

Green Book Functionality

DRAFT Design

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1.0 Purpose

The “Green Book” is used at the Albuquerque office of Reclamation to summarize water accounting activity on the Rio Grande River. Requirements for incorporating Green Book functionality into RiverWare were identified and discussed in an earlier document (Green Book Functionality - Requirements, April 8, 2008). Based on these requirements, this document describes a high level design for incorporating Green Book functionality into RiverWare.

2.0 Identified Requirements Based on Current Green Book

The following list is a summary of requirements that have been identified for incorporating existing Green Book functionality into RiverWare:

1. Each page should summarize activity involving SJ-C water by day for a particular reservoir over a particular month for every water user.
2. Summaries for the month for each water user should be totaled at the bottom of the page.
3. Numbers presented for a water user should represent the sum for all accounts on the reservoir associated with that water user (storage plus pass-throughs).
4. Values for each day should present two numbers: inflow to the water users accounts and outflow from their accounts.
5. Total values for the month should present inflow and outflow as well as the net change for the month.
6. Green Book values for a water user should automatically calculate based on information in the accounts associated with the water user on a reservoir and should automatically recalculate when the relevant water accounting information is updated.
7. Green Book in RiverWare should be flexible in terms of adding new water users.
8. An annotation capability should be available to describe information about a release, such as purpose of the release or its destination.
9. Annotations are made where water is released, not where it arrives.
10. Annotations should be flexible in applying to a single value, a group of contiguous values, or a group of non-contiguous values in the Green Book.
11. It should be possible to readily view annotations with their associated Green Book values.
12. Green Book pages should be easily printable into hard copy (including annotations).

3.0 Design

RiverWare has the capability through Series Slots with Expressions to create summary time series for water users by summing their individual accounts. Series for inflows, outflows, and the net of these two for a water user on a

reservoir can be created through this mechanism. Series Slots with Expressions can be set to evaluate when the model is run or evaluated interactively through the GUI. Since this capability to create summary data series already exists in RiverWare, it will not be recreated in some other form for this task.

The SCT functionality in RiverWare allows the user to group Series Slots (and Series Slots with Expressions) side by side into a table-type arrangement. It also provides the capability to generate a summary row in the data series (such as for each month). The existing note functionality in RiverWare can be accessed via a context menu to add notes to the series, which can be viewed as tool tips when hovering over the resulting note icon.

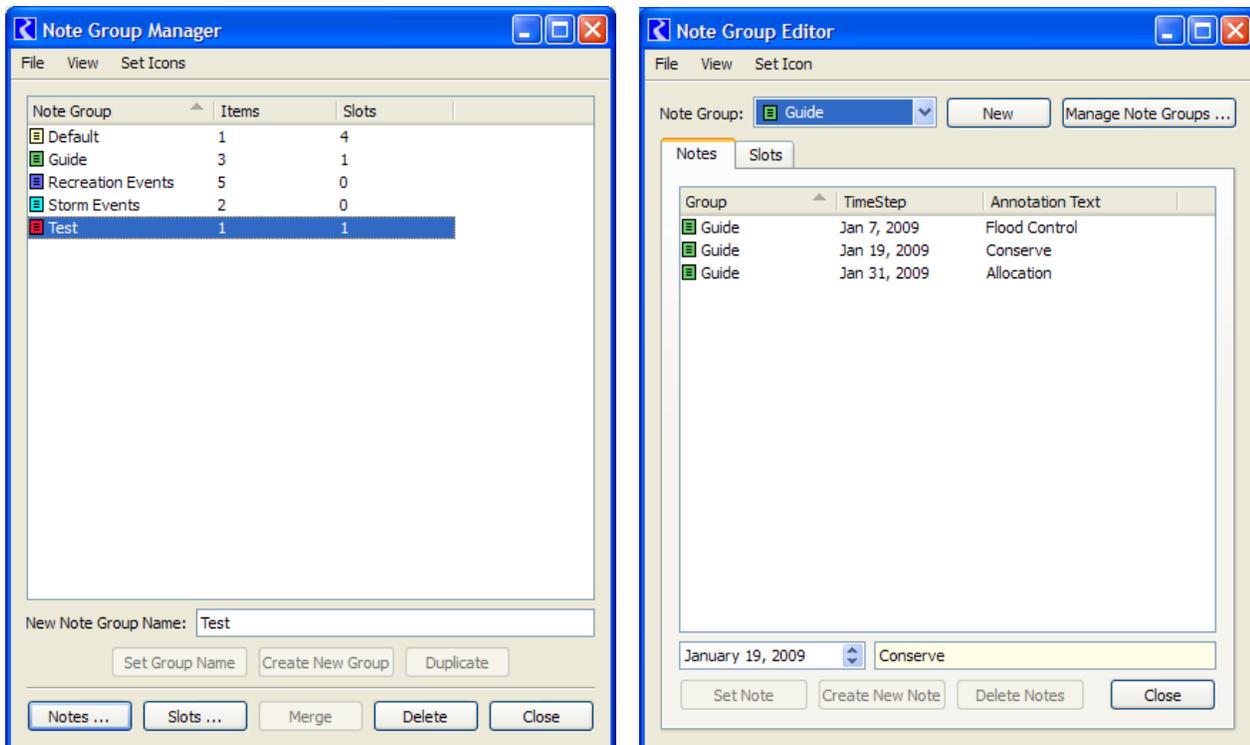
The SCT as it currently exists, therefore, can provide a functional work environment in RiverWare for entering, viewing, and annotating water accounting information like that used in the Green Book. It does not, however, allow for report generation in the form that the Green Book requires.

