To: URGWOM Technical Team Members
Date: August 31, 2021
Subject: Notes of the August 10, 2021 URGWOM Technical Team Meeting

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These notes summarize the items discussed during the August 10, 2021 Upper Rio Grande Water Operations Model (URGWOM) Technical Team meeting. The meeting began at 9:00 am and was conducted as an on-line collaboration hosted by the Corps of Engineers using the Corps' WebEx account. All those participating in the meeting introduced themselves and their names and affiliation are listed on the last page of these meeting notes.

This month's meeting agenda topics include reports on the development and calibration of the deep aquifer objects, the July, 2021 Tech Team field site visits, the update of the URGWOM database, simplification of the Colorado portion of URGWOM, model modifications to separate the Lower Rio Grande portion of the model when not needed, simplified Lower Rio Grande demand, adding the Santa Fe River (City and County) system to the model and RiverWare updates and enhancements.

Phil reported that the solicitation for candidates to fill Marc Sidlow's position has closed and it is anticipated that the position will be filled by the start of the Fiscal Year (October 1st).

Nick provided background information on the development and calibration of Deep Aquifer Objects (DAO) in URGWOM where deep aquifer heads from MODFLOW models are replaced with 100 DAOs in the Middle Rio Grande and 88 in the Lower Rio Grande. Data (aquifer parameters, average heads, recharge and pumping data) from four MODFLOW models (Albuquerque Basin, Socorro Basin, Mesilla Basin and Hueco Bolson) were extracted into the URGWOM DAOs. The Middle Rio Grande was calibrated using PEST (Parameter Estimation and Uncertainty Analysis), and the Lower Rio Grande was calibrated by hand over a 20-year period. The calibration targeted deep and shallow aquifer heads and river channel and riverside drain conductivity. The parameter data statistics were collected and evaluated. Surface flow calibration was satisfactory however Nick suggested that the calibration of groundwater parameters could be improved by evaluation of a mass balance of cells between models. Nick also recommended that additional work to organize GIS data sets be undertaken, that the Lower Rio Grande should be calibrated using PEST and additional head data should be extracted from the Mesilla Valley model. The final step would be to incorporate the DAOs into the official model.

In follow-up to Nick's presentation, the Tech Team discussed the change in run time due to implementation of the DAOs (not yet evaluated), the requirements for additional DSS file inputs (e.g., aquifer pumping and recharge) and the simulation of pumping from irrigation wells (already incorporated in the simulation of shallow groundwater-surface water interaction). The implementation of the DAOs into the official model is scheduled to be completed by the end of 2022.

Katie Markovich (Intera) reported on the QA/QC review of the DAO calibration. Overall, the calibration method is based on a defensible approach, with the URGWOM and MODFLOW models matching trends and flow directions; there are no major concerns (refer to May, 2021 Intera Report). The QA/QC review recommendations include performing a mass balance flux comparison between URGWOM and MODFLOW. Katie presented a plan for the mass balance study approach which is currently underway. The study is intended to answer the following questions: do the URGWOM and MODFLOW mass balances compare and are there calibration parameters that unreasonably affect the mass balance?

Other recommendations from Intera include fixing the DAO and shallow groundwater naming conventions to make them consistent, change the DAO areas and inflows (if the large DAO areas are boundary conditions, then these should be documented). The assumptions used in extracting the aquifer properties into URGWOM should be described. The groundwater heads in the DAOs should match the MODFLOW model heads and Hydros is updating the calibration to ensure that there is a reasonable match. The calibration statistics should be reviewed to address errors in contradictory slope in the aquifer head v. time curves. The lateral / longitudinal flows between objects / cells match well between the models (URGWOM and MODFLOW). In response to a question, Katie reported that the shallow aquifers are being simulated as unconfined aquifer and the DAOs are simulated as a confined aquifer, or more like a leaky confined aquifer. Phil stated that the Hydros DAO implementation report and the Intera QA/QC report will be posted on the URGWOM myUSGS web page.

Miller reported on the July 13-14, 2021 URGWOM Technical Team field inspection trip of MRGCD irrigation facilities. Thirteen individuals participated on the trip, including Anne Marken and Matt Martinez of the MRGCD. A total of nine locations in the Corrales to Isleta reach were inspected on day one and nine locations in the Belen to Bernardo reach were inspected on the second day. All participants were provided a trip itinerary of sites inspected and a .kmz file of the location of each site. With the exception of the Isleta Diversion Dam, all sites visited are locations where water is returned to the Rio Grande (drain outfalls or wasteways). The purpose of the trip was to gather information and to become familiar with the MRGCD facilities and to obtain an understanding about how each facility operates and its function within URGWOM. During the visit to the Upper Corrales Riverside Drain outfall at the Alameda Bridge, trip participants noted that the Albuquerque Bernalillo County Water Utility diversion, which is located about ½ mile below the Alameda Bridge, is simulated in URGWOM at a location downstream of the Paseo del Norte Bridge. Mike Brown reported that he has reviewed the URWOM documentation and he was unable to uncover a reason for this discrepancy; perhaps Nabil could provide some assistance on this matter. There were other takeaways from the field inspections concerning the reliability of records from individual gaging locations, which are summarized in the Inspection Trip Report which has been uploaded to the myUSGS web page.

Mike reported on the update to the URGWOM database, in which 1,000 of the total 1,300 data elements were updated through 2019. This update supersedes the May, 2020 database update, however the files that will become obsolete with the implementation of the DAOs were not updated. Some data on Colorado diversions were not updated as these data have not yet been posted on the Colorado State Engineer web page. The database catalog (.xls spreadsheet) of metadata was also updated to assist in the future database updates. Mike suggested that the periodic or constant coefficients that do not change do not need to be stored as daily data. This would not result in a significant reduction in file size but would reduce the database complexity. The coefficients could be imported to the model using methods. Mike projected the database to grow about 5-10 MB per year into the future. Mike's recommendations include the regular (annual) update of the database including data QA/QC and to update the MRGCD irrigated acreage based on an inventory or survey of these lands.

Lucas reported to the Team on the work Reclamation has performed on the incorporation of the Santa Fe River system into the URGWOM model. This build out has been completed and has been documented, which will be shared with Tech Team members. The Santa Fe River system add-on was developed to help Santa Fe with their study of the Buckman Diversion return flow alternatives and will also be included in Reclamation's Rio Grande Basin Study. The additions to the model are intended to simulate the Buckman Direct Diversion return flow (pipeline or Cochiti Lake exchange), the operation of the two city Reservoirs, diversions by Acequias from the Santa Fe River, the City's "Living River" releases from the Reservoirs and the Buckman Diversion demand from the Rio Grande. New objects added to the model include: the Buckman Direct Diversion return flow (Cochiti exchange is to the Cochiti Recreation Pool account), a return flow object (effluent pipeline to Rio Grande at Buckman Diversion), a constant diversion object (Buckman) and the Santa Fe River (reservoirs, Compact Accounting and Acequia operations (with a "master switch" to turn this object on or off). There are no reservoir methods or accounts and both reservoirs are combined into a single facility to simplify the system. Lucas presented a series of hydrographs displaying initial model run results for each alternative. The model documentation will be release in the next few weeks. Cindy requested that Lucas ensure that the pre-compact storage in McClure Reservoir is considered in the model simulation.

Lucas reported on recommendations to simplify the Colorado portion of the model. He suggested that the purpose of the simulation of the Colorado portion of the model is to compute Compact delivery obligations, but since the state of Colorado is not using the model, the number of water right diversions simulated in the model could be reduced. He further added that in some years, manual adjustments to the model are required to ensure that the Colorado delivery obligations are properly simulated. Nick suggested that the Compact delivery obligations are based on upstream forecasts and that a script could be added that would turn off the water right solver if it is not required.

Lucas reported to the Team on his proposal to modify the script that would disable the Lower Rio Grande portion of the model when it is not in use in order to reduce run time. He will also add a simplified release demand schedule for Caballo Reservoir. This matter was discussed during a previous Technical Team meeting. The demand would be based on the December 31st storage in Elephant Butte and Caballo Reservoirs and the January to June inflow forecast. The new method does not account for Elephant Butte or El Paso Water Improvement District #1 supply allocations. This simplified release pattern will be implemented into the Rio Grande Basin Study and Lucas will send documentation on these changes to the Team for their review. Lucas recommended that everybody update the RiverWare model to version 8.3 and he offered to assist with using and updating OpenSSL to those who may require assistance.

David reported on RiverWare enhancements to be found in the version 8.3 update. These updates include development of a scalar data viewer, the ability to undo or re-do SCTs, improvements to the model comparison tool, a new ensemble data tool and script analysis, more compact display of scripts (displays only groups shown in work space) and DMIs for USGS site maps (requires installation of OpenSSL version 1.1.1). Future enhancements to RiverWare include improved "windowing" to preserve and restore model window layouts, which will be released in version 8.4 as a Beta version.

The next meeting of the Technical Team is scheduled for September 14, 2021.

There being no additional matters to be brought before the Team, the meeting was adjourned at about 11:30 am.

ATTENDANCE LIST

URGWOM TECHNICAL TEAM MEETING
August 10, 2021

| NAME | REPRESENTING |
|---|---|
| Phillip Carrillo | USACE |
| William Miller | Southwest Water Design/USACE Contractor |
| Mike Brown | Tetra Tech/USACE Contractor |
| Dave Moeser | US Geological Survey |
| Lucas Barrett | Bureau of Reclamation |
| Michele Estrada Lopez | Bureau of Reclamation |
| Andrew Gelderloos | Bureau of Reclamation |
| Jerry Melendez | Bureau of Reclamation |
| Andrew Gelderloos | Bureau of Reclamation |
| Carolyn Donnelly | Bureau of Reclamation |
| David Neumann | CADSWES |
| Nick Mander | Hydros Consulting |
| John Craven | Hydros Consulting |
| Zhuping Sheng | Paso del Norte Watershed Council |
| Katie Markovich | Intera |
| Guillermo Martinez | Intera |
| Brian Westfall | Keller-Bliesner Engineering |
| Cindy Stokes | NM Interstate Stream Commission |
| Emma Kelly | Bureau of Reclamation |
| Steve Shultz | |
| Bill Schneider | City of Santa Fe |

# URGWOM RiverWare Model

## Aquifer Object Update

Hydros Consulting Inc.

