TETRA TECH

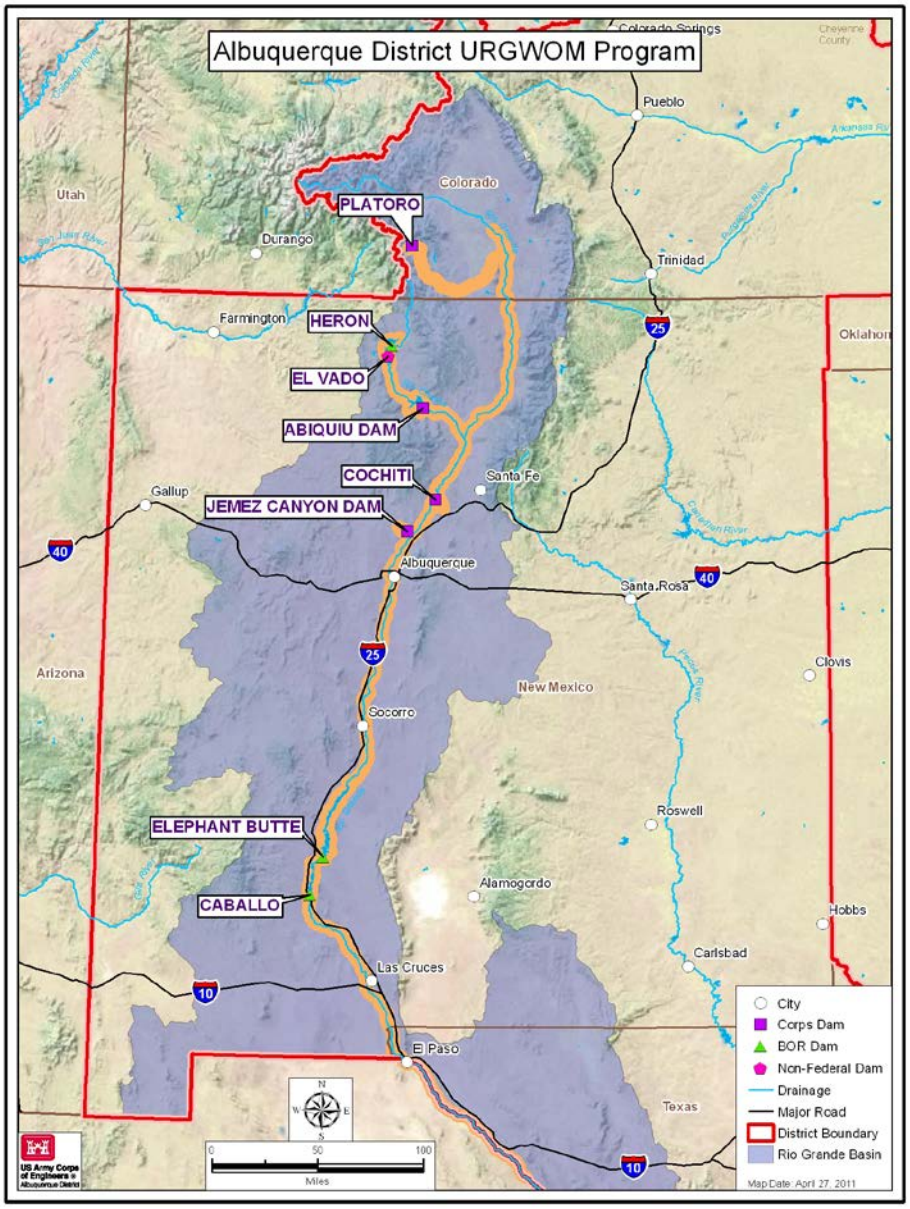
URGWOM 2014:

Headwaters, GW-Reservoir Interactions, and Monthly Timesteps

Jesse Roach
Kyle Shour
Tetra Tech Inc.
Albuquerque

URGWOM User's Group Meeting
Tuesday February 3rd, 2015
Boulder

URGWOM: Overview of Current Status

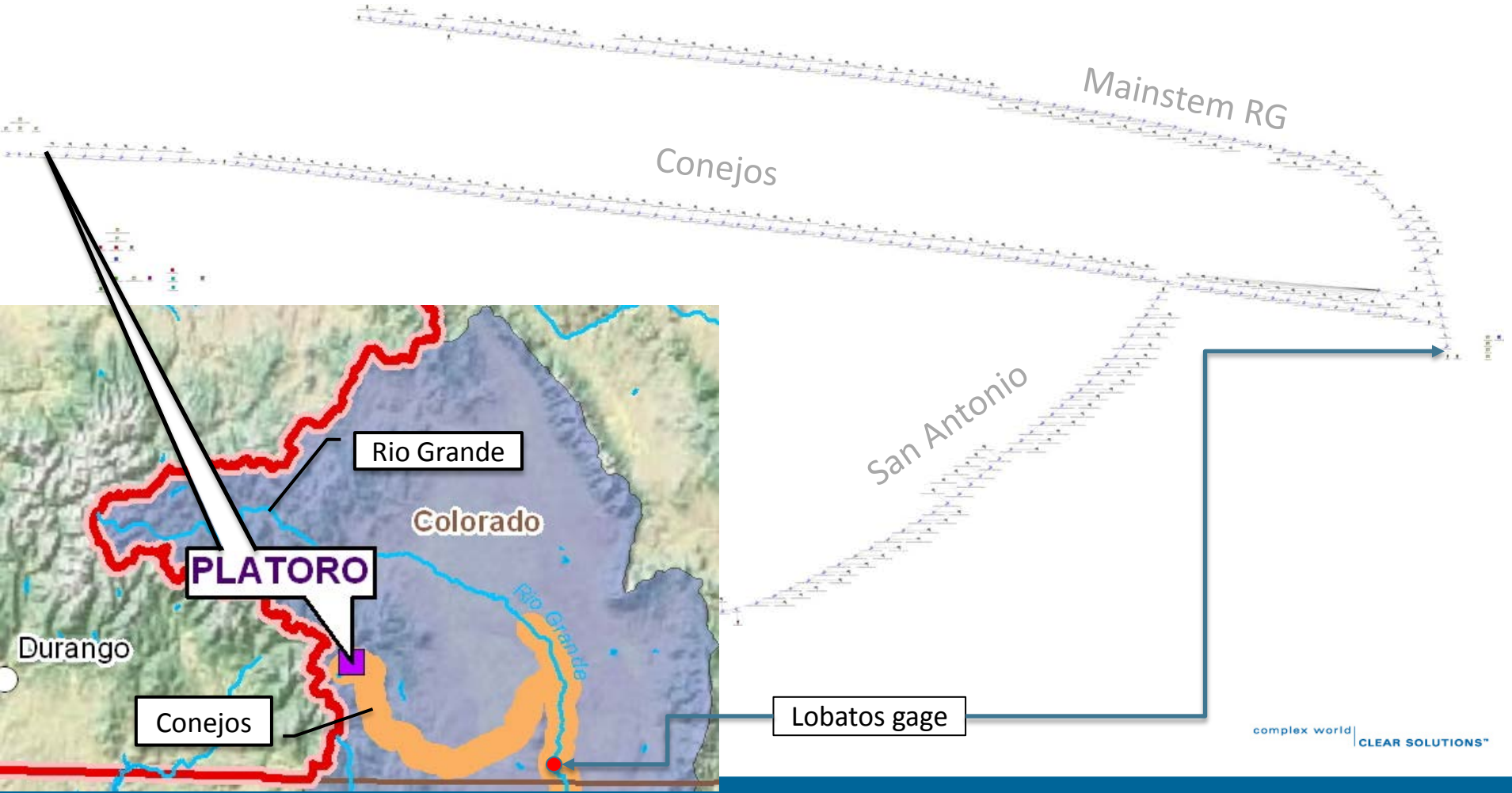


Upper Rio Grande Water Operations Model:
One model file with a single rule-set which can be used for a variety of applications:

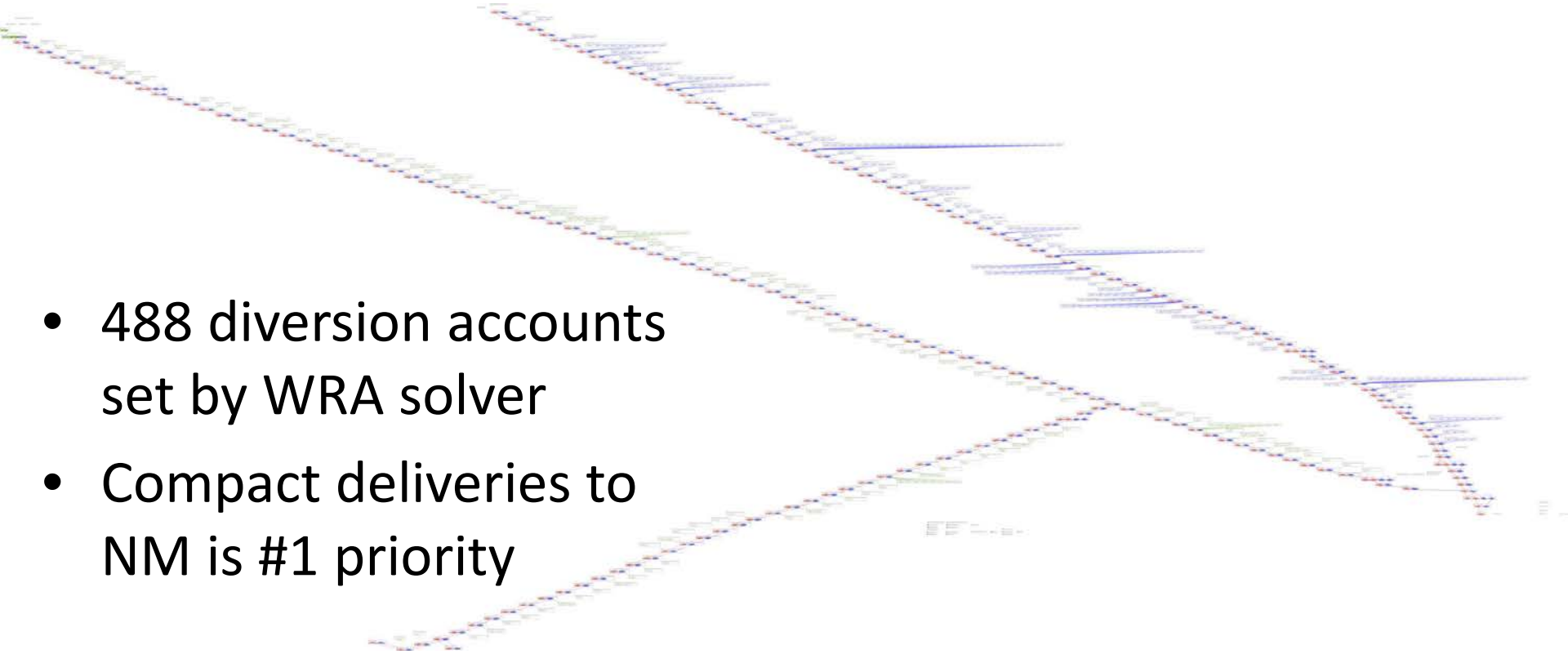
1. Daily, data driven accounting of native and trans-basin (Colorado River) water in the system. (Typically run daily by Reclamation)
2. Annual operating plan runs. (typically run a couple of times per year by USACE)
3. Planning runs. (typically every several years by Reclamation, USACE, or NMISC)
4. (A combination of 1 and 2 or 1 and 3, going from data driven accounting to rule driven operations where historic data ends.)

Colorado Model - Background

- Test RiverWare model developed in 2013
- Model inputs: measured and forecast data above diversions
- Improves forecast flows at the Lobatos gage for annual and long-term planning