The note functionality mentioned above that is available in RiverWare does not currently have the flexibility to accommodate the annotation requirements for the Green Book.

Implementing Green Book functionality, therefore, involves two primary tasks - annotation revision and report generation. These are discussed separately below.

3.1 Annotation Revision

Annotations in RiverWare are currently implemented as notes on series slots via the Note Group Manager and the Note Group Editor dialogs:



A note group currently consists of multiple notes, each of which is associated with a particular timestep. The whole group of notes is then assigned to one or more slots.

To be more flexible and to accommodate annotations for water accounting, the structure of notes will be changed. Note groups will remain as a way to organize notes into related categories. The individual notes in a note group will not have a timestep assigned to them, but will just be the annotation text. Notes will not be assigned to a slot as a note group, but instead, any individual note will be assignable to any slot at any timestep. So an individual note could be assigned to several different timesteps in the same slot, or to the same or different timesteps in other slots. Other notes in the group could similarly be assigned to any desired slot at any desired timestep. More than one note can be assigned to a single timestep in a slot.

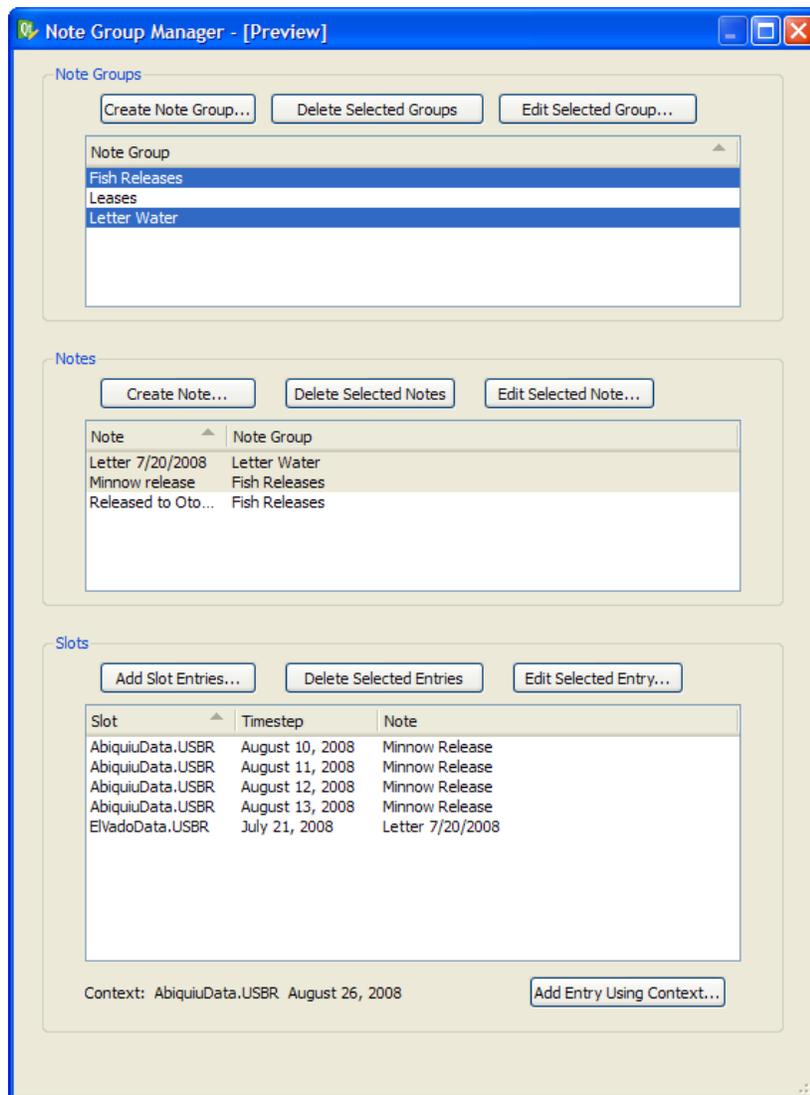
This new structure for notes will require significant rewrites of the AnnoGroup and AnnoGroupMgr classes in the RiverWare code. The AnnoGroupMgr remains a collection of annotation groups. An AnnoGroup becomes a collection of annotations instead of a class containing a map of note strings paired to timesteps along with a list of slots. An annotation now becomes a class that associates a text string with one or more slot/timestep pairs.

