

# RECLAMATION

*Managing Water in the West*

## **Advanced Water Accounting Transactions for the Truckee River Operating Agreement**

**RiverWare User Group Meeting**

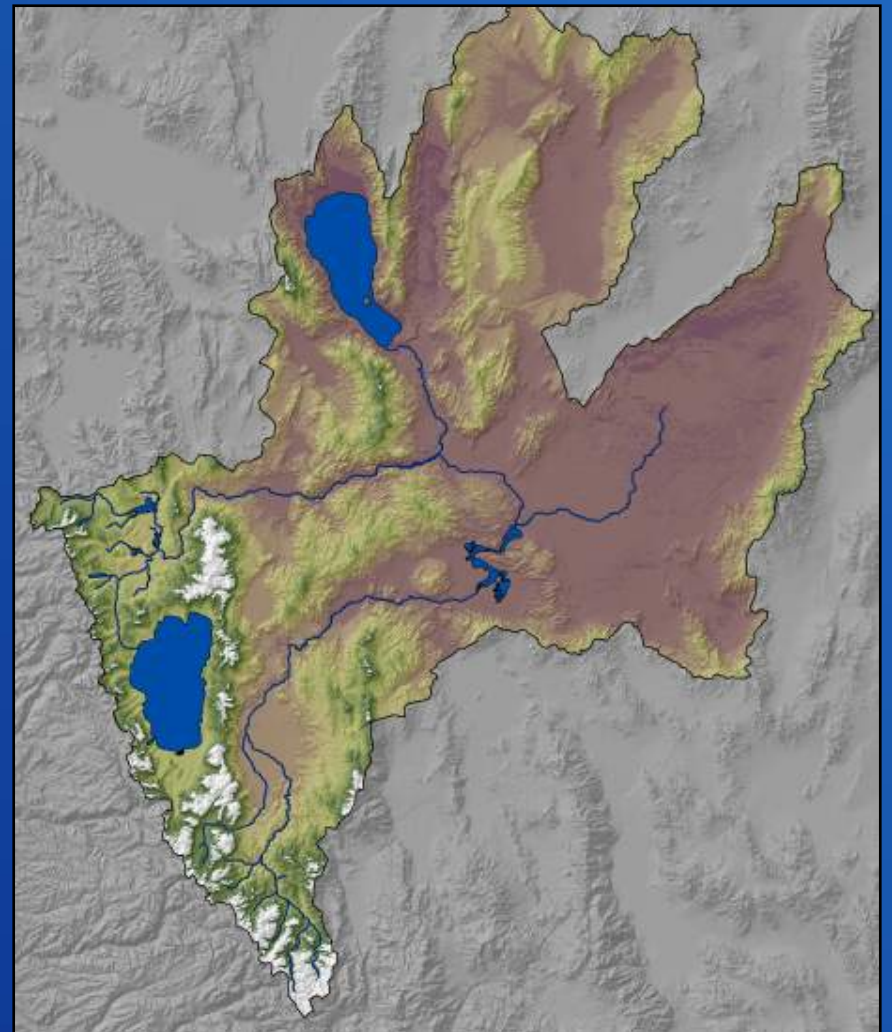
**August 13<sup>th</sup>, 2008**

**Shane Coors – Lahontan Basin Area Office**



U.S. Department of the Interior  
Bureau of Reclamation

# Basin Location



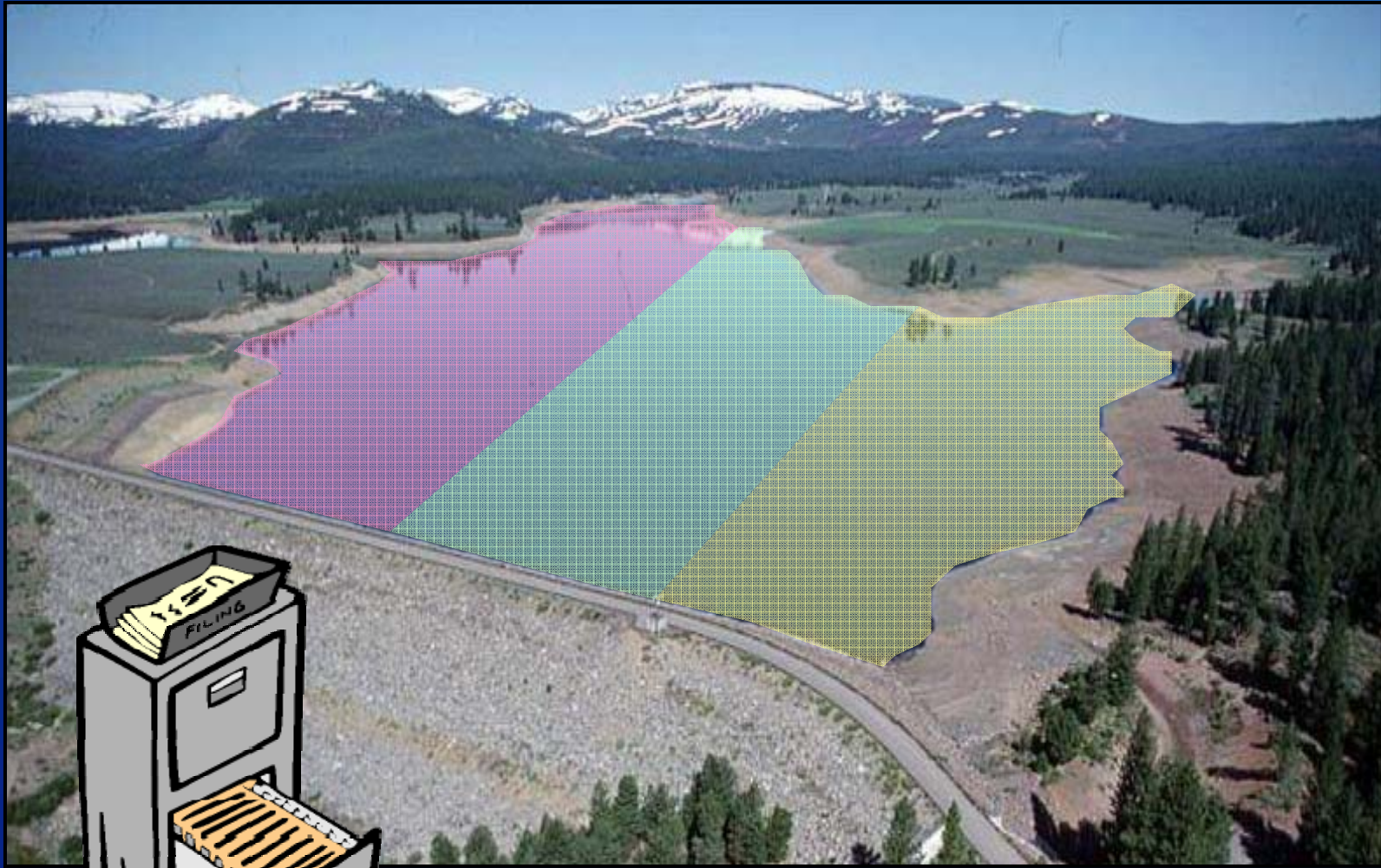
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# Water Accounting



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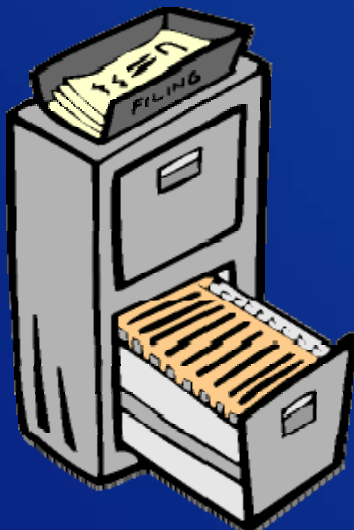
# Water Accounting



