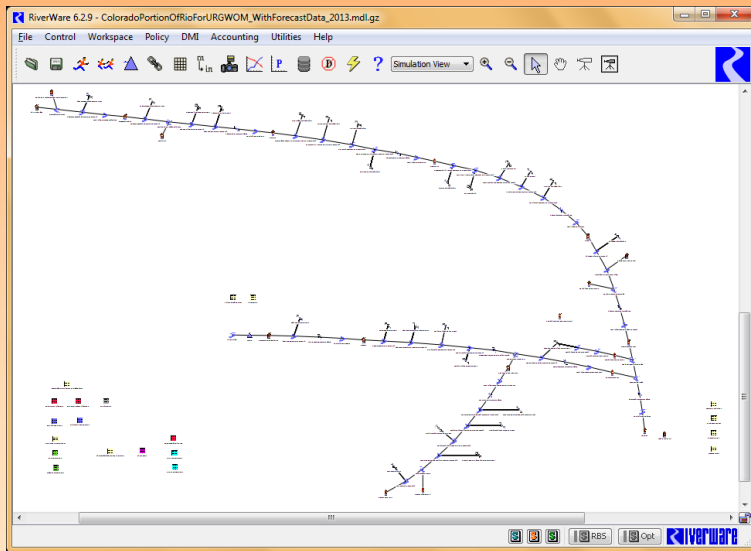


RiverWare Model for the Colorado Portion of the Rio Grande Basin for Use with URGWOM



**URGWM Technical Team Meeting with
Colorado Division of Water Resources at
Division 3 Office, Alamosa, Colorado
June 24, 2013**



Lobatos Gage

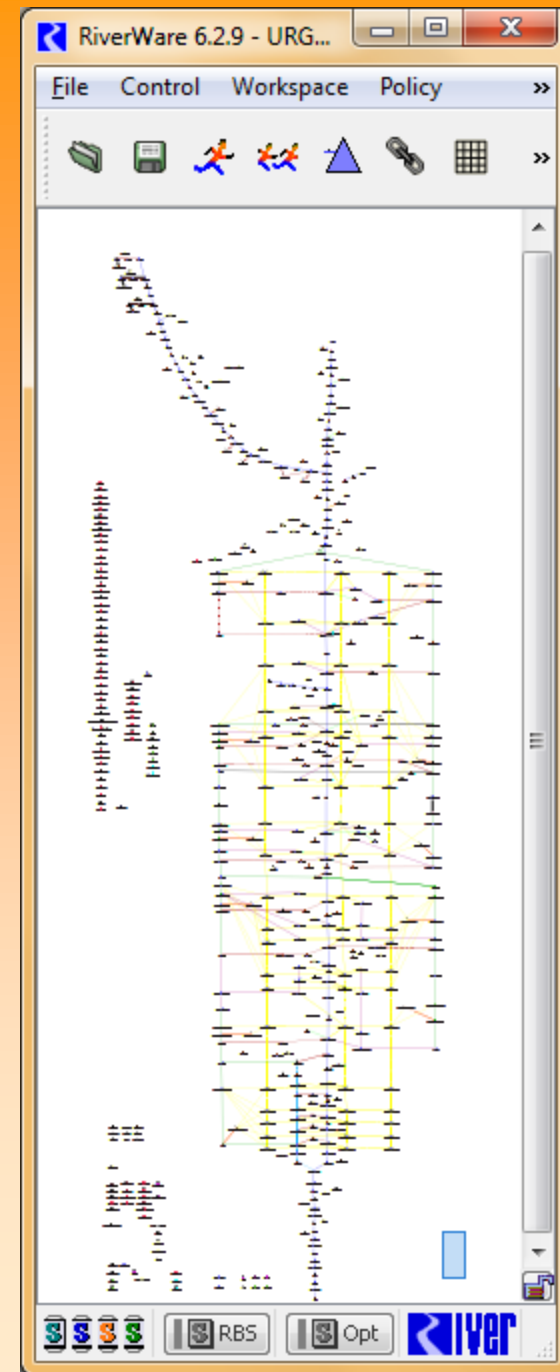
URGWOM

- The Upper Rio Grande Water Operations Model (URGWOM) was developed through an interagency effort led by the
 - U.S. Army Corps of Engineers,
 - Bureau of Reclamation, and
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 - with many other contributing and cooperating agencies.
- Used to simulate processes and operations of facilities in New Mexico.



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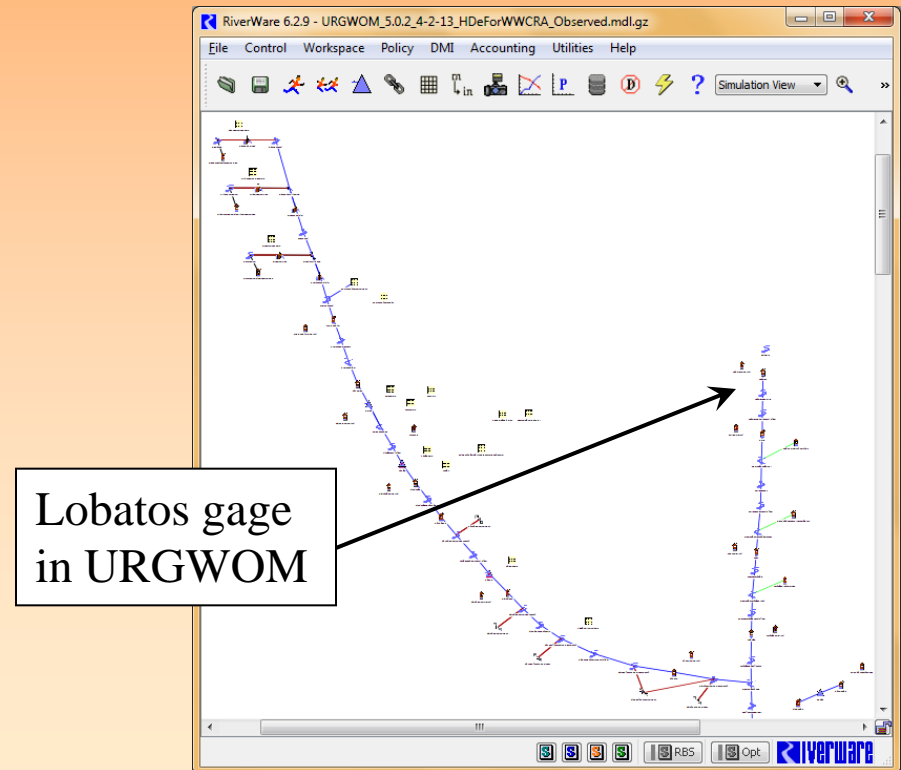
- URGWOM was developed with RiverWare and is used extensively for
 - daily Accounting to track water for individual users including contractors for San Juan-Chama Project water,
 - planning studies to evaluate operations in New Mexico, and
 - preparing Annual Operating Plans (AOPs).