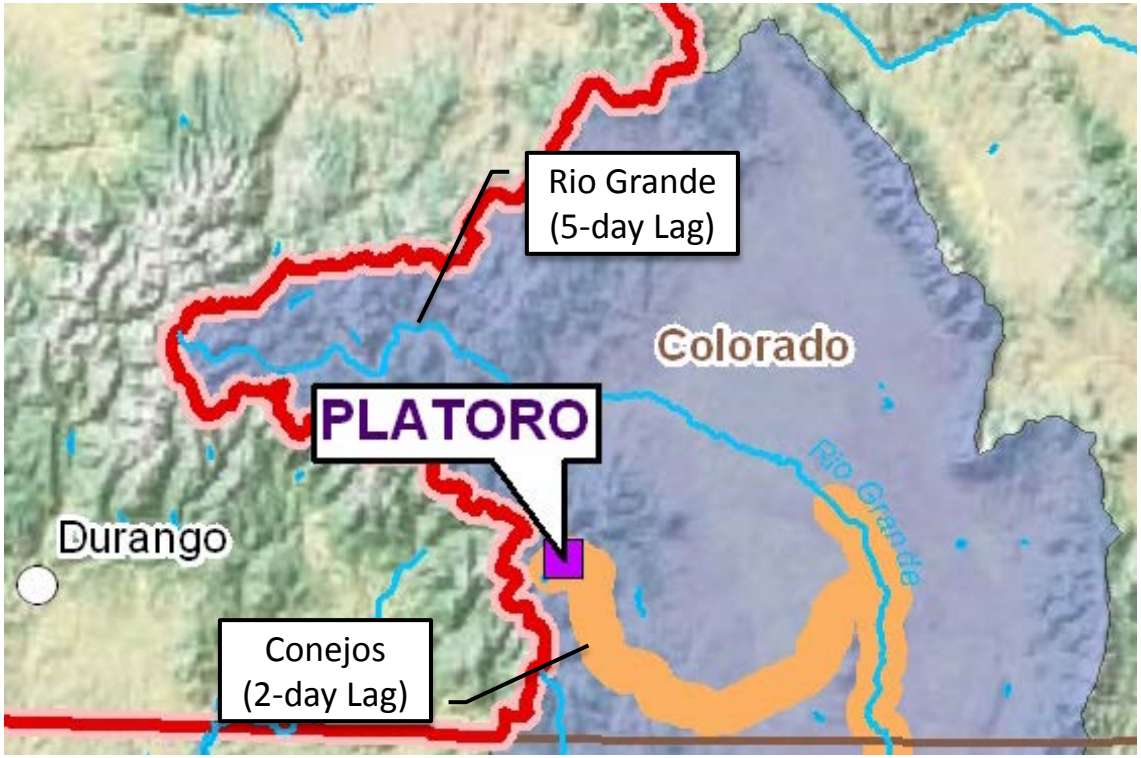


Colorado Model - Background (Cont.)



- 488 diversion accounts set by WRA solver
- Compact deliveries to NM is #1 priority
- Calibrated with local inflows, loss rates, and return flow fractions

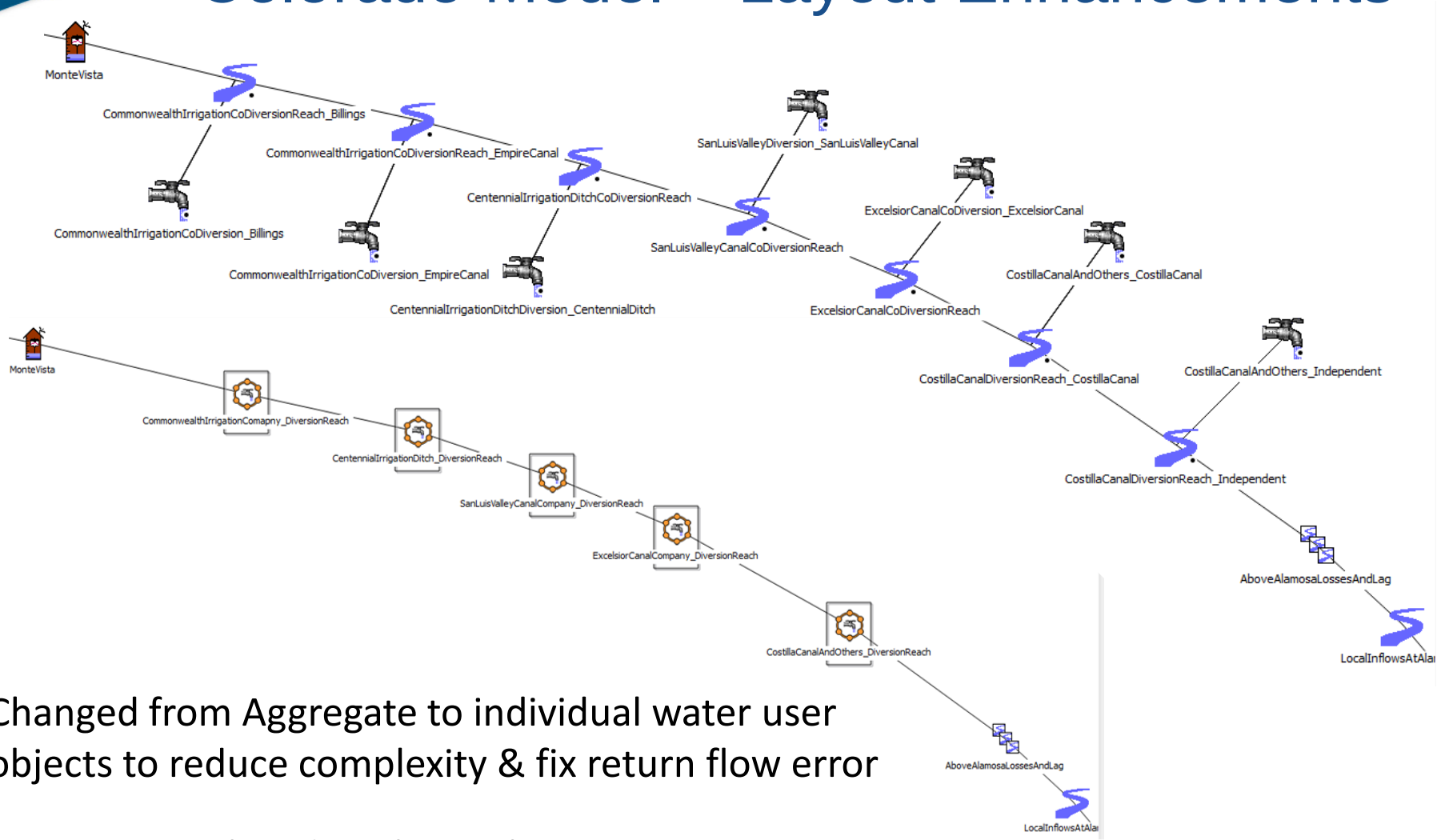
Colorado Model: WRA Solver



- 1 computational subbasin: Platoro needs to solve at t+3.
- Solving rules into future adds complexity when combining with main URGWOM model

- Instead, 2 computational subbasins and WRA rules are used.
- Result: diversions correctly set, but simulation slowed 10-15 sec/year.

