BUREAU OF RECLAMATION

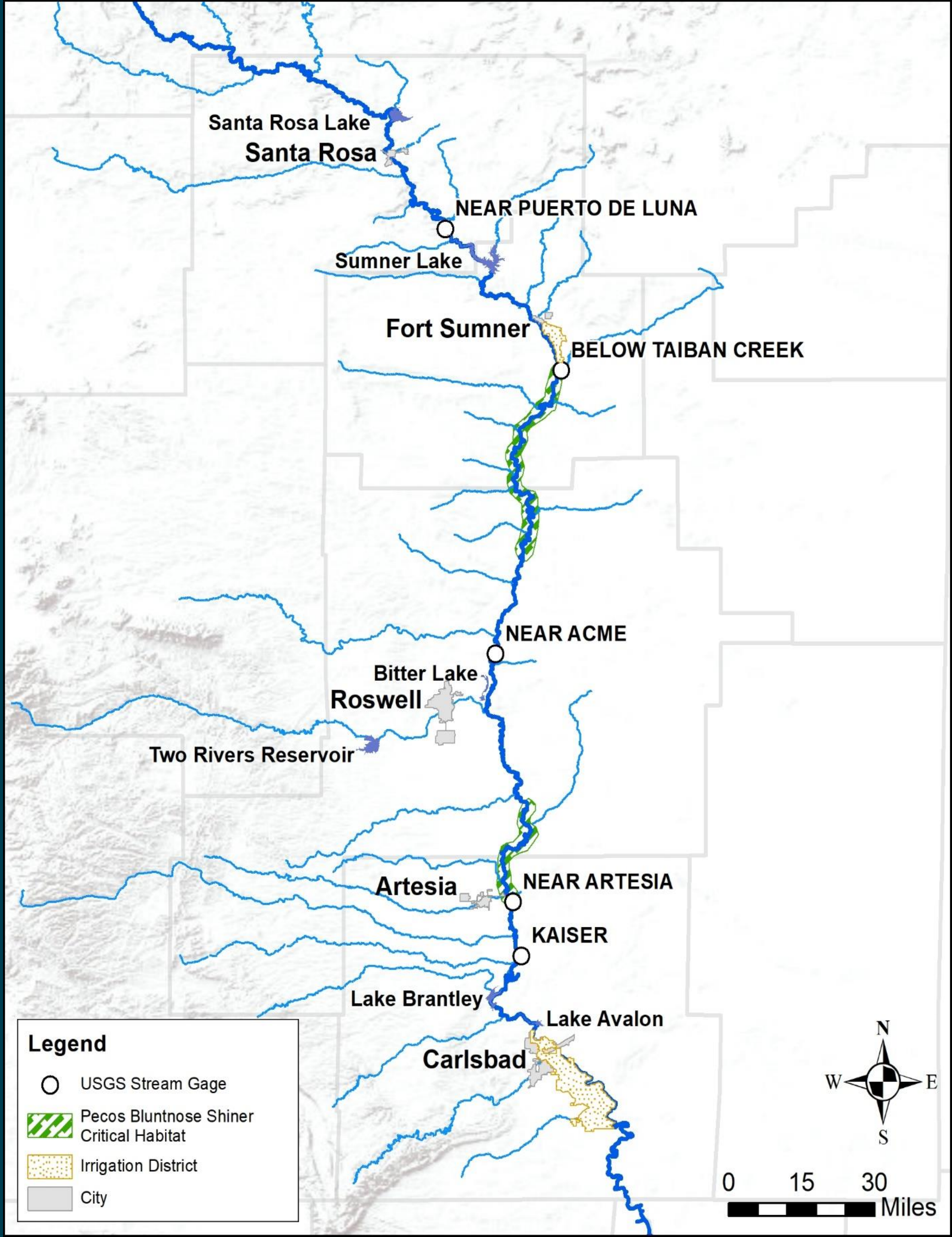
Calculating Depletions from ESA Actions on the Pecos River