Modeling Needs for Colorado Portion of the Rio Grande Basin for Use with URGWOM

- For planning studies, it has been assumed that historical Lobatos flows would be repeated if the same upstream hydrology in Colorado is repeated.



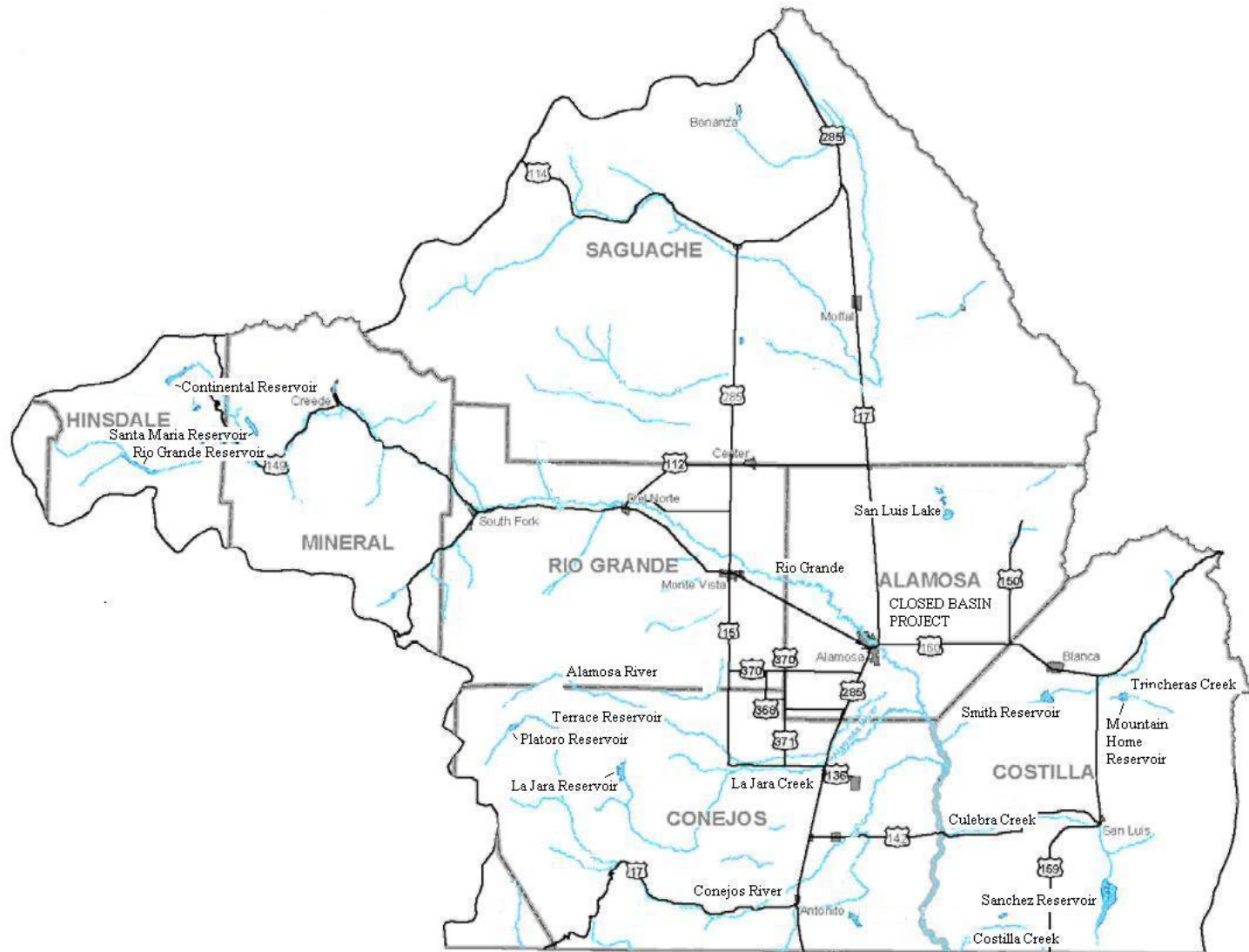
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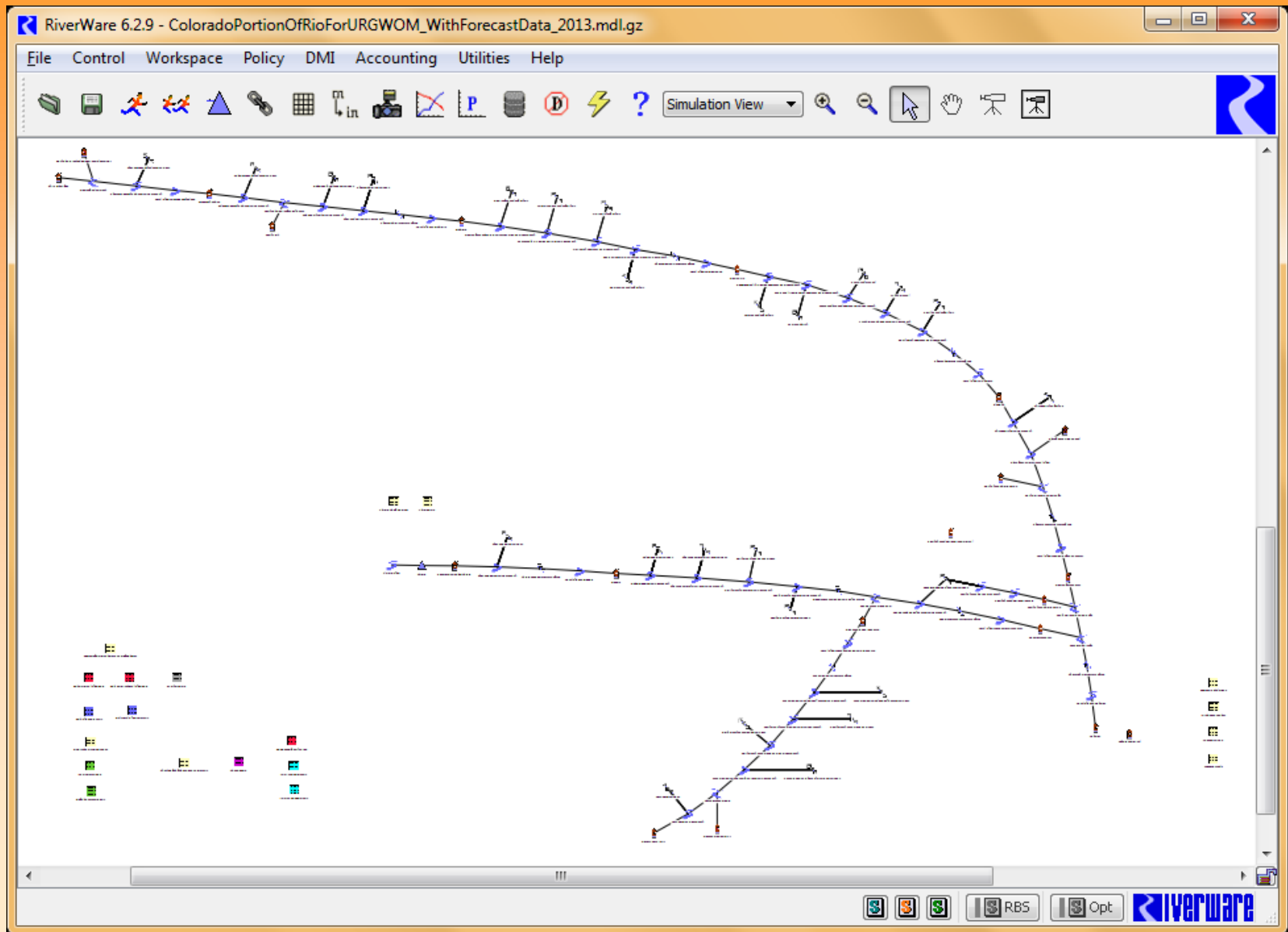
Modeling Needs for Colorado Portion of the Rio Grande Basin for Use with URGWOM