The methods for writing to the model file and reading from it will need to be changed to reflect how timesteps and slots will now be paired and associated with a particular note. Conversion code will need to be created for loading model files written with the original annotation structure. This one-time conversion will assign the date currently associated with each note in the group to the slots that are listed for the group to create slot/timestep pairs for the new note structure. Existing similar code for handling notes with the export and import of objects via a file will also need to be modified.

Classes for the open slot dialogs and the SCT dialog that interact with annotation classes to display annotation icons and text will need to be modified to interface with the new annotation structure.

3.1.1 Note Group Manager Dialog

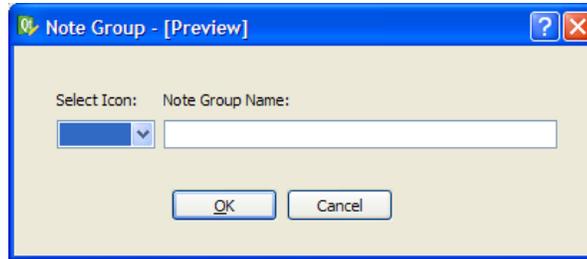
The Note Group Manager and Note Group Editor will be replaced with a single manager dialog presenting functionality consistent with the new note structure as follows:



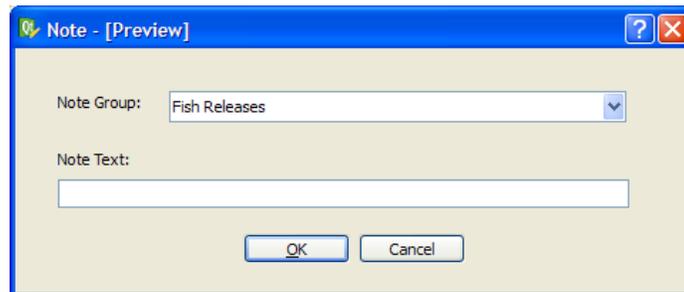
In this dialog, display in the lower panels will be dependent on selection in the upper panels. Selecting a note group in the upper list will display its notes in the center list, and selecting a note will show what slots at what timesteps the note is attached to in the lower list. Multiple selections in the panels will be supported so that selecting multiple note groups will display a combined list of notes for all selected groups, and selecting multiple notes will show a combined slot/timestep list for all selected notes. With the column sort operations, this allows all notes for a slot or all notes at a timestep to be seen. The delete buttons can be used with multiple selections. but multiple selections in a window will disable the associated edit button. Editing will apply to a single selection only. The Create Note Group button will always be available. The Create Note button will be available as long as at least one note group has been created. Similarly, the Add Slot Entries button will be available as long as at least one note has been cre-

ated. Note that in the actual implementation, the note groups will display their colored icons as they do now, they are just not part of this preview dialog.

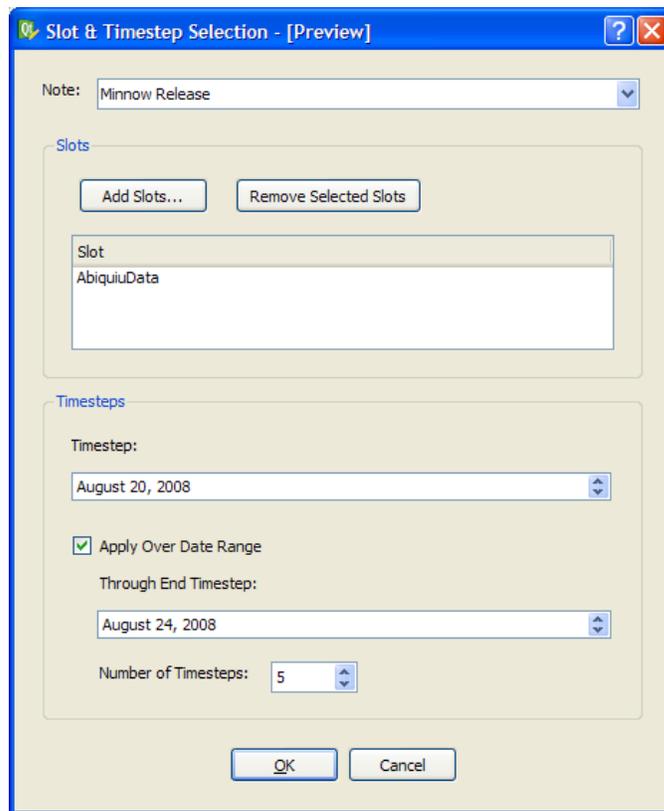
The Create Note Group and Edit Selected Group buttons will bring up a separate dialog where the group name can be entered and its colored icon selected (an alternative to this separate dialog that may be implemented instead is “in place” adding and editing of note groups in the Note Groups list of the main dialog).



