).
- Selection Statistics on Series Slots

# Open Slot Dialog Enhancements

---

*Recently available in RiverWare 4.9:*

- Support for Date/Time Slot Values
- Table Slots: optional Column Sum Row
- Adjust Values operation
  - Add entered value or percentage to selected cells
- Show Slot in SCT / Add to SCT operations

# Series Display Compression Compress Repeated Values

**Tsubasa Res.K Factor**

File Edit View TimeStep I/O Adjust

K Factor Value: 0.0001 ft/F

Scroll: March 19, 1996

	ft/F	
12-31-1995 Sun	0.00008	I
<b>01-01-1996 Mor</b>	<b>0.00010</b>	<b>I</b>
01-02-1996 Tue	0.00010	I
01-03-1996 Wed	0.00010	I
01-04-1996 Thu	0.00010	I
01-05-1996 Fri	0.00010	I
01-06-1996 Sat	0.00010	I
01-07-1996 Sun	0.00010	I
01-08-1996 Mon	0.00010	I
01-09-1996 Tue	0.00010	I
01-10-1996 Wed	0.00010	I
01-11-1996 Thu	0.00010	I
01-12-1996 Fri	0.00010	I
01-13-1996 Sat	0.00010	I
01-14-1996 Sun	0.00010	I

**Tsubasa Res.K Factor**

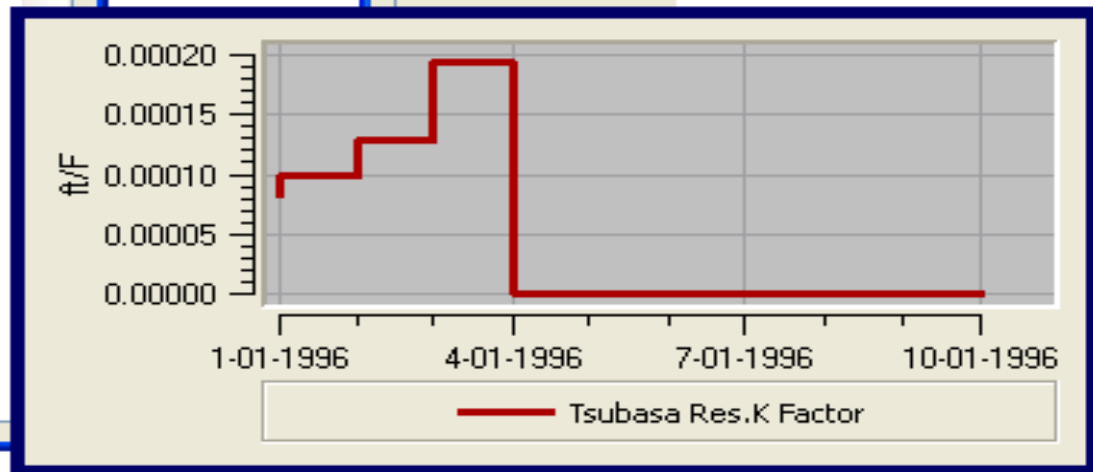
File Edit View TimeStep I/O Adjust

K Factor Value: 0.0001 ft/F

Scroll: March 19, 1996

Compress Repeated Values

	Cnt	ft/F	
12-31-1995 Sun	1 :	0.00008	I
<b>01-01-1996 Mor</b>	<b>31 :</b>	<b>0.00010</b>	<b>I</b>
02-01-1996 Thu	29 :	0.00013	I
03-01-1996 Fri	31 :	0.00019	I
04-01-1996 Mon	183 :	0.00000	I



# Series Display Compression Show Values $\geq 0.4$

Mithrim Res.Precipitat...

File Edit View TimeStep I/O Adjust

Precipitation Rate  
Value: 0.48 in/day

Scroll: March 19, 1996

	in/day	
12-30-1995 Sat	NaN	O
12-31-1995 Sun	0.00	I
01-01-1996 Mon	0.00	I
01-02-1996 Tue	0.00	I
01-03-1996 Wed	0.00	I
01-04-1996 Thu	0.00	I
01-05-1996 Fri	0.00	I
01-06-1996 Sat	0.00	I
01-07-1996 Sun	0.00	I
01-08-1996 Mon	0.00	I
01-09-1996 Tue	0.00	I
01-10-1996 Wed	0.00	I
01-11-1996 Thu	0.00	I
01-12-1996 Fri	0.00	I
01-13-1996 Sat	0.00	I

Mithrim Res.Precipitat...