- For planning studies, it has been assumed that historical Lobatos flows would be repeated if the same upstream hydrology in Colorado is repeated.
- For AOPs, forecasted flows are provided by the Colorado Division of Water Resources.
- The Corps also needs a modeling tool for evaluating Platoro Dam flood control operations.

Rio Grande Basin in Colorado

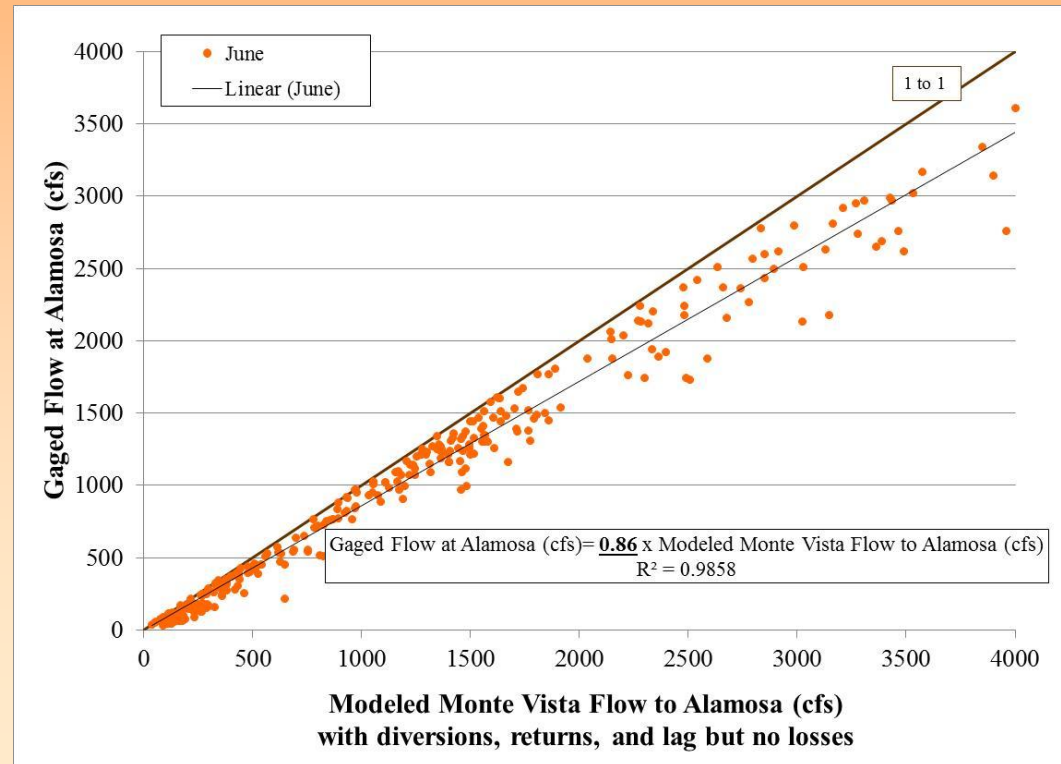


Representation of System in RiverWare



Methods for Physical Processes

- Monthly loss coefficients calibrated for major reaches between gages.
 - Coefficients reflect conveyance losses to open water evaporation, evapotranspiration, seepage.



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 - Five one-day lags from headwaters of mainstem to Lobatos.
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 - Five one-day lags from headwaters of mainstem to Lobatos.
 - Three one-day lags from Platoro Dam to La Saucos.
- Evap and precip at Platoro Reservoir.

* The numbers indicated on this report are the best data available at time of printing and are not official record.

Diversions

- Diversions included for each physical diversion along the mainstem and for the Conejos River Basin as included on the call sheets for District 20 and 22.
 - 63 diversions along the mainstem of the Rio Grande.
 - 114 diversions in the Conejos River basin.



Diversion to Romero Ditch

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 - 63 diversions along the mainstem of the Rio Grande.
 - 114 diversions in the Conejos River basin.
- Fractions used to set returns.
 - Returns generally set to 10 percent with 30 percent returns used above Del Norte.
 - No returns for diversions to the Closed Basin.

Accounting – Passthrough Accounts

- Water accounting used to track
 - portion of river flow allocatable for diversion versus
 - portion that may be specifically designated for Compact delivery.

Accounting – Diversion Accounts

- Separate diversion accounts used for water rights associated with each physical diversion.
 - 298 diversion accounts used for water rights along the mainstem of the Rio Grande.
 - 190 diversion accounts used for rights for the Conejos basin.
 - Priority date for water right set up for each account.
 - Water Owner names established that match name for the associated physical diversion.