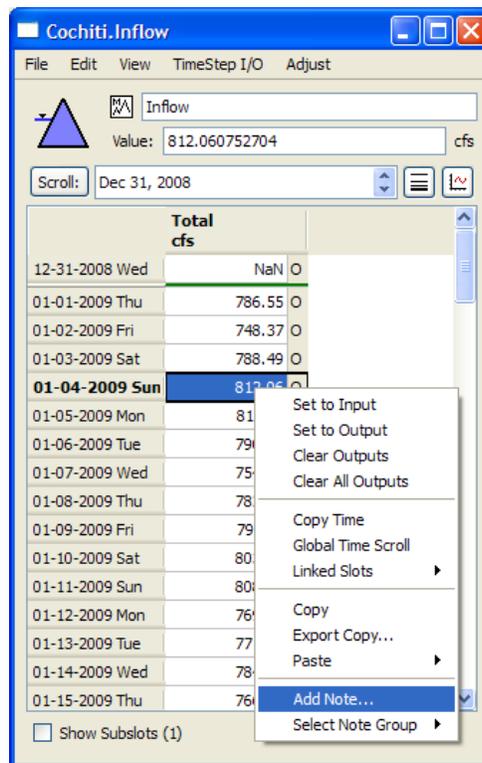
The Create Note and Edit Selected Note buttons will activate a dialog to enter note text. Edit will prefill both fields with the existing note information and create will prefill the Note Group field with the first selected note group in the manager dialog (or the first one if none is selected). Note Group can be changed, if desired, via the combo box. (An alternative to this separate dialog that may be implemented instead is “in place” adding and editing of notes in the Notes list of the main dialog.)



The Add Slot Entries and Edit Selected Entry buttons will bring up the following dialog that allows specification of slot/timestep associations for the note. Edit will prefill the fields with the existing entry information and Add will prefill the Note field with the first selected note in the manager dialog (or the first one if none is selected). The Note can be changed, if desired, via the combo box. The user can choose one or more slots through the standard slot selector to pair with a selected timestep. In addition, a range of timesteps can be selected where the note will be applied to each timestep in the range for the specified slot(s). When OK is clicked, any resulting slot/timestep pairs will appear as individual items in the Slots panel of the Note Group Manager.



Currently a note can be added via a context menu from a cell in the slot dialogs that display series or in the SCT as seen in the following screen shot:



Consistent with the current note structure where a whole note group is associated with a slot, the Select Note Group option in the context menu is available to make this association. This option is no longer applicable to the new note structure where slots are associated with individual notes, so this item will be removed from the context menus.

The Add Note... item in the context menu will bring up the new Note Group Manager dialog where an existing note can be assigned or a new note created. In either case it is most likely that the user will want to use the slot and timestep from which the dialog was launched to attach the note. To facilitate this, the slot and timestep context will be recorded into the Note Group Manager dialog when it is accessed from a slot (see previous Note Group Manager screenshot). The user can then use the Add Entry Using Context button to launch the Slot & Timestep Selection dialog prefilled with the context information.

The open slot dialog for Series Slots with Expressions on data objects does not currently contain the context menus for adding annotation notes to cells or the “navigation to annotation” button in the dialog header. This type of slot does support annotations in the underlying code and notes can actually currently be added to this type of slot in the SCT. Water accounting annotations will likely need to be made on this type of slot, so its slot dialog will be modified to support notes in the same way as the regular series slot dialog does.

3.2 Report Generation

The SCT can provide a functional work environment in RiverWare for entering, viewing, and annotating water accounting information like that used in the Green Book. An SCT can currently be printed, but does not contain the kind of formatting desired for a Green Book Report. The following is a list of desired formatting capability:

- Omit slots having only Nan or zero values
- Show Nan or zero values as blank
- Page breaks after summary rows (i.e. each month)
- User labels on columns instead of full object/slot name
- Optional unit labels in column headers
- Limit reporting to a specified time range
- Report titles
- Font specifications
- Annotations referenced as numbered footnotes to table

Two potential approaches were considered for incorporating this report generation capability into RiverWare. One was to have report generation available as an option in the SCT where the report would be configured and the configuration saved with the SCT. This has the disadvantage that anyone wishing to generate a series table report in RiverWare would need to construct an SCT to accomplish this, and an SCT has a lot of complexities to navigate for someone unfamiliar with its workings. Also the report is not saved with the model file.

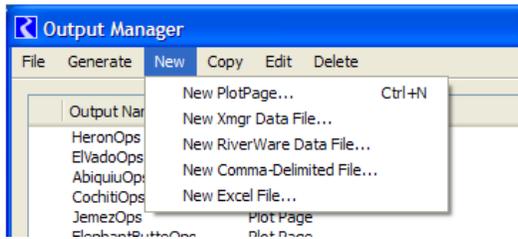
The other option was to create a series table report output device for the Output Manager where the user would configure and save the device into the model file like other existing output device types (.rdf files, Excel files, plots, etc). This would likely be a natural place for someone to look if they're interested in producing a report from RiverWare. The series table report would present series as columns and timesteps as rows. The device would be focused on generating the series table report only and the user would not have to navigate through other configuration complexities as in the SCT. For these reasons, this second approach was selected.

3.2.1 Series Table Report Output Device

The series table report device will function in a way similar to other output devices like .rdf or Excel files. The device will be created through the Output Manager dialog and will be configured through its own configuration dialog. When generated, the device will take the configuration information and create an output file that will contain the report. In this way the report is generated in an electronic version, which can then be printed to hard copy or used in its electronic form.