August 10th, 2021

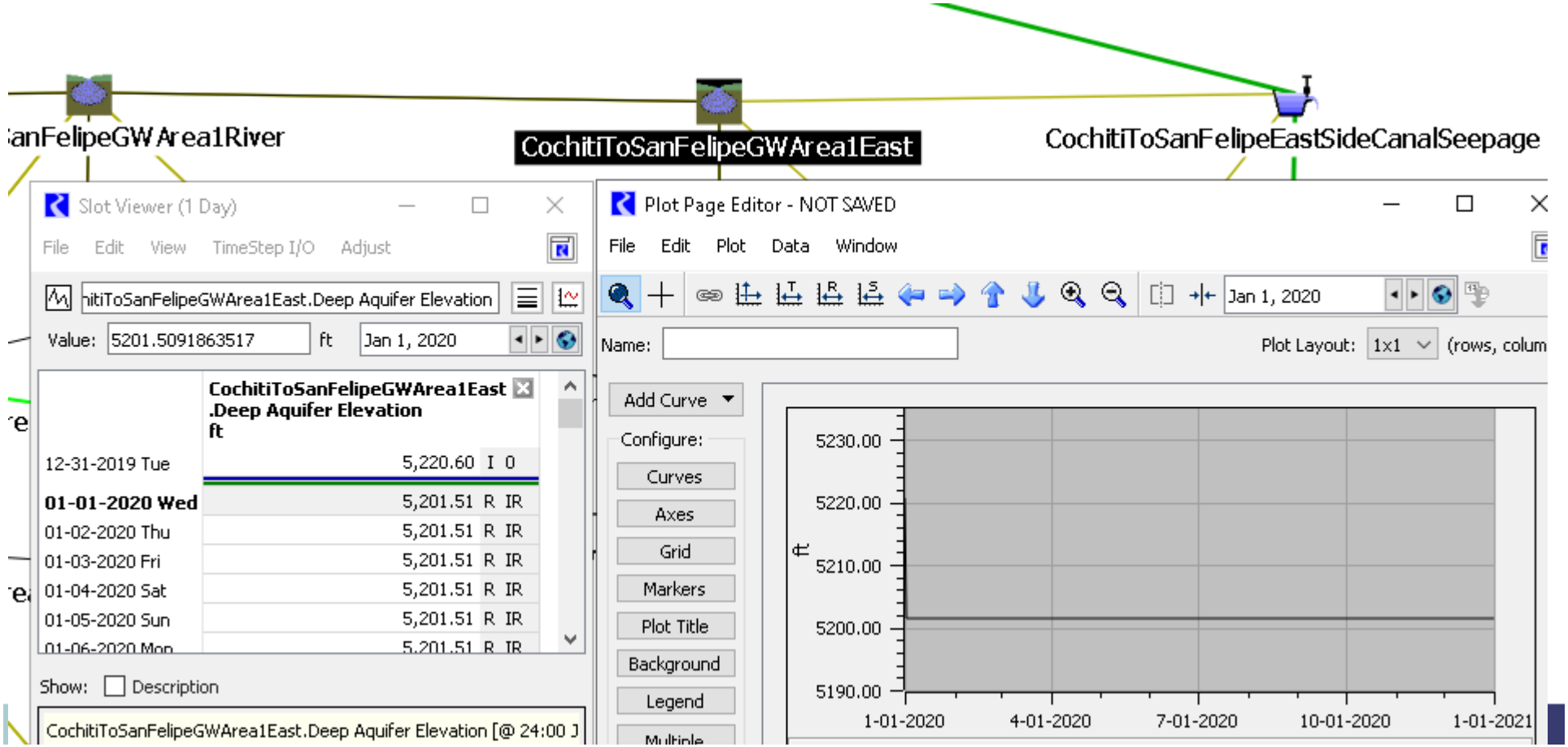
# Outline

Hydros Consulting

1. Background
2. Aquifer Objects in MRG and LRG
3. MODFLOW models used
4. Calibration Process
5. Next Steps

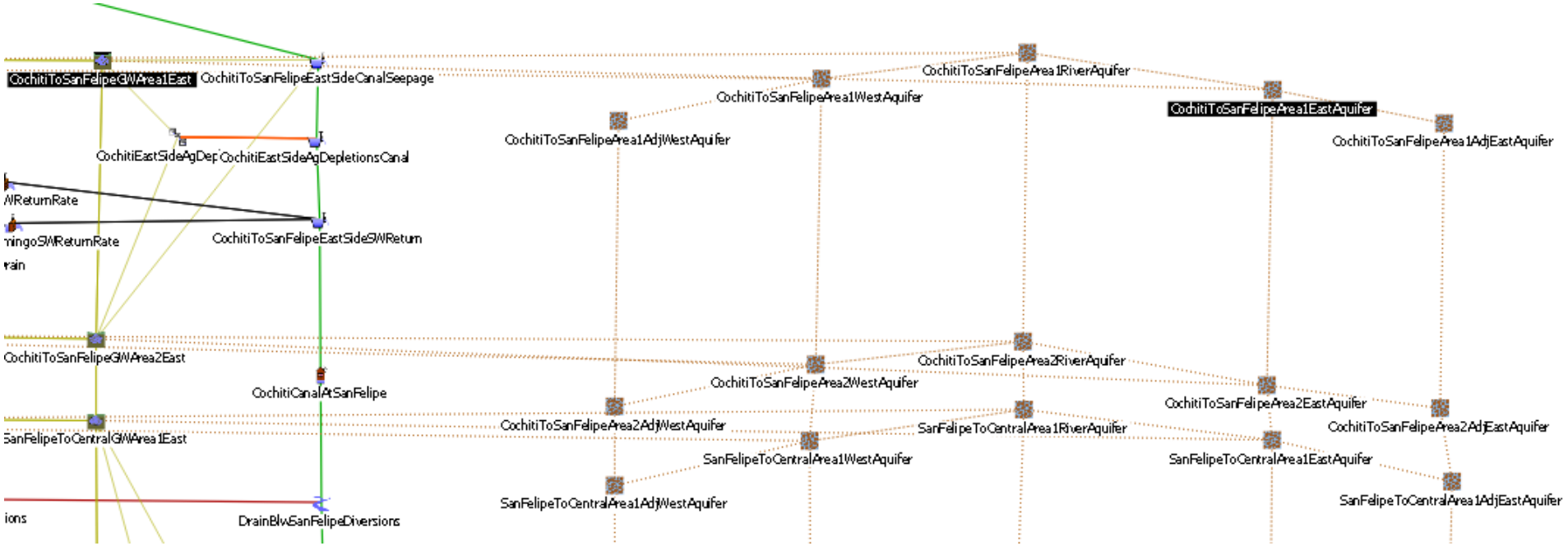
# 1. Background

- Currently in URGWOM, Deep Aquifer Heads are inputs on the Shallow Groundwater Objects.
- These heads are used to compute Percolation to/from Shallow Layer in into a Deep Layer (which isn't explicitly modeled in URGWOM)



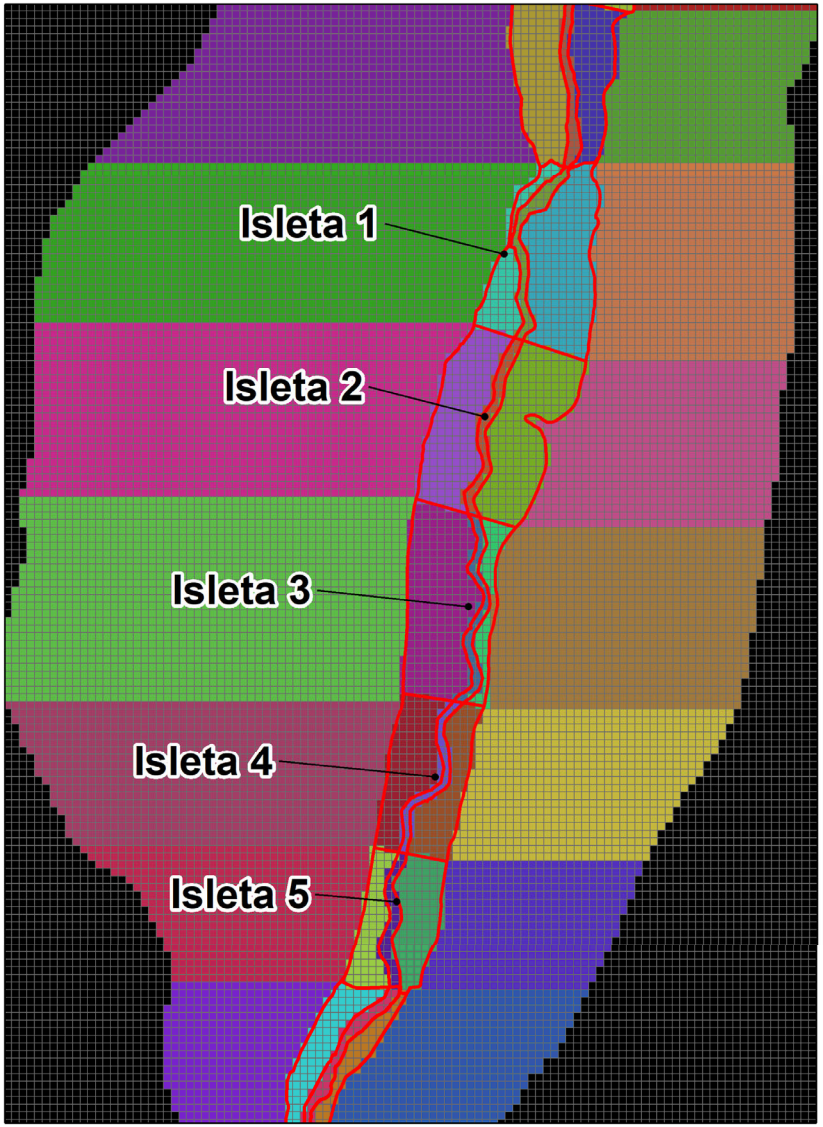
# 2. Aquifer Objects in MRG and LRG

- USACE tasked us with adding Deep Aquifer Objects to the MRG and LRG portions of URGWOM, so the Deep Layer is explicitly modeled (and we aren't relying on several external MODFLOW models)
- NMISC has helped with budget
- 85 new aquifer objects in LRG, 100 in MRG
- After GIS review, added new drains (which improve calibration)



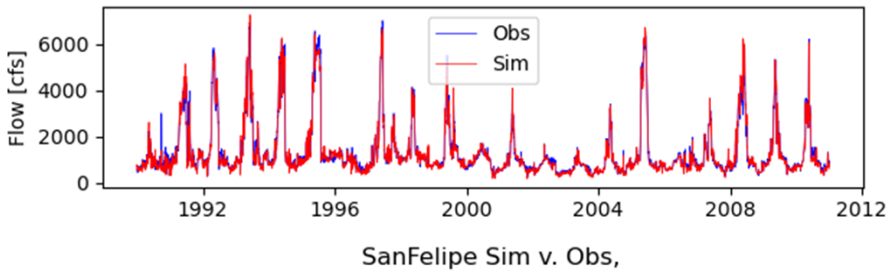
# 3. MODFLOW models

- Extracted data from MODFLOW models:
  - Aquifer parameter data (adjusted during calibration to account for large differences between RiverWare and MODFLOW)
  - Aquifer head data (averaged)
  - M&I pumping and recharge data (summed)
- MODFLOW models used:
  - Cochiti to San Acacia: Meyers (USGS) et al., 2019
  - San Acacia to San Marcial: Shafike (NMISC), 2005
  - Caballo to Mesilla: NMISC 2011 Mesilla Bolson model
  - El Paso to Hudspeth: USGS 2003 Hueco Bolson model



# 4. Calibration Process

- MRG calibrated using PEST
- LRG calibrated by hand
- Calibration period: 1990-2010
- Calibration targets: averaged aquifer heads from MODFLOW models, and gaged river flow
- Calibration parameters: Kx, Ky, Kz, Ss, river/drain/canal conductivities, river/drain streambed elevs*
- Calibration statistics: RMSE, ME, PBIAS, NSE, Median Difference, Low Flow Median Difference



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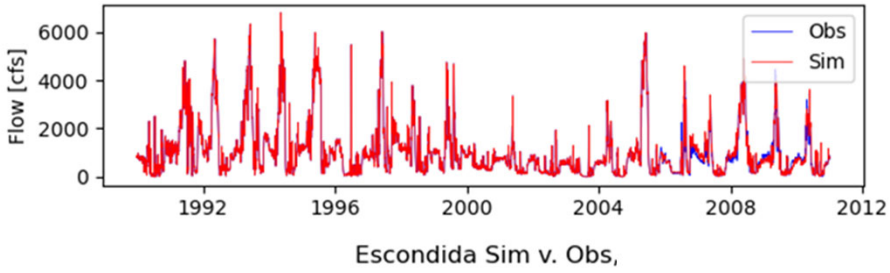

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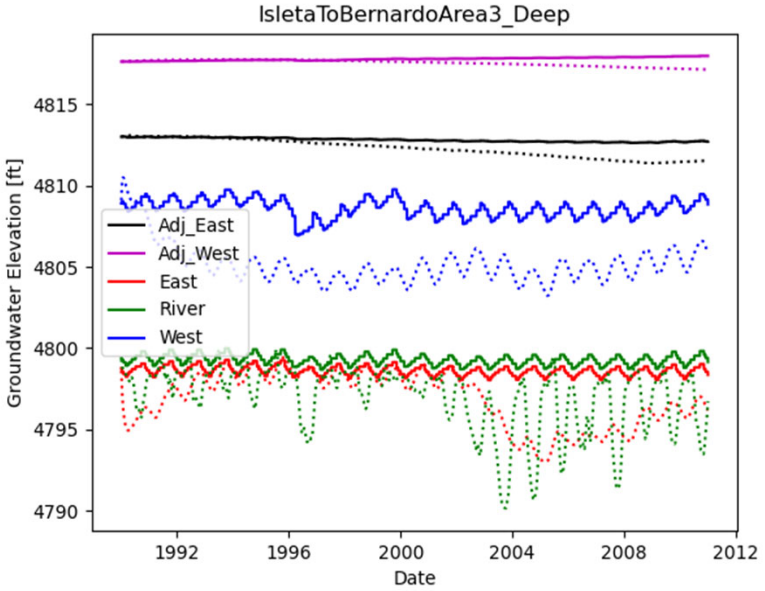

# 5. Next Steps

1. System mass balance comparison between RiverWare and the 4 MODFLOW models (working with Intera)
2. Improved documentation and GIS dataset
3. Revisit LRG calibration
   - Extract additional head data from MODFLOW models and use PEST for calibration
4. Bring everything into Official URGWOM model

# Review of URGWOM Aquifer Object Implementation and Calibration

A Presentation to

The URGWOM Technical Team

**10 August 2021**

# Task Overview

INTERA Incorporated was tasked as subcontractor for Tetra Tech to provide a quality control and quality assurance review and comment on the implementation of newly developed deep aquifer objects in the Middle and Lower Rio Grande portions of URGWOM.

This includes reviewing the deep aquifer objects for:

1. Implementation
2. Assumptions
3. Performance against the MODFLOW models
4. Hydraulic parameter comparison with MODFLOW models

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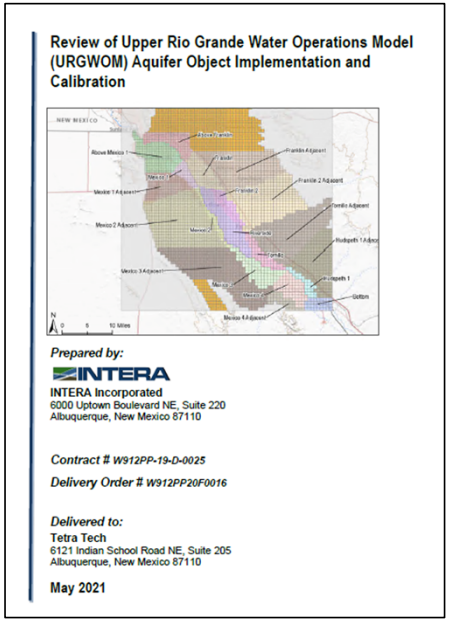

Review of Upper Rio Grande Water Operations Model (URGWOM) Aquifer Object Implementation and Calibration

Prepared by:

INTERA Incorporated
6000 Uptown Boulevard NE, Suite 220
Albuquerque, New Mexico 87110

Contract # W912PP-19-D-0025

Delivery Order # W912PP20F0016

Delivered to:
Tetra Tech
6121 Indian School Road NE, Suite 205
Albuquerque, New Mexico 87110

May 2021

# Key Conclusions

**INTERA concludes that basing the deep aquifer objects in URGWOM on existing, calibrated MODFLOW models of the Rio Grande aquifer system is a defensible initial approach.**

Despite substantial differences in model structure, the URGWOM deep aquifer heads match the magnitude, trend, and flow direction of the spatially averaged MODFLOW heads reasonably well.

Given the information provided, there are not any major concerns with the assumptions made in extracting areas, thicknesses, hydraulic conductivities, and specified fluxes from the existing models.

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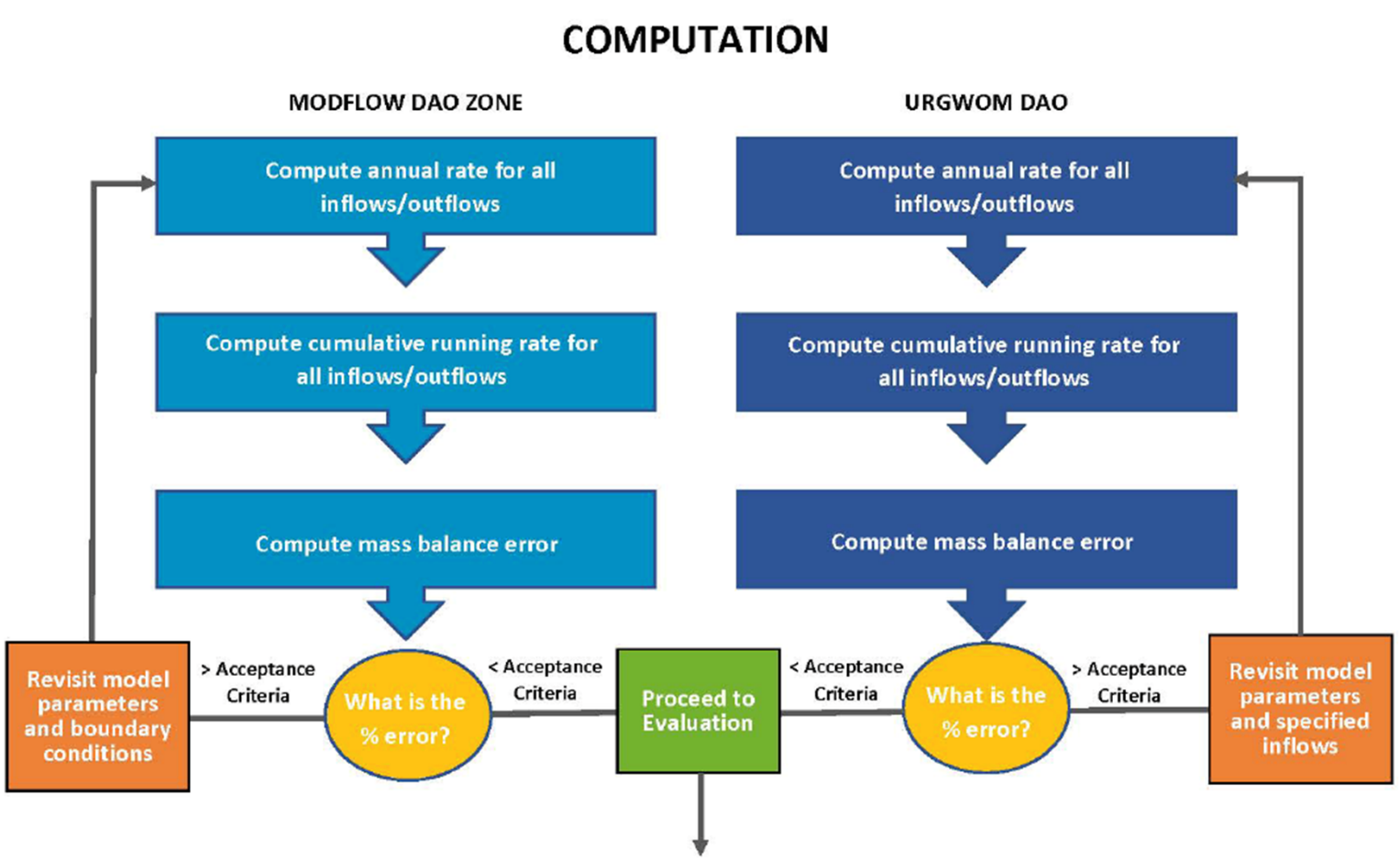
**Given the information provided, there are not any major concerns with the assumptions made in extracting areas, thicknesses, hydraulic conductivities, and specified fluxes from the existing models.**