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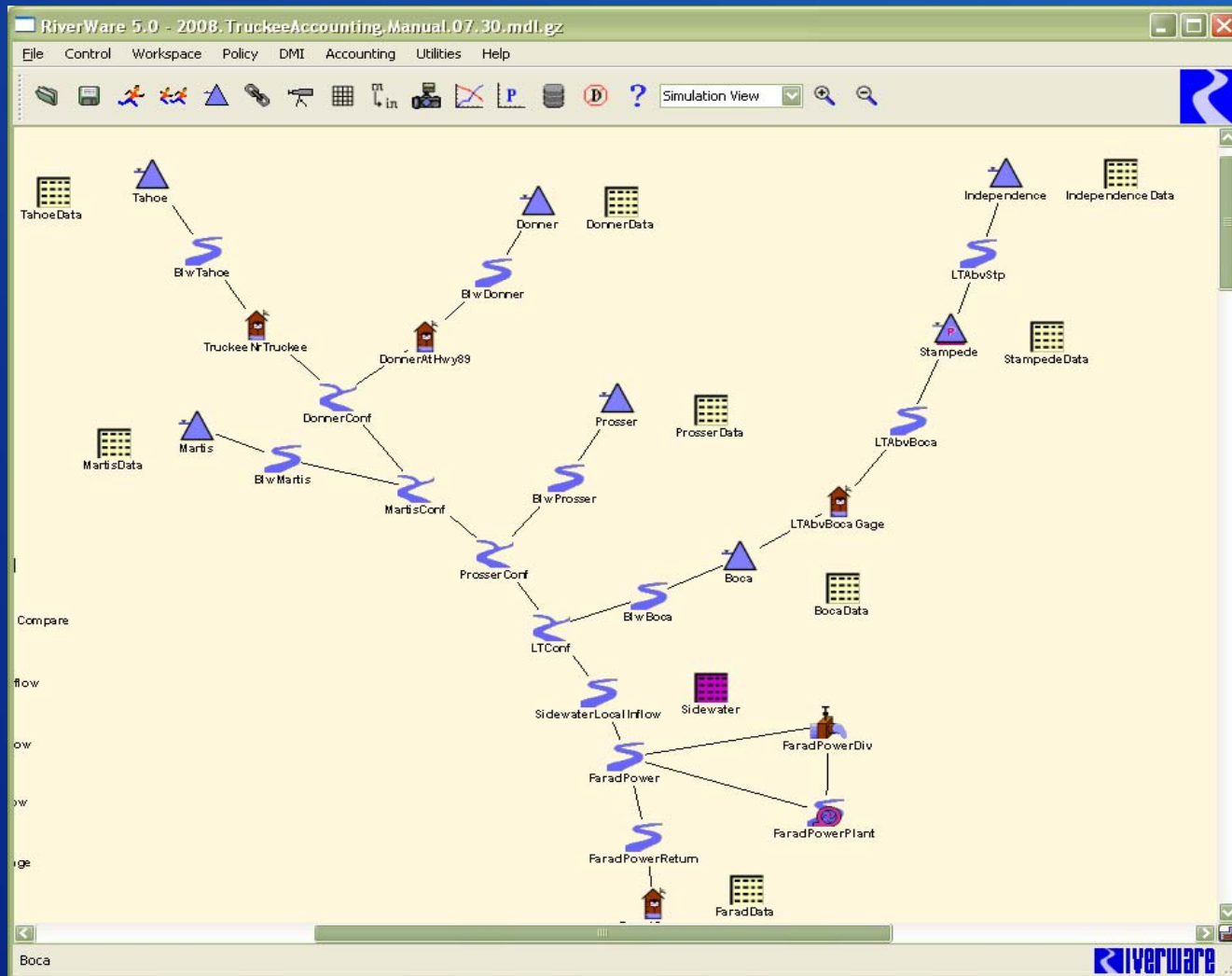
# Water Accounting

- Accounts add an additional layer to the management framework of the basin beyond its physical orientation
- Accounts denote ownership or designated purpose of the water
- Accounts add significant complexity (and capability) to the management framework, and therefore to the modeling system
- In order to administer the agreements and decrees that govern the highly contentious Truckee River, a water accounting approach is necessary
- Every drop of water in the Truckee-Carson system is assigned to an account as soon as it enters the system



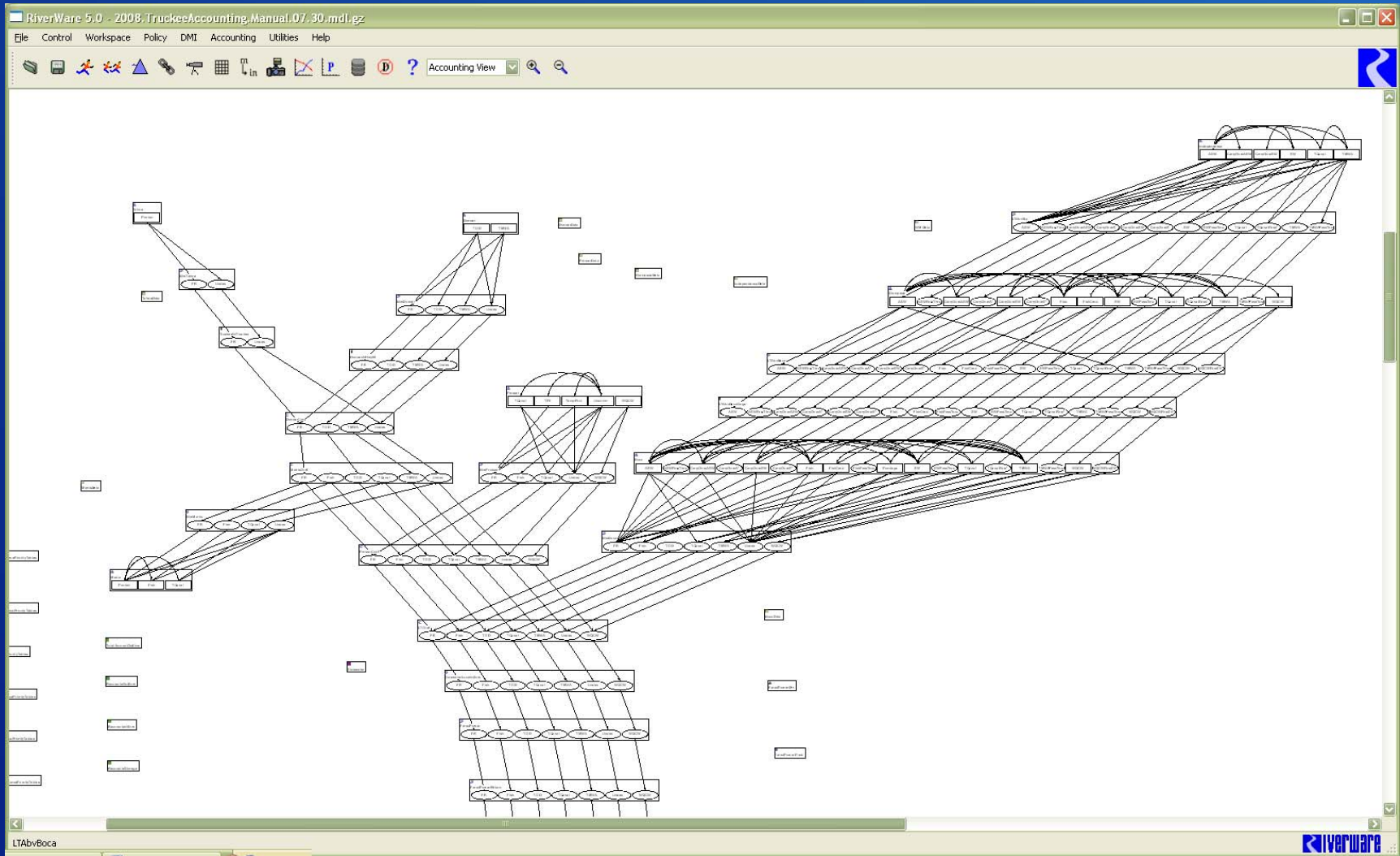
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# Water Accounting - RiverWare

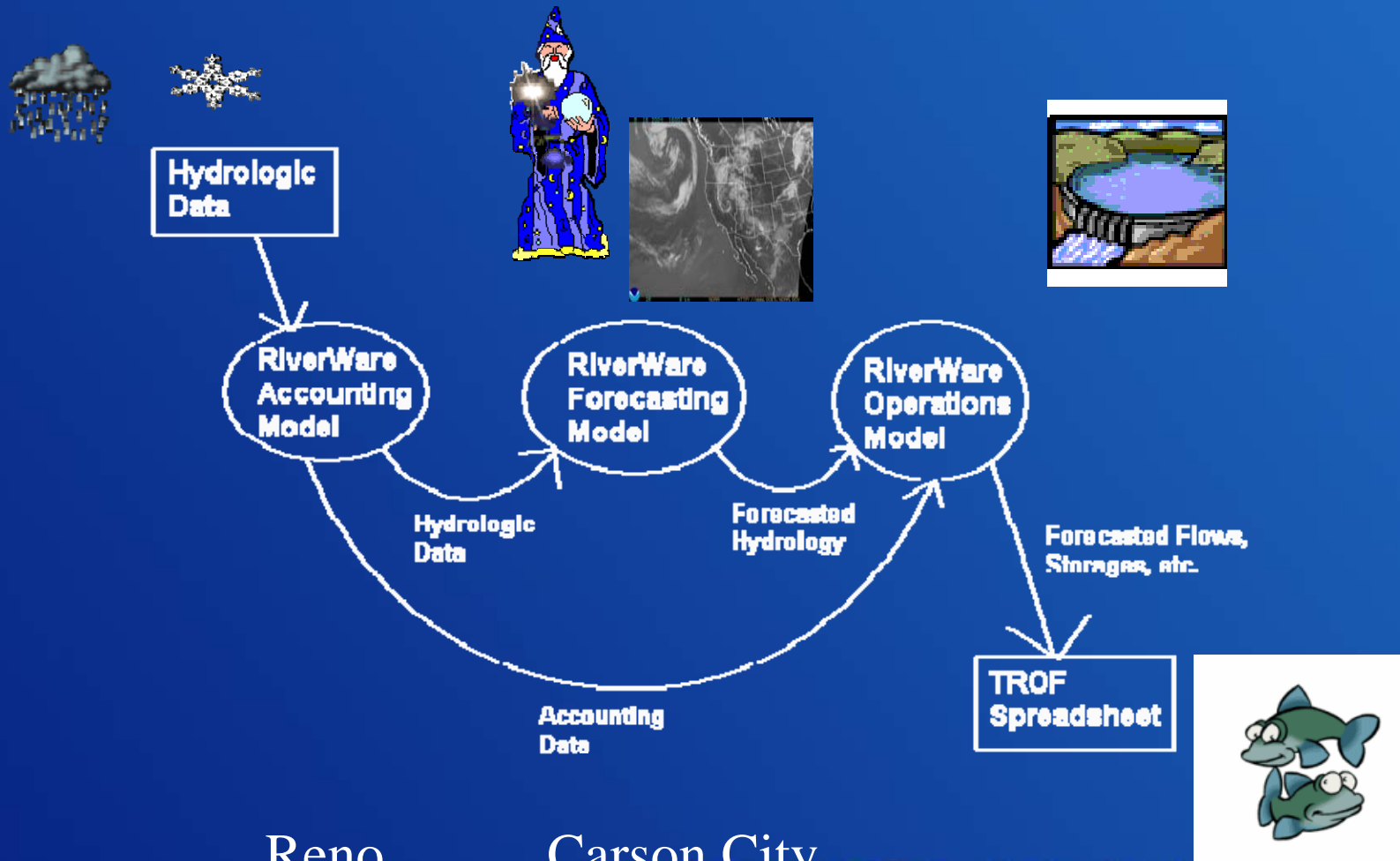


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# Water Accounting - RiverWare



# Current RiverWare Modeling System



Reno

Carson City

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# What is the purpose of TROA?