The new series table report device will need to be incorporated into the existing output device framework in RiverWare. The new class for the device will inherit from the `cwOutputDevice` class to give it behavior compatible with the other output device types managed by the output manager. The new class will also inherit from the `cwSlot-SetOutput` class to give it the slot list behavior common to the other device types.

The Output Manager dialog will need to be updated to include the new device type as an option in the Generate, New, Copy, Edit, and Delete menus, partially illustrated here without the new device listed:



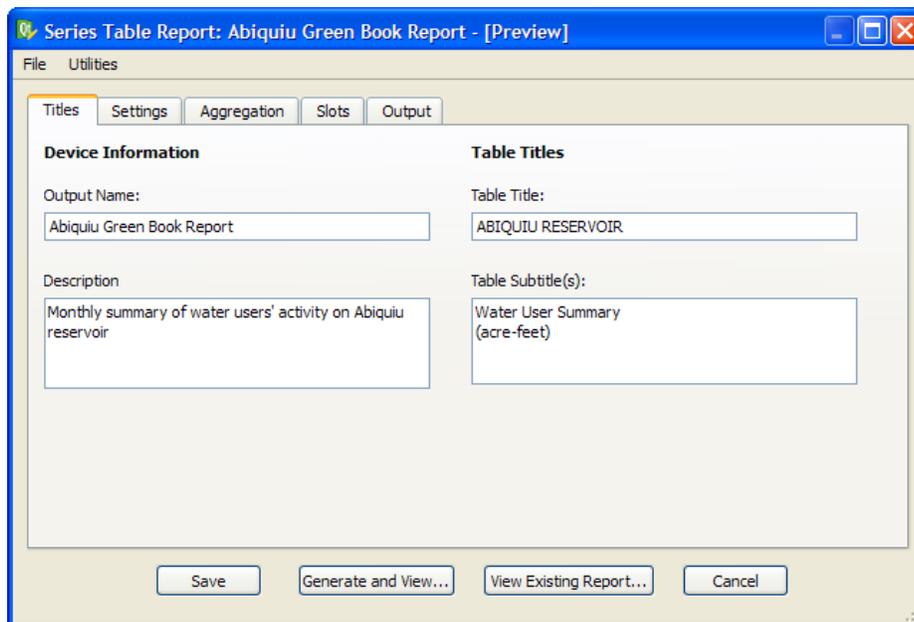
Significant tasks in writing the new class will be in the generate method and in the save/load code. The generate code will need to determine all of the text, values, and formatting for the report and write these data in the appropriate format to the specified output file.

The save code will need to serialize all of the configuration information for the device for writing to the model file. The load code will then translate model file entries to recreate the device when a model file is loaded. Output devices can be exported from a model and imported to another model. The save and load code will also need to handle the writing of export files and the reading of import files.

3.2.2 Series Table Report Configuration Dialog

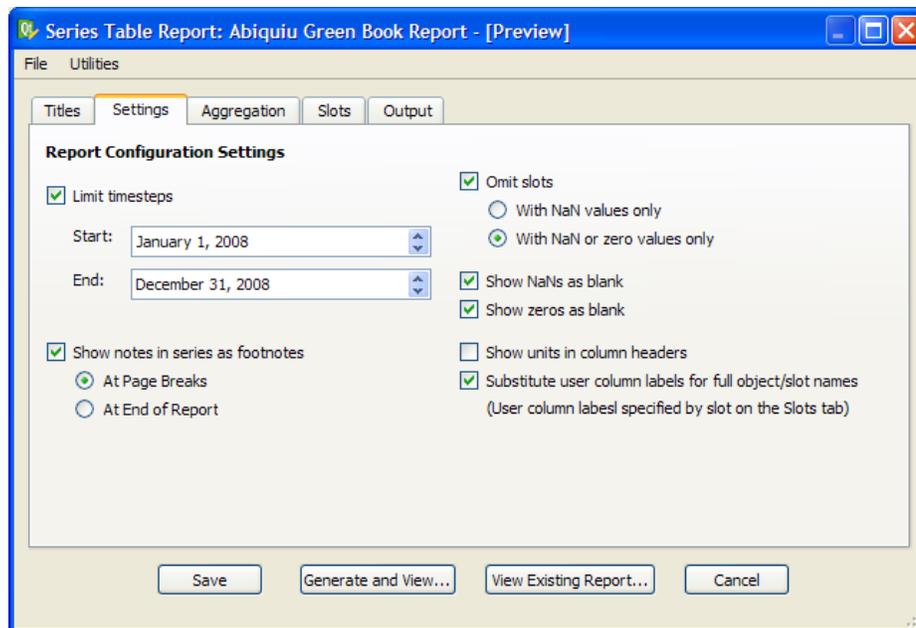
The primary GUI task for the series table report output device will be creating its configuration dialog, which will be accessible from the Output Manager dialog. The series table report configuration dialog for this output device will be tabbed to group related information. The dialog is described in the following sections:

Config Dialog - Titles Tab



The Titles tab contains device information similar to the other output device types. The name of the device, which will appear in the Output Manger list, is specified here. An optional description can also be included to characterize the device. The title that will appear in the report is entered here, as well as any subtitles that will appear under the main title.