# Recommendations

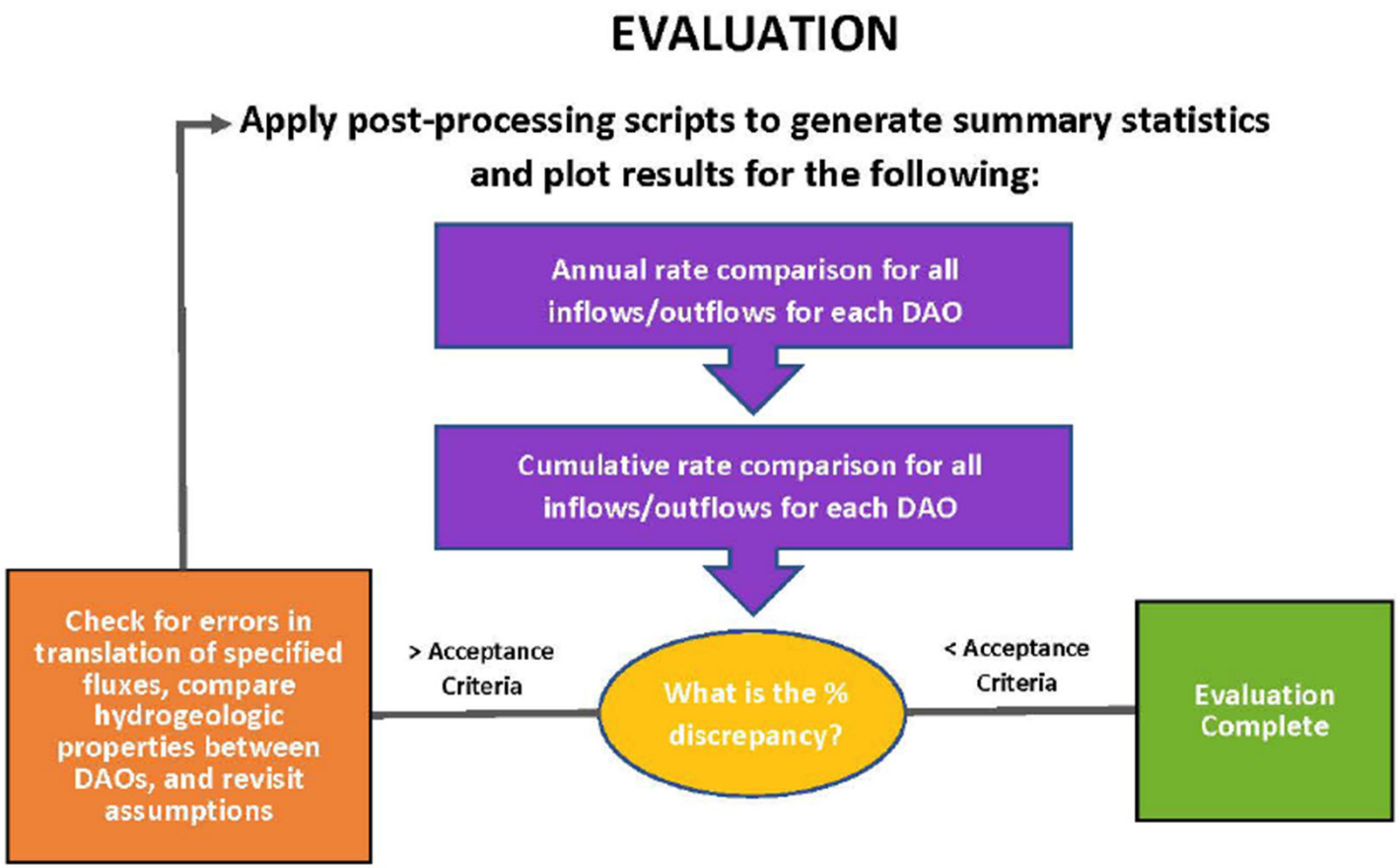
**Conduct a mass balance (flux) comparison between the URGWOM deep aquifer objects and respective MODFLOW zones.**

A flux mass balance comparison could provide the complete picture of deep groundwater processes, including issues that may be masked by reasonable looking heads.

# Flux Mass Balance Comparison



# Flux Mass Balance Comparison



# Flux Mass Balance Objectives

Do the URGWOM object flux mass balances compare reasonably well to the MODFLOW zones?

Is there parameter compensation occurring in the URGWOM objects leading to unrealistically high or low fluxes?

Recommendations for further improvement, if needed.

# Flux Mass Balance Deliverables

- **Reproducible (scripted) Workflow**

- **Technical Memorandum**
  - Tabulated output of flux mass balance results and comparison for MODFLOW and URGWOM by object
  - Plots of flux mass balance results for MODFLOW and URGWOM by object
  - Conclusions/Discussion/Recommendations for the flux mass balance objectives

# Questions?

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# Extra Slides

# RiverWare Nomenclature

Table 2. DAO nomenclature in the MRG section.

| Area | Sub-area | Row |
|---|---|---|
| **Cochiti** | CochitiToSanFelipeArea1 | MRG 1 |
| | CochitiToSanFelipeArea2 | MRG 2 |
| **San Felipe** | SanFelipeToCentralArea1 | MRG 3 |
| | SanFelipeToCentralArea2 | MRG 4 |
| | SanFelipeToCentralArea3 | MRG 5 |
| | SanFelipeToCentralArea4 | MRG 6 |
| **Isleta** | IsletaToBernardoArea1 | MRG 7 |
| | IsletaToBernardoArea2 | MRG 8 |
| | IsletaToBernardoArea3 | MRG 9 |
| | IsletaToBernardoArea4 | MRG 10 |
| | IsletaToBernardoArea5 | MRG 11 |
| **Central** | CentralToIsletaArea1 | MRG 12 |
| | CentralToIsletaArea2 | MRG 13 |
| **Bernardo** | BernardoToSanAcaciaArea1 | MRG 14 |
| **San Acacia** | SanAcaciaToSanMarcialArea1 | MRG 15 |
| | SanAcaciaToSanMarcialArea2 | MRG 16 |
| | SanAcaciaToSanMarcialArea3 | MRG 17 |
| | SanAcaciaToSanMarcialArea4 | MRG 18 |
| | SanAcaciaToSanMarcialArea5 | MRG 19 |
| | SanMarcialBoundary | MRG 20 |

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# RiverWare Nomenclature

**Table 3. DAO Nomenclature and topology in the Mesilla LRG section.**

| Row | AdjWest | West | River | East | AdjEast |
|---|---|---|---|---|---|
| MESILLA 1 | S1AdjWestAquifer | S1UnderIrrigationAquifer | S1UnderRiverAquifer | | S1AdjEastAquifer |
| MESILLA 2 | S2AdjWestAquifer | | S2UnderRiverAquifer | S2UnderIrrigationAquifer | S2AdjEastAquifer |
| MESILLA 3 | S3AdjWestAquifer | S3UnderIrrigationAquifer | S3UnderRiverAquifer | | S3AdjEastAquifer |
| MESILLA 4 | S5AdjAquifer | S5UnderIrrigationAquifer | S4andS5UnderRiverAquifer | S4UnderIrrigationAquifer | S4AdjAquifer |
| MESILLA 5 | S6AdjWestAquifer | | S6UnderRiverAquifer | S6UnderIrrigationAquifer | S6AdjEastAquifer |
| MESILLA 6 | S8AdjAquifer | S8UnderIrrigationAquifer | S7andS8UnderRiverAquifer | S7UnderIrrigationAquifer | S7AdjAquifer |
| MESILLA 7 | S10AdjAquifer | S10UnderIrrigationAquifer | S10andS9UnderRiverAquifer | S9UnderIrrigationAquifer | S9AdjAquifer |
| MESILLA 8 | S11AdjAquifer | S11UnderIrrigationAquifer | S11andS15UnderRiverAquifer | S15UnderIrrigationAquifer | S15AdjAquifer |
| MESILLA 9 | S12AdjAquifer | S12UnderIrrigationAquifer | S12andS16UnderRiverAquifer | S16UnderIrrigationAquifer | S16AdjAquifer |
| MESILLA 10 | S13AdjAquifer | S13UnderIrrigationAquifer | S13andS17UnderRiverAquifer | S17UnderIrrigationAquifer | S17AdjAquifer |
| MESILLA 11 | S14AdjAquifer | S14UnderIrrigationAquifer | S18andS14UnderRiverAquifer | S18UnderIrrigationAquifer | S18AdjAquifer |
| MESILLA 12 | S19AdjAquifer | S19UnderIrrigationAquifer | S19andS20UnderRiverAquifer | S20UnderIrrigationAquifer | S20AdjAquifer |

* Locations in gray color indicate locations with no DAO.
** Locations in beige color indicate cells that are transposed with lateral alignment.

**Table 4. DAO Nomenclature and topology in the Hueco LRG section.**

| Row | AdjWest | West | River | East | AdjEast |
|---|---|---|---|---|---|
| HUECO 1 | | AbvMexico1 | AbvFranklinUnderRiver | AbvFranklin | |
| HUECO 2 | Mexico1Adj | Mexico1UnderIrrigation | FranklinUnderRiver | FranklinUnderIrrigation | FranklinAdj |
| HUECO 3 | Mexico2Adj | Mexico2UnderIrrigation | RiversideAndFranklinUnderRiver | RiversideAndFranklinUnderIrrigation | RiversideAndFranklinAdj |
| HUECO 4 | Mexico3Adj | Mexico3UnderIrrigation | TornilloUnderRiver | TornilloUnderIrrigation | TornilloAdj |
| HUECO 5 | Mexico4Adj | Mexico4UnderIrrigation | Hudspeth1UnderRiver | Hudspeth1UnderIrrigation | Hudspeth1Adj |
| HUECO 6 | | Mexico5UnderIrrigation | Hudspeth2UnderRiver | Hudspeth2UnderIrrigation | |
| HUECO 7 | | Mexico6UnderIrrigation | Hudspeth3UnderRiver | Hudspeth3UnderIrrigation | |

* Locations in gray color indicate locations with no DAO.

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# MRG DAO Area (1000 acres)/Inflows (acre-ft/year)

| | DAO Area (1000 acres) | | | | | DAO Average Specified Inflows (acre-ft/year) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Row | AdjWest | West | River | East | AdjEast | AdjWest | West | River | East | AdjEast |
| MRG 1 | 59 | 5 | 2 | 7 | 22 | 11,504 | -46 | -8 | -100 | 9,001 |
| MRG 2 | 43.1 | 2 | 4 | 4 | 15 | 12,794.6 | -15 | -7 | -18 | 1,212 |
| MRG 3 | 8 | 1 | 1 | 4 | 7 | 1,263 | 0 | 0 | -159 | 734 |
| MRG 4 | 9 | 1 | 2 | 5 | 4 | -1,278 | -123 | -1 | -40 | 1,645 |
| MRG 5 | 6 | 6 | 2 | 5 | 1 | -12,746 | -2,148 | 0 | -36 | 672 |
| MRG 6 | 6 | 3 | 2 | 16 | 8 | -10,126 | -4 | -971 | -13,054 | -43,753 |
| MRG 7 | 74 | 4 | 2 | 12 | 39 | -3,107 | -2,126 | -725 | -1,469 | -33,021 |
| MRG 8 | 74 | 10 | 2 | 11 | 37 | 207 | -442 | -52 | -298 | 755 |
| MRG 9 | 85 | 13 | 2 | 3 | 50 | 183 | -1,991 | -24 | -870 | 688 |
| MRG 10 | 54 | 6 | 2 | 5 | 36 | 230 | -464 | -133 | -316 | 323 |
| MRG 11 | 30 | 4 | 2 | 5 | 18 | 199 | -1,754 | -36 | -24 | -724 |
| MRG 12 | 28 | 8 | 1 | 6 | 29 | 138 | 0 | -10 | -20 | 831 |
| MRG 13 | 59 | 9 | 2 | 6 | 30 | 303 | -1 | -1 | -2 | 737 |
| MRG 14 | 22 | 7 | 4 | 5 | 17 | 2,026 | -2 | -1 | 0 | 257 |
| MRG 15 | 12 | 9 | 3 | 1 | 12 | 495 | 0 | 0 | 0 | 333 |
| MRG 16 | 7 | 4 | 2 | 1 | 6 | 570 | 0 | 0 | 0 | 231 |
| MRG 17 | 20 | 7 | 4 | 2 | 18 | 2,883 | 0 | 0 | 0 | 481 |
| MRG 18 | 13 | 9 | 4 | 4 | 15 | 391 | 0 | 0 | 0 | 360 |
| MRG 19 | 100 | 7 | 6 | 2 | 9 | 3,769 | 0 | 0 | 0 | 0 |
| MRG 20 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | NA | NA | NA | NA | NA |

Blank cells indicate locations with no DAO.

Blue colors indicate DAO area.

Green colors indicate net positive specified fluxes.

Red colors indicate net negative specified fluxes.