2025 RiverWare Users Group Meeting

Lucas Barrett - USBR

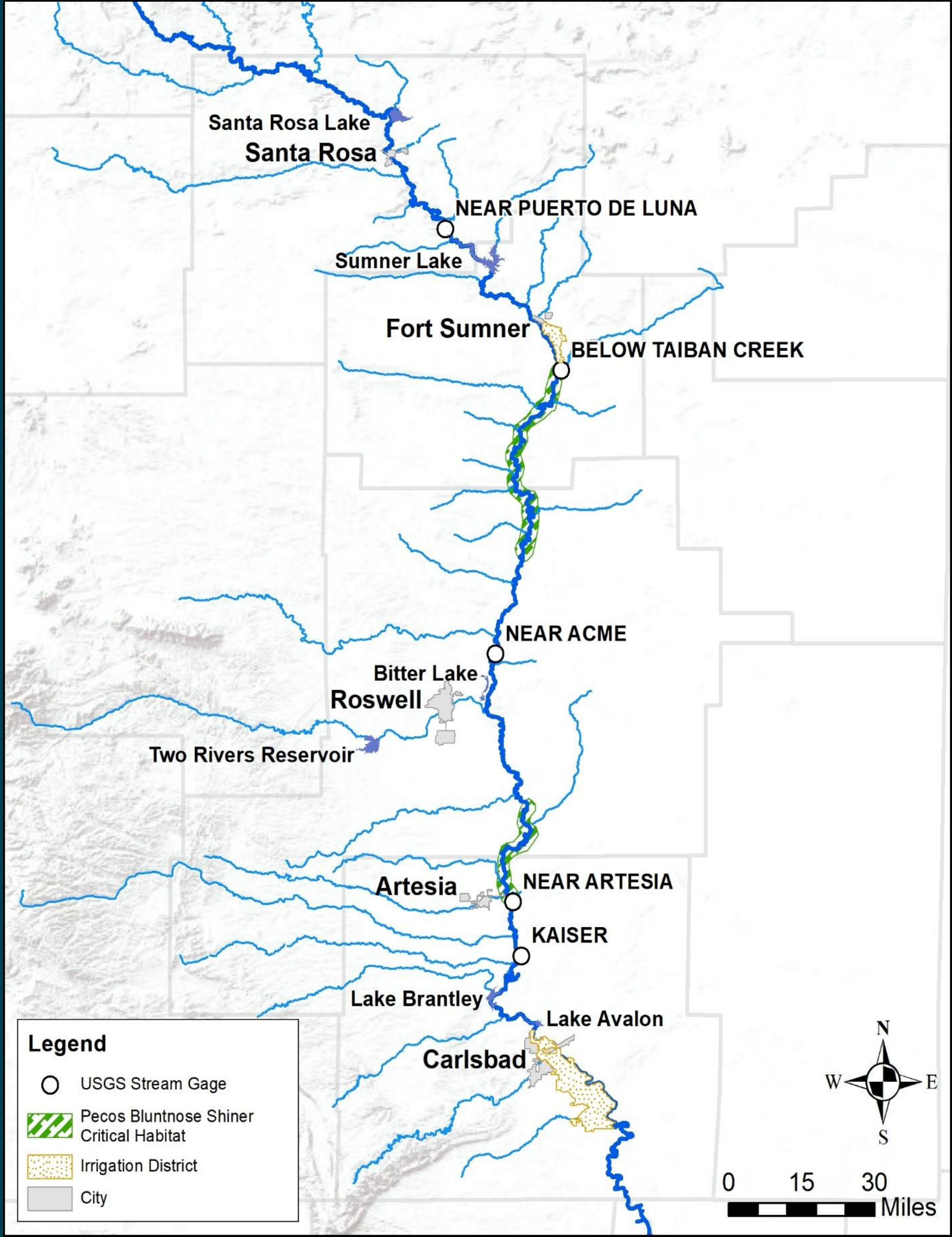
Why is for Depletions Accounting needed?

- The Pecos Bluntnose Shiner (shiner) was federally listed as a threatened species, and critical habitat designated, in 1987.
- Reclamation is required to avoid "take" on shiners.
- The <u>actions</u> taken <u>must not decrease</u> the water supply of the Carlsbad Project.

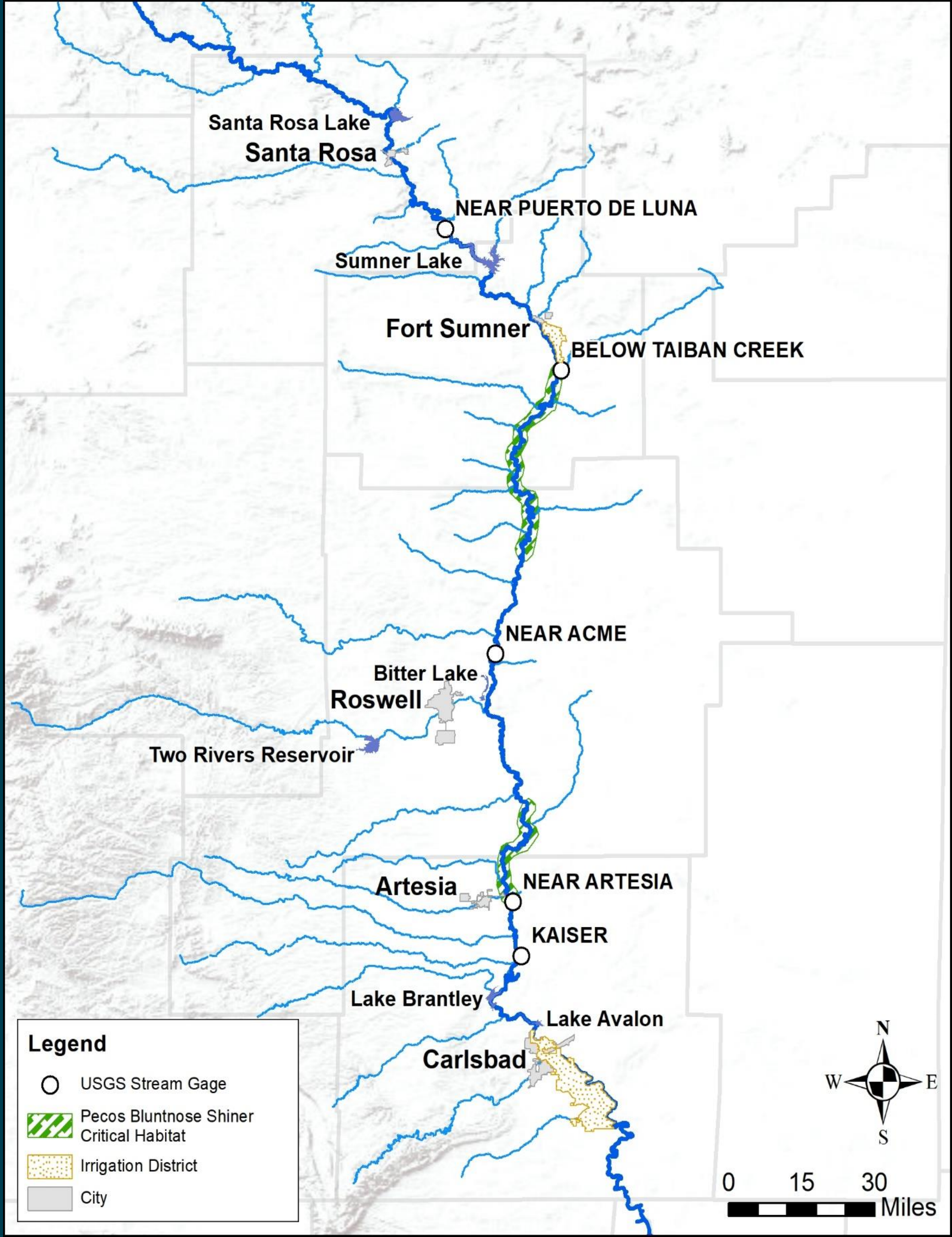


What does this mean for Reclamation?