Accounting – Diversion Accounts

Water Accounts Manager

File Account System View

☒ **S** Storage
☒ **D** Diversion
☐ **F** InstreamFlow
☐ **P** PassThrough

NONE
 Set Water Type

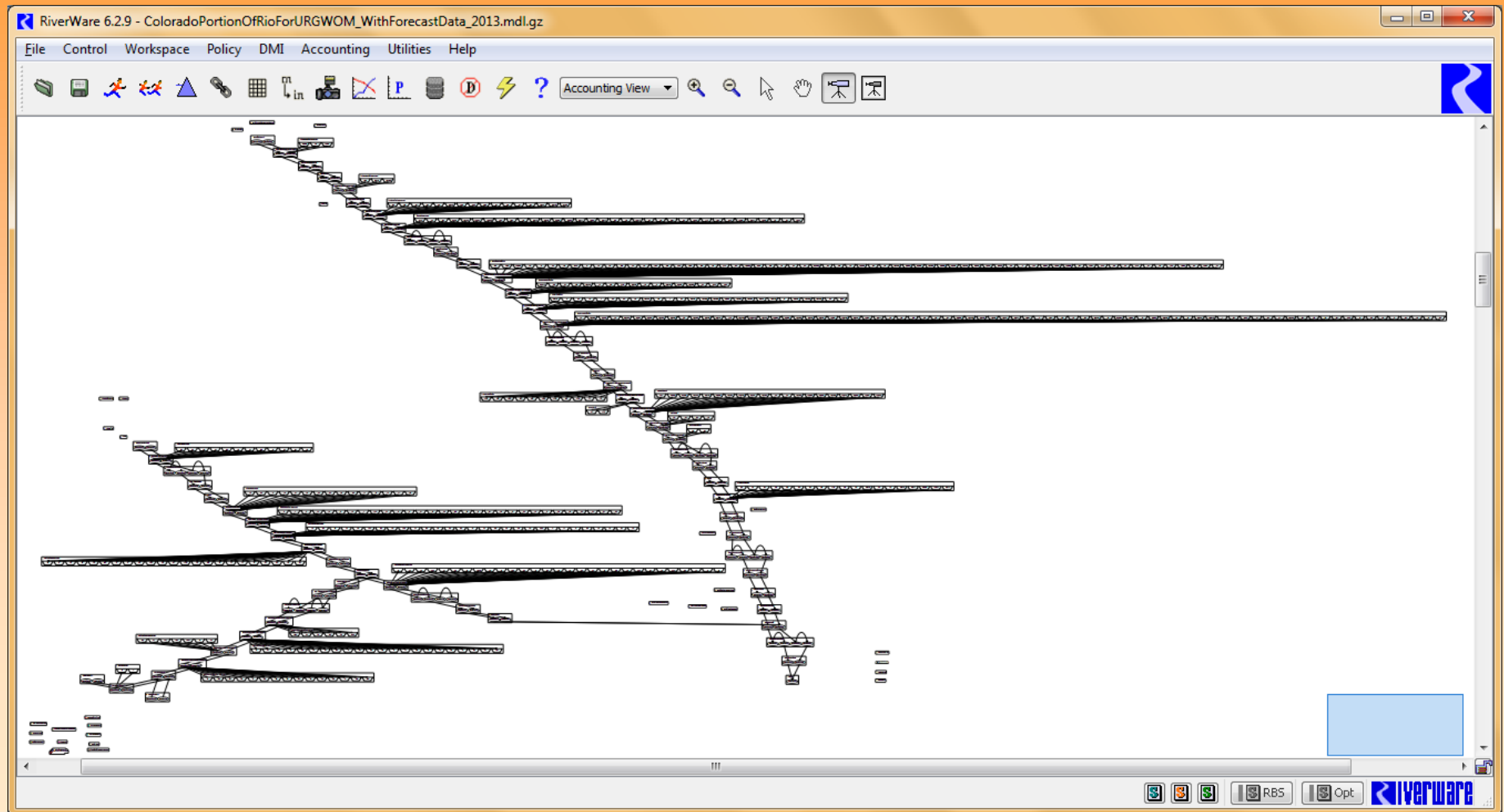
NONE
 Set Water Owner

1/1/1950 00:00
 Set Priority Date Clear

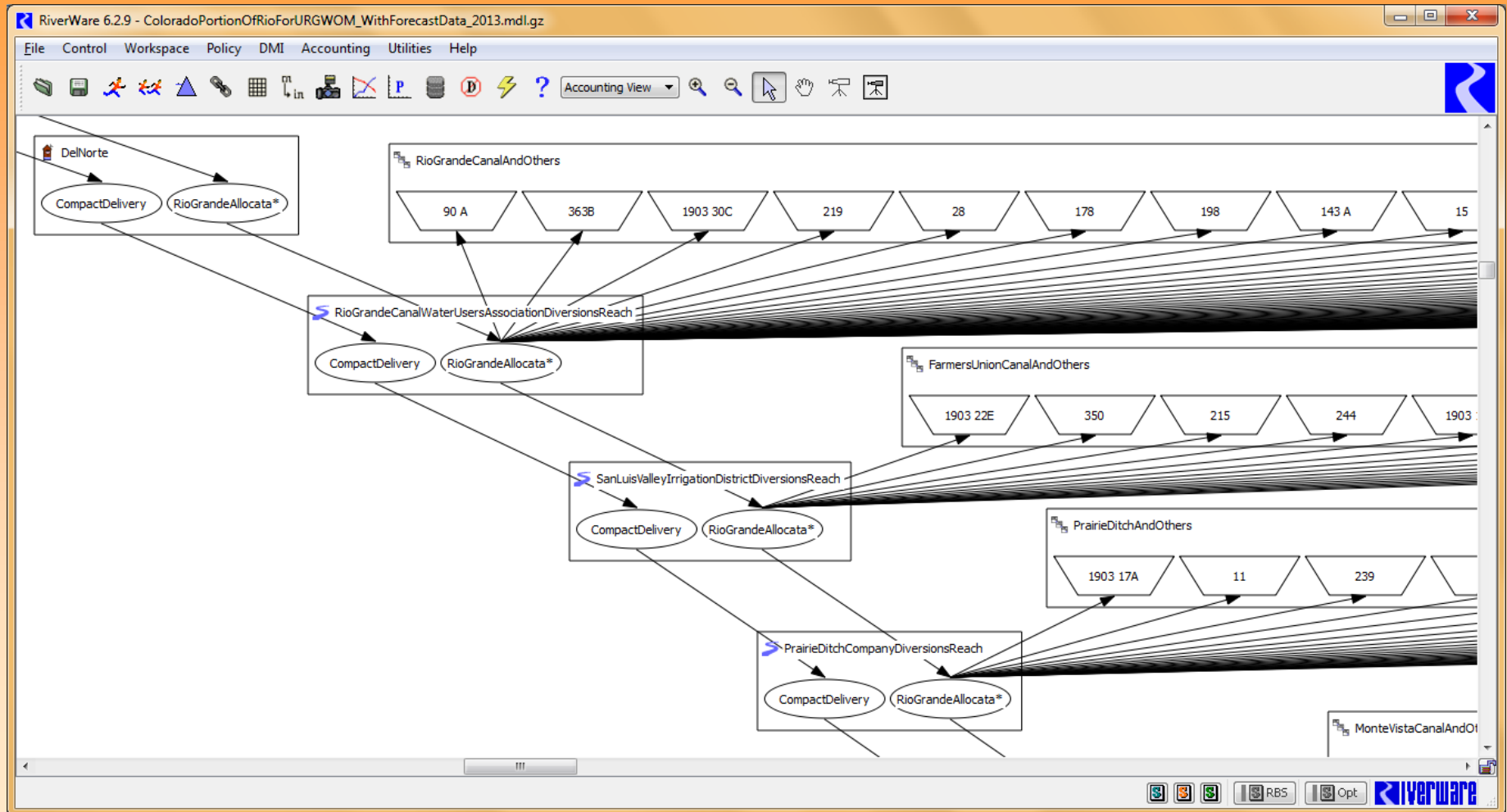
Object	Account Name	Type	Water Type	Water Owner	Priority Date
AboveConejosBifurcationDiversions	D 0	Diversion	Conejos	Town Of Antonito Pipeline	Jan. 1, 1800 00:00
AboveConejosBifurcationDiversions	D 1	Diversion	Conejos	Guadalupe Main	Mar. 1, 1855 00:00
NorthBranchConejosDiversions	D 1 A	Diversion	Conejos	Manassa No 3	Mar. 1, 1855 01:00
AboveConejosBifurcationDiversions	D 1 C	Diversion	Conejos	ROMERO	Mar. 1, 1855 02:00
NorthBranchConejosDiversions	D 1 B	Diversion	Conejos	Manassa No 3	Jun. 1, 1855 00:00
AboveConejosBifurcationDiversions	D 2	Diversion	Conejos	Heads Mill Irr	Jun. 1, 1855 01:00