To improve operational flexibility and efficiency of the Truckee River Reservoirs while satisfying water rights in conformance with existing decrees

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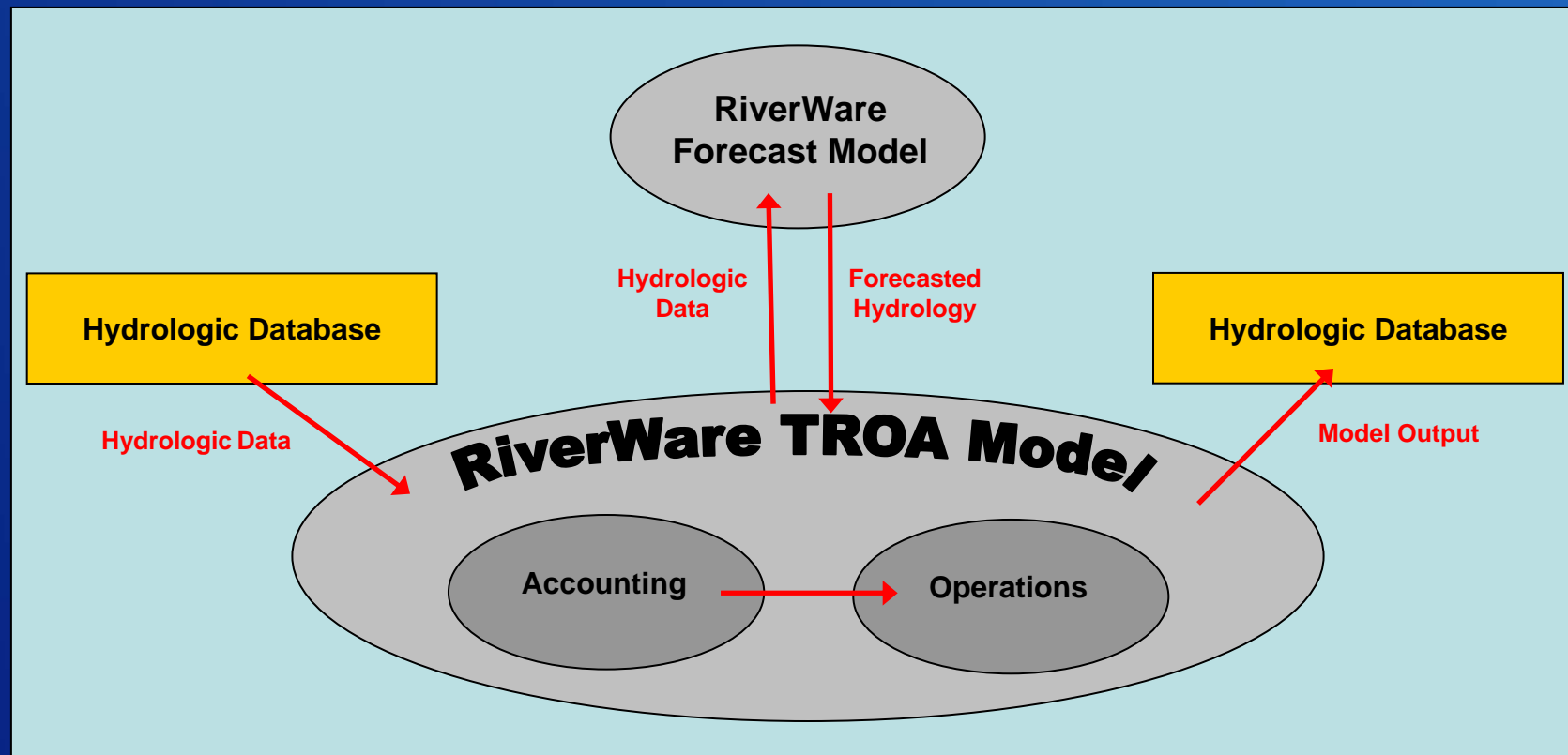
# How Does TROA Work?

- The core of TROA is the ability to store water upstream for later use
- Water not needed to meet current demand will be stored pursuant to water rights
- Additional Water may be stored for
  - M&I
  - Pyramid Lake Fishes
  - Water Quality
  - Environmental Uses
- Storage, Exchange and release of water will be coordinated through detailed schedules

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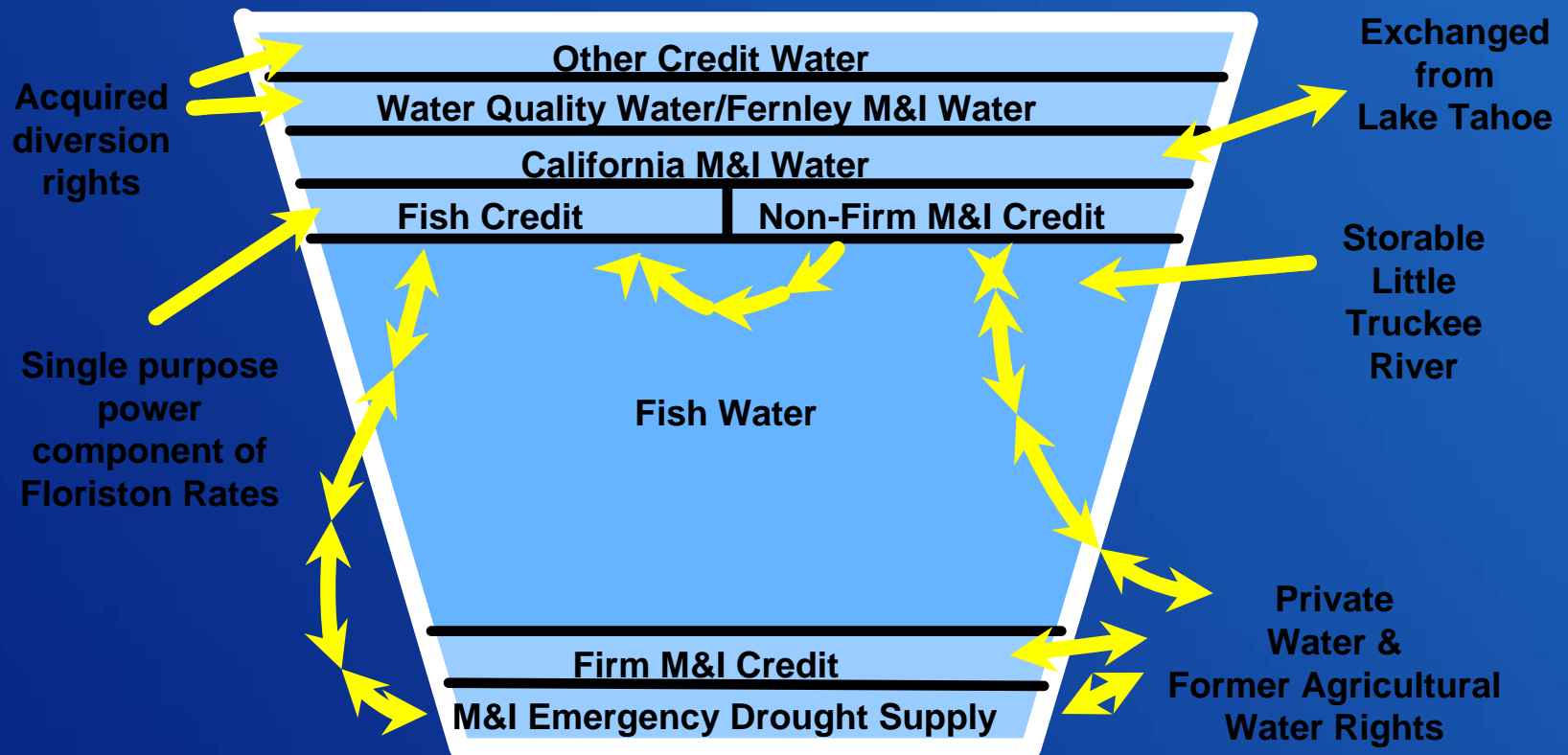
# RiverWare Modeling System

## TROA Schematic



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# What is Different about TROA?



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# What is Different about TROA?