Colorado Model – Layout Enhancements

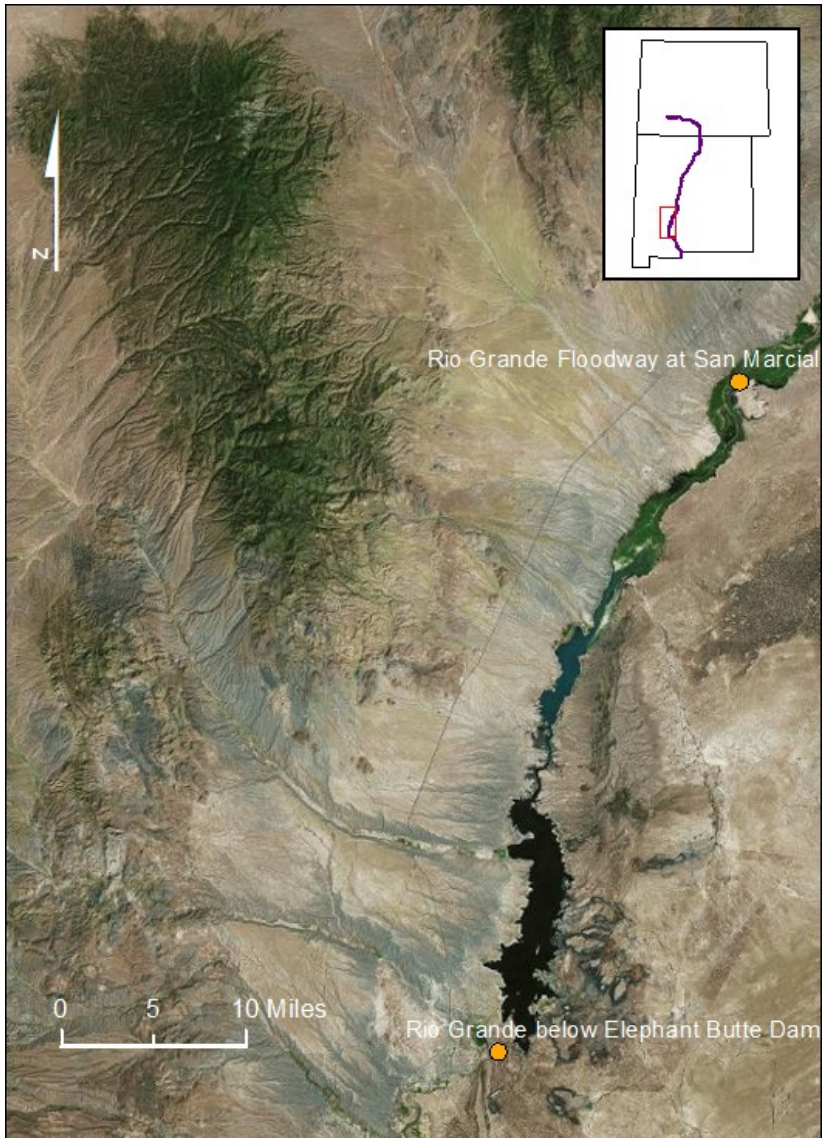


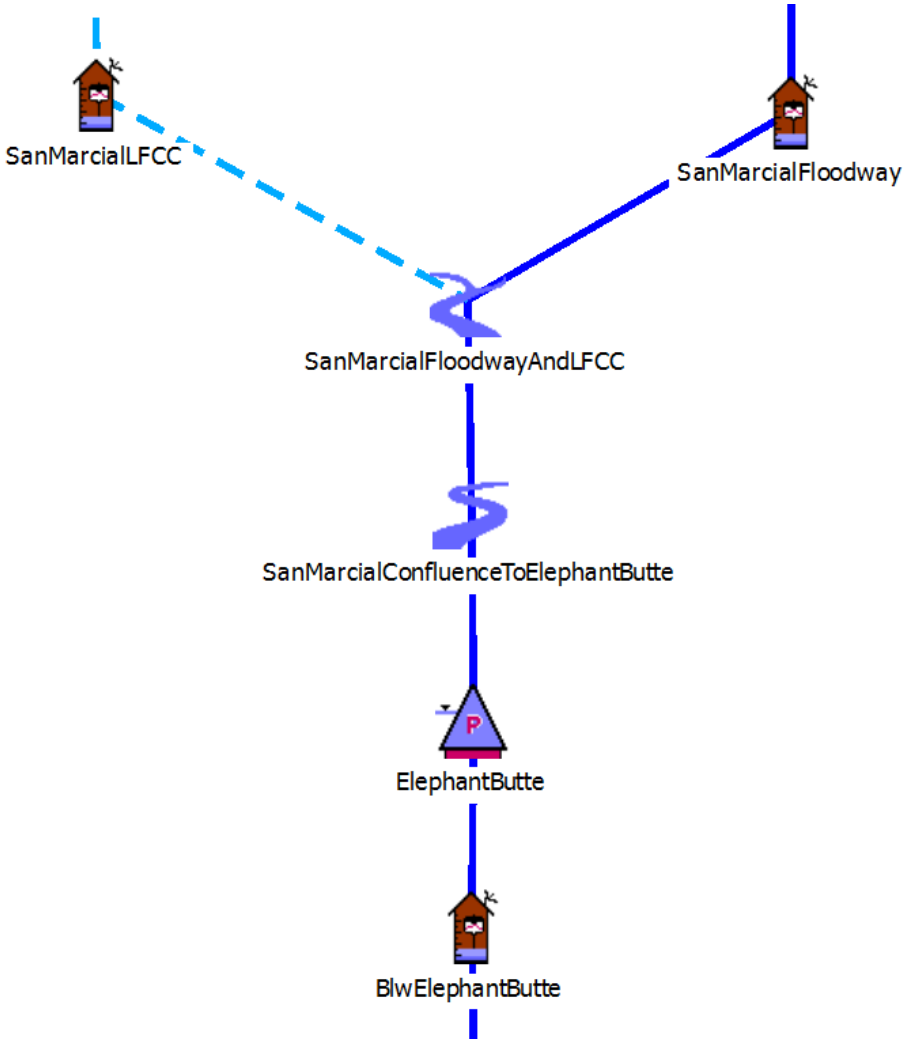
- Changed from Aggregate to individual water user objects to reduce complexity & fix return flow error
- Water users placed in object clusters
- Increase model flexibility and simplified some rules