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# MRG DAO Area Differences

| | Area difference (acres) between model files and Table 10 | | | | |
|---|---|---|---|---|---|
| Row | AdjWest | West | River | East | AdjEast |
| 1 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | -42,154 | 0 | 0 | 0 | -1,846 |
| 4 | -64,571 | 0 | 0 | 0 | -11,991 |
| 5 | -69,676 | 0 | 0 | 0 | -9,999 |
| 6 | -41,040 | 0 | 0 | 0 | -21,170 |
| 7 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 0 |
| 9 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 0 | 0 | 0 |
| 14 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 610 | 290 | -454 | 0 |
| 16 | 0 | 291 | 32 | 66 | 0 |
| 17 | 0 | 139 | 71 | -693 | 0 |
| 18 | 0 | 1,007 | 459 | 746 | 0 |
| 19 | 84,361 | 46 | 709 | -476 | 0 |
| 20 | NA | NA | NA | NA | NA |

# LRG DAO Area (1000 acres)/Inflows (acre-ft/year)

| | DAO Area (1000 acres) | | | | | DAO Average Specified Inflows (acre-ft/year) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Row | AdjWest | West | River | East | AdjEast | AdjWest | West | River | East | AdjEast |
| MESILLA 1 | 55 | 3 | 1 | | 6 | 6,390 | 0 | 0 | | 36 |
| MESILLA 2 | 56 | | 1 | 7 | 25 | 1,799 | | 0 | 187 | 136 |
| MESILLA 3 | 40 | 6 | 1 | | 12 | 404 | 0 | 0 | | 124 |
| MESILLA 4 | 18 | 2 | 1 | 5 | 12 | 999 | 0 | 0 | 166 | 568 |
| MESILLA 5 | 3 | | 1 | 7 | 6 | 19 | | 0 | -12 | 809 |
| MESILLA 6 | 5 | 3 | 1 | 9 | 9 | 81 | -44 | 0 | -3,128 | 4,263 |
| MESILLA 7 | 19 | 3 | 1 | 14 | 15 | -292 | -25 | 0 | -4,316 | -4,458 |
| MESILLA 8 | 69 | 6 | 1 | 8 | 14 | 0 | 0 | 0 | -329 | 243 |
| MESILLA 9 | 63 | 9 | 1 | 5 | 19 | 0 | -84 | 0 | -698 | -18 |
| MESILLA 10 | 99 | 8 | 1 | 7 | 10 | 0 | -708 | 0 | -2 | -387 |
| MESILLA 11 | 78 | 9 | 4 | 4 | 5 | 0 | -6,674 | 0 | -14,002 | 300 |
| MESILLA 12 | 157 | 6 | 3 | 1 | 1 | -529 | -27 | 0 | -162 | 0 |
| | | | | | | | | | | |
| HUECO 1 | | 29 | 1 | 18 | | | -44,795 | 0 | -17,508 | |
| HUECO 2 | 24 | 8 | 0 | 17 | 58 | -29,863 | 0 | 0 | -40 | -834 |
| HUECO 3 | 81 | 6 | 1 | 37 | 71 | 0 | 0 | 0 | 0 | -668 |
| HUECO 4 | 89 | 19 | 0 | 11 | 69 | 0 | 0 | 0 | 0 | -93 |
| HUECO 5 | 9 | 17 | 1 | 5 | 47 | 0 | 0 | 0 | 0 | 0 |
| HUECO 6 | | 15 | 1 | 6 | | | 0 | 0 | 0 | |
| HUECO 7 | | 18 | 1 | 13 | | | 0 | 0 | 0 | |

Blank cells indicate locations with no DAO.

Blue colors indicate DAO area.

Green colors indicate net positive specified fluxes.

Red colors indicate net negative specified fluxes.

INTERA

# MRG Conductance Upstream/Left (1000 ft²/day)

| | Conductance Upstream (1000 ft²/day) | | | | | Conductance Left (1000 ft²/day) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Row | AdjWest | West | River | East | AdjEast | AdjWest* | West | River | East | AdjEast |
| MRG 1 | N/A | N/A | N/A | N/A | N/A | 39 | 39 | 6 | 3 | 3 |
| MRG 2 | 0.5 | 21 | 4 | 6 | 10 | 2.5 | 3 | 3 | 8 | 21 |
| MRG 3 | 150 | 11 | 8 | 21 | 2 | 1 | 1 | 3 | 1 | 1 |
| MRG 4 | 11 | 8 | 4 | 10 | 3 | 7 | 7 | 50 | 1 | 4 |
| MRG 5 | 2 | 14 | 2 | 39 | 2 | 171 | 171 | 85 | 200 | 4 |
| MRG 6 | 3 | 5 | 5 | 113 | 3 | 107 | 107 | 129 | 4 | 175 |
| MRG 7 | 7 | 2 | 46 | 175 | 11 | 70 | 70 | 27 | 5 | 83 |
| MRG 8 | 5 | 5 | 13 | 18 | 24 | 14 | 14 | 33 | 4 | 12 |
| MRG 9 | 7 | 4 | 3 | 9 | 3 | 13 | 13 | 3 | 60 | 30 |
| MRG 10 | 8 | 16 | 9 | 77 | 6 | 1 | 1 | 6 | 40 | 12 |
| MRG 11 | 11 | 46 | 13 | 32 | 6 | 4 | 4 | 5 | 5 | 2 |
| MRG 12 | 19 | 36 | 8 | 38 | 3 | 2 | 2 | 5 | 50 | 3 |
| MRG 13 | 10 | 28 | 4 | 85 | 4 | 3 | 3 | 5 | 1 | 1 |
| MRG 14 | 19 | 150 | 15 | 39 | 5 | 4 | 4 | 5 | 2 | 60 |
| MRG 15 | 2 | 4 | 10 | 19 | 3 | 50 | 50 | 50 | 11 | 8 |
| MRG 16 | 7 | 10 | 25 | 38 | 7 | 3 | 3 | 4 | 4 | 6 |
| MRG 17 | 10 | 9 | 12 | 23 | 5 | 3 | 3 | 4 | 4 | 4 |
| MRG 18 | 5 | 10 | 9 | 35 | 4 | 9 | 9 | 20 | 5 | 1 |
| MRG 19 | 12 | 4 | 7 | 15 | 5 | 7 | 7 | 5 | 6 | 6 |
| MRG 20 | 13 | 34 | 13 | 11 | 13 | 5 | 5 | 5 | 5 | 5 |

*Conductance Right for leftmost DAO element

Red colors indicate higher conductances.

INTERA

# LRG Conductance Upstream/Left (1000 ft$^2$/day)

| | Conductance Upstream (1000 ft$^2$/day) | | | | | Conductance Left (1000 ft$^2$/day) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Row | AdjWest | West | River | East | AdjEast | AdjWest* | West | River | East | AdjEast |
| MESILLA 1 | N/A | N/A | N/A | | N/A | 100 | 100 | 5 | | 18 |
| MESILLA 2 | 2 | | 10 | 10 | 10 | 76 | | 76 | 7 | 3 |
| MESILLA 3 | 12 | 8 | 10 | | 12 | 20 | 20 | 30 | | 30 |
| MESILLA 4 | 2 | 2 | 28 | N/A | 2 | 130 | 130 | 130 | 135 | 80 |
| MESILLA 5 | 8 | | 2 | 10 | 10 | 1 | | 1 | 1 | 1 |
| MESILLA 6 | 30 | N/A | 28 | 26 | 26 | 1 | 1 | 10 | 70 | 50 |
| MESILLA 7 | 2 | 2 | 30 | 20 | 20 | 0 | 0 | 0 | 58 | 59 |
| MESILLA 8 | 4 | 4 | 30 | 40 | 40 | 50 | 50 | 50 | 12 | 12 |
| MESILLA 9 | 13 | 15 | 10 | 40 | 40 | 8 | 8 | 8 | 20 | 20 |
| MESILLA 10 | 10 | 10 | 10 | 40 | 40 | 8 | 8 | 8 | 200 | 200 |
| MESILLA 11 | 10 | 10 | 10 | 55 | 55 | 15 | 15 | 15 | 200 | 200 |
| MESILLA 12 | 9 | 10 | 10 | 4 | 4 | 50 | 50 | 50 | 12 | 12 |
| | | | | | | | | | | |
| HUECO 1 | | N/A | N/A | N/A | | | 2 | 2 | 8 | |
| HUECO 2 | N/A | 40 | 30 | 10 | N/A | 20 | 20 | 2 | 8 | 20 |
| HUECO 3 | 10 | 10 | 5 | 25 | 25 | 5 | 5 | 5 | 20 | 2 |
| HUECO 4 | 3 | 3 | 5 | 3 | 3 | 9 | 9 | 9 | 10 | 1 |
| HUECO 5 | 10 | 25 | 5 | 1 | 1 | 9 | 9 | 9 | 1 | 1 |
| HUECO 6 | | 2 | 5 | 1 | | | 7 | 7 | 1 | |
| HUECO 7 | | 8 | 5 | 2 | | | 8 | 8 | 2 | |

*Conductance Right for leftmost DAO element

Red colors indicate higher conductances.

INTERA

# MRG Storativity (-)

| | Storativity (-) | | | | |
|---|---|---|---|---|---|
| Row | AdjWest | West | River | East | AdjEast |
| MRG 1 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 2 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 3 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 4 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 5 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 6 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 7 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 8 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 9 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 10 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 11 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 12 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 13 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 14 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 15 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 16 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 17 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 18 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 19 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| MRG 20 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |

Red colors indicate higher storativities.

INTERA

# LRG Storativity (-)

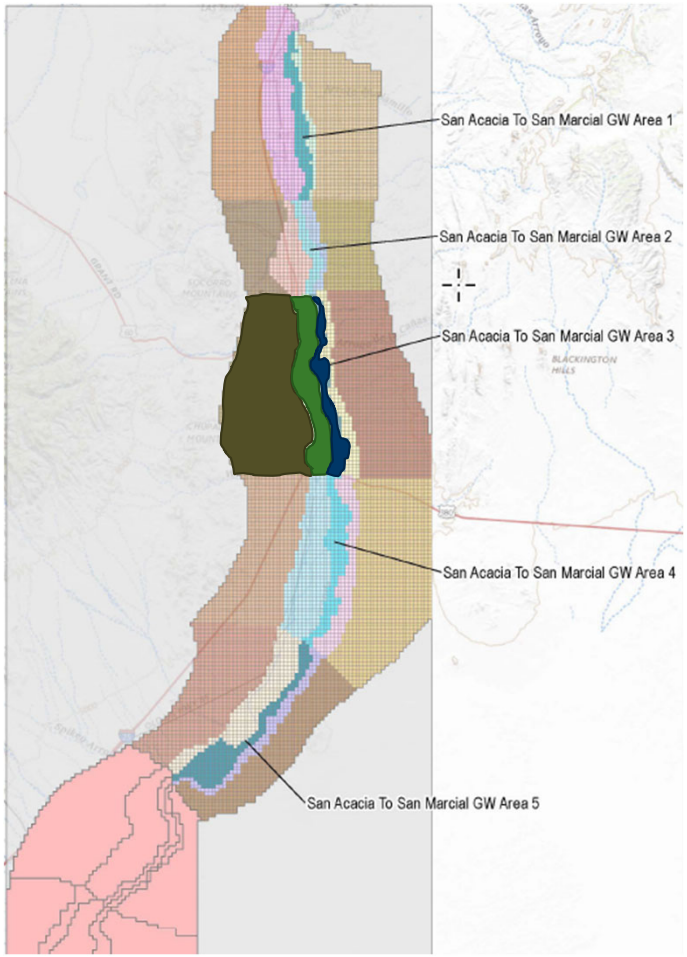
| | Storativity (-) | | | | |
|---|---|---|---|---|---|
| Row | AdjWest | West | River | East | AdjEast |
| MESILLA 1 | 0.02 | 0.01 | 0.004 | | 0.02 |
| MESILLA 2 | 0.02 | | 0.004 | 0.004 | 0.02 |
| MESILLA 3 | 0.02 | 0.004 | 0.004 | | 0.02 |
| MESILLA 4 | 0.02 | 0.02 | 0.01 | 0.01 | 0.02 |
| MESILLA 5 | 0.02 | | 0.02 | 0.06 | 0.02 |
| MESILLA 6 | 0.02 | 0.04 | 0.02 | 0.02 | 0.02 |
| MESILLA 7 | 0.02 | 0.01 | 0.01 | 0.02 | 0.02 |
| MESILLA 8 | 0.02 | 0.01 | 0.02 | 0.02 | 0.02 |
| MESILLA 9 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 |
| MESILLA 10 | 0.02 | 0.01 | 0.02 | 0.02 | 0.02 |
| MESILLA 11 | 0.02 | 0.01 | 0.02 | 0.04 | 0.02 |
| MESILLA 12 | 0.02 | 0.01 | 0.01 | 0.04 | 0.02 |
| | | | | | |
| HUECO 1 | | 0.20 | 0.20 | 0.10 | |
| HUECO 2 | 0.20 | 0.20 | 0.10 | 0.20 | 0.20 |
| HUECO 3 | 0.20 | 0.10 | 0.10 | 0.10 | 0.10 |
| HUECO 4 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| HUECO 5 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| HUECO 6 | | 0.10 | 0.10 | 0.10 | |
| HUECO 7 | | 0.10 | 0.10 | 0.10 | |

Red colors indicate higher storativities.