SanAntonioRiverAboveBifurcationDiversions	D 3	Diversion	Conejos	El Coda	Aug. 4, 1855 00:00
LosPinosDiversions	D 4	Diversion	Conejos	Llano	Aug. 20, 1855 00:00
NorthBranchConejosDiversions	D 4 5	Diversion	Conejos	Garcia	Oct. 1, 1855 00:00
NorthBranchConejosDiversions	D 5	Diversion	Conejos	Manassa No 3	Mar. 5, 1856 00:00
NorthBranchConejosDiversions	D 5 A	Diversion	Conejos	Servietta	Mar. 5, 1856 01:00
SouthBranchConejosDiversions	D 6	Diversion	Conejos	Seledonia Valdez Irr	Mar. 20, 1856 00:00
LosPinosDiversions	D 7	Diversion	Conejos	Los Pinos	Apr. 1, 1856 00:00
SouthBranchConejosDiversions	D 8	Diversion	Conejos	Salazar	Apr. 1, 1856 01:00
SouthBranchConejosDiversions	D 9	Diversion	Conejos	Mill	Apr. 1, 1856 02:00
SouthBranchConejosDiversions	D 10	Diversion	Conejos	San Jose	Apr. 15, 1856 00:00
SanAntonioRiverAboveBifurcationDiversions	D 11	Diversion	Conejos	Sinecero	Apr. 15, 1856 01:00