File Edit View TimeStep I/O Adjust

Precipitation Rate  
Value: 0 in/day

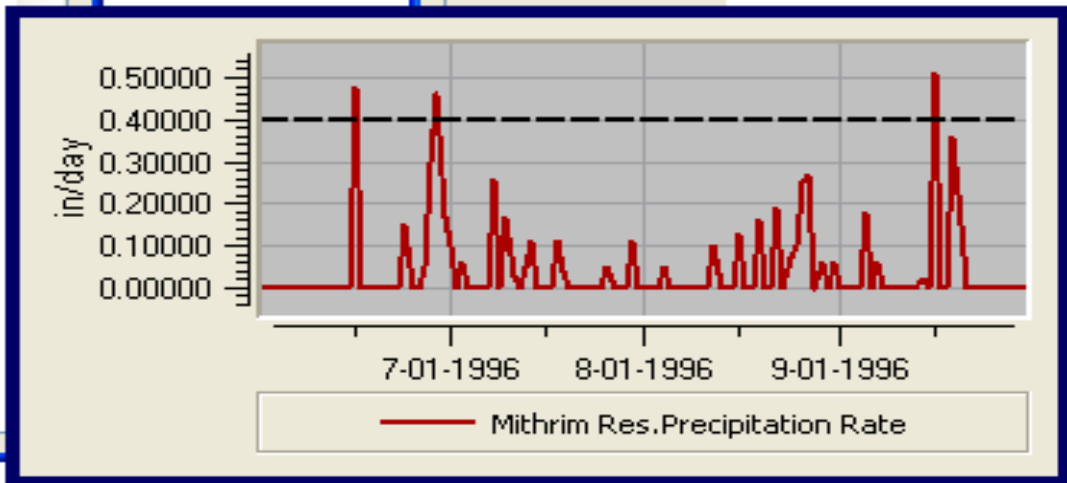
Scroll: March 19, 1996

Show Values  $\geq 0.4$

Precision Type: Display

273 Timestep Rows Hidden

	in/day	
06-15-1996 Sat	0.48	I
06-28-1996 Fri	0.46	I
09-15-1996 Sun	0.51	I





# Open Series Slot Dialog: Import Paste

Tsubasa Res.Seasonal I... [Min] [Max] [Close]

File Edit Row Column View Adjust

Seasonal Inflow Coefficients

Value: 0 cfs

	Month	Inflow	Coefficient	E>
	NONE	cfs	NONE	NONE
1	1.00	139.00	2.25260000	
2	1.00	875.00	1.35040000	
3	2.00	0.00	0.00131410	
4	2.00	139.00	2.25260000	
5	2.00	875.00	1.35040000	
6	3.00	0.00	0.40826000	
7	3.00	600.00	68.94800000	

Import from Clipboard [Help] [Close]

System Clipboard: 3 rows, 3 columns

	1	2	3
1	0	0.00210256	2.603
2	222.4	3.60416	1.172
3	1400	2.16064	1.1553

Paste To: Tsubasa Res.Seasonal Inflow Coeff

Slot Cell Selection: 3 rows, 2 columns

Limit paste operation to Slot Cell Selection

Paste Cancel

# SCT Dialog Enhancements

---

## *New in RiverWare 5.0:*

- SCT Slot List Tabs
  - Scalars (and 1x1 Tables)
  - Other Slot Types
- “Synchronize Time Range with Slots” option
- Support for Integer Indexed Series Slots
- Selection Stats: Accumulated Volume
  - Sum of selected Flow cells
- [4.9] Support for Timestep Size differing from Run

# “GUS” Selector Enhancements

---

*New in RiverWare 5.0:*

- Slot Type Filtering: “Scalar and 1x1 Table”  
... and scalar values are shown in GUS
- Account Filtering by Priority Date
  - Senior To / Junior To Priority Date

\* *GUS: Grand Unified Selector*

# Major Dialogs Enhanced in Qt4 Port / RiverWare 5.0

---

- Multiple Object Method Selector
- Snapshot Manager
- Subbasin Manager
- Unit Converter
- User Descriptions on Data Objects
  - Open Object Dialog
  - Open Slot Dialogs

### Multiple Object Method Selector

File Objects

Add Objects...  Filter by Type: Reach

Select All Invert Remove

Unfiltered Object List: 11 Objects; 57 in model.  
 Displayed Object List: 4 Reach Objects; 11 in model; 4 selected.