INTERA

# Assumptions

- Alluvial and deep aquifers sub-areas can be aggregated into a single element in URGWOM.
  - Spatial discretization of SGWO and DAO from April 2013
- Representativity
  - Heads
  - Fluxes
  - Material properties
  - Geochemistry




INTERA

# Assumptions

- Deep aquifer can be represented by a single layer of DAO

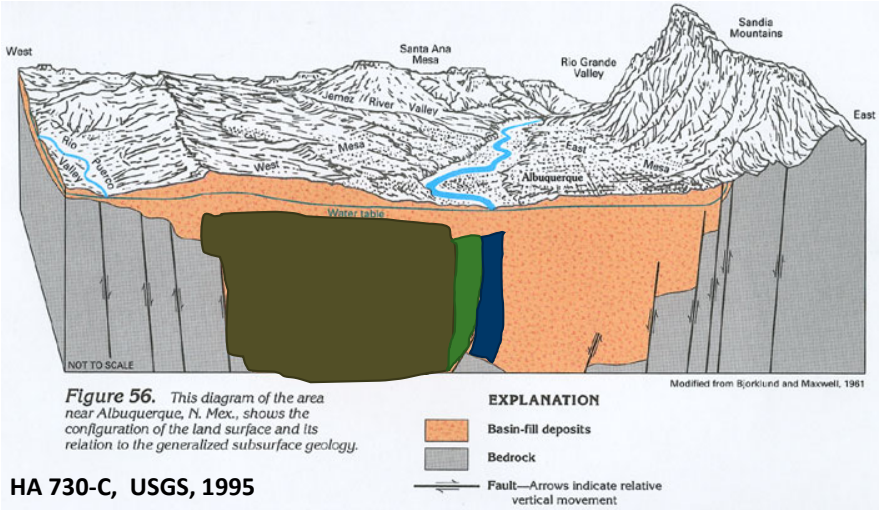



*Figure 56. This diagram of the area near Albuquerque, N. Mex., shows the configuration of the land surface and its relation to the generalized subsurface geology.*

**HA 730-C, USGS, 1995**

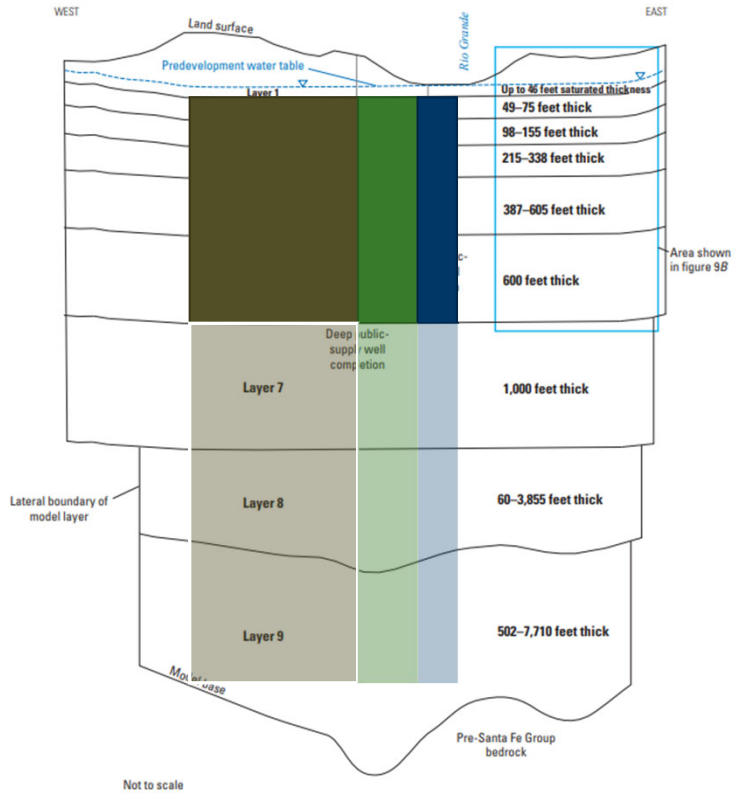



**Figure 9.** Layer thicknesses in *A*, the updated regional model (modified from Bexfield and others, 2011, fig. 2.13) and *B*, the local-scale model.

**2019–5052, USGS, 2019**

# Assumptions

- Additional analysis would be required to compare the horizonal and vertical hydraulic conductivity defined for deep percolation in the SGWOs.

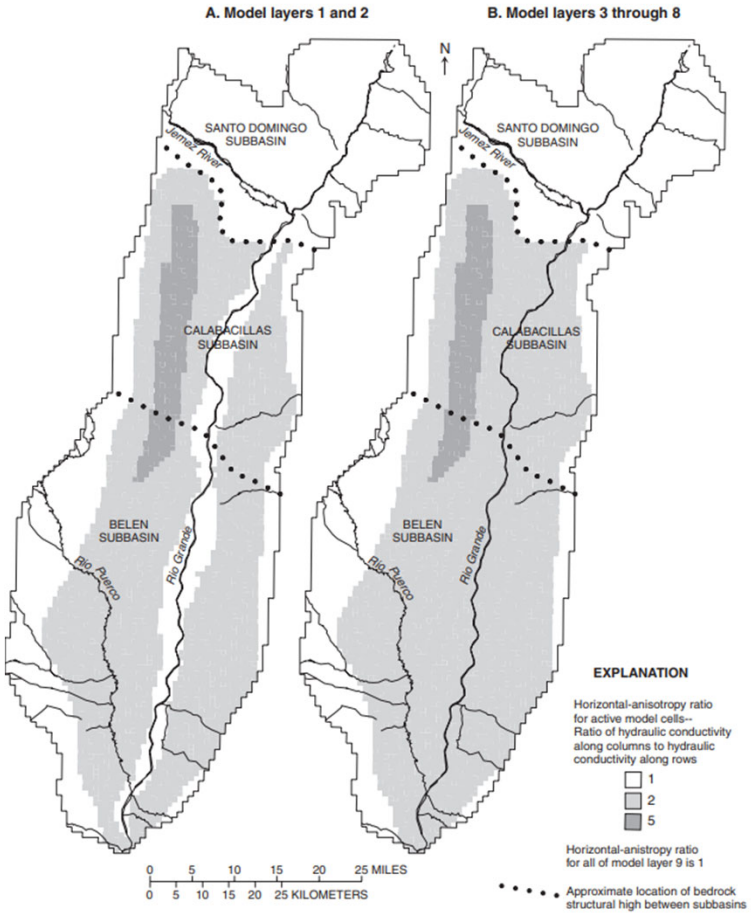



**Figure 13.** Distribution of simulated horizontal anisotropy in the model.

2019–5052, USGS, 2019

# Groundwater Evaluation: Heads Comparisons


Heads comparison plots were developed and inspected for all spatially averaged MODFLOW zones and URGWOM deep aquifer objects. In general, the URGWOM heads matched the MODFLOW heads well, with some exceptions.

# Groundwater Evaluation: Spatial Trends

**Table 8. Water level difference statistics.**

| Region | Median | Maximum | Mean | Standard Deviation |
|---|---|---|---|---|
| Middle Rio Grande | 1.69 | 34.43 | 2.92 | 7.04 |
| Mesilla | 1.32 | 288.23 | 13.05 | 57.24 |
| Hueco | 0.54 | 73.43 | 3.64 | 12.95 |

Overall, the median differences between URGWOM and MODFLOW heads were consistently small for the different URGWOM regions.

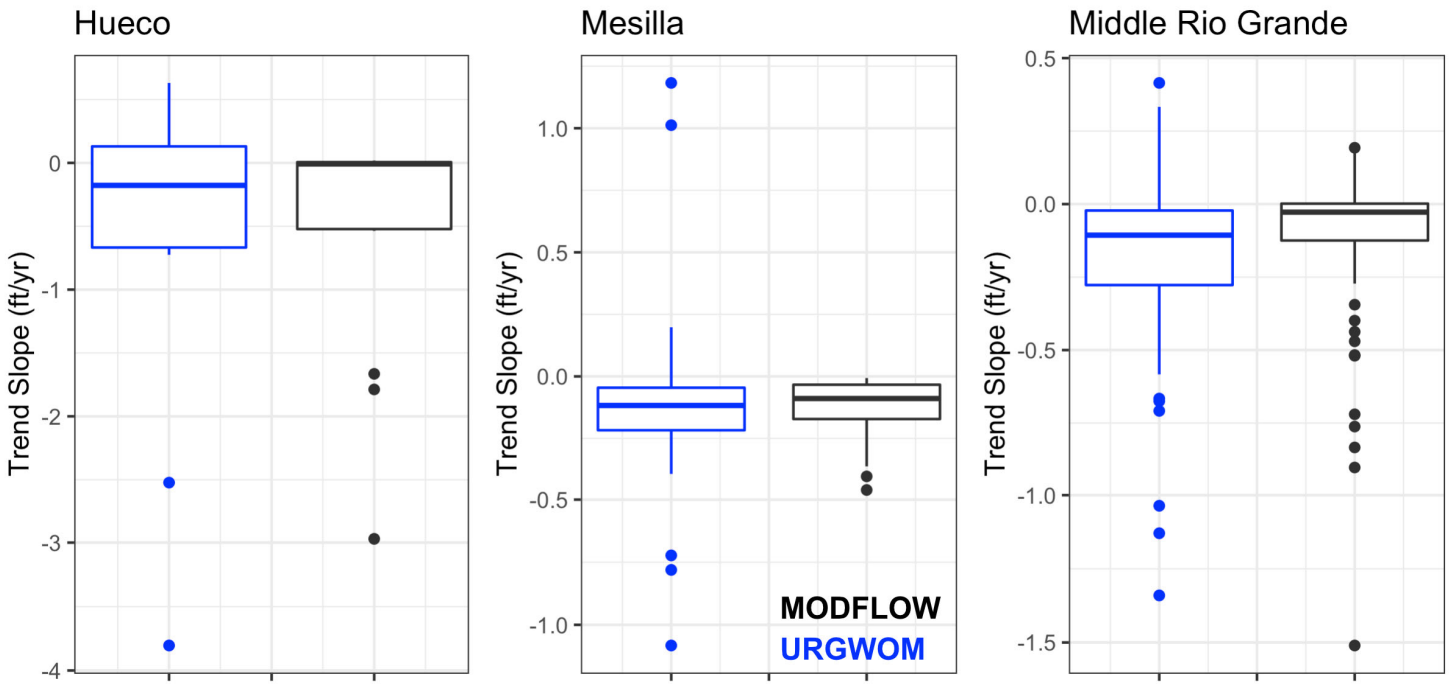
# Groundwater Evaluation: Spatial Trends

**Table 8. Water level difference statistics.**

| Region | Median | Maximum | Mean | Standard Deviation |
|---|---|---|---|---|
| Middle Rio Grande | 1.69 | 34.43 | 2.92 | 7.04 |
| Mesilla | 1.32 | 288.23 | 13.05 | 57.24 |
| Hueco | 0.54 | 73.43 | 3.64 | 12.95 |

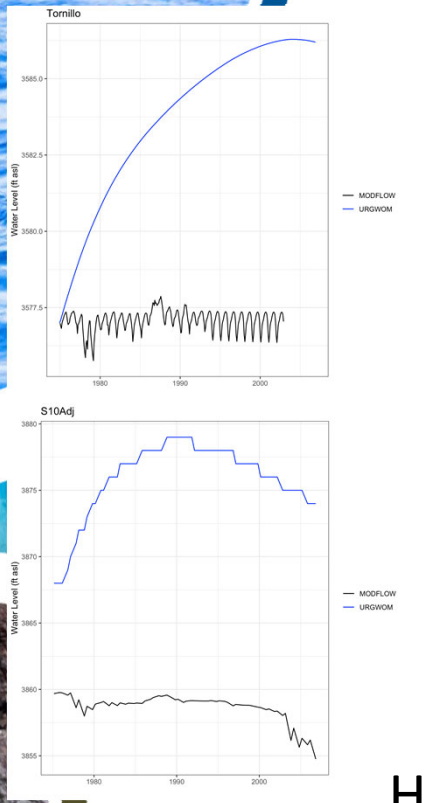
The Mesilla and Hueco regions show larger head differences (most often in the adjacent objects), which are attributed to differences in the calibration as compared to the MRG.

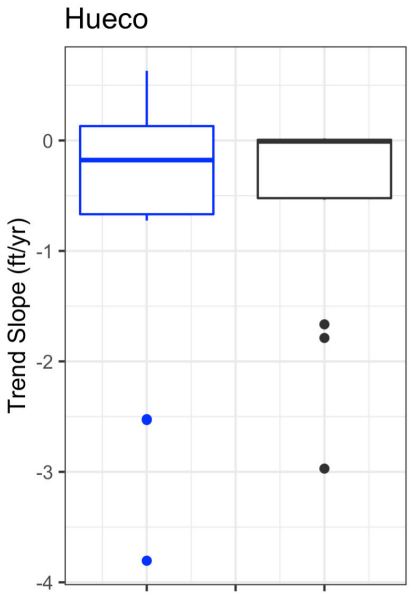
# Groundwater Evaluation: Temporal Trends

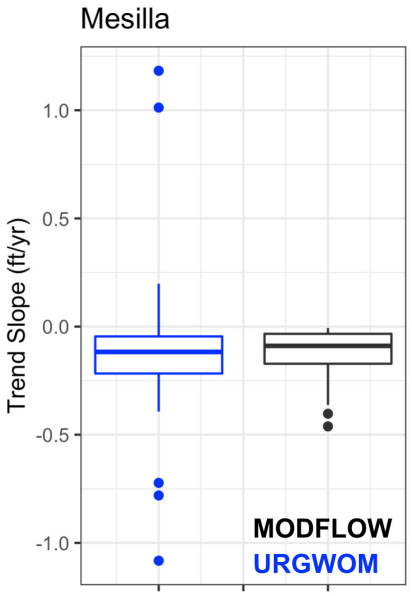


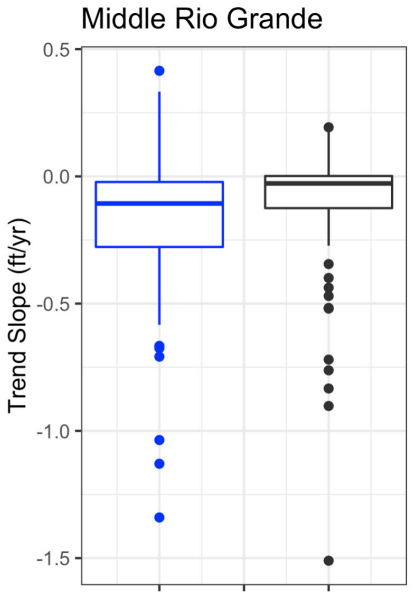

URGWOM matched the temporal trends in the MODFLOW data, with similar medians and ranges for the trend slopes

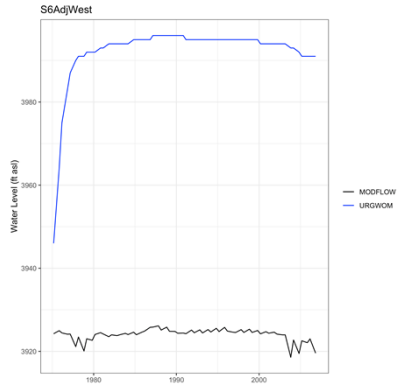
# Groundwater Evaluation: Temporal Trends