Edit ... Configure ... Open Object ... Delete Close

Accounting View



Accounting View



Accounting Methods

- Accounting methods used to distribute physical gains/losses among passthrough accounts.
 - Gaged or ungaged local inflows may be designated for allocatable flow or specific for Compact delivery.
 - Lags and loss coefficients set up on passthrough accounts to exactly match lags and coefficients on physical methods.
- * Methods all set to solve first each timestep.

Water Rights Solver

- An initial request is set at each timestep for every diversion account that matches the water right amount for the diversion account.

Water Rights Solver

- An initial request is set at each timestep for every diversion account that matches the water right amount for the diversion account.
- A water rights solver is called that references the chain of allocatable flow passthrough accounts and determines the diversions that can be met, in priority, at that timestep with the allocatable flow.
 - Two separate calls to the water rights solver completed for the mainstem of the Rio Grande and Conejos River basin.

Compact

- Delivery obligations for Colorado under the Rio Grande Compact are computed separately for the Rio Grande versus the Conejos River basin.

Compact Delivery Obligation

- Obligations computed based on an upstream index flow and a lookup table for each basin.

DISCHARGE OF CONEJOS RIVER	
Quantities in thousands of acre feet	
Conejos Index Supply (1)	Conejos River at Mouths (2)
100	0
150	20
200	45
250	75
300	109
350	147
400	188
450	232
500	278
550	326
600	376
650	426
700	476

Compact Delivery Obligation

- Obligations computed based on an upstream index flow and a lookup table for each basin.
 - Conejos Index Supply computed as
 - natural flow near Mogote for calendar year plus
 - gaged flow in the Los Pinos River at Ortiz from April to October plus
 - gaged flow in San Antonio River at Ortiz from April to October.



San Antonio River gage at Ortiz



Los Pinos River gage at Ortiz



Mogote gage site

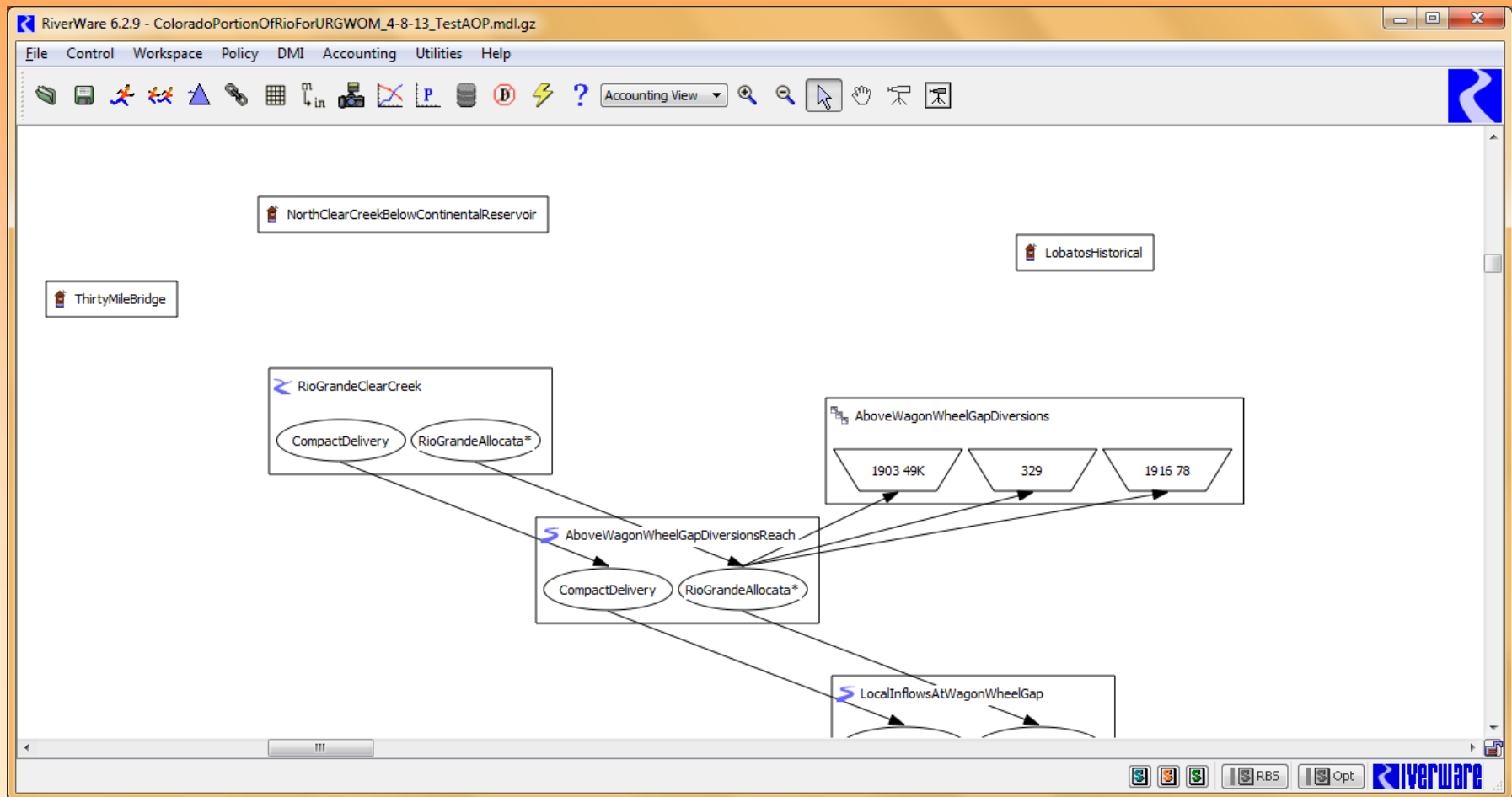
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 - gaged flow in San Antonio River at Ortiz from April to October.
 - Rio Grande index flow computed based on flow at Del Norte.