Config Dialog - Settings Tab

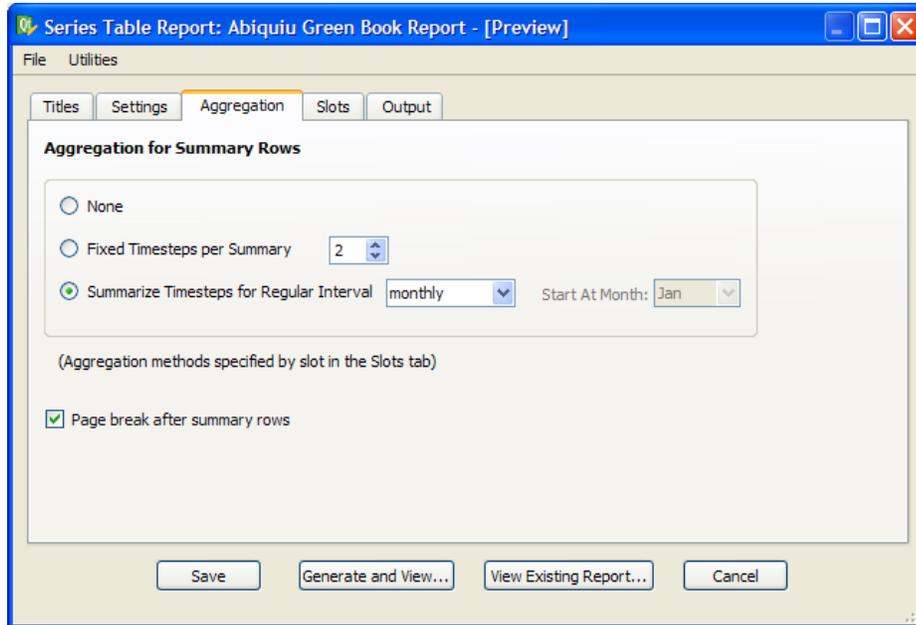


This is the tab where much of the formatting for the report is specified. The time range for the series that are presented in the report can be limited here. Notes (annotations) that are associated with the series may optionally be included in the report as footnotes reference by number from the data in the series. Footnotes can either appear at the end of the report or at page breaks that are introduced by summary rows (discussed later under the Aggregation tab).

Options are presented for handling NaNs and zeros. Slots can be omitted from the report if all of the data are Nans or if all the data are either NaNs or zeros. Also specifications can be made to display NaNs and/or zeros in the series as blanks in the report.

The column header for each series can optionally show the units of the slot. In addition, the user can specify that alternate labels be substituted for the complete object.slot name in the column header. The alternate labels are specified with each slot in the Slots tab.

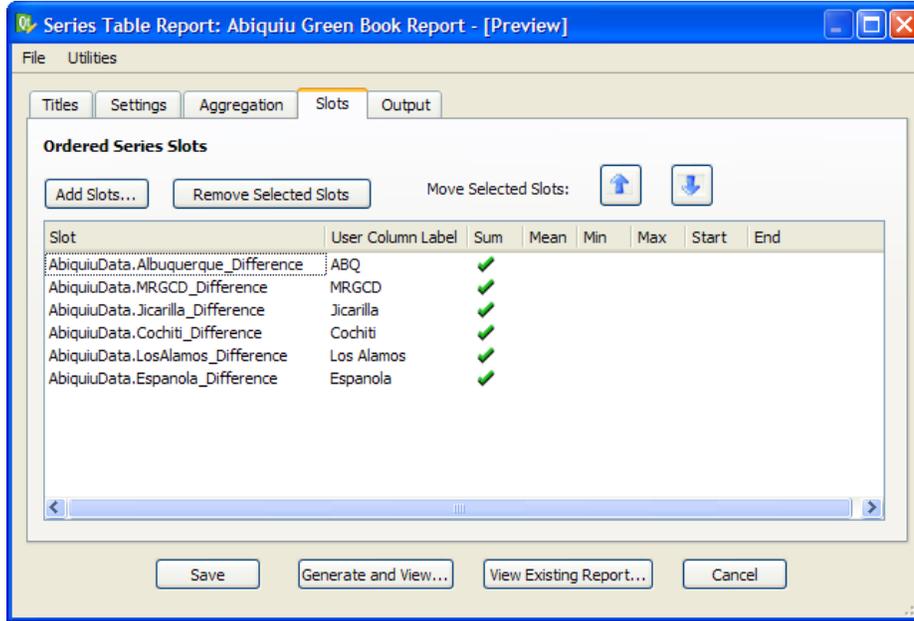
Config Dialog - Aggregation Tab



The Aggregation tab is where the user specifies that summary rows be added to the report. Summary rows can be added at every fixed number of timesteps, or can be added at regular time intervals (6-hour, 12-hour, daily, weekly, monthly, quarterly, or yearly, depending on the timestep of the series). A check box also allows the user to have page breaks inserted into the report after the summary rows (after each month in this example).