- Reclamation releases water from Sumner Reservoir to keep the river wet during:
  - Non-block release periods
  - High temp, low flow periods
- This causes <u>depletions</u> to the Carlsbad Project water supply.
- To offset the depletions from ESA actions, Reclamation purchases water or leases land to be fallowed.

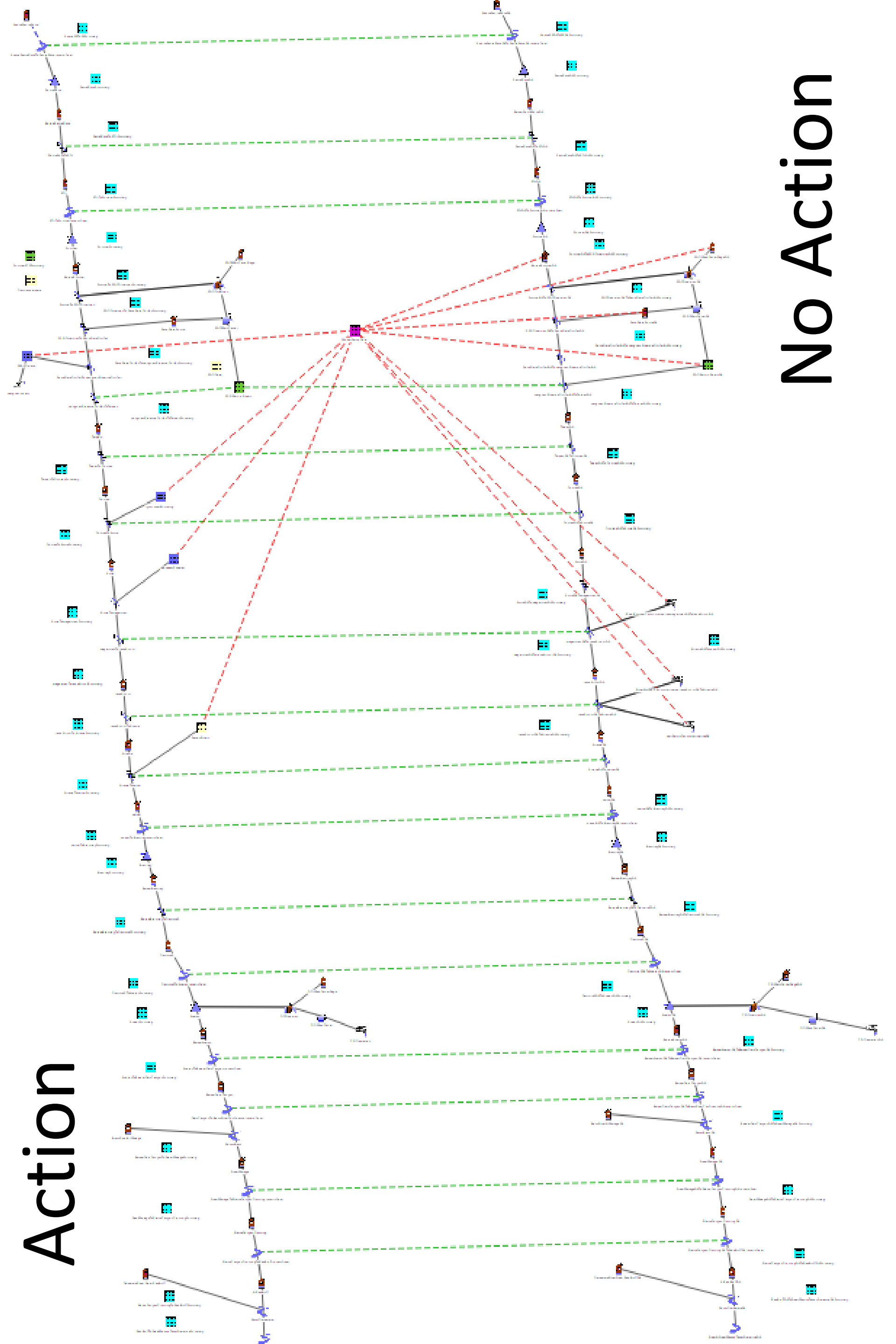


The issue is, how do we know we are doing enough (or possibly more) to completely offset the depletions?



Depletion Accounting Over the Years

- 1999 to 2002 – Borough's RiverWare model
- 2003 to 2005 – 50% Accounting Method (Assumed Reclamation releases were 50% efficient compared to 75% for block release)
- 2006 to 2016 – Multiple iterations of the Depletions Accounting Spreadsheet
- 2017 to 2022 – Two-Stream Depletions Model



Why Develop Another Method?

- The Two Stream Depletions model was:
  - Difficult to understand
  - Confusing to set up
  - Likely inaccurate (black box)
  - Found issues when digging into it