Compact Calcs and Curtailment Percentage

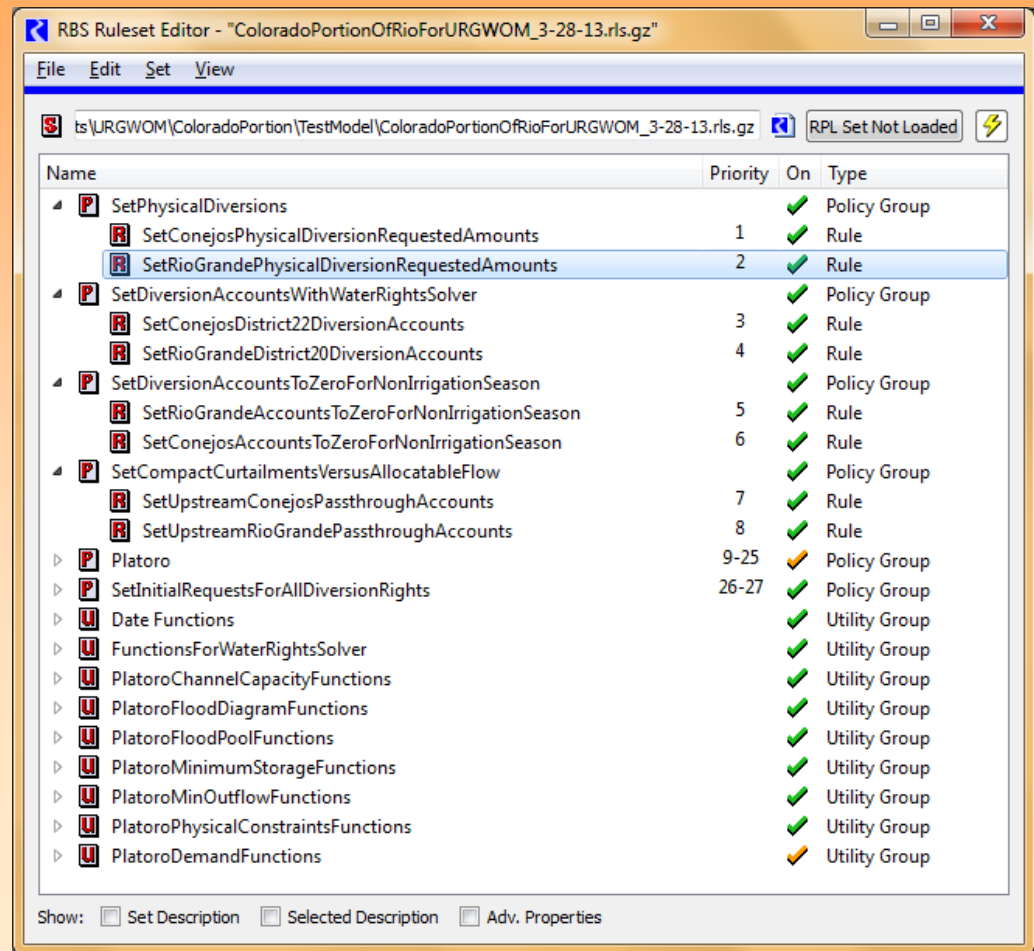
- Expression series slots are used to compute the index flow, delivery obligation, and the departure between delivery and obligation.
- A projected index flow for the year and projected annual delivery obligation are used to compute a Compact curtailment percentage to target the delivery obligation.

Portion of Flow for Compact Delivery versus Flow Allocatable for Diversion



Ruleset

- RiverWare ruleset developed with rules used to set diversions and Platoro operations in steps.



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 - Two calls to water rights solver for mainstem of Rio Grande and the Conejos River basin,
 - For the irrigation season – April 1 to October 31,
 - Accounts set to zero in the non-irrigation season,

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 - Set initial request for diversion accounts,
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 - Check Platoro for flood control operations,
 - Two calls to water rights solver for mainstem of Rio Grande and the Conejos River basin,
 - For the irrigation season – April 1 to October 31,
 - Accounts set to zero in the non-irrigation season,
 - Physical diversions set to sum of resulting diversions for accounts (or water rights) associated with each diversion.

Database

- A DSS database file created with historical data, back to 1950, to use for model runs.
 - File set up in DSS.
 - Includes historical gaged and ungaged inflows, fraction return percentages for diversions, and historical diversions.
 - Platoro records are incomplete.