Note that the actual aggregation methods to generate the summary rows are specified by slot as shown in the Slots tab.

Config Dialog - Slots Tab

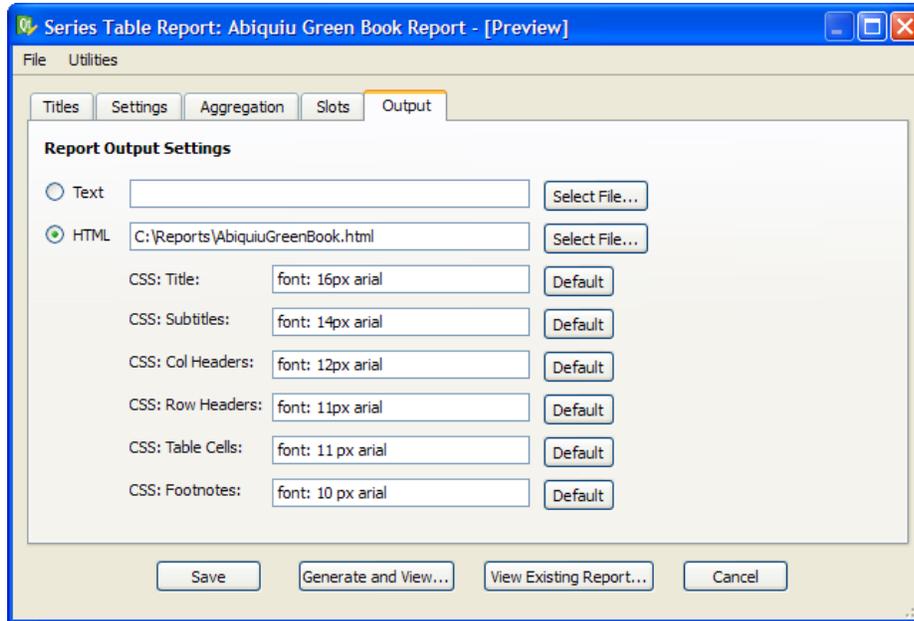


This tab allows the user to select the series slots that will go into the report. The slots are in an ordered list, meaning the order of the columns (series) in the report will reflect the order of the slots in the list. The Move Selected Slots controls allows the user to rearrange the list to get to a desired order.

On the Settings tab the user can specify that user column labels be substituted for complete object.slot names in the column header of the report. If this option has been selected, a column is added to the slot list in the Slots tab where the substitute labels can be entered.

Similarly, if an aggregation for a certain time period has been selected on the Aggregation tab, columns are added to the slot list in the Slots tab to allow the user to specify aggregation methods. Methods can be selected for each slot by checking or unchecking the method columns associated with that slot. Sum may be appropriate for a slot like inflows expressed as a volume, but End may be more appropriate for a volume like storage. This arrangement for selecting methods has the flexibility to allow different methods to be selected for different slots, depending on what the slot represents. In addition, multiple methods can be selected for a slot. The user can check Mean, Min, and Max if they want all three of these types of summary data. In the report, a row will be generated and labeled for each aggregation method that has been selected for the report (a summary row for Mean, a summary row for Min, and a summary row for Max in this case). If a summary row is being generated for a method and a particular slot does not have that method selected, that row will just be blank for that slot's column.

Config Dialog - Output Tab



The output tab allows the report to be generated in one of two file formats, plain text or HTML, and through the associated Select File... button, launches a file chooser for the user to specify the report's file.

Plain text will be formatted with the assumption that the file is presented in a monospaced font (e.g. Courier). A font specification is not associated with the text file here because that is a property of the plain text viewer being used to view the file. Only printable ASCII characters will be used to generate the table, with the exception of Ctrl-L for page breaks. Table rows and columns will be delineated with the following four text characters: '+', '-', '|', and '='. Lines will be wrapped at 78 characters. An example to show what this looks like follows:

ABIQUIU RESERVOIR
Water User Summary
(acre-ft)

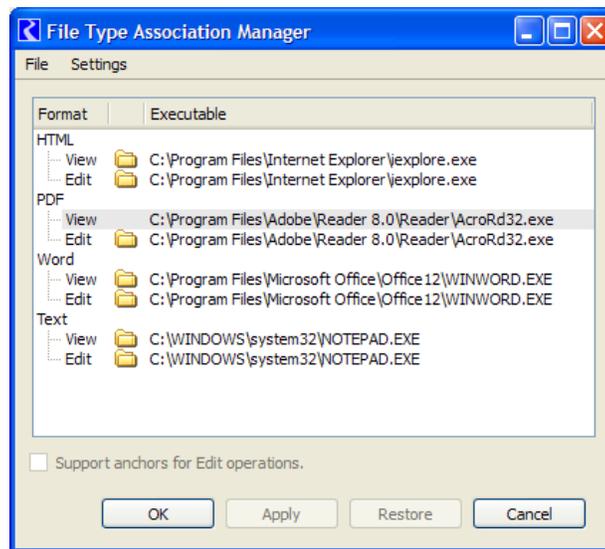
	ABQ	N	MRGCD	N	Cochiti	N	Espanola	N
01-02-2009								
01-02-2009			80	2				
01-03-2009			80	2				
01-04-2009			80	2				
01-05-2009			80	2				
01-06-2009	307	1					10	
01-07-2009	125							
01-08-2009	100							
01-09-2009	100							
01-10-2009	75							
01-11-2009	50							
01-12-2009	25							
01-13-2009					35			
01-14-2009								
01-15-2009								
Sum	782		320		35		10	