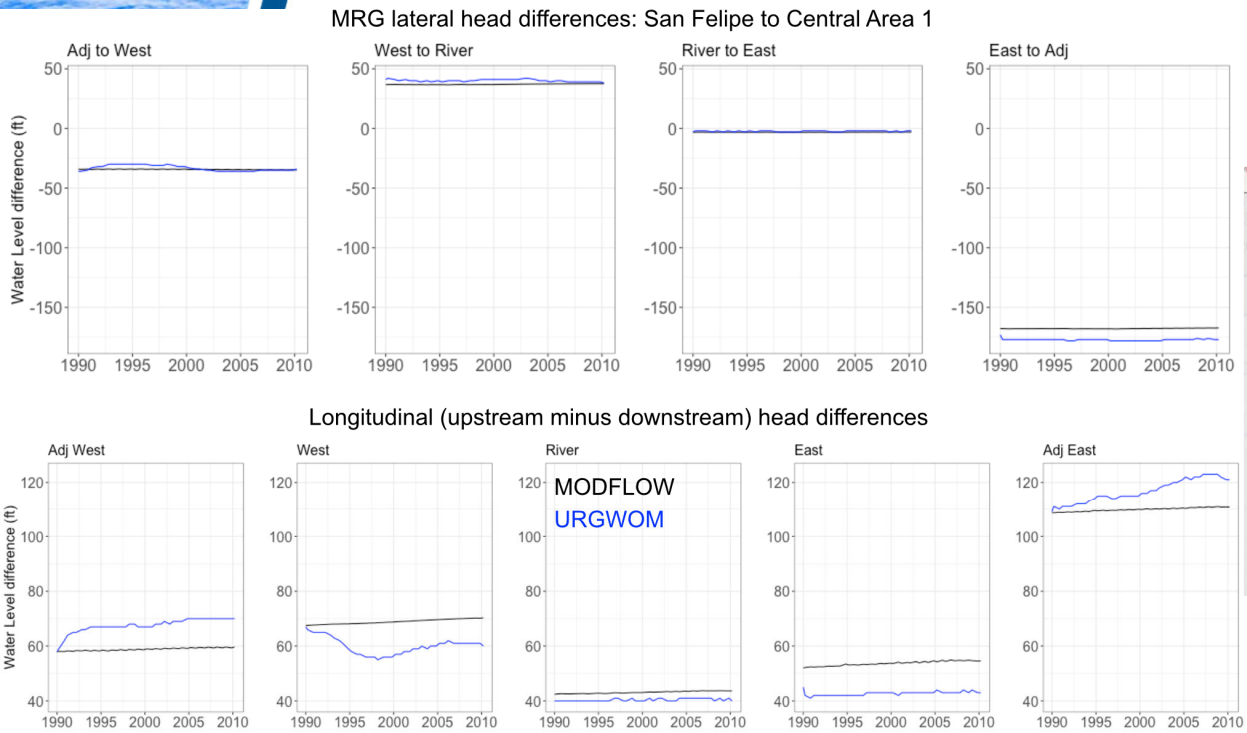



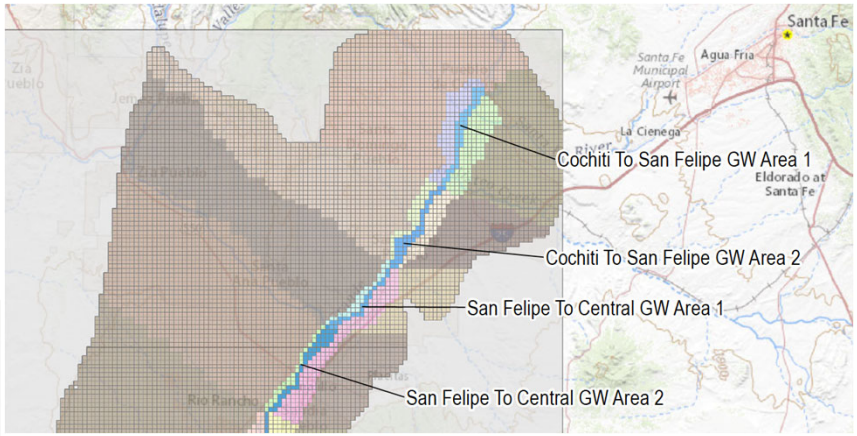




Hueco and Mesilla show some positive trend slopes that were not existent in the MODFLOW head trends.

# Groundwater Evaluation: Head Gradients

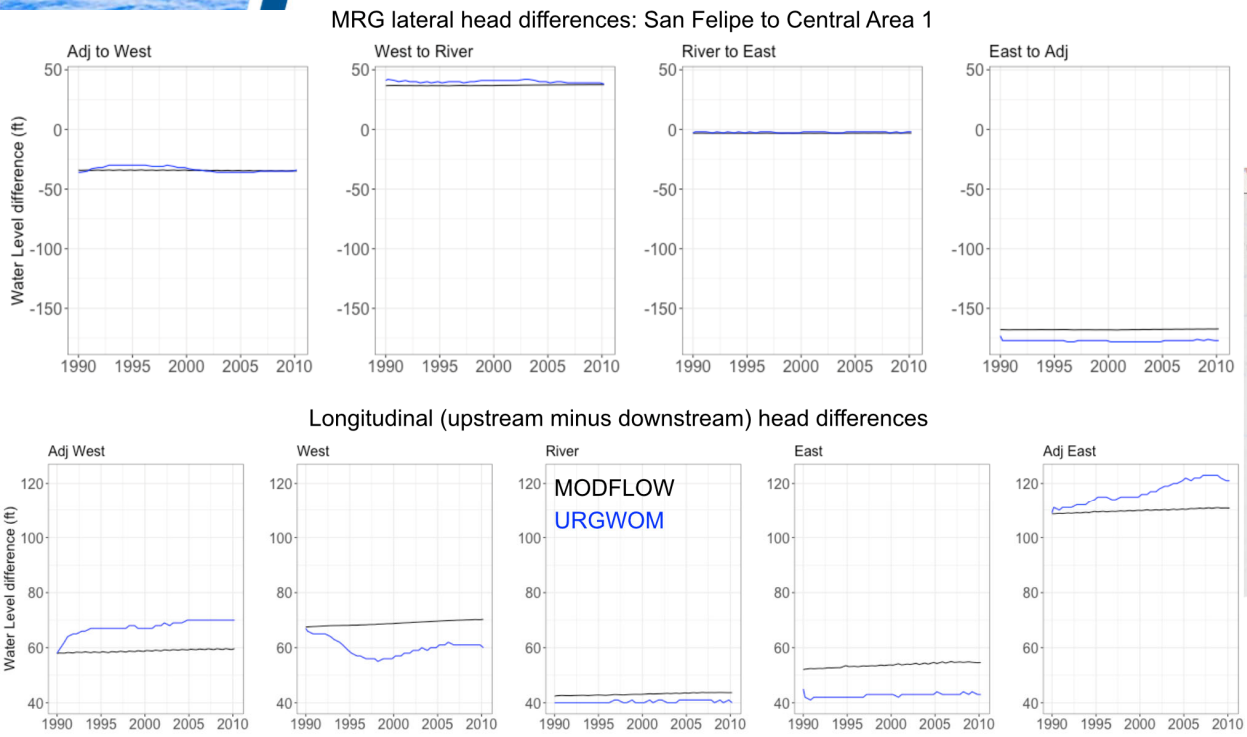


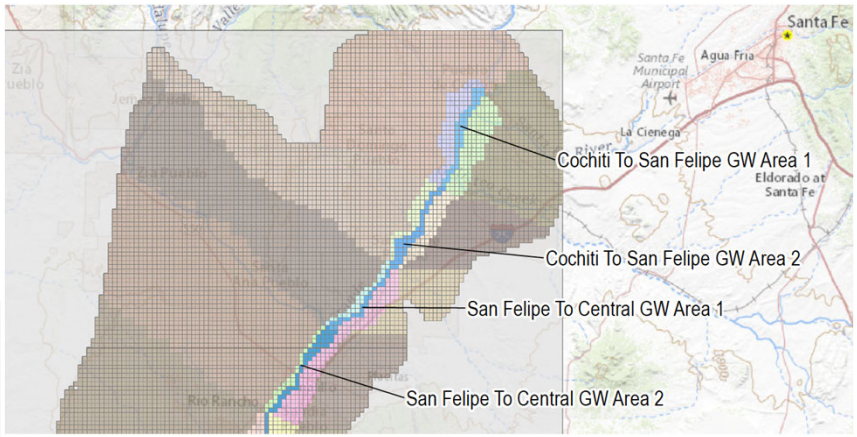




Water level differences between laterally and longitudinally adjacent objects can tell us about the flow direction and gradient in URGWOM.

INTERA

# Groundwater Evaluation: Head Gradients

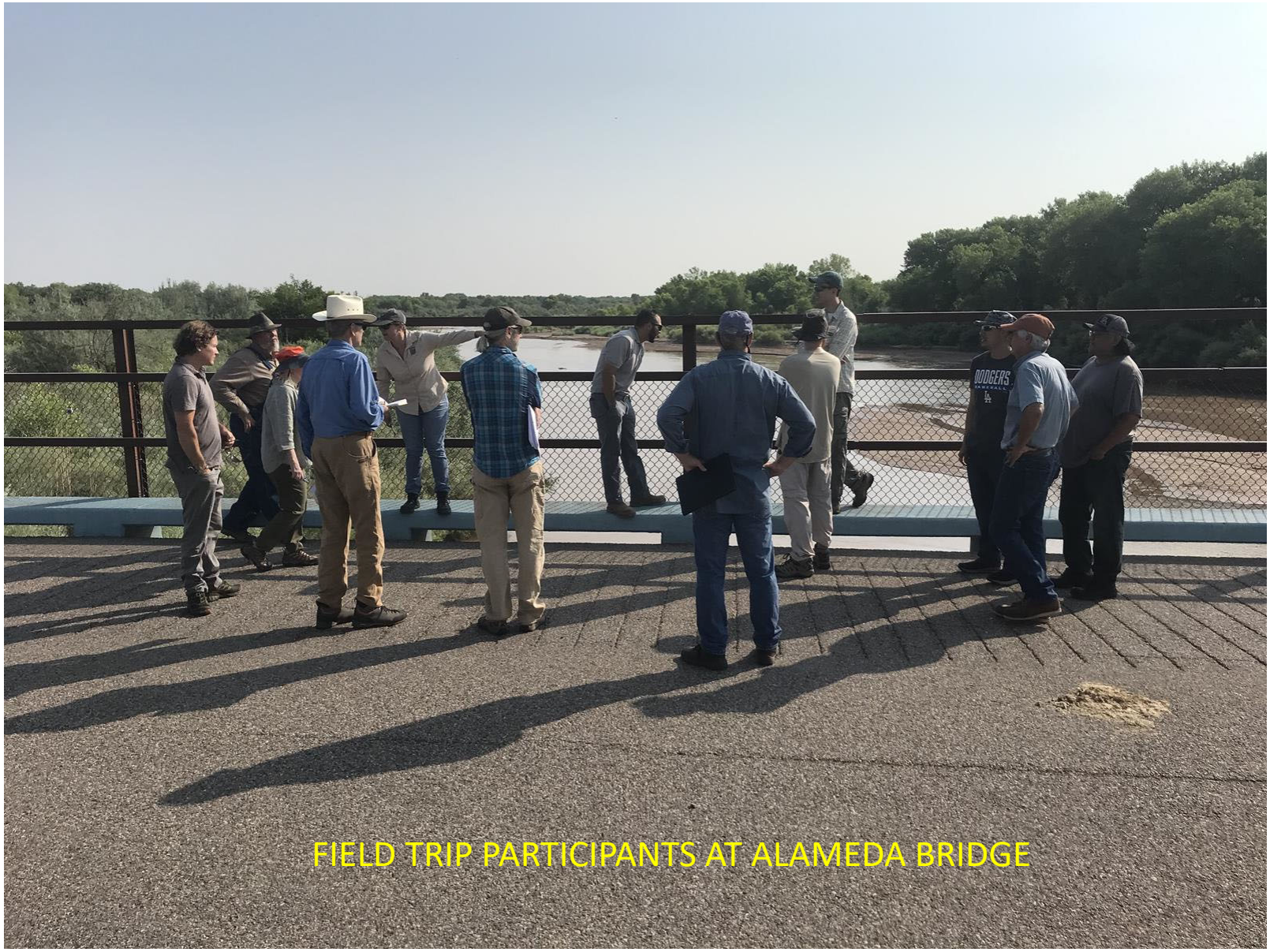


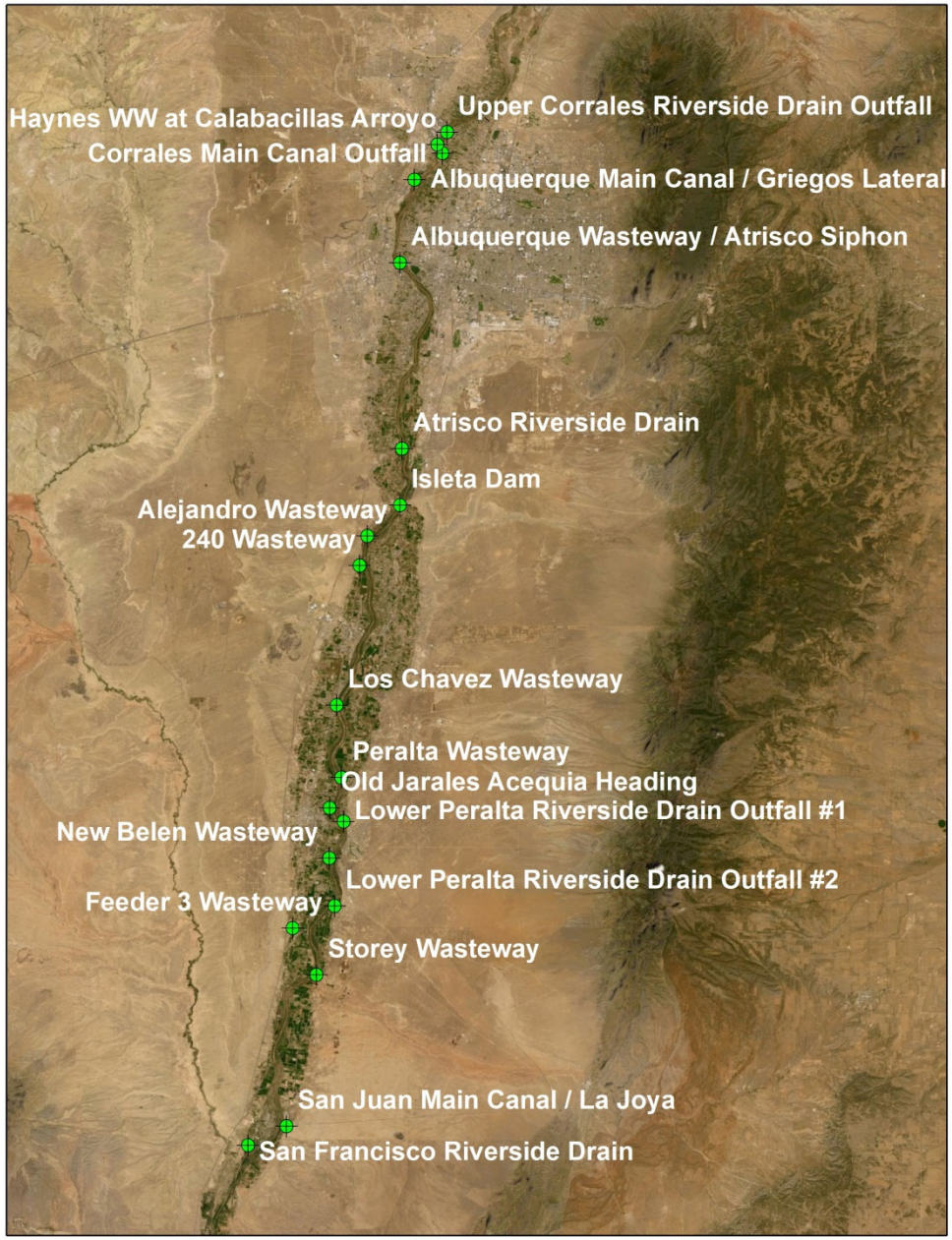

Overall, the URGWOM differences match the sign (flow direction) and magnitude (gradient) of the spatially averaged MODFLOW heads.