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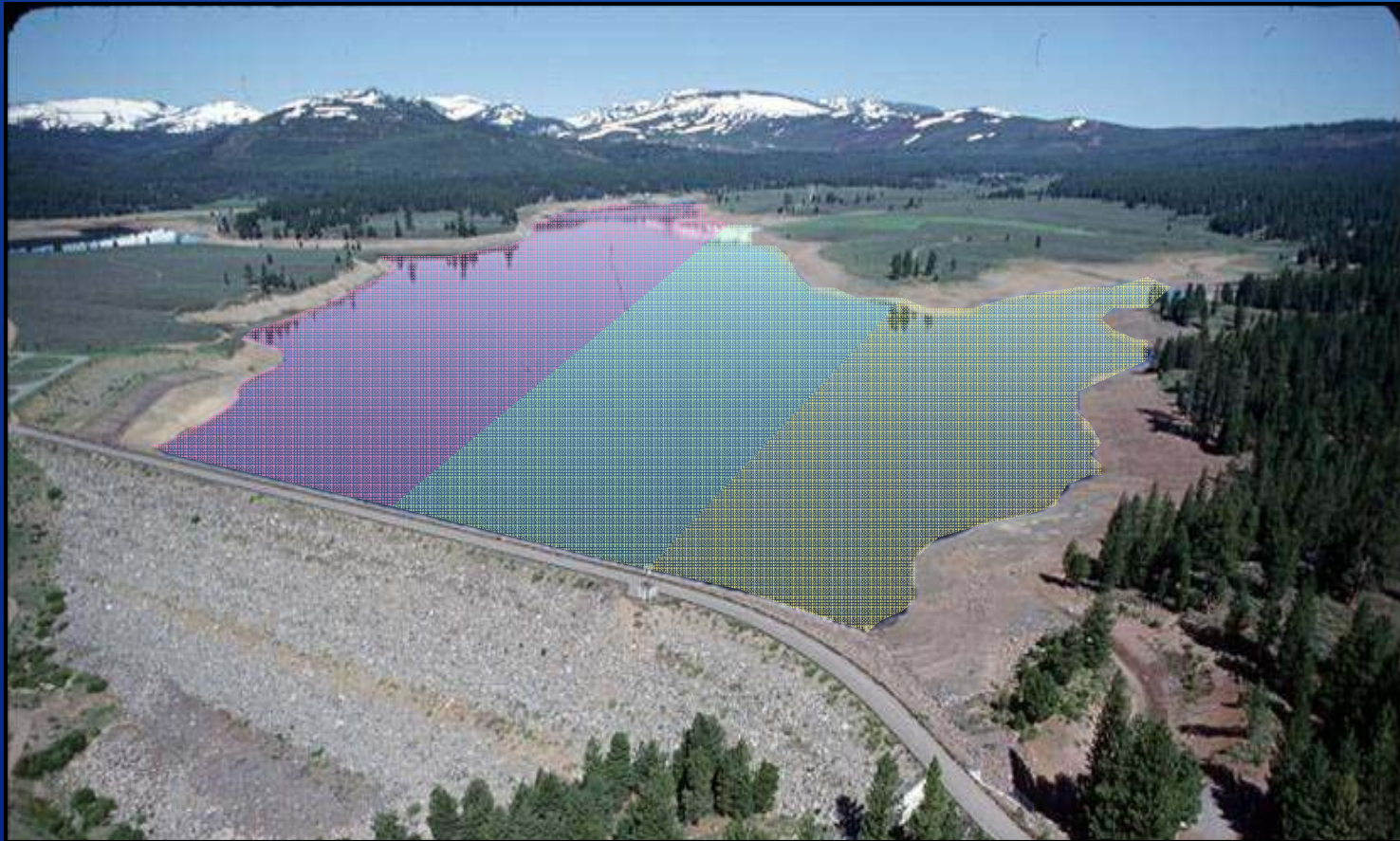
- Proliferation of accounts: 7 → 20
- Each Reservoir goes from single purpose to multi-purpose. Any kind of water in any reservoir
- Extensive exchanges and transfers throughout basin
- “Operation by Committee” – Model must facilitate interaction by stakeholders.

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# Implementation of TROA

- An advanced, customized, flexible hydraulic and hydrologic model will be needed in order to implement TROA
- Model requirements
  - simulate physical processes like inflow forecasting, evaporation, channel losses, etc. on a daily timestep
  - simulate operations of the Truckee Carson system as prescribed by TROA
  - track the status of accounts on the reservoirs and in-stream
  - perform complex accounting transactions such as transfers, trades and exchanges of water throughout the basin

# Truckee River Operating Agreement Accounting Transactions



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# Truckee River Operating Agreement Accounting Transactions

1. Trades
2. Credit Water Accumulation
3. Exchanges

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# Trades - Concept

Before



After



A Trade is a “Paper Transaction.” Physically no water moves.

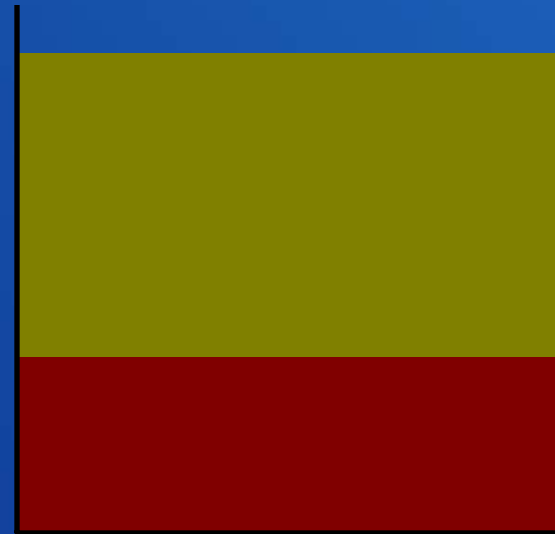
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# Trades - Concept

Before



Reservoir 1



Reservoir 2

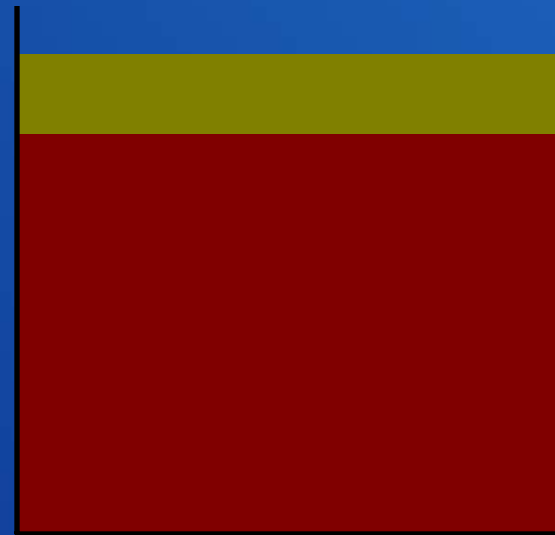
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# Trades - Concept

After



Reservoir 1



Reservoir 2

In Accounting a TRADE requires relabeling water on two reservoirs

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# Trades – RiverWare Implementation

1) Schedule a trade on the Trades table (operator entry)

	Julian Date FullDateTime	Borrow Volume acre-feet	Payback Volume acre-feet
0: TestTrade	24:00 October 1, 2006	500.00	500.00
1: Test Trade2	24:00 December 1, 2007	2000.00	2500.00
2	DT NaN	NaN	NaN
3	DT NaN	NaN	NaN
4	DT NaN	NaN	NaN
5	DT NaN	NaN	NaN
6	DT NaN	NaN	NaN
7	DT NaN	NaN	NaN
8	DT NaN	NaN	NaN