[1] Letter 1/1/2009
[2] Minnow Release

The HTML output will make use of the user-specified CSS (Cascading Style Sheet) styles for fonts. The styles will allow separate font specifications for the title, subtitles, column headers, row headers, data cells, and footnotes. The HTML will create a nicer appearing output than plain text, with solid lines for table dividers along with the flexibility of the different fonts.

With HTML, footnotes can be generated as HTML named anchors. Internal links to these named anchors can be implemented for the footnote references in the series data so that a user can click on the reference number in the table and navigate directly to the footnote text.

The File Type Association Manager was introduced in RiverWare 5.1 as part of the RiverWare Link to External RPL Documents feature. This dialog allows configuration of programs to be used for editing and viewing documents of various formats.



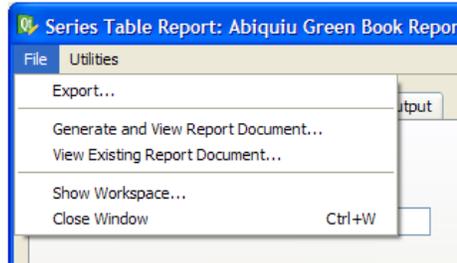
The buttons and menus discussed below that allow viewing of report files will use these associations to determine what programs to use for viewing the generated text and HTML files.

Config Dialog - Bottom Buttons

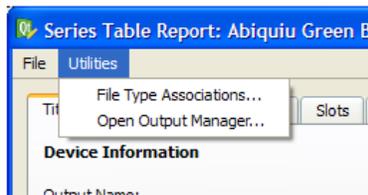


Similar to the other output device types, the Save button will save the configuration for the series table report device and close the dialog. The Cancel button will close the dialog without saving the configuration. The Generate and View... button will generate the report file and open it in the program specified in the File Type Association Manager dialog. The View Existing Report... dialog will bring up a file chooser where the user can select an existing report file, which will then be opened in the specified associated program for viewing.

Config Dialog - Menus



As with other output devices, the File menu will allow the series table report configuration to be exported to a file. Through the Output Manager, this configuration file can then be imported into a different model. Like the bottom buttons described above, the similarly name menu items allow generating and viewing of the report or viewing of an existing report file. As a convenience, a menu item to navigate to the main RiverWare workspace is also provided.



The Utilities menu provides an item to open the File Type Association Manager dialog that was discussed above. An item is also provided to open the Output Manager Dialog.

4.0 Time Estimates

Annotation Enhancement

<u>Hours</u>	<u>Task</u>
6	Revise the annotation interface functions in the AnnoGroupMgr class used by other RiverWare code
8	Remove slot information and slot callbacks from AnnoGroup class
8	Create Annotation class to associate slots and timesteps with a note and to hold slot callbacks
8	Revise model file dump and load code for annotations including creating load code for old format
8	Revise export and import objects code for new annotation structure
24	Create new Note Group Manager dialogs and their underlying code
10	Revise Series Slot dialog, Account dialog, and SCT dialog code to use new interfaces to annotations
12	Revise Series Slots with Expressions dialog to add support for creating and displaying annotations
6	Rewrite Annotation Online Help
90	Subtotal (hours)

Report Generation

<u>Hours</u>	<u>Task</u>
8	Modify cwOutputDevice and cwOutputDeviceMgr classes to add the new device type
6	Modify cwSlotSetOutput class to handle the ordered slot list logic
4	Modify Output Manager dialog to include new device type
16	Write save and load code for new device type needed for the model file and export/import
40	Write code to determine the actual text and values that will go into the report on generation (limiting time range, omitting slots, substituting values, incorporating notes, calculating and adding aggregation summary data, determining column header labels)
28	Write code to incorporate required formatting to create output stream to text file.
22	Write code to incorporate required HTML formatting to create output stream to HTML file
20	Coding the remainder of the cwSeriesReport class (besides save/load and generation) Create Series Table Report Configuration dialog and its underlying code
2	Titles tab
6	Settings tab (coordinate with columns shown in Slot tab)
6	Aggregation Tab (coordinate with columns shown in Slot tab)
16	Slots Tab (incorporate slot ordering and slot callbacks)
6	Output Tab (launch file choosers and handle CSS)

10 User Documentation

190 Subtotal (hours)

280 Total Development Estimate (hours)