INTERA

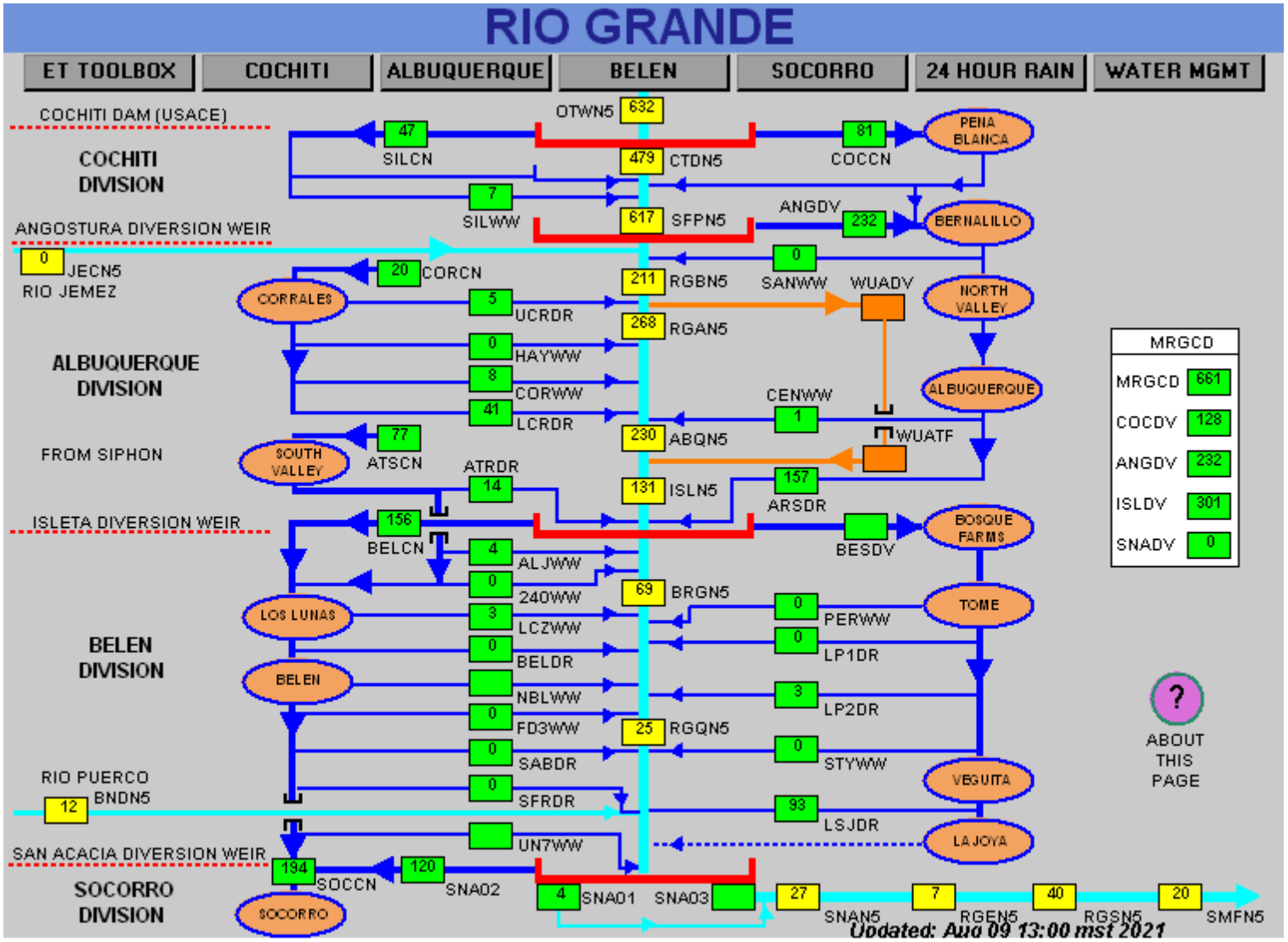

UPPER RIO GRANDE WATER OPERATIONS MODEL
REPORT TO TECHNICAL TEAM
August 10, 2021
URGWOM Technical Team
Summer, 2021 Inspection Trip
July 13-14, 2021
Middle Rio Grande – Corrales to Bernardo, NM
william j. miller
ENGINEERS




FIELD TRIP PARTICIPANTS AT ALAMEDA BRIDGE




Inspection Site Locations



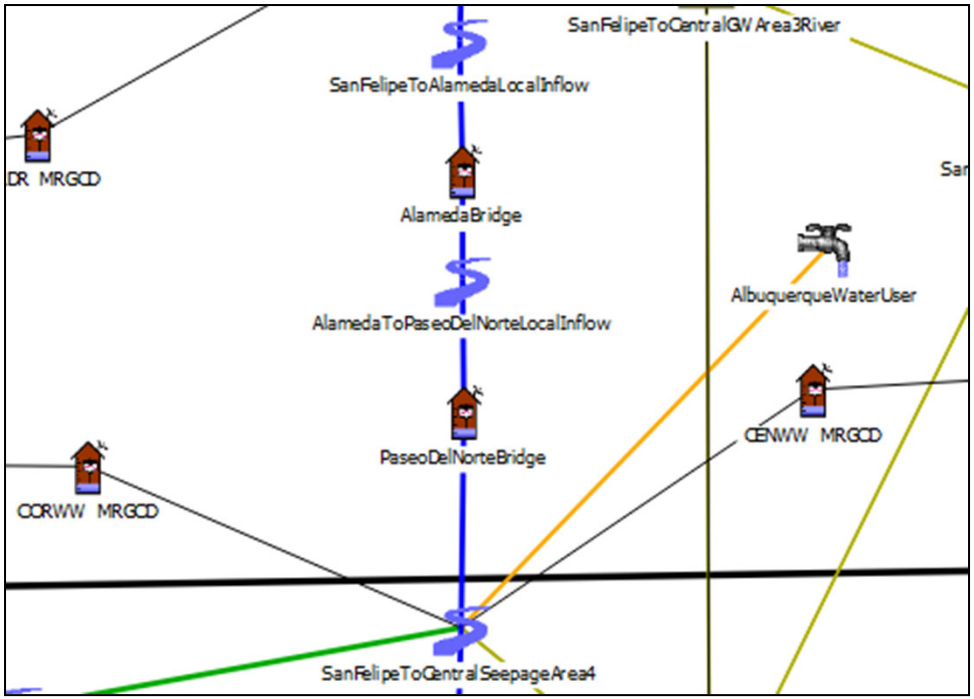

**Middle Rio Grande Conservancy District (MRGCD) Gage Schematic**

## Conclusions and Findings:

1. Copy of Inspection Report posted on my USGS web page.
2. MRGCD gages where discharge record may be unreliable due to backwater effects on stage:
   a. Upper Corrales Riverside Drain (when ABCWUA diversion is in service);
   b. Lower Corrales Riverside Drain (due to beaver activity);
   c. Los Chavez Wasteway (due to beaver activity);
   d. San Francisco Riverside Drain (sediment deposition in channel).
3. Gage at the Atrisco Riverside Drain has been moved upstream and the record of flow at the new gage location may not be comparable to the old location due to intervening inflow.

## Conclusions and Findings (continued):

4. Confirm if the location of the ABCWUA diversion as modeled in URGWOM (AlbuquerqueWaterUser) should be upstream or downstream of the PaseoDelNorteBridge gage.



Questions?

TETRA TECH

# URGWOM DSS Database Update 2021

URGWOM Tech Team Meeting

August 10, 2021

Michael Brown
Mike.Brown@tetratech.com

complex world | CLEAR SOLUTIONS™

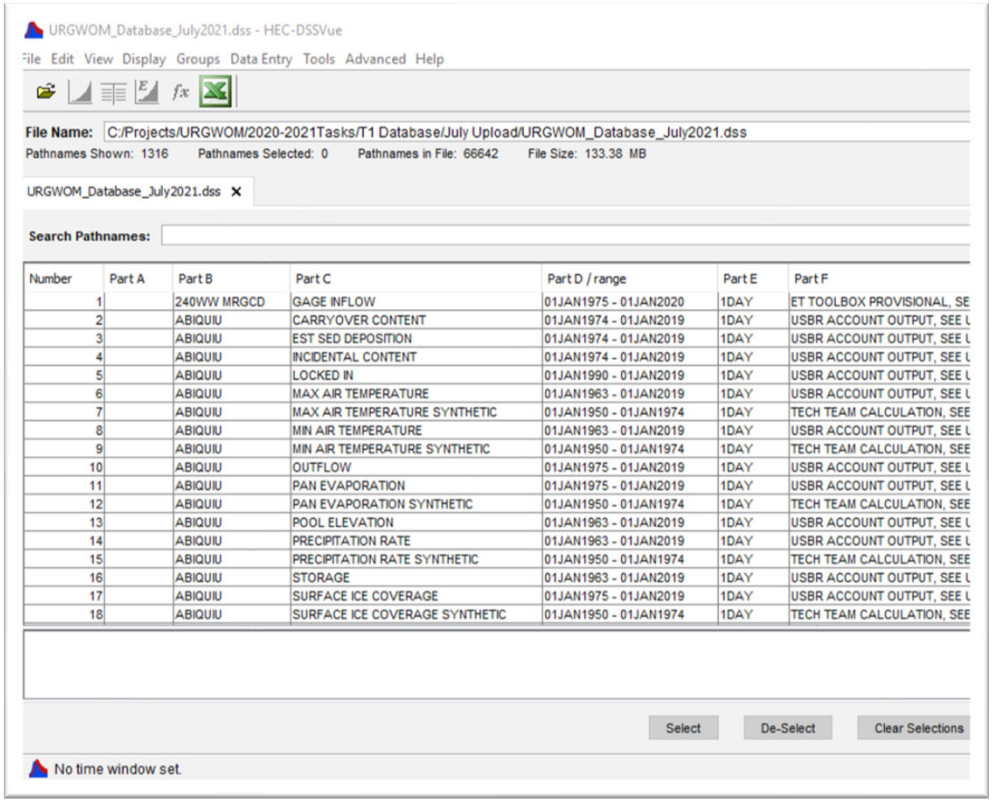
# URGWOM DSS Database Update 2021

- Description
- Highlight a few notes
- Discuss on-going topics

# Database Update 2021

## DSS Database updated through 2019 (mostly)

- URGWOM_Database_July2021.dss
- 1,300 unique database elements
- 1,000 elements updated
- Supersedes URGWOM_Database_May2020.dss




| Number | Part A | Part B | Part C | Part D / range | Part E | Part F |
|---|---|---|---|---|---|---|
| 1 | | 240WW MRGCD | GAGE INFLOW | 01JAN1975 - 01JAN2020 | 1DAY | ET TOOLBOX PROVISIONAL, SE |
| 2 | | ABIQUIU | CARRYOVER CONTENT | 01JAN1974 - 01JAN2019 | 1DAY | USBR ACCOUNT OUTPUT, SEE L |
| 3 | | ABIQUIU | EST SED DEPOSITION | 01JAN1974 - 01JAN2019 | 1DAY | USBR ACCOUNT OUTPUT, SEE L |
| 4 | | ABIQUIU | INCIDENTAL CONTENT | 01JAN1974 - 01JAN2019 | 1DAY | USBR ACCOUNT OUTPUT, SEE L |
| 5 | | ABIQUIU | LOCKED IN | 01JAN1990 - 01JAN2019 | 1DAY | USBR ACCOUNT OUTPUT, SEE L |
| 6 | | ABIQUIU | MAX AIR TEMPERATURE | 01JAN1963 - 01JAN2019 | 1DAY | USBR ACCOUNT OUTPUT, SEE L |
| 7 | | ABIQUIU | MAX AIR TEMPERATURE SYNTHETIC | 01JAN1950 - 01JAN1974 | 1DAY | TECH TEAM CALCULATION, SEE |
| 8 | | ABIQUIU | MIN AIR TEMPERATURE | 01JAN1963 - 01JAN2019 | 1DAY | USBR ACCOUNT OUTPUT, SEE L |
| 9 | | ABIQUIU | MIN AIR TEMPERATURE SYNTHETIC | 01JAN1950 - 01JAN1974 | 1DAY | TECH TEAM CALCULATION, SEE |
| 10 | | ABIQUIU | OUTFLOW | 01JAN1975 - 01JAN2019 | 1DAY | USBR ACCOUNT OUTPUT, SEE L |
| 11 | | ABIQUIU | PAN EVAPORATION | 01JAN1975 - 01JAN2019 | 1DAY | USBR ACCOUNT OUTPUT, SEE L |
| 12 | | ABIQUIU | PAN EVAPORATION SYNTHETIC | 01JAN1950 - 01JAN1974 | 1DAY | TECH TEAM CALCULATION, SEE |
| 13 | | ABIQUIU | POOL ELEVATION | 01JAN1963 - 01JAN2019 | 1DAY | USBR ACCOUNT OUTPUT, SEE L |
| 14 | | ABIQUIU | PRECIPITATION RATE | 01JAN1963 - 01JAN2019 | 1DAY | USBR ACCOUNT OUTPUT, SEE L |
| 15 | | ABIQUIU | PRECIPITATION RATE SYNTHETIC | 01JAN1950 - 01JAN1974 | 1DAY | TECH TEAM CALCULATION, SEE |
| 16 | | ABIQUIU | STORAGE | 01JAN1963 - 01JAN2019 | 1DAY | USBR ACCOUNT OUTPUT, SEE L |
| 17 | | ABIQUIU | SURFACE ICE COVERAGE | 01JAN1975 - 01JAN2019 | 1DAY | USBR ACCOUNT OUTPUT, SEE L |
| 18 | | ABIQUIU | SURFACE ICE COVERAGE SYNTHETIC | 01JAN1950 - 01JAN1974 | 1DAY | TECH TEAM CALCULATION, SEE |

# Database Update 2021

## Data Summary

| Data Description | Previous Range | Updated Range |
|---|---|---|
| CO Gages / Diversions | 1950-2015 | 2016-2018 |
| CO Historical Data (Losses, Lags, Local Inflows) | 1950-2012 | 2013-2018 |
| USGS Gages (NM) | Various -2015 | 2016-2019 |
| Accounting Data | 1975-2015 | 2016-2019 |
| Chama Diversions (WJM) | 1975-2015 | 2016-2020 |
| MRG Consumption Data (Riparian, Crop) | 1950-2015 | 2016-2019 |
| MRG Historical Data (GW, Seepage, Local Inflows) | 1975-2012 | 2013-2019 |
| MRGCD Gages | 1975-2015 | 2016-2020 |
| LRG Ag / Consumption Data | 1975-2018 | 2019 |
| Municipal Demands/Returns | 1975-2016 | 2017-2020 |