Trade Name

Trade Date

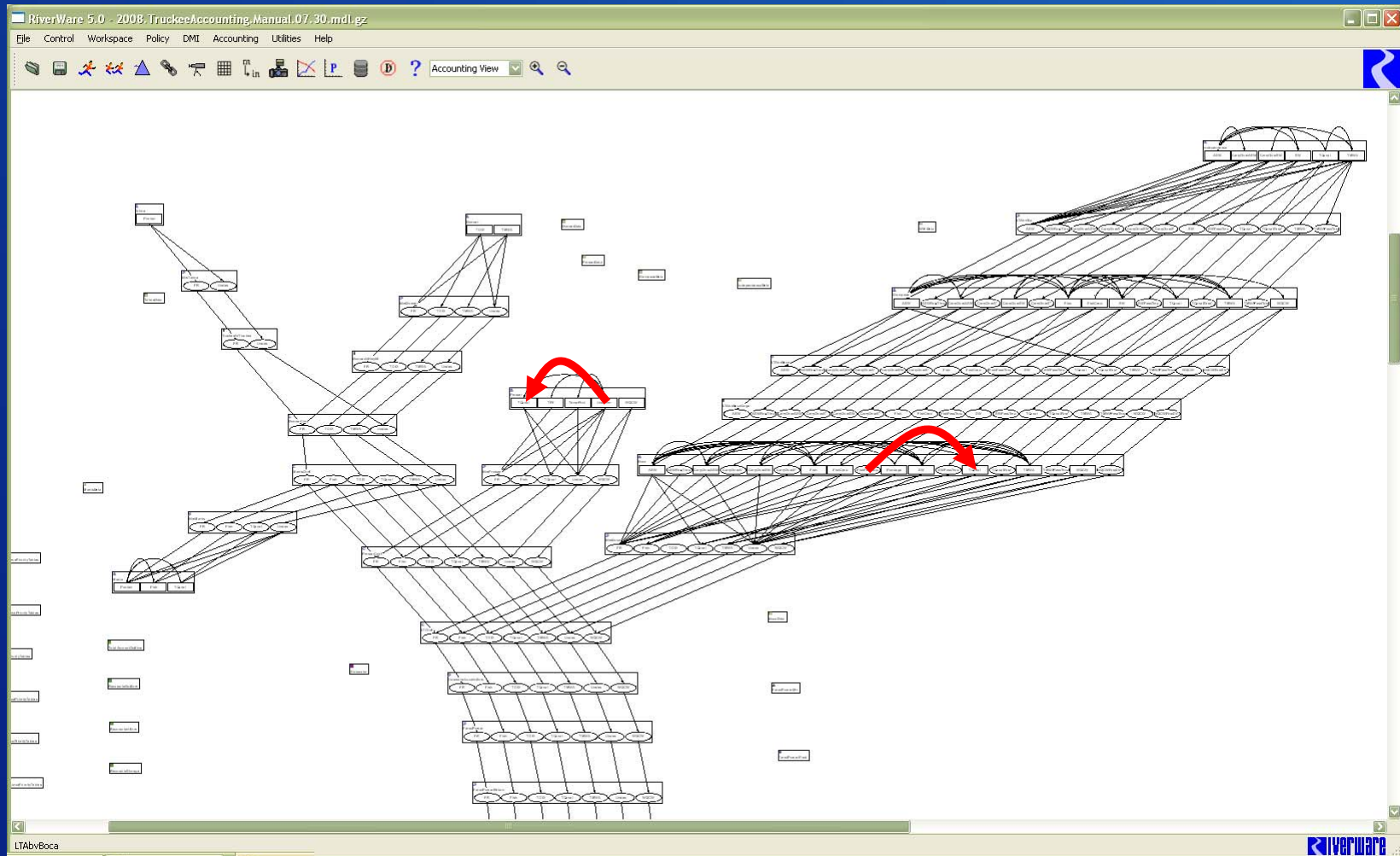
Payback Volume

Borrow Volume

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# Trades – RiverWare Implementation

## 2) Create Transfer supplies with appropriate attributes



# Trades – RiverWare Implementation

2) Create Transfer supplies with appropriate attributes

“Borrow”



Borrow Supply

- Release Type = Trade Name
- Destination = “Borrow”

“Payback”



Payback Supply

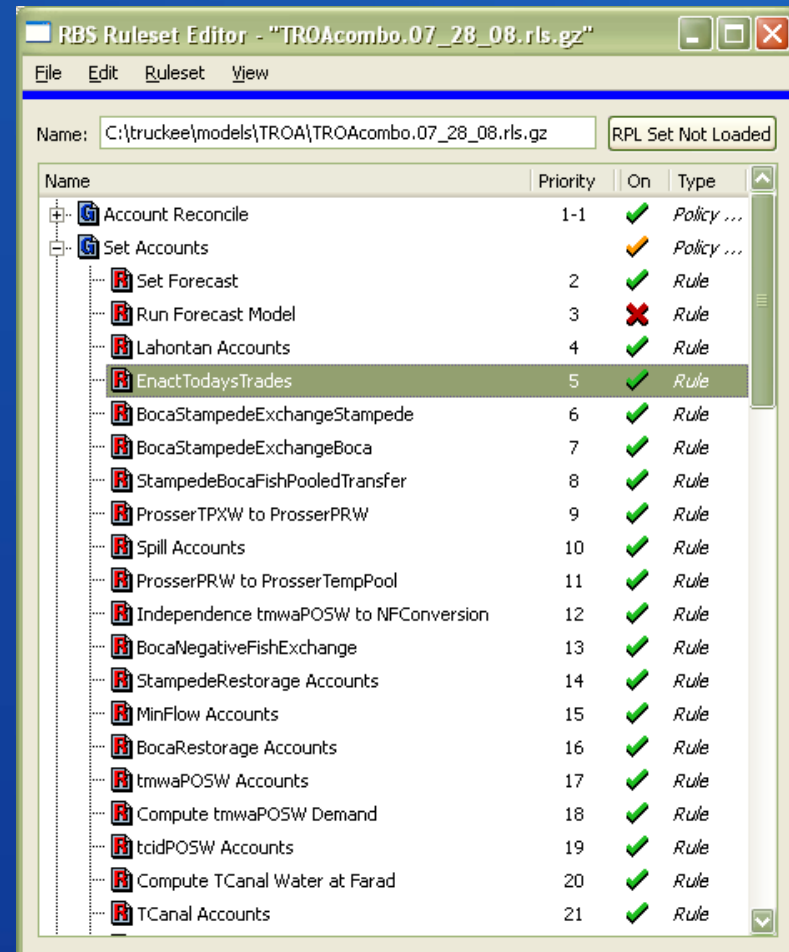
- Release Type = Trade Name
- Destination = “Payback”

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# Trades – RiverWare Implementation

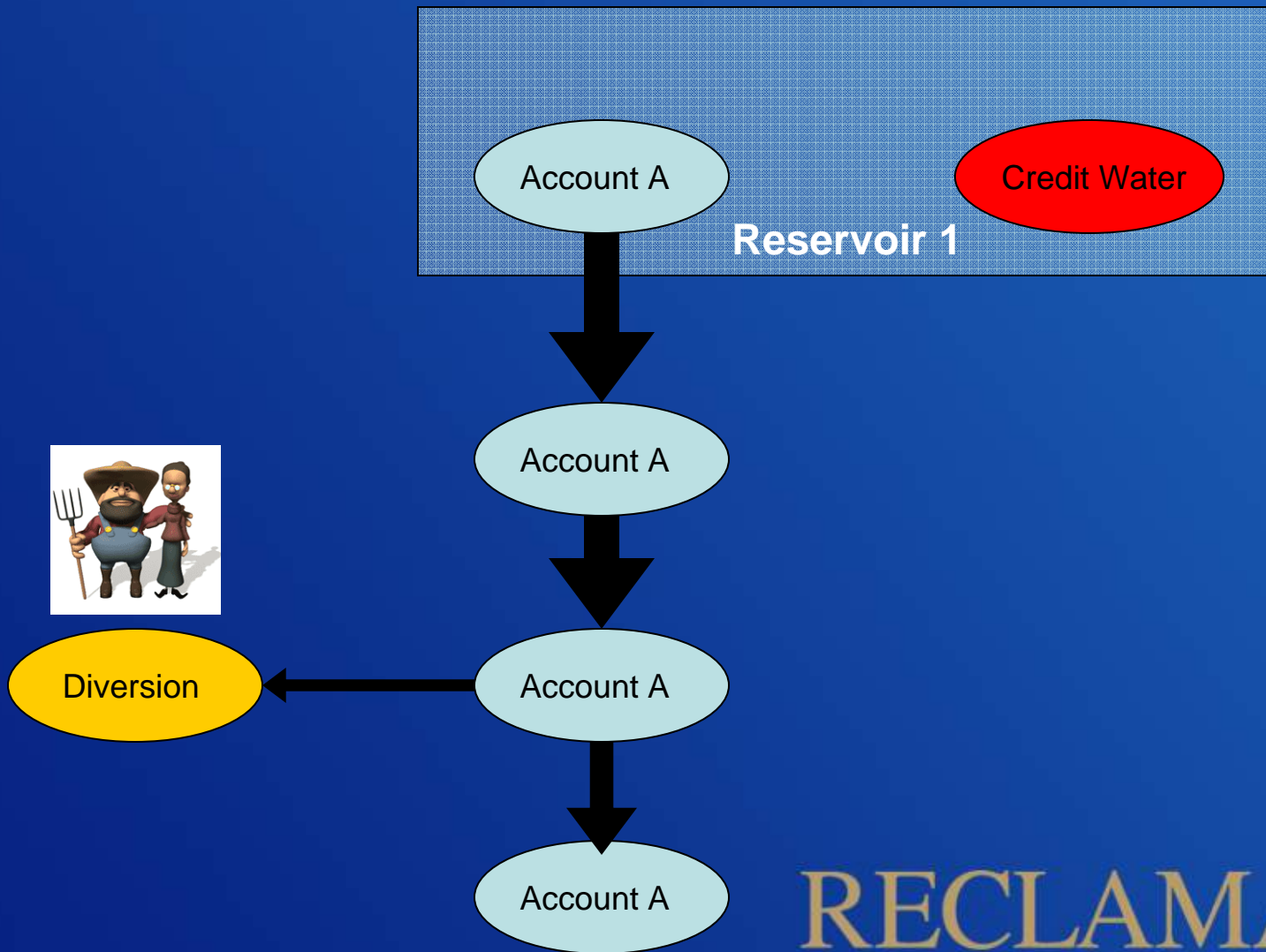
3) One rule then reads the Trades request table, evaluates limits, and executes all trades scheduled for the current timestep.