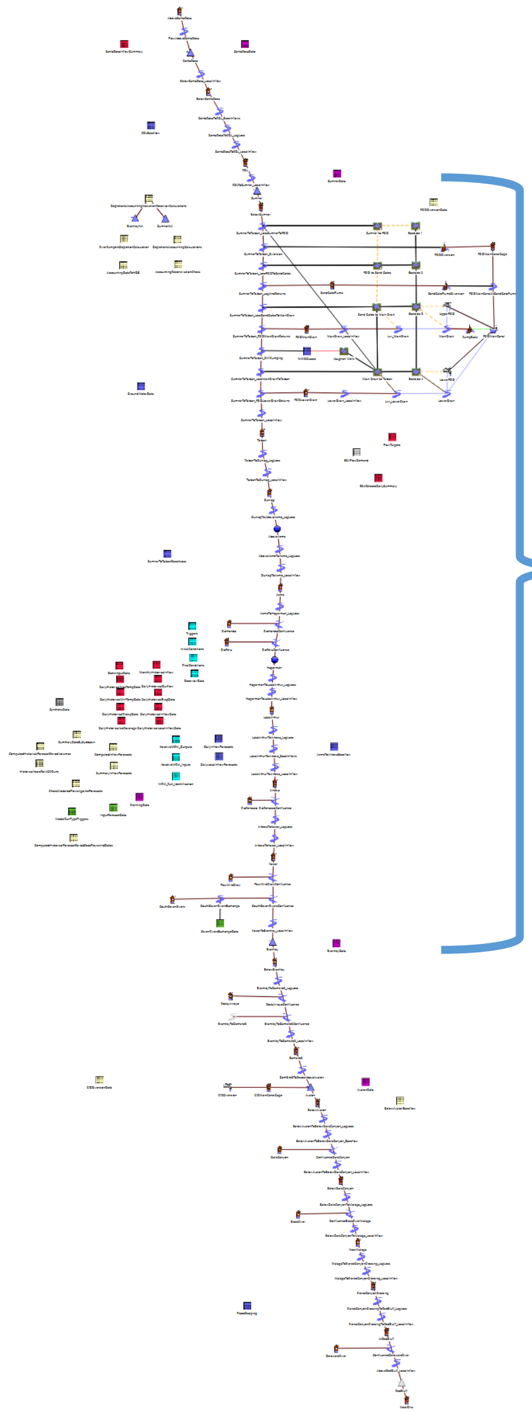
- Reclamation hired a contractor (WEST) to examine the model and document what was discovered and their recommendation.
  - Based on their findings and the issues that we came across it was agreed that a better way to calculate depletions was needed.

How We Decided on a “New” Model

- Three main criteria:
  - Easy to use
  - Easy to understand (both for user and stakeholders)
  - Provide accurate results
- Decided on adding to the Pecos RiverWare Operations Model (PROM).
  - Daily operations data are already being tracked in this model regularly, although no accounting was developed.
  - Most of the Pecos Hydrology workgroup was already familiar with this.
  - Allows us to keep everything within one model.
- Worked with Carlsbad Irrigation District and New Mexico through the entire process

Implementation into PROM

- 7 accounts added
- Need the accounts to work with Muskingum Cunge physical routing
- Calculate credits from fallowing land from river pumpers
- Simulate reservoirs for a “no action” scenario
- Calculate total net depletion



Sumner to Brantley Reservoir

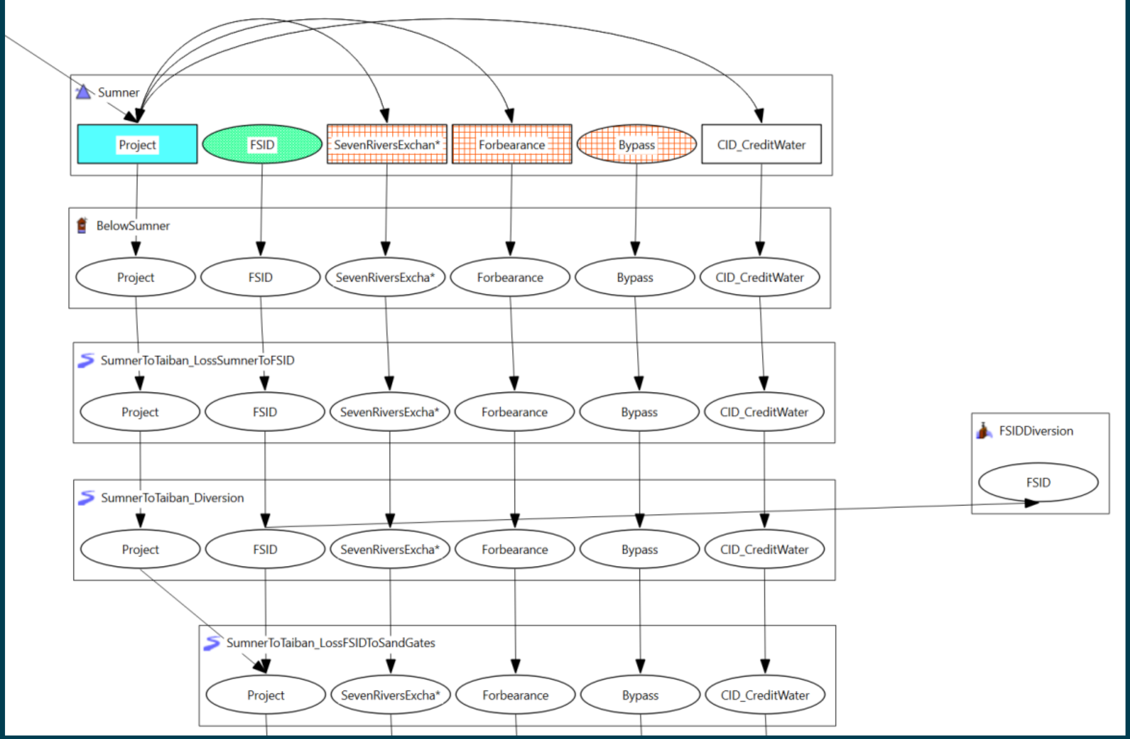
Implementation into PROM - Accounts

2 accounts for irrigation districts:

- Carlsbad Irrigation District (Project)
- Fort Sumner Irrigation District

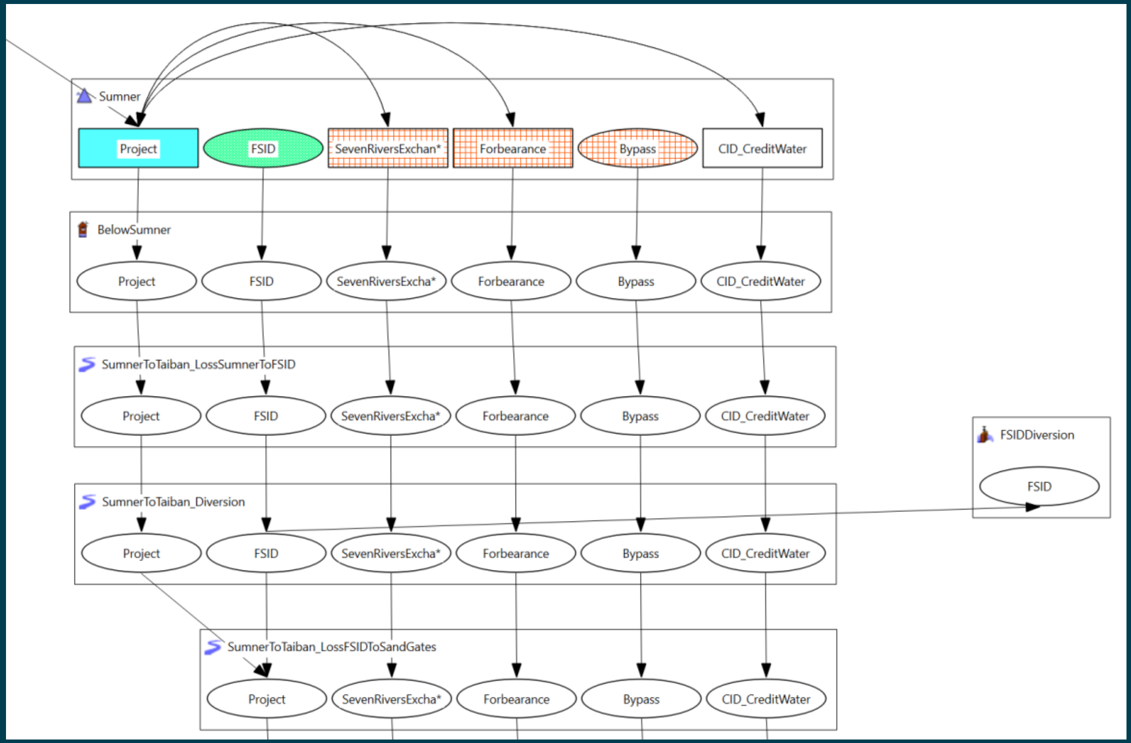
5 accounts for different ESA water:

- Bypass (main source of depletion)
- Fish Conservation Pool
- Forbearance
- Vaughan Conservation Pumps
- Credit



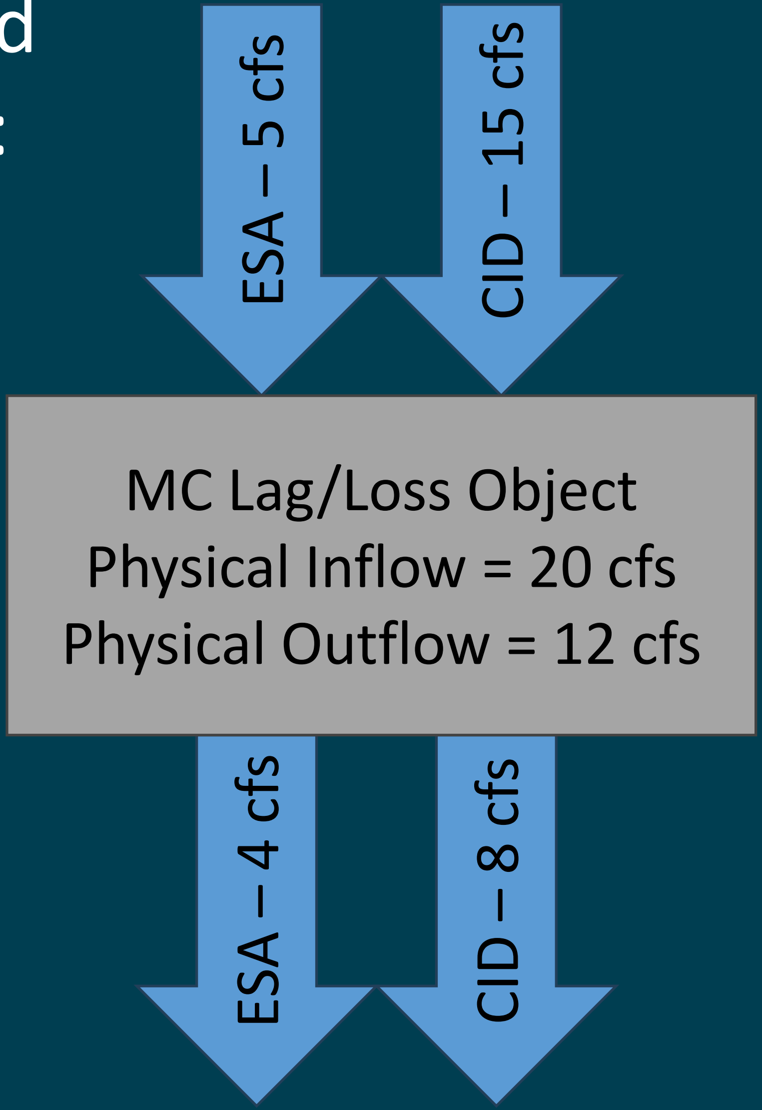
Implementation into PROM - Routing

- More difficult than expected.
- No ability to route accounts using Muskingum Cunge.
- Created accounting methods to simulate routing based on mass balance analysis.