Type	Object	Current Method	Available
Reach	Confluence to Mithrim	timeLagRouting	AVAIL
Reach	Confluence to Mithrim Local Inflow	noRouting	AVAIL
Reach	Evendim to Above Wobegon	noRouting	AVAIL
Reach	Taeglin Loss from Evendim to Wobegon	timeLagRouting	AVAIL

Method Category	Method	Obj Count
routingMethodCategory	noMethod	
Stage Calculation	noRouting	2
Local Inflow Solution Direction	timeLagRouting	2
Volume Calculation	variableTimeLagRouting	
MODFLOW Link Category Reach	impulseResponseRouting	
GainLoss Calculation	Step Response	
Negative Outflow Adjustment	Variable Step Response	
Reach PassThrough Slot Inflow	muskingumRouting	
Reach Pass Through Acct Gain Loss	kinematicRouting	
Seepage Calc	muskingumCungeRouting	
Generate Local Inflows	Muskingum Cunge Improved	
Evaporation Calculation	macCormackRouting	
Reach Bank Storage Calculation	Storage Routing	
Diversion from Reach	Variable Storage Routing	

Category: routingMethodCategory

Current Methods: timeLagRouting, noRouting

New Method: variableTimeLagRouting

Apply New Method... Close

# RiverWare 5.0

## New Multiple Object Method Selector

### Apply Method to Objects

Are you sure you want to set the new method on each of the following 4 objects?

Objects:

- Confluence to Mithrim
- Confluence to Mithrim Local Inflow
- Evendim to Above Wobegon
- Taeglin Loss from Evendim to Wobegon

Proceeding with this change may allocate memory for the following 4 slots:

- Min Max Lags
- Return Flow
- Variable Lag Time
- Variable LagTime Table

Category: routingMethodCategory

New Method: variableTimeLagRouting

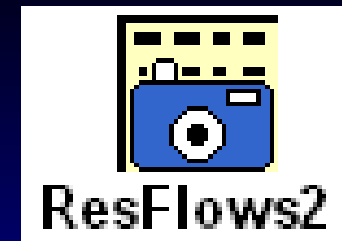
OK Cancel

# Multiple Object Method Selector

---

- Displayed Objects and Method Categories can be filtered by Object Type
- All possible Methods are shown for the selected Method Category
- More detailed confirmation dialog box
- Can open Objects by double-clicking

# Snapshot Manager



**Snapshot Manager** [Minimize] [Maximize] [Close]

File Slots Sort

Snapshot Template: 6 Slots (2 Selected)    3 Snapshots (3 Selected)

New Snapshot Name:

	Snapshot Object	Slots	Timestamp
1	Wobegon Res.Inflow		
2	Wobegon Res.Outflow		
3	Mithrim Res .Inflow		
4	Mithrim Res .Outflow		
5	Tsubasa Res .Inflow		
6	Tsubasa Res .Outflow		

	Snapshot Object	Slots	Timestamp
1	ResFlows	6	14:12:45 Aug 11, 2008
2	ResFlows1	6	14:13:05 Aug 11, 2008
3	ResFlows2	6	14:14:19 Aug 11, 2008

# Snapshot Manager

---

- Can specify a Base Name for new snapshots
- Slot List is re-organizable
- Snapshot List items show
  - Number of Slots in the Snapshot
  - Creation Timestamp
- Camera icon actually flashes
- *Change:* Deleting Slots from Snapshot Slot Template doesn't affect existing snapshots.



# Subbasin Manager

The screenshot shows the 'Subbasin Manager' window with the 'User Defined' tab selected. The main area contains a tree view of subbasins. The 'Wobegon Res' subbasin is highlighted in blue. Below the tree view are buttons for 'Open' and 'Remove', along with up and down arrow icons. At the bottom of the window are buttons for 'Restore Custom Order', 'Hide Objects', and 'Close'.