Next stop: San Marcial to Elephant Butte

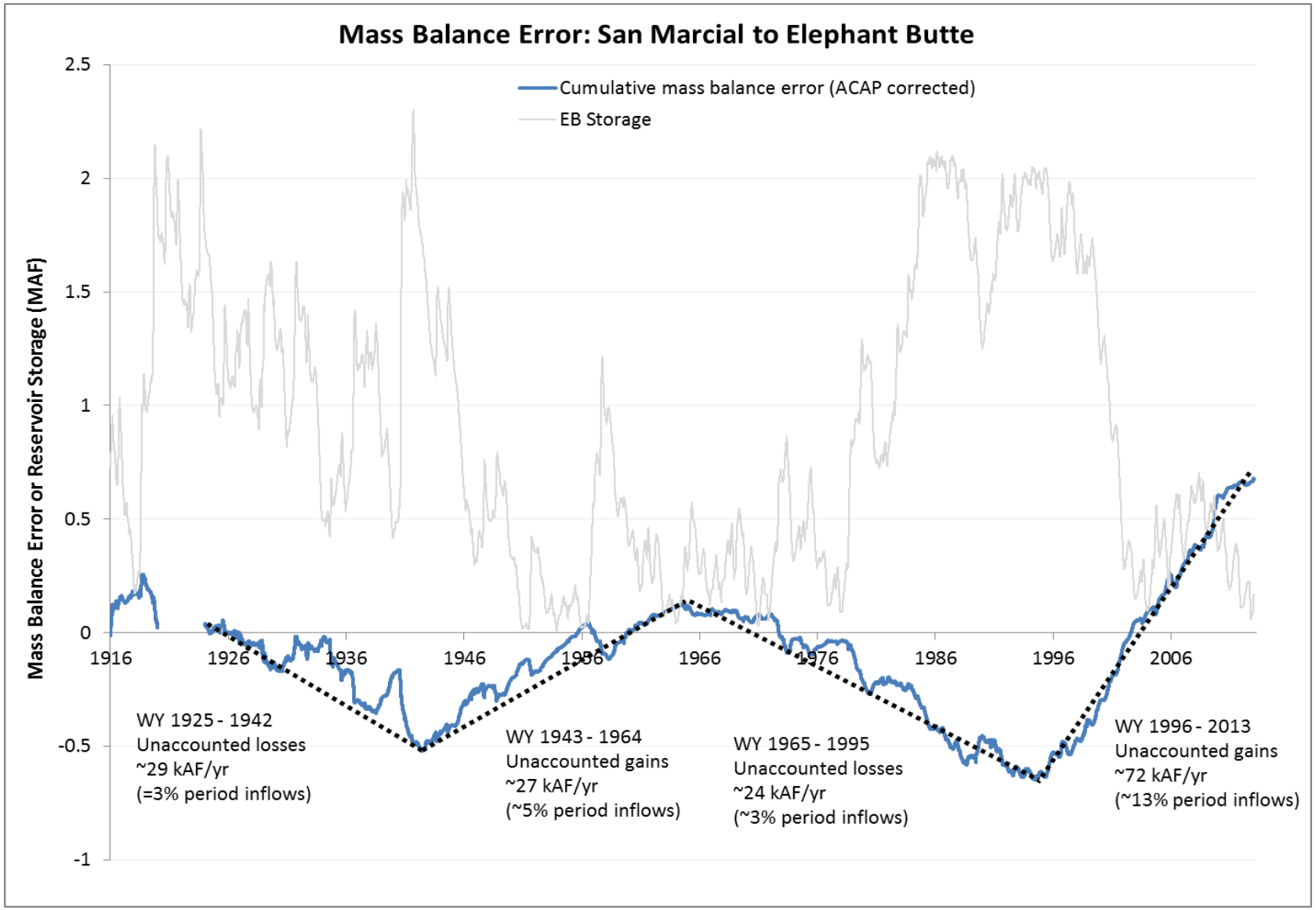
- Colorado Model Development
- San Marcial to Elephant Butte Mass Balance
- Daily to monthly timestep conversion