Routing Implementation Overview

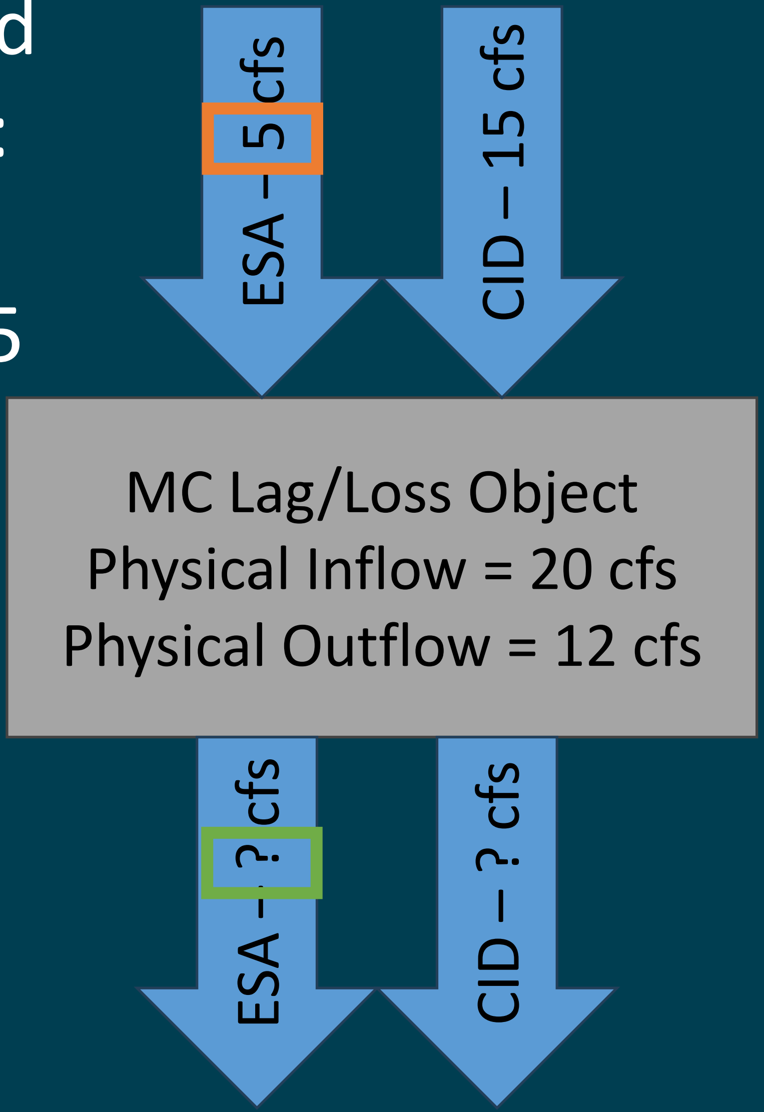
Simplified Example:



- Sum the total inflow, subtract total outflow, add gains/losses for each account to date.
- The remaining balance is the water that needs to still go through the object for each account.
- Proportionally split accounts by the balance to the physical outflow.

Routing Example – ESA flow

Simplified Example: For January 5

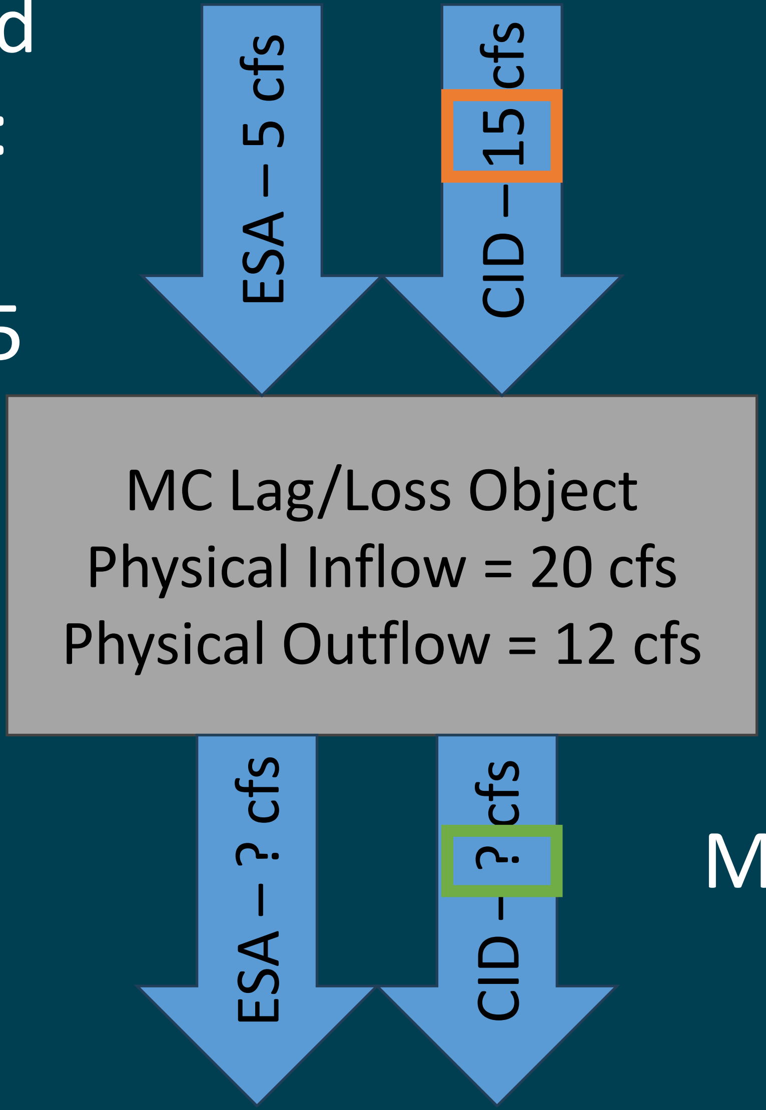


	ESA Inflow	ESA losses	ESA outflow
1-Jan	20	-1	12
2-Jan	20	-1	17
3-Jan	10	-1	13
4-Jan	10	-1	11
5-Jan	5	-1	?
Sum	65	-5	53