4) Actual Borrow and Payback amounts are written to series slots for export to HDB



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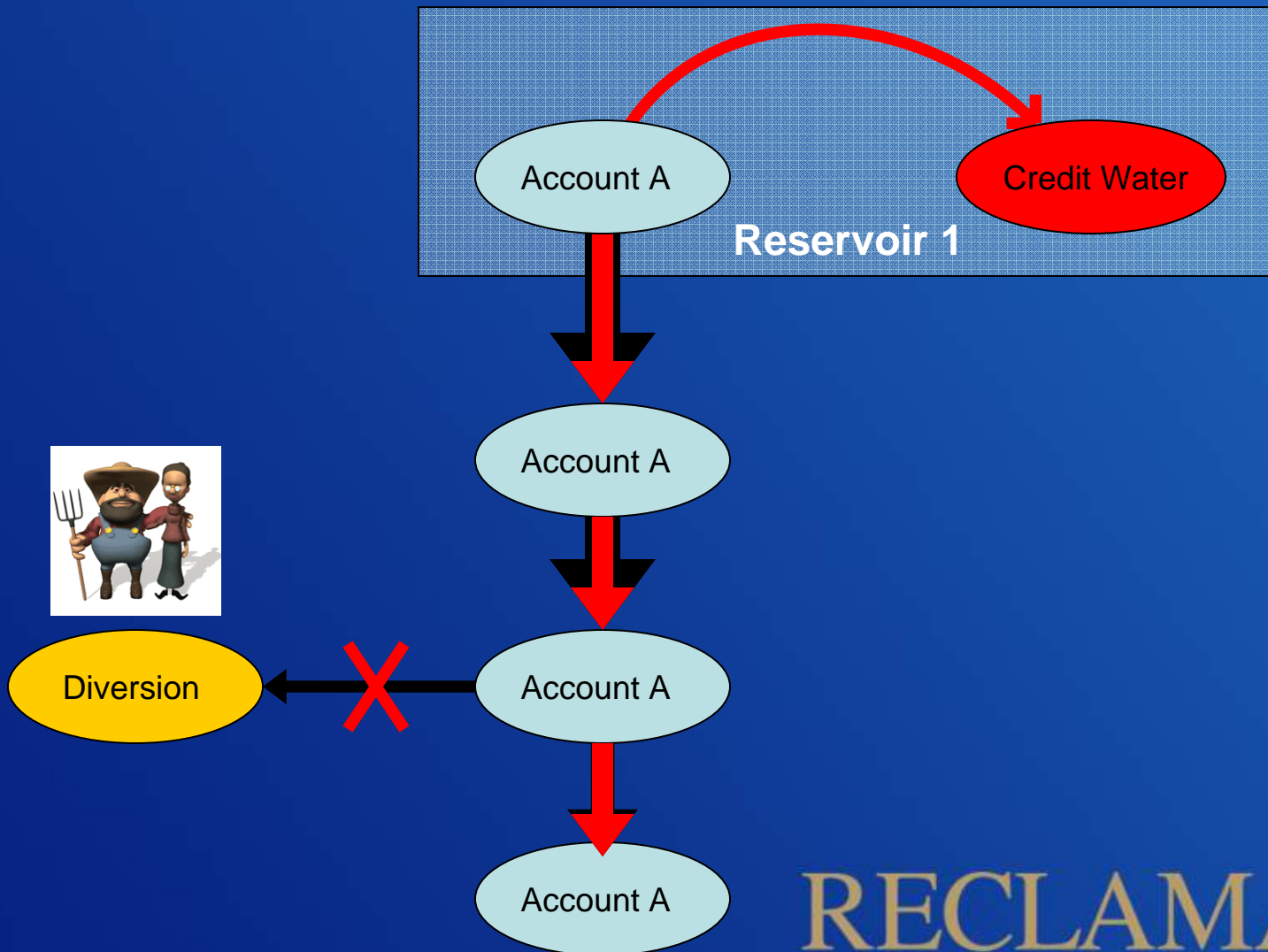
# Credit Water Establishment – Concept



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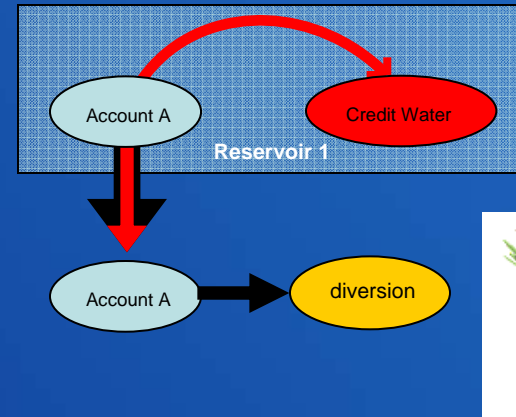
# Credit Water Establishment – Concept



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# Credit Water Establishment – RiverWare Implementation

1. Calculate Amount Available (Floriston Rate)
2. Calculate Daily Demand (scheduled)
3. Calculate CW establishment limit ((available-demand) \* consumptive use fraction)
4. Cycle through reservoirs in user-defined priority order and holdback releases, where possible, up to total CW establishment limit
5. Convert like amount of FR water to Credit Water on each reservoir where a holdback occurred



SCT FRcredWaterReservoirPriorities.sct (TROAcomboWY2008\_July22.mdl.gz)

File Edit Slots Aggregation View Config DMI Run Diagnostics Go To

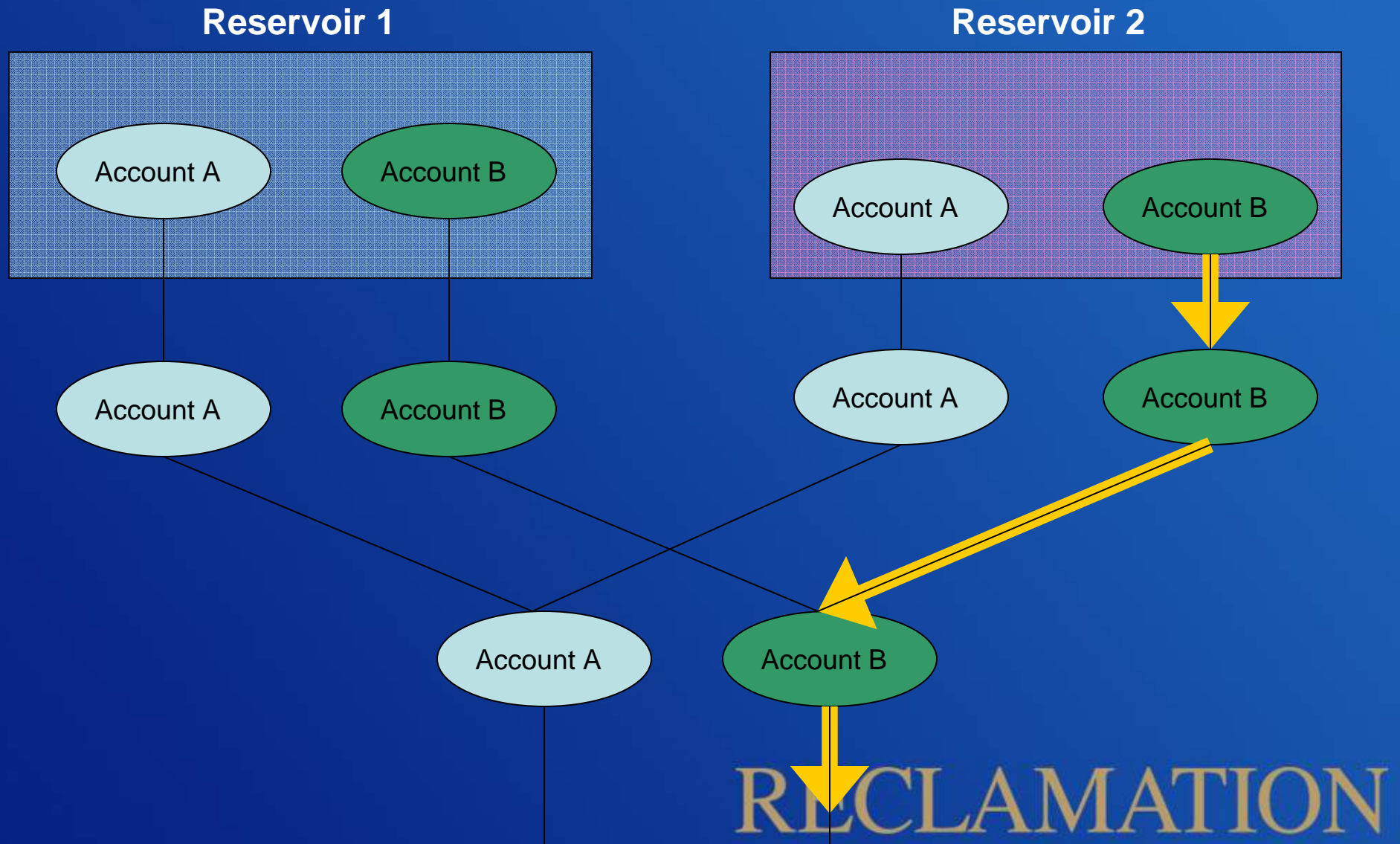
Series Slots Scalar Slots Other Slots

Timestamp	tmwaFRcredWater .Donner	tmwaFRcredWater .Independence	tmwaFRcredWater .Martis	tmwaFRcredWater .Prosser	tmwaFRcredWater .Stampede	tmwaFRcredWater .Tahoe
8/10/08 Sun	NONE	NONE	NONE	NONE	NONE	NONE
8/11/08 Mon	7.00	4.00	6.00	5.00	1.00	2.00
8/12/08 Tue	7.00	4.00	6.00	5.00	1.00	2.00
8/13/08 Wed	7.00	4.00	6.00	5.00	1.00	2.00
8/14/08 Thu	7.00	4.00	6.00	5.00	1.00	2.00
8/15/08 Fri	7.00	4.00	6.00	5.00	1.00	2.00
8/16/08 Sat	7.00	4.00	6.00	5.00	1.00	2.00
8/17/08 Sun	7.00	4.00	6.00	5.00	1.00	2.00
8/18/08 Mon	7.00	4.00	6.00	5.00	1.00	2.00
8/19/08 Tue	7.00	4.00	6.00	5.00	1.00	2.00
8/20/08 Wed	7.00	4.00	6.00	5.00	1.00	2.00

tmwaFRcredWaterTables.Stampede [ @ 10/10/07 ]  
1 value: 1.00 [NONE]