San Marcial to Elephant Butte: Background

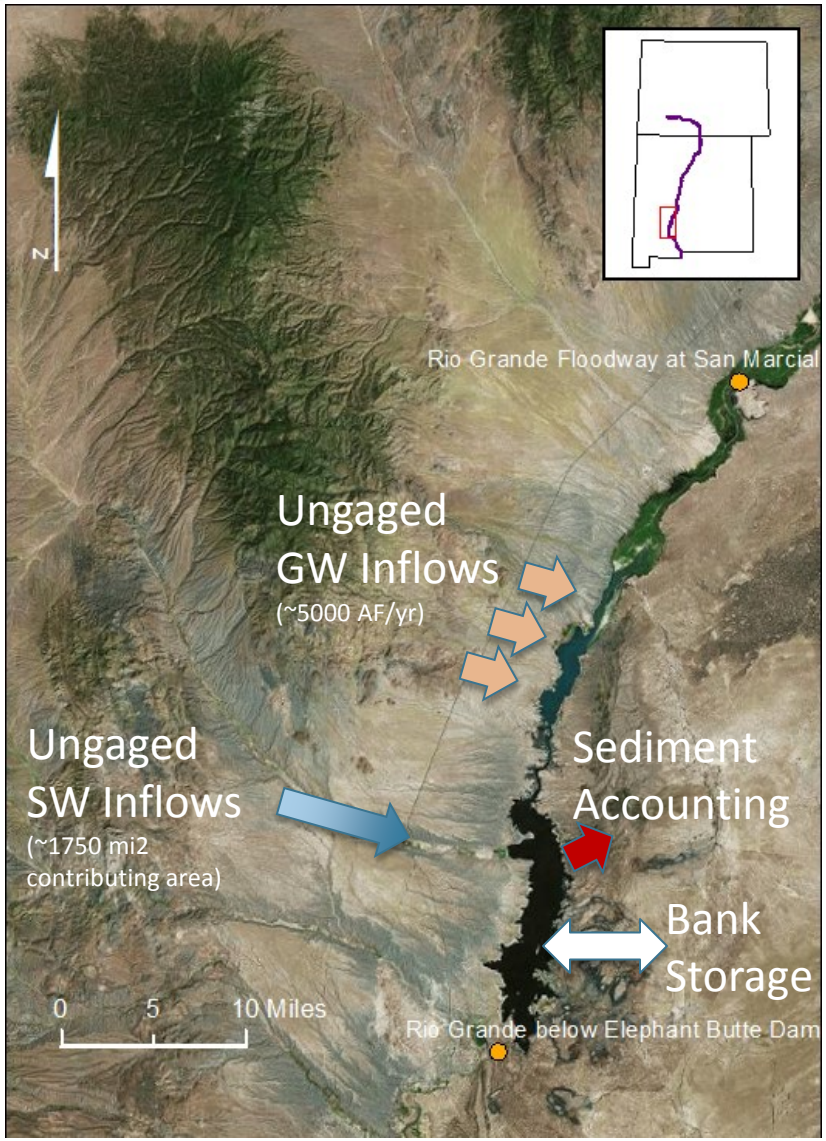




San Marcial to Elephant Butte: The Problem



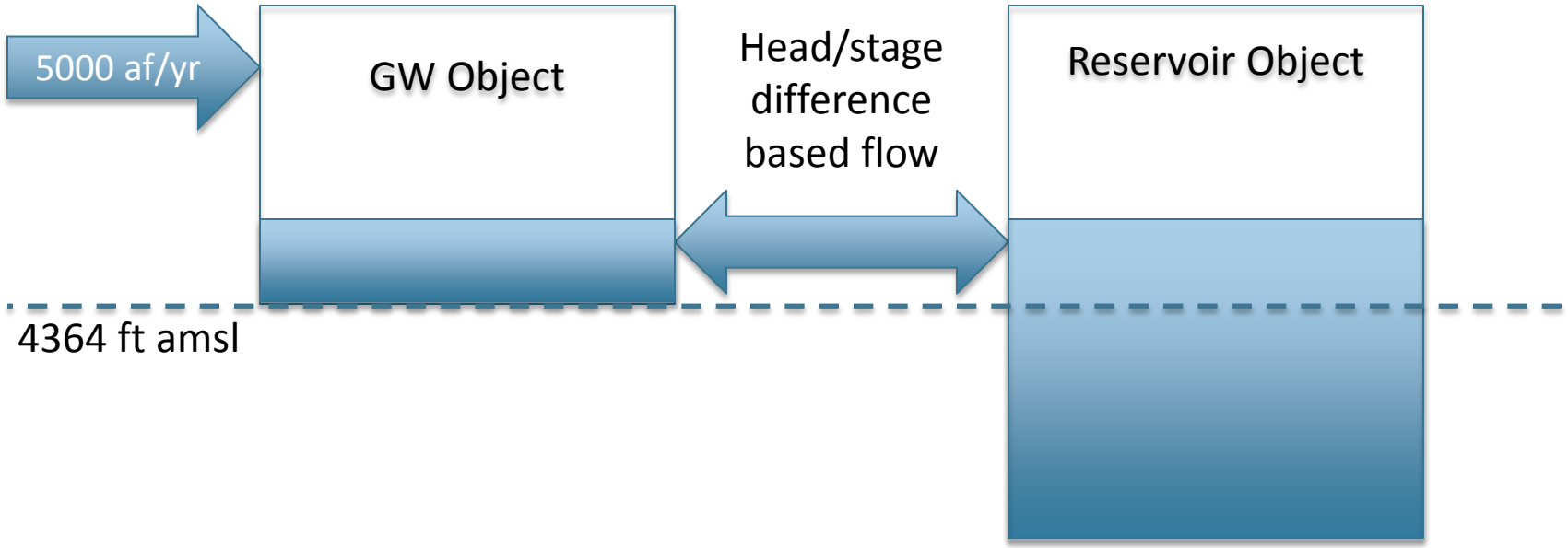
SM2EB: Conceptual Model of Potential Sources of Unaccounted Gains/Losses



Implementation in RiverWare:

- Sediment Accounting: 'Time Varying Elevation Volume' Sediment Calculation method enabled in Reservoir Object
- Bank Storage: CRSSBankStorageCalc bankStorageCalcCategory method enabled in Reservoir Object
- Ungaged SW Inflows: Expression Slot RPL code in a table object linked to Local Inflow
- Ungaged GW Inflows: Problematic….

San Marcial to Elephant Butte: Desired GW-SW Relationship

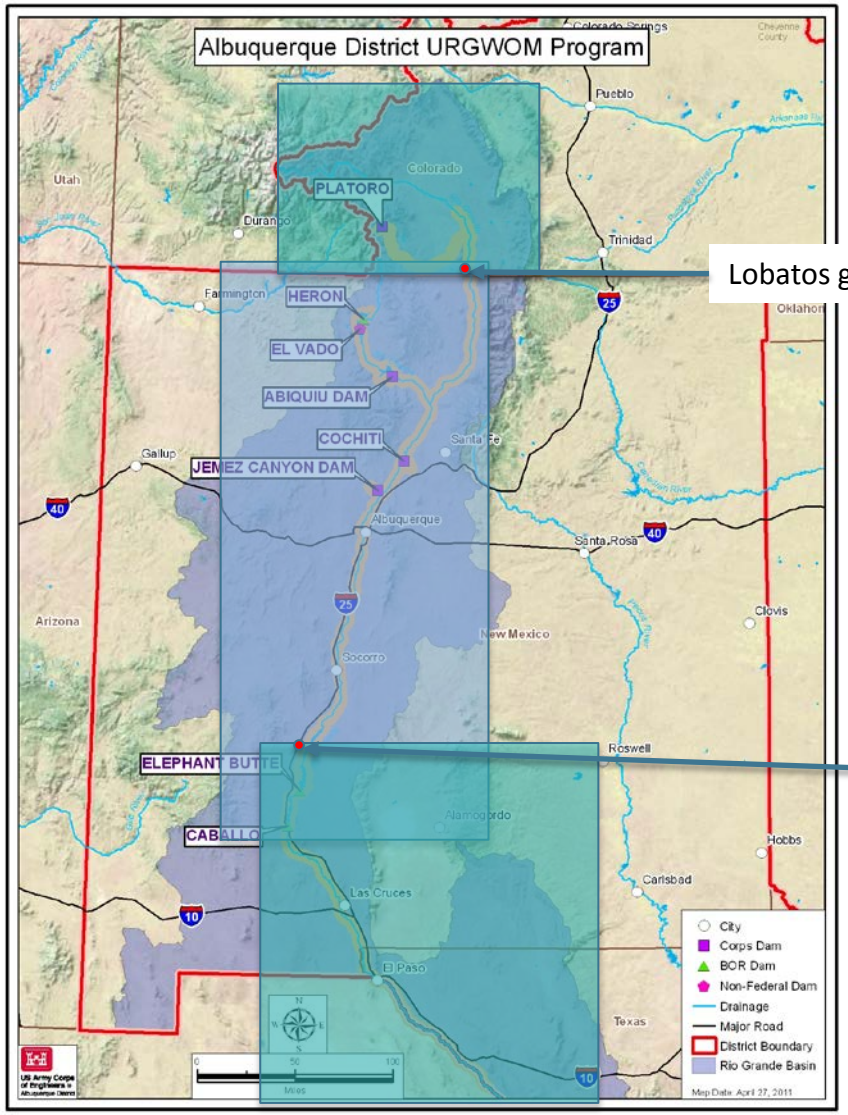


The Problem(s) in RiverWare:

- (Can't directly connect a gw object to a reservoir, so would need to add a seepage reach upstream of the reservoir. GW object would have to be filled by river flows, not stored water, but shouldn't matter.)
- GW Objects are not and cannot be limited to positive storage values. So when reservoir stage falls below base of gw object, flow from gw object increases with head/stage difference and gw object storage goes negative.