Mass Balance -> 65 + (-5) – 53 = 7 cfs

Routing Example – CID flow

Simplified Example:
For January 5

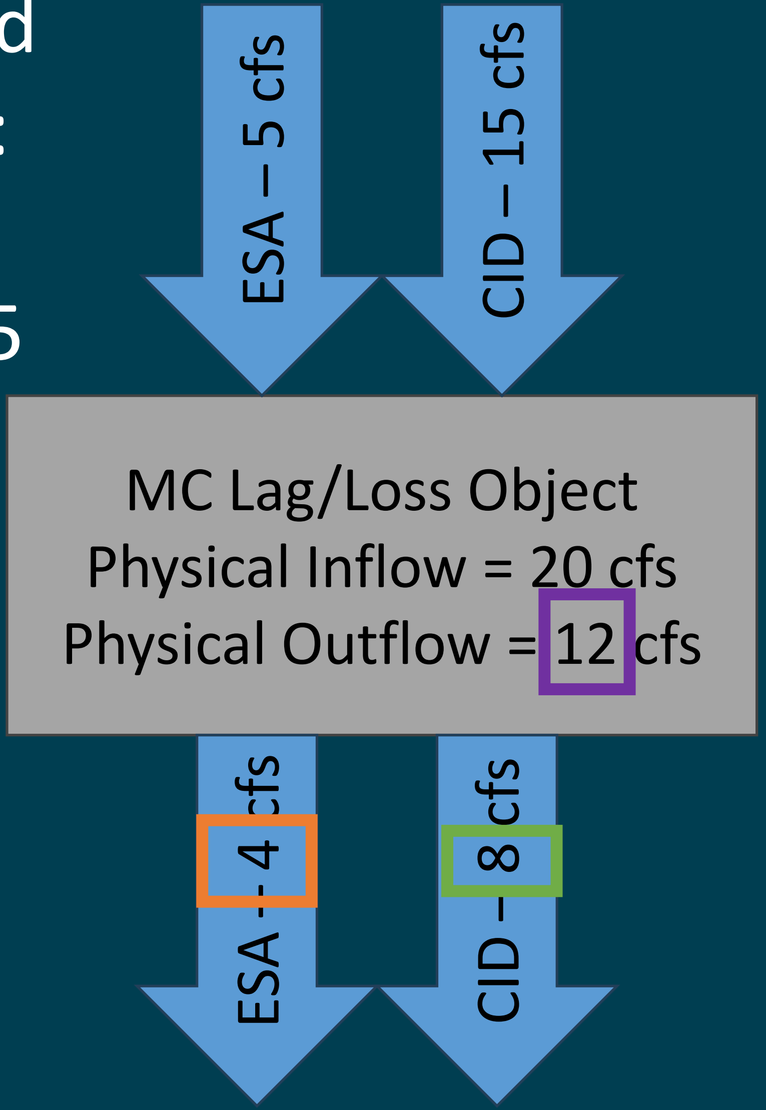


	CID Inflow	CID losses	CID outflow
1-Jan	30	-1	20
2-Jan	50	-1	45
3-Jan	50	-1	52
4-Jan	30	-1	39
5-Jan	15	-1	?
Sum	175	-5	156

Mass Balance -> 175 + (-5) – 156 = 14 cfs

Routing Example – Final Calculation

Simplified Example:
For January 5



ESA water remaining = 7 cfs
CID water remaining = 14 cfs
Physical Outflow = 12 cfs

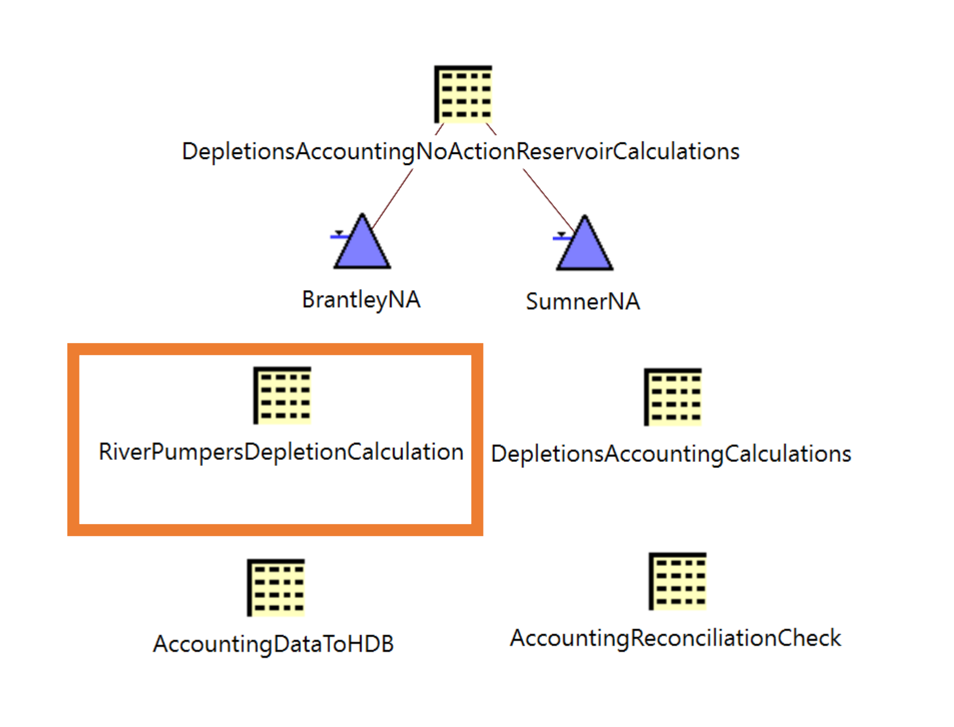
ESA outflow = 12(7/(7+14))
ESA outflow = 4 cfs

CID outflow = 12(14/(7+14))
CID outflow = 8 cfs

Implementation into PROM – River Pumpers

- Created object to calculate estimated water saved by Reclamation paying for fallowing of land by river pumpers or by farmers releasing more water back into the river.