ColoradoPortionDatabase.dss - HEC-DSSVue

File Edit View Display Groups Data Entry Tools Advanced Help

File Name: C:\Projects\URGWOMModelFiles\HistoricalDSSfiles\ColoradoPortionDatabase.dss

Pathnames Shown: 350 Pathnames Selected: 0 Pathnames in File: 22119 File Size: 41.66 MB

ColoradoPortionDatabase.dss x

Search A: C: E: By Parts: B: D: F:

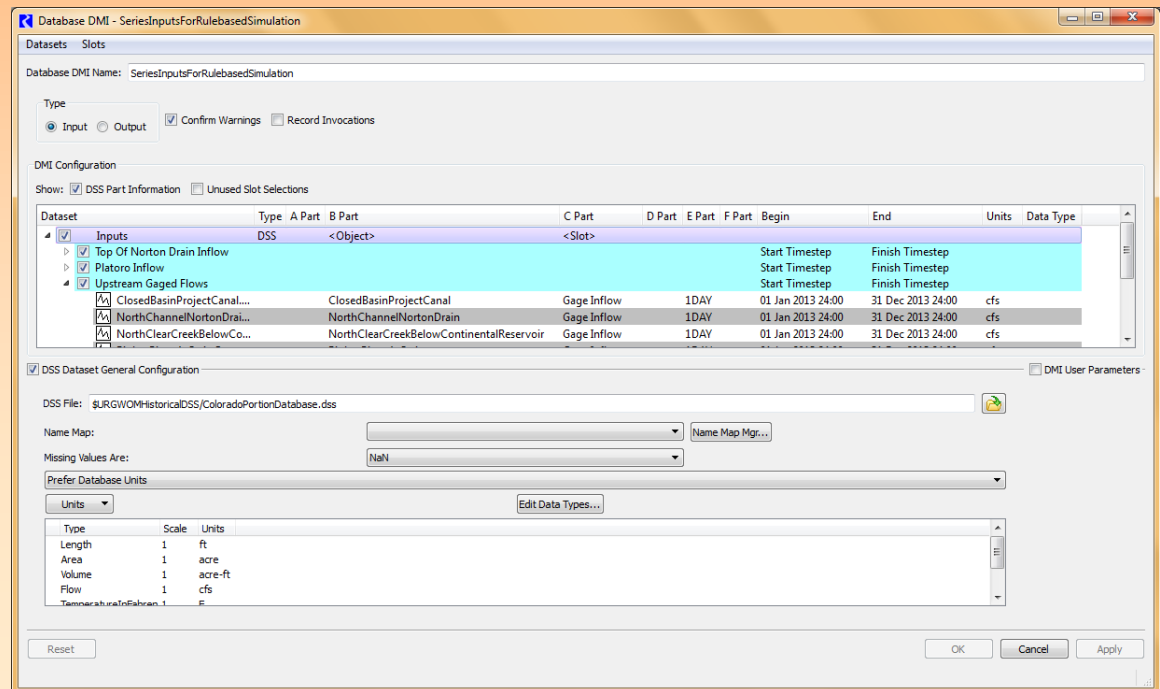
Number	Part A	Part B	Part C	Part D / range	Part E	Part F
1	ABOVEALAMOSALOSSESANDLAG-LAGS		INFLOW	01JAN1949 - 01JAN2011	1DAY	
2	ABOVECONEJOSBIFURCATIONDIVERSIONS:A D ARCHULETA		DIVERSION REQUESTED	01JAN1950 - 01JAN2011	1DAY	
3	ABOVECONEJOSBIFURCATIONDIVERSIONS:A D ARCHULETA		FRACTIONAL RETURN FLOW	01JAN1950 - 01JAN2011	1DAY	
4	ABOVECONEJOSBIFURCATIONDIVERSIONS:AN CON IRR		DIVERSION REQUESTED	01JAN1950 - 01JAN2011	1DAY	
5	ABOVECONEJOSBIFURCATIONDIVERSIONS:AN CON IRR		FRACTIONAL RETURN FLOW	01JAN1950 - 01JAN2011	1DAY	
6	ABOVECONEJOSBIFURCATIONDIVERSIONS:BERNARDO ROMERO		DIVERSION REQUESTED	01JAN1950 - 01JAN2011	1DAY	
7	ABOVECONEJOSBIFURCATIONDIVERSIONS:BERNARDO ROMERO		FRACTIONAL RETURN FLOW	01JAN1950 - 01JAN2011	1DAY	
8	ABOVECONEJOSBIFURCATIONDIVERSIONS:CHACON NO 1		DIVERSION REQUESTED	01JAN1950 - 01JAN2011	1DAY	
9	ABOVECONEJOSBIFURCATIONDIVERSIONS:CHACON NO 1		FRACTIONAL RETURN FLOW	01JAN1950 - 01JAN2011	1DAY	
10	ABOVECONEJOSBIFURCATIONDIVERSIONS:GUADALUPE MAIN		DIVERSION REQUESTED	01JAN1950 - 01JAN2011	1DAY	
11	ABOVECONEJOSBIFURCATIONDIVERSIONS:GUADALUPE MAIN		FRACTIONAL RETURN FLOW	01JAN1950 - 01JAN2011	1DAY	

Select De-Select Clear Selections Restore Selections Set Time Window

No time window set

DMIs

- Data management interfaces (DMIs) set up to import data from the DSS file to the model as needed for
 - initial conditions,
 - series inputs for rulebased simulations, and
 - additional series for simulations for historical operations.



Next Steps

- CADSWES Review
- Set up reservoirs at headwaters of the Rio Grande.
 - Additional data and information needed.
- Model Use for AOP runs.
 - Work initiated by URGWOM Tech Team.
- Add rules for Platoro Dam ops for storage and deliveries for the Conejos Water Conservancy District.
- Identify needs and combine model with URGWOM.
- Set up model for real-time water operations modeling.
 - Simulations for upcoming 2 week period using forecasts from the NWS and other near-term forecast information.