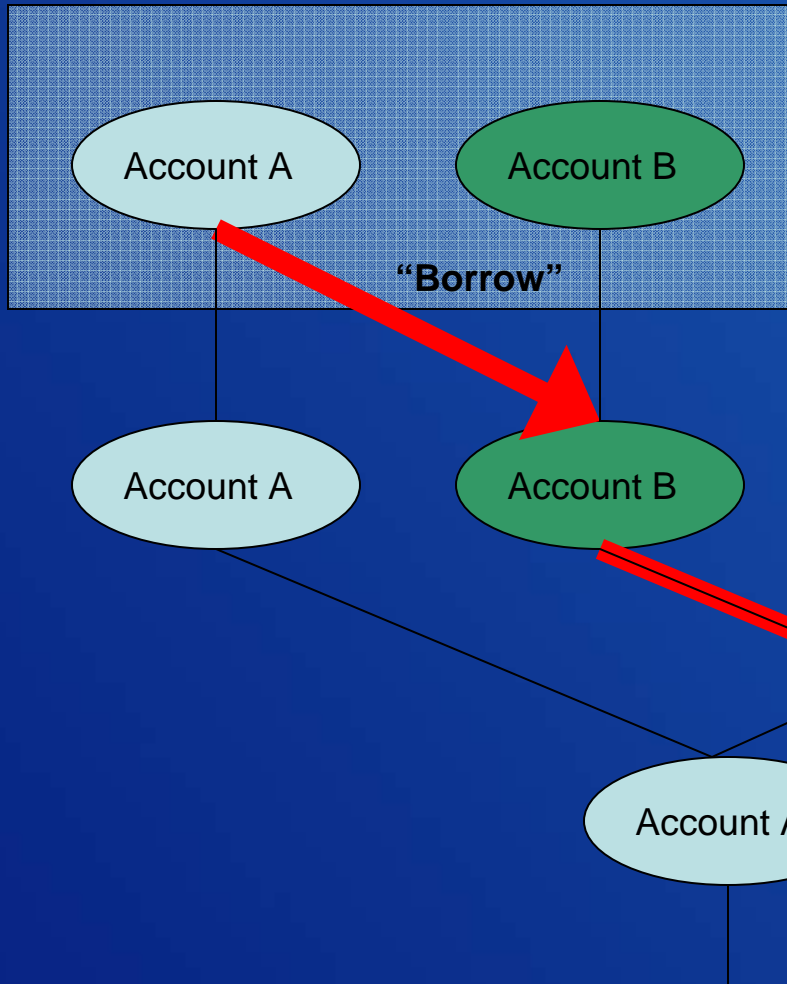
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# Exchanges – Concept

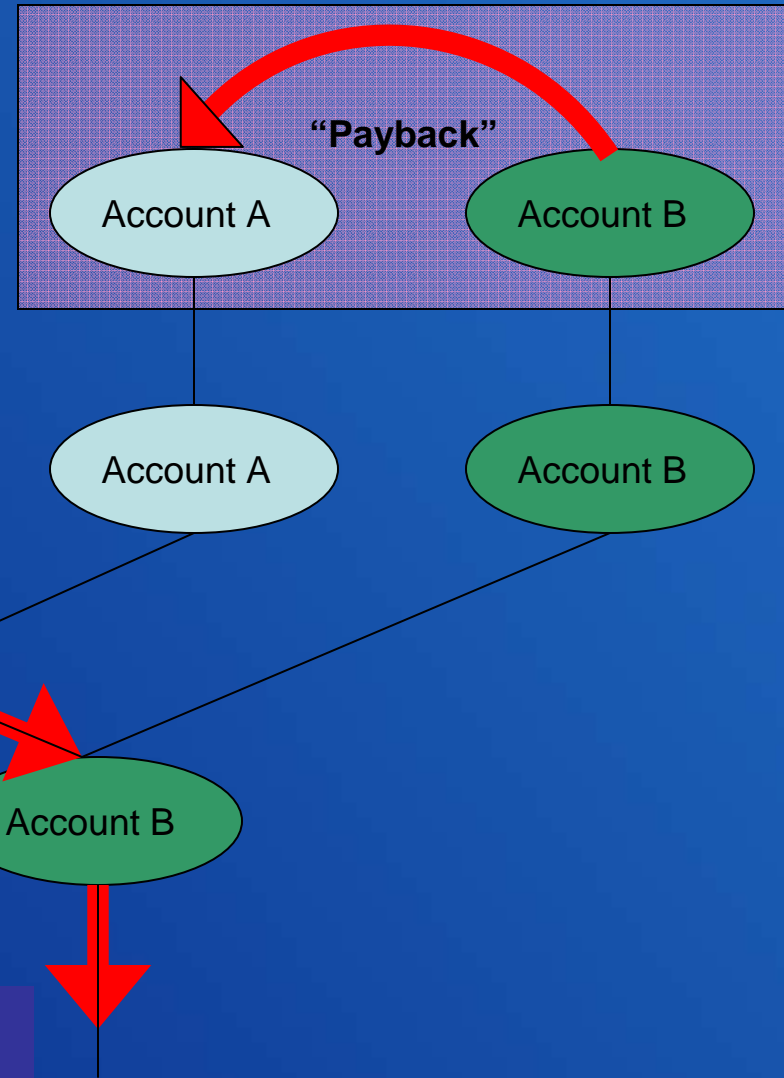


# Exchanges – Concept

Reservoir 1



Reservoir 2



Net effects are:

- Account A water moved from Reservoir 1 to 2
- Increased flows below Res 1
- Account B storage is unaffected
- Original purpose for release of Account B water is maintained

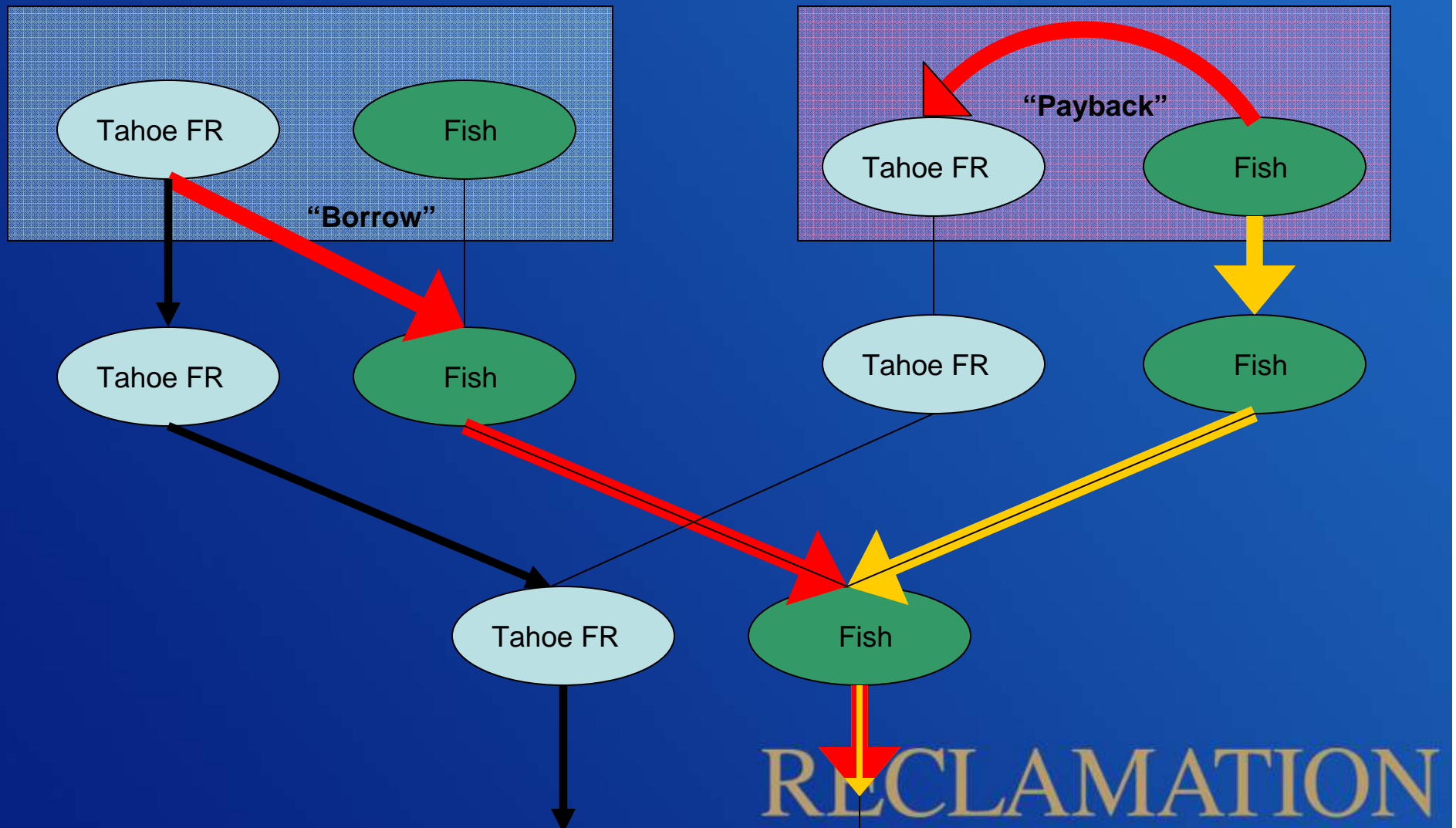
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# Exchanges Example