URGWOM: Spatial & Temporal Development Plans

1. Combine Upper, Main, Lower Models



Lobatos gage

Colorado Portion
Daily timestep
(relatively new)

Current
"URGWOM"
Daily timestep
(mature)

San Marcial Gages
Elephant Butte & Caballo

Lower RG
Daily timestep
(relatively new)

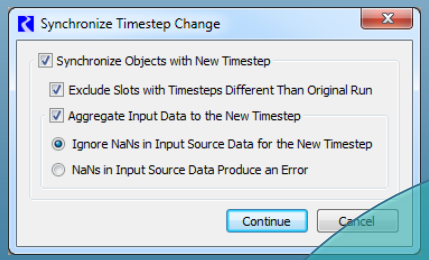
2. Automated conversion to monthly timestep

3. Real time operations & forecasts

URGWOM: Daily to Monthly

RiverWare Changes

- Data Aggregation ✓
- Simulation Methods ✓
- Object Level Accounting Methods ✓



URGWOM Base Changes

- Rules Generalization
  - Initialization ✓
  - Expression Slot ✓
  - Utility Groups
  - Policy Groups
- Lags (Hyp. sim & rules logic)
- GW Parameters??
- Table series slots initialize

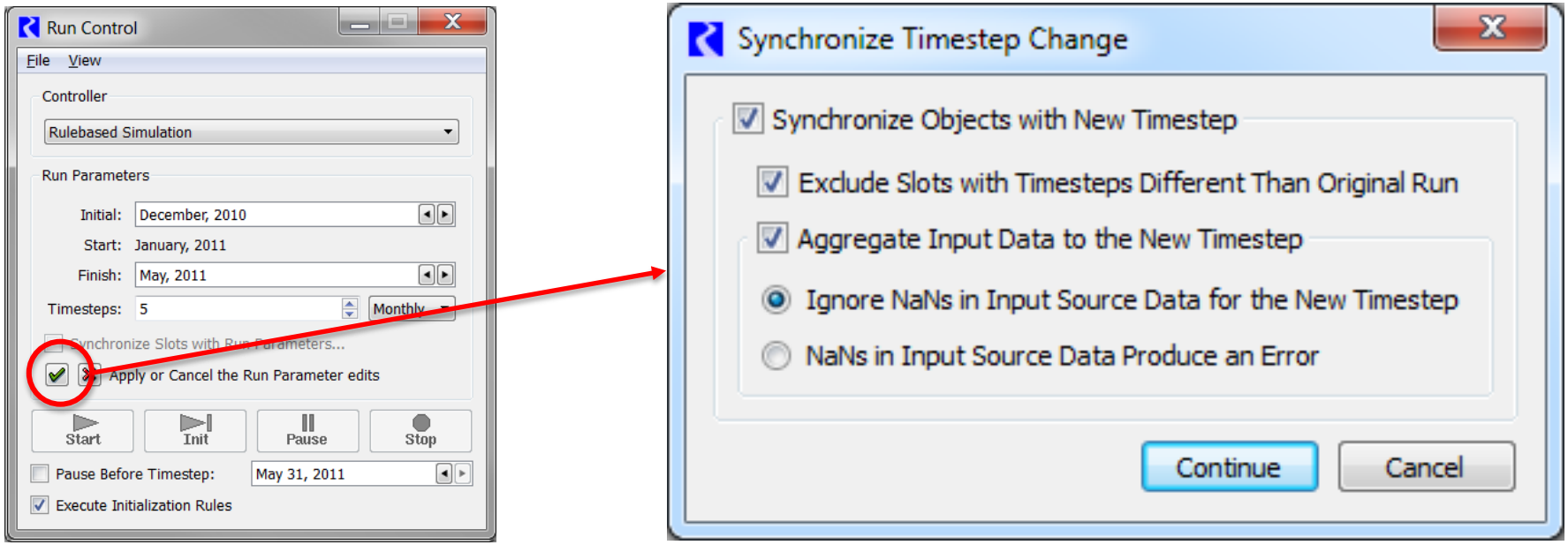
Changes for Automated Conversion

- Set lag times (& gw parameters?) using initialization rules or scripts
- Default data aggregation method override (e.g. Begin Year Allocation & Carry Over) (or re-do of logic associated w latter two)
- Table series slots rework

URGWOM daily to URGWOM monthly with a few mouse clicks

Automated Input Data Aggregation Methods:

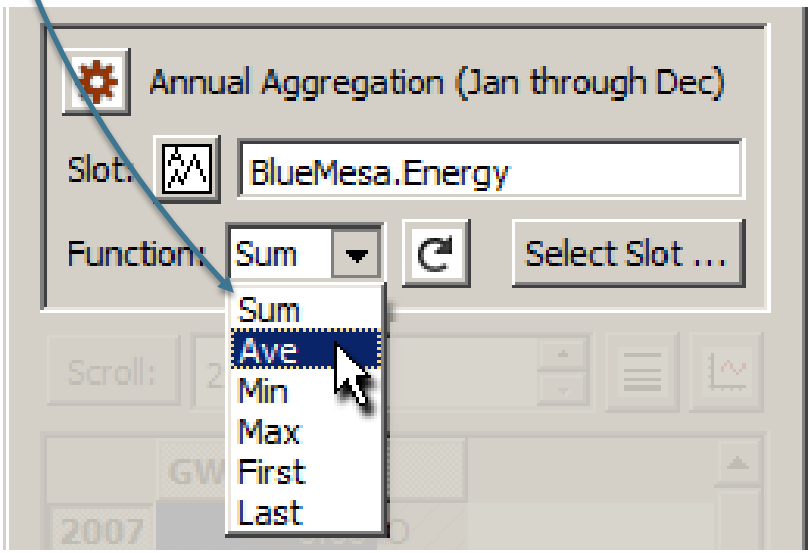
- New RiverWare functionality designed to facilitate input data aggregation triggered from the Run Control dialog:

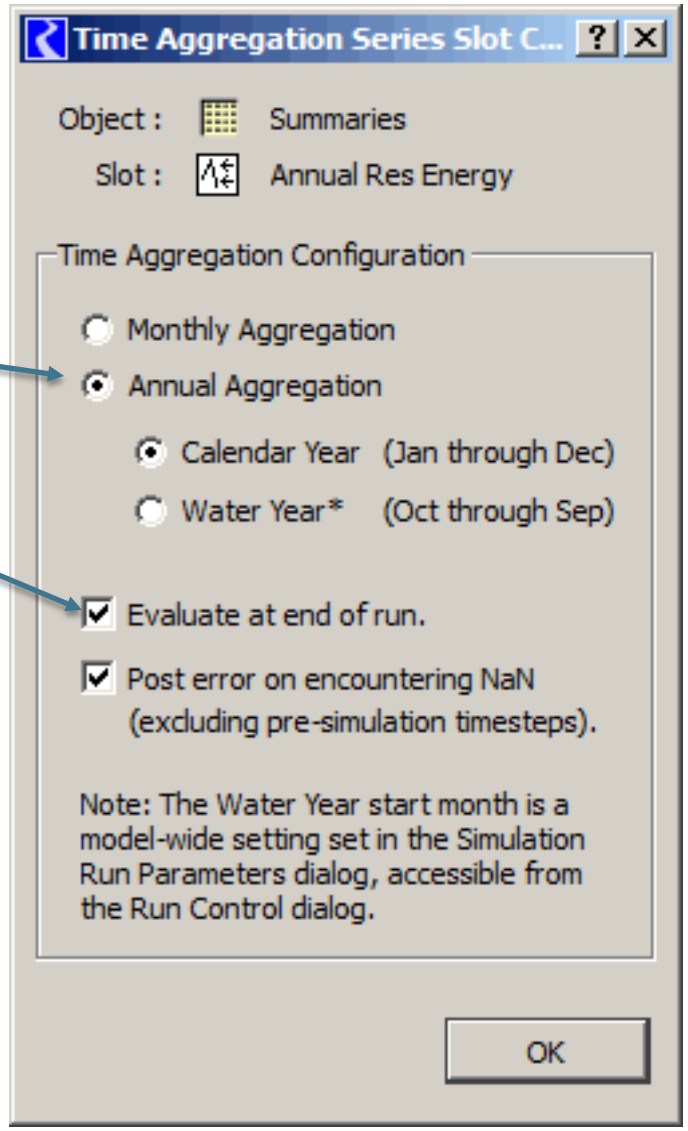


- Input data aggregation method depends on slot unit.
  - Sum for Energy & Mass
  - Last for Area, Length, Volume, or unitless
  - Average for all others
- Potential enhancement for slot specific default method override

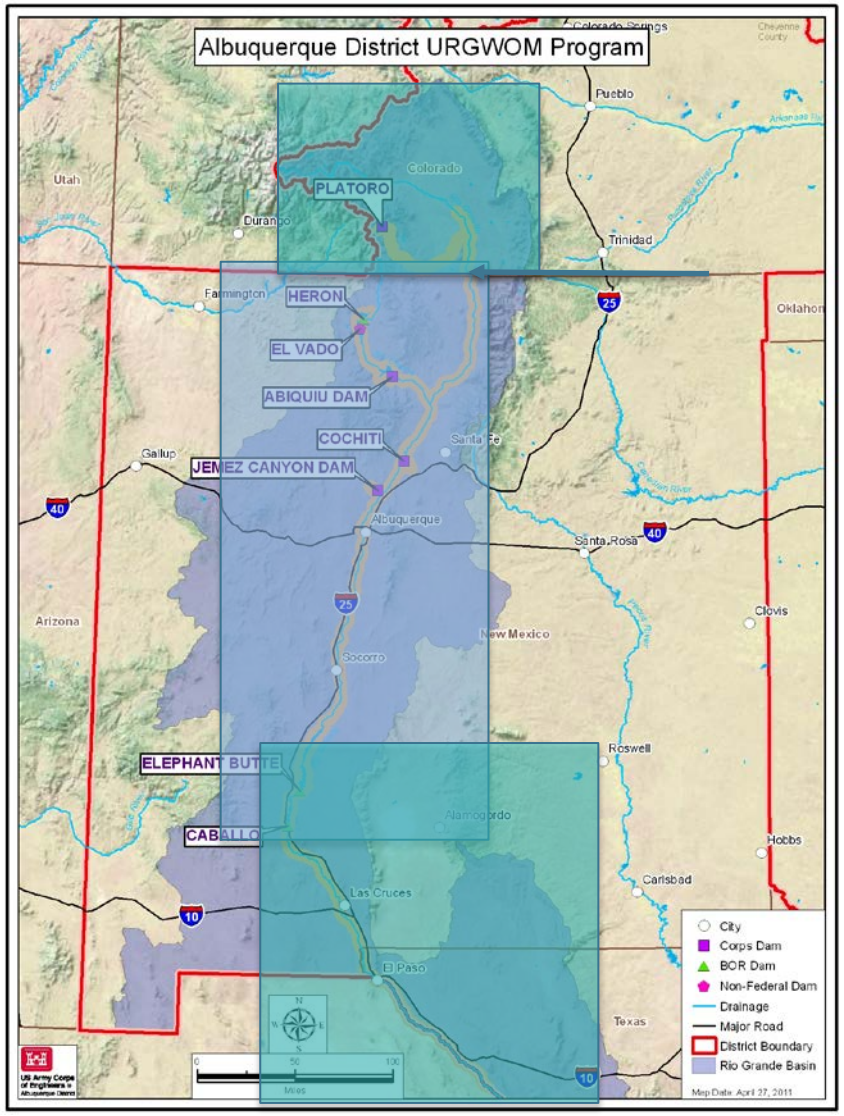
Time Aggregation Series Slots:

- A special series slot that temporally aggregates another series slot
- Aggregation method chosen by the slot creator during configuration
- Can aggregate to Monthly or Annual, the latter either as Calendar or Water year
- Aggregation can be delayed until the end of the run.





Questions? Comments?



Colorado Portion
Daily timestep
(relatively new)

Current
"URGWOM"
Daily timestep
(mature)

San Marcial Gages
Elephant Butte & Caballo

Lower RG
Daily timestep
(relatively new)

Accounting
Operations planning
Long term planning
- Daily timestep
- Monthly timestep

Real time forecasting