Subbasin	Cnt	Type
U Above Mithrim	11	
Evendim Outlet		
Taeglin Loss from Evendim to Wobegon		
Evendim and Withywindle		
Evendim to Above Wobegon		
Withywindle Creek above Wobegon		
<b>Wobegon Res</b>		
Wobegon Seepage		
Celos nr Poros		
Withywindle and Celos		
Confluence to Mithrim		
Confluence to Mithrim Local Inflow		

The screenshot shows the 'Subbasin Manager' window with the 'Object Membership' tab selected. The main area displays a message: "'Wobegon Res' is a member of:" followed by a 'Reselect...' button. Below this is a tree view showing the membership of 'Wobegon Res'. The 'Wobegon Res' subbasin is highlighted in blue. At the bottom of the window are buttons for 'Restore Default Order', 'Hide Objects', and 'Close'.

Subbasin	Cnt	Type
A Entire Network	46	
A StorageReservoir	2	
A SimObj	60	
A Reservoir	3	
<b>Wobegon Res</b>		
Mithrim Res		
Tsubasa Res		
U Above Mithrim	11	

# Subbasin Manager

---

- Tabs, including Object Membership Tab
  - Instead of stand-alone membership dialog
- Subbasin List improvements:
  - Subbasin items show number of objects
  - Object items show object type icon
  - Open Objects (with context menu or double-click)
  - User Defined Subbasins can be reordered
  - Multiple Subbasin and Object selections supported for various operations.

# Unit Converter

**Unit Converter** [Minimize] [Maximize] [Close]

Unit Type:  [v]

	Value	Scale	Unit	Duration for Rate
Convert From:	<input type="text" value="5"/>	<input type="text" value="1"/>	<input type="text" value="cms"/> [v]	<input type="text"/>
Multiplier:	<input type="text"/>			
Result:	<input type="text" value="10.5060429915"/>	<input type="text" value="1000"/>	<input type="text" value="acre-ft/month"/> [v]	<input type="text" value="30 Days"/> [v]

Use Scaled Units

# Unit Converter

---

- Immediate automatic recomputation
  - No “Calculate” button.
- Quick selection of common unit types:
  - Flow, Volume, Area, Length
- Support for Scaled Units, plus a Multiplier
- Support for Rate entities using pseudo-time intervals (e.g. “... per month”)
- “Copy Result” (to clipboard) button

# Data Objects and Slots

## User Provided Descriptions

Open Object - GreenResData

File Edit View Slot Account

Object Name: GreenResData

DataObj

Slots Methods Accounts Description

Monthly series expression slots evaluated at the end of the run that compute the monthly inflows to Green Reservoir for the run length.

Also contains a WaterYearRelease |

OK Cancel Edit

BlueResData.PeakPowerFlowT...

File Edit View Adjust

PeakPowerFlowTable

Value: 0 cfs

Slot Description

This table is used to interpolate the peak power flow, the most efficient flow through the turbines for the given operating head, based on the average pool elevation.

This table was created based on the results of letting RiverWare user method "PeakPowerCalc" compute the peak power flow for every possible elevation of Blue Reservoir. This interpolation is done, given the average pool elevation, to determine whether or not Blue Reservoir will spill for a decision regarding the magnitude of spike flow to be released.

Edit Print... Hide

# Misc. Usability Improvements

---

- File Loading: Cascaded submenus to load recently accessed Models, RplSets, SCTs.
- Plot Dialog: Date Marker Line (optionally drawn at Date Time spinner value).
- Timestep Navigation Features (some in 4.9)
  - Global Time Scroll (in various places).
  - Series Slot Text Annotations as Timestep Bookmarks

# GUI Demos – Phil

---

- Series Display Compression, *and:*
  - Annotations as Timestep Bookmarks
  - Global Time Scroll
- SCT Slot List Tabs, *and:*
  - Add Slots to SCT from Open Object Dialog
- Import Paste
- Multiple Object Method Selector, *and:*
- Subbasin Manager