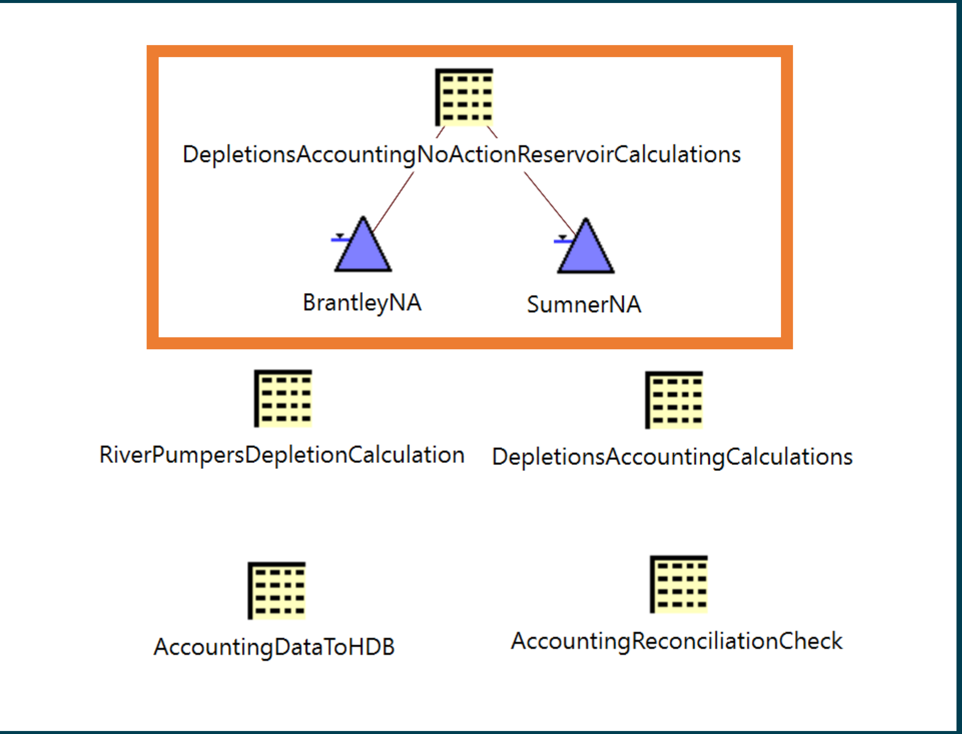
- Calculated using:
  - Acre-ft leased by acreage
  - Estimated/agreed upon CU
  - Interpolated loss rates from river pumpers to Brantley



Implementation into PROM – No Action

- Created “No Action” reservoirs to calculate depletions if there were no ESA actions.

- Utilizing the accounts on the operations (“Action”) side of the model, a mini-simulation can calculate what Sumner and Brantley content would be if there were no ESA actions.



Implementation into PROM - Depletions

- The Depletions Account object then has all the data needed to calculate the Depletions using the following equations:

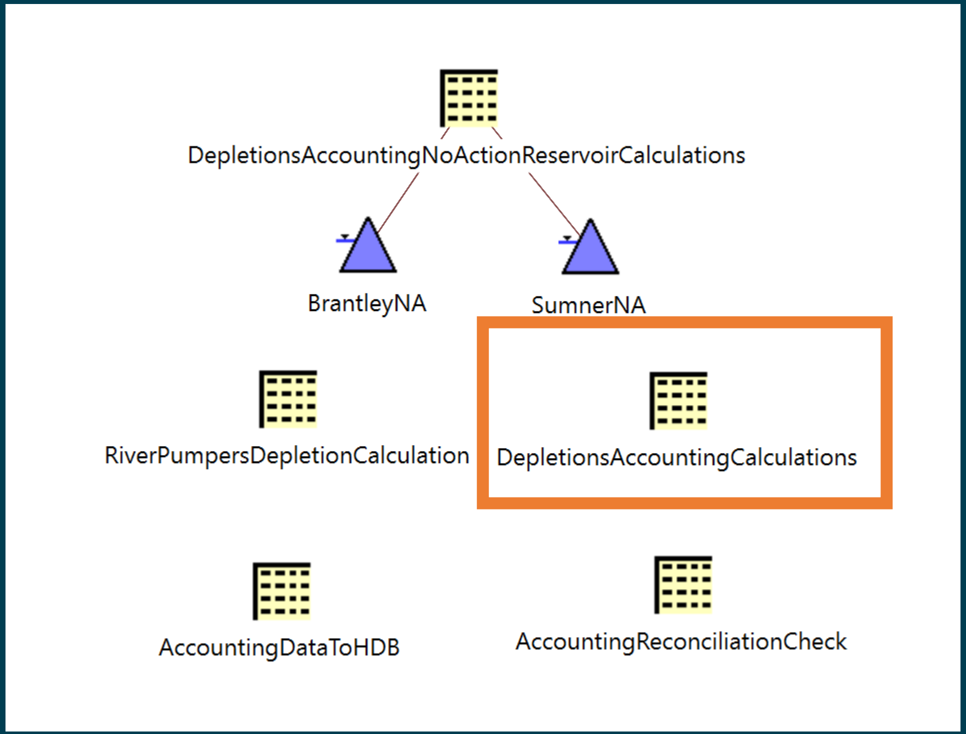
(Sumner Storage Action – Sumner Storage No Action) * 0.75 +

(Brantley Storage Action – Brantley Storage No Action) +

(Brantley Bank Storage Action – Brantley Bank Storage No Action) +

River Pumper and PVACD Lease Credit +

Leftover FCP water in Sumner * 0.75



Questions?

Contact:

Lucas Barrett

lbarrett@usbr.gov

USBR – Albuquerque Area Office - WMD