## TROA 8S Exchange

### Lake Tahoe

### Stampede Reservoir



# Exchanges – RiverWare Implementation

1) Schedule an exchange on the Exchanges table (operator entry)

Exchange Name

Exchange Dates

Borrow Rate

Payback Rate

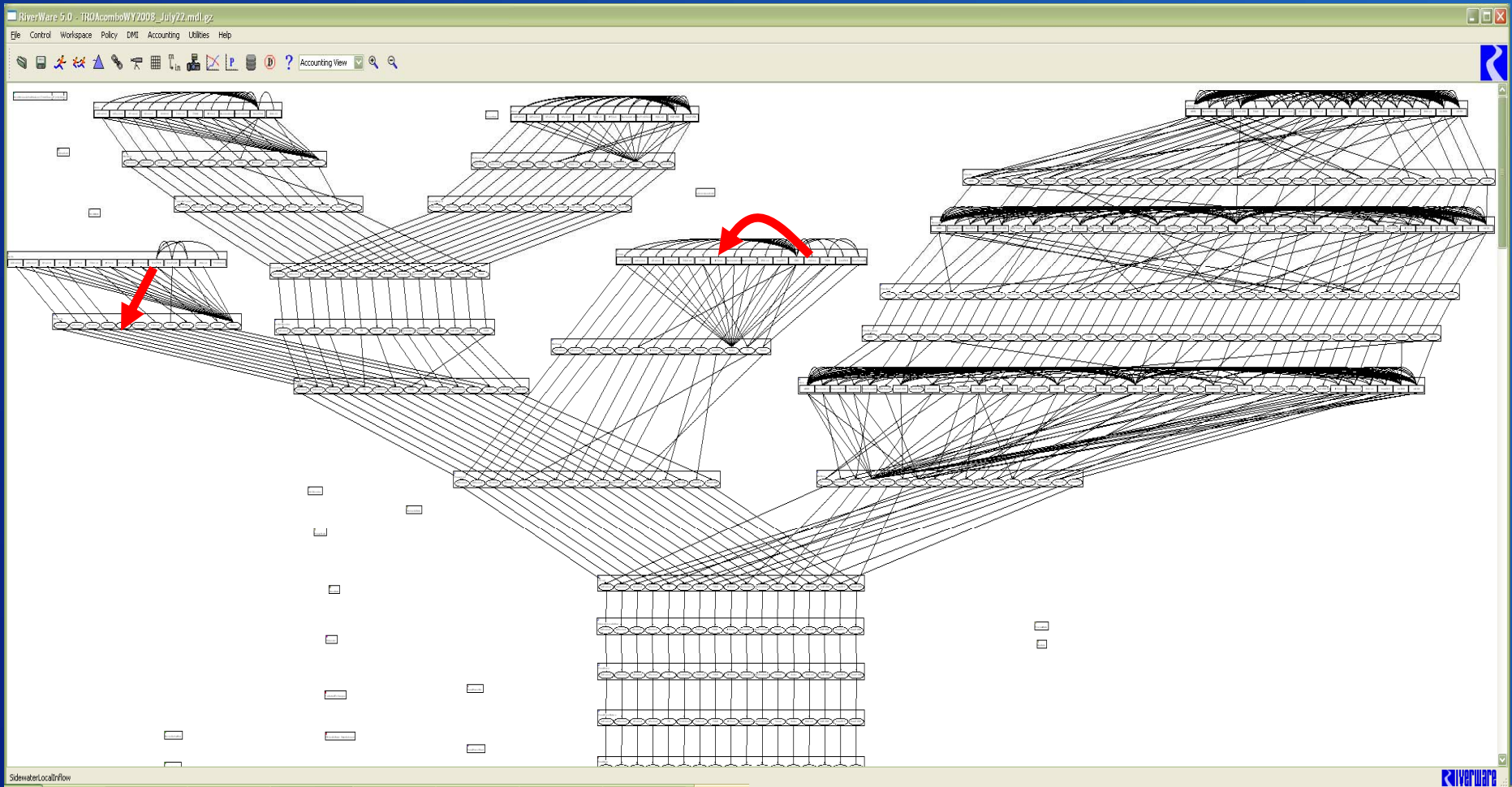
Cumulative Volume Limit

	Start Date FullDateTime	End Date FullDateTime	Borrow Rate Lir acre-feet/day	Payback Rate Lir acre-feet/day	Cumulative Volume Limit acre-feet
0: McCarranDiversionExchange	24:00 June 1, 2006	24:00 July 31, 2006	3.97	3.97	NaN
1: Article85	24:00 November 1, 2008	24:00 November 5, 2008	100.00	100.00	500.00
2: HunterCreekExchange	24:00 June 1, 2006	24:00 June 30, 2006	26.98	26.98	NaN
3: TMWADonnerBocaFRExchange	24:00 October 1, 2008	24:00 October 31, 2008	100.00	100.00	2000.00
4: FishWStampedeBocaFRExchange	24:00 October 1, 2005	24:00 December 31, 2005	NaN	NaN	NaN
5: TMWADonnerTahoeFRExchange	24:00 August 25, 2006	24:00 August 31, 2006	99.17	99.17	NaN
6: FishWStampedeIndependenceTMWExchange	24:00 August 25, 2006	24:00 August 31, 2006	49.59	49.59	NaN
7: TPXW_AExchange	24:00 October 1, 1960	24:00 October 1, 2060	0.00	0.00	1.00
8: TPXW_BExchange	24:00 October 1, 1900	24:00 October 1, 2060	0.00	0.00	1.00
9: FishWStampedeIndependenceTMWTrade	24:00 July 12, 2006	24:00 July 12, 2006	1000.00	1000.00	2000.00

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# Exchanges – RiverWare Implementation

## 2) Create Supplies with appropriate attributes



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# Exchanges – RiverWare Implementation

2) Create Supplies with appropriate attributes

“Borrow”



Borrow Supply (Inflow/Outflow)

- Release Type = Exchange Name
- Destination = “Borrow”

“Payback”



Payback Supply (Transfer)

- Release Type = Exchange Name
- Destination = “Payback”

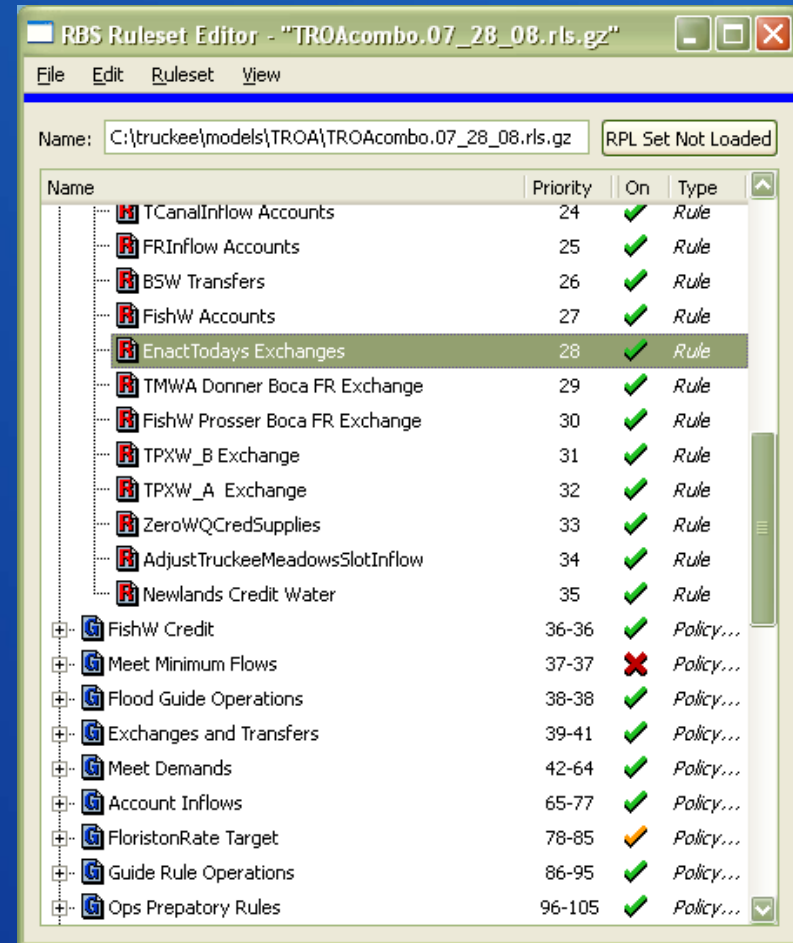
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# Exchanges – RiverWare Implementation

3) One rule then reads the Exchanges request table, evaluates limits, and executes all exchanges scheduled for the current timestep.

4) Actual daily Borrow and Payback amounts are written to series slots for export to HDB



# Current Status of Development

- TROA Model development team is working with CADSWES to generalize and automate these accounting transactions within RiverWare.



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# The End



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