# Configure Existing Slots Dialog – Neil

---

- Workspace > Slots > Configure Slots
- Configure Multiple Slots at Same Time
- Non-Accounting Slots Only
- User Unit, Scale, Min Value, Max Value, Display Format, Convergence
- Also Unit Type for Slots on Data Objects



# Configure Existing Slots Dialog

Add or remove slots from the list

Slot list

Change user units

Change display format

Change unit type for slots on Data Objects

Change convergence

Apply to all slots in list

Apply only to highlighted slots in list

Object	Slot	Column	Unit Type	User Units	Scale	Min	Max	Format	Precision	Conv. Value	Conv. Ty
Bartlett Reservoir	Outflow	Outflow	Flow	cfs	1	NaN	NaN	Float	2	0.01	Percent
Bartlett Reservoir	Pool Elevation	Pool Elevation Length	Length	ft	1	NaN	NaN	Float	2	0.01	Percent
Bartlett Reservoir	Power	Power	Power	MW	1	NaN	NaN	Float	2	0.01	Percent
Bartlett Reservoir	Spill	Spill	Flow	cfs	1	NaN	NaN	Float	2	0.01	Percent
Muddy Reservoir	Outflow	Outflow	Flow	cfs	1	NaN	NaN	Float	2	0.01	Percent
Muddy Reservoir	Pool Elevation	Pool Elevation Length	Length	ft	1	NaN	NaN	Float	2	0.01	Percent
Muddy Reservoir	Release	Release	Flow	cfs	1	NaN	NaN	Float	2	0.01	Percent
Muddy Reservoir	Spill	Spill	Flow	cfs	1	NaN	NaN	Float	2	0.01	Percent

Configuration

User Units  
 For Unit Type: Flow

User Units: cms Scale:   
 Min Value:  Max Value:   
 Convert slot values to new User Units and Scale

Unit Type for Slots on Data Objects  
 Old Unit Type: Flow  
 New Unit Type: NONE  
 New User Units: NONE

Display Format  
 Type: Float Precision: 2

Convergence  
 Value: .0001 Type: Percent

Apply To All Apply To Selected Close

# Other major GUI work to be featured in subsequent talks

---

- RPL display and editing enhancements (*Patrick*)
- Water accounting (*David*)
  - Subordination dialog
  - Exchange balance dialog
- Database DMI edit dialog (*Bill*)
- Plotting and statistical slots (*Neil*)

# Linux and 64 Bit - Bill

---

- Linux: Unix operating system on Intel hardware; open source environment
- 64 bit: Larger address space = larger models

# Linux and 64 Bit

---

## ➤ Common issues

- Acquire hardware and operating systems
- Third party tools and libraries
  - Remove RogueWave; what should replace it?  
(Wrong choice could impact performance)
  - License or compile Linux / 64 bit versions
- Infrastructure – overnight builds, regression tests, release procedures

# Linux and 64 Bit

---

## ➤ Linux

- New compilers (g++, g95) can expose deficiencies in code (order of parameter evaluation)
- More compilers produce more robust code
- New compiler might produce more/less efficient code

## ➤ 64 Bit

- Data type sizes (size\_t, int)
- RiverWare code is not “64 bit clean”; how much effort is required to make it clean?

# Highlights of Upcoming Enhancements- Edie

---

- Geo-referencing and map layers
- Rulebased Simulation and RPL
  - Link rules to external documentation
  - “Undo” in RPL editor
  - Design (and some implementation) of Debugger
  - Initialization rules
  - Time-varying priorities
  - Comments between statements
  - Shared user-defined functions among RPL applications
- Input/Output
  - Import/export plot configurations; tabbed plots
  - Copy/paste from Windows or Unix clipboard to slots
  - Text output of model information

# Highlights of Upcoming Enhancements

---

- Water Accounting
  - Exchange manager dialog for stakeholders
  - Priority allocation controller
- Diagnostics – new implementation
- Multiple Run Management – more powerful
- Performance – runtime, smaller size, loading
- Optimization – Integer programming
- Training – Accounting, Optimization

# Unfunded (as yet) Enhancements

---

- Debugger for rules
- Rules/Optimization merging
- New (free) optimization controller
- Easier ways to compare models
- Linux and 64-bit versions
- Improved online help (html)
- Online training courses