# Database Update 2021

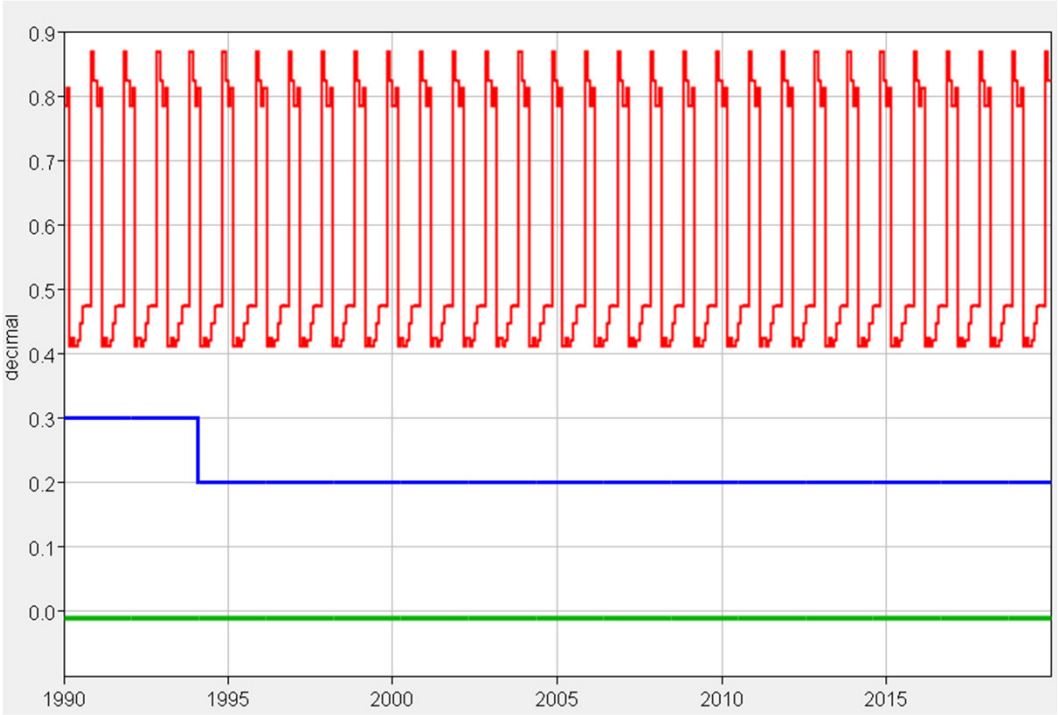
## Database Catalog

- URGWOM Database Catalog July2021.xlsx

| B Part | C Part | B Part C Part MetaData |
|---|---|---|
| ABVWAGONWHEELGAPDIVERSION_SPRINGRANCH | DIVERSION REQUESTED | CO DWR Structure WDID #2000861(dwr.state.co.us/Tools/Structures) |
| ALAMEDABRIDGEHISTORICAL | GAGE INFLOW | USGS 8329918. Rio Grande at Alameda Bridge. Agency collecting data: Station number/ CDWR Abbr: Latitude: 35°11'51.8" Longitude: 106°38'34". Hydrologic unit code: 13020203. Datum elevation (ft): 4998 NGVD29. Drainage area (sq. mi.): 17129 |
| BLWISLETADIVERSIONS:CACIQUEACEQUIA | DIVERSION REQUESTED | CACCN available from MRGCD or USBR ET Toolbox (https://www.usbr.gov/uc/albuq/water/ETtoolbox/rg/PROD/gage/archive/gage/2019/CACCN.gage.txt) |
| ALAMOSA | GAGE INFLOW | https://dwr.state.co.us/Tools/Stations - RIOALCO |
| ALBUQUERQUEWASTEWATER | DAILY RETURN | Download data from https://echo.epa.gov/. Search for Permit NM0022250 "More Search Options". Click on "CWA Effluent Charts". Download data for "Flow, in conduit or thru treatment plant". Look at 30-day average ("Statistical_base_short_desc") data |
| ALBUQUERQUEWATERUSER | DIVERSION REQUESTED | Data Provided by Albuquerque Bernalillo County Water Utility Authority (ABCWUA) https://www.abcwua.org/your-drinking-water-diversion-and-recharge-data |
| ANGOSTURAEASTSIDEAGDEPLETIONS:AREA1 | EVAPOTRANSPIRATION RATE | Crop CIR Calc Weather data from Corrales Station (USC00292100). https://climate.usu.edu/mapGUI/mapGUI.php. Use Albuquerque Valley station for missing data (https://weather.nmsu.edu/coop/)Tech Memo - 'Lower And Middle Rio Grande Crop CIR Documentation' (2021) |
| BERNARDOTOSANACACIAGWAREA1EAST | ELEVATION | URGWOM Historical Run Output, Use DMI "HistoricalRunOutputToDss" to extract data |
| ABVCONFLUENCEDIVERSIONS:CHILI | DIVERSION REQUESTED | NM OSE Measured (http://meas.ose.state.nm.us/subbasin.jsp?id=Lower%20Chama#title) |
| ABVCONFLUENCEDIVERSIONS:CHILI | DEPLETION REQUESTED | = (DIVERSION REQUESTED X 0.6667). RIO CHAMA ACEQUIAS Report on Diversion and Depletion Analysis_FINAL_2021.05.15.pdf |
| DAILYHISTORICALLRGDIVERSIONDATA | LEASBURGANDPICACHO HISTORICAL | Data came from EBID - Diversion 2 Leasburg - https://onerain.ebid-nm.org/ |
| ABIQUIU | MAX AIR TEMPERATURE SYNTHETIC | Historical Data. No update necessary |

# Constant / Periodic data in database

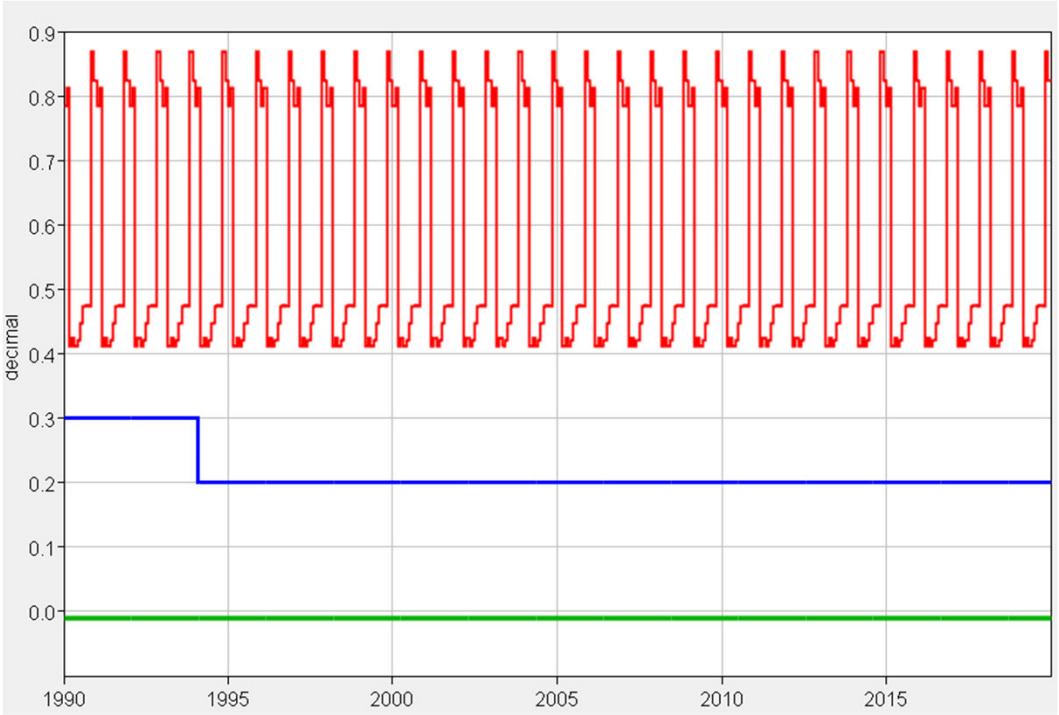
- Riparian and Agricultural Areas
- Fractional return flows
- Canal Seepage fractions
- Evaporation coefficients



# Constant / Periodic data in database

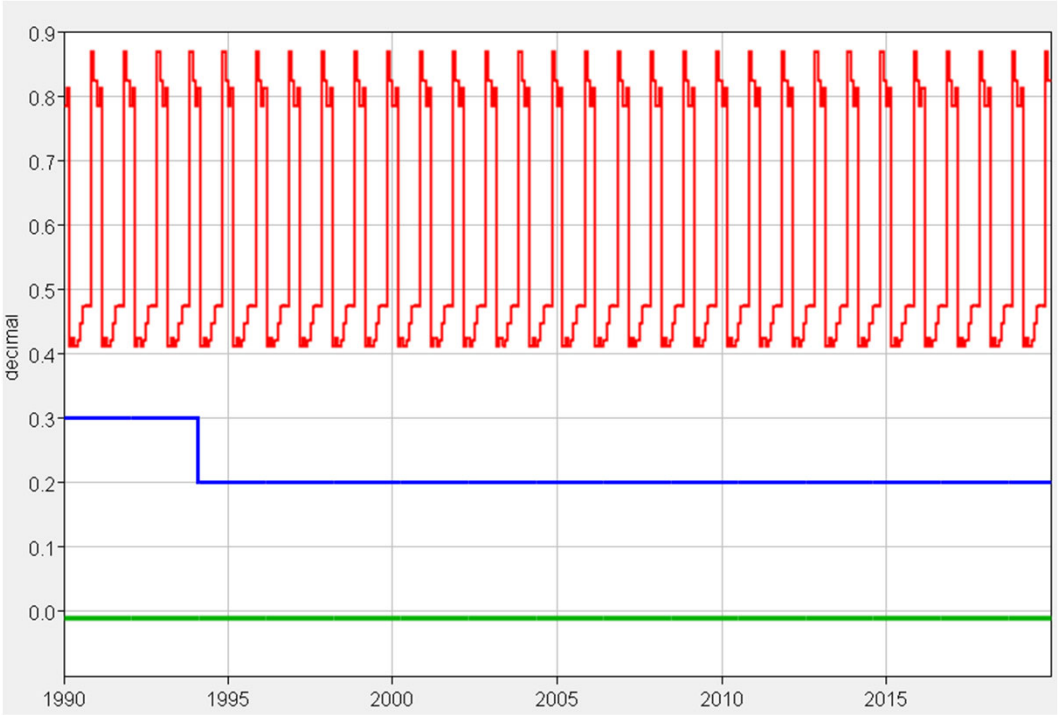
- Riparian and Agricultural Areas
- Fractional return flows
- Canal Seepage fractions
- Evaporation coefficients

*Should they be handled differently?*



# Constant / Periodic data in database

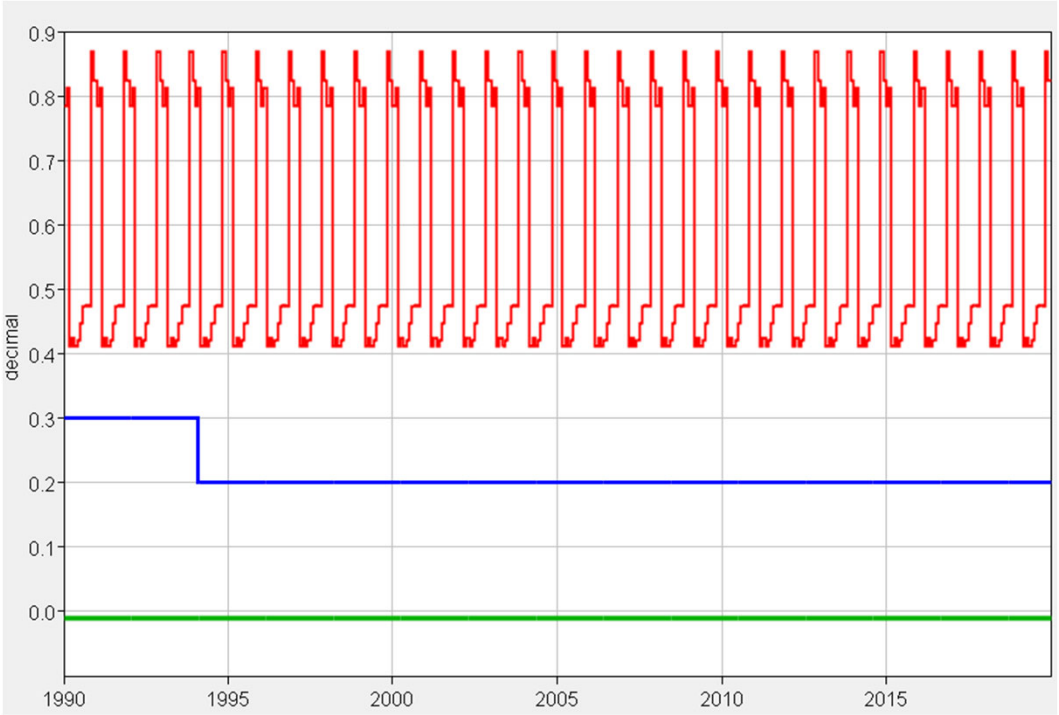
- Effect on database size is not significant
  - 134 Mb vs 132 Mb
  - Can hold 750 yrs of data
- No functional issue in model runs
- Adding changes/complexity provides little benefit



# Constant / Periodic data in database

- Effect on database size is not significant
  - 134 Mb vs 132 Mb
  - Can hold 750 yrs of data
- No functional issue in model runs
- Adding changes/complexity provides little benefit

*No changes recommended, with one exception*



# Database Update 2021

## 17 Top of Drains in MRG deleted from Database

- Function performed by Input DMI

- Pena Blanca Riverside Drain
- Eastside Santo Domingo Riverside Drain
- Lower Westside Santo Domingo Drain

- San Felipe To Central Drains
  - East
  - West 1, 3, 4

- Central To Isleta Drains
  - East
  - West 1 and 2

- Isleta to Bernardo Drains
  - East 1(Upper Peralta), 4
  - West 1, 2, 3, 4

**Continuing with the remaining periodic and constant data in the database maintains consistency and simplicity in model and rules logic**

# Database Update 2021

## Ongoing Topics

- Regular updates are recommended
  - Continually improve efficiency
- Quality Control
  - Accuracy and consistency
  - Example - MRG crop consumption vs riparian consumption
- MRGCD data is problematic
  - Not currently used in the model
  - Many gages produce unreliable data due to field conditions

*Update scoped for next year*

# Database Update 2021

**Thanks!**

BUREAU OF RECLAMATION

# URGWOM Tech Team Meeting

August 10, 2021

BUREAU OF RECLAMATION

# Adding Santa Fe to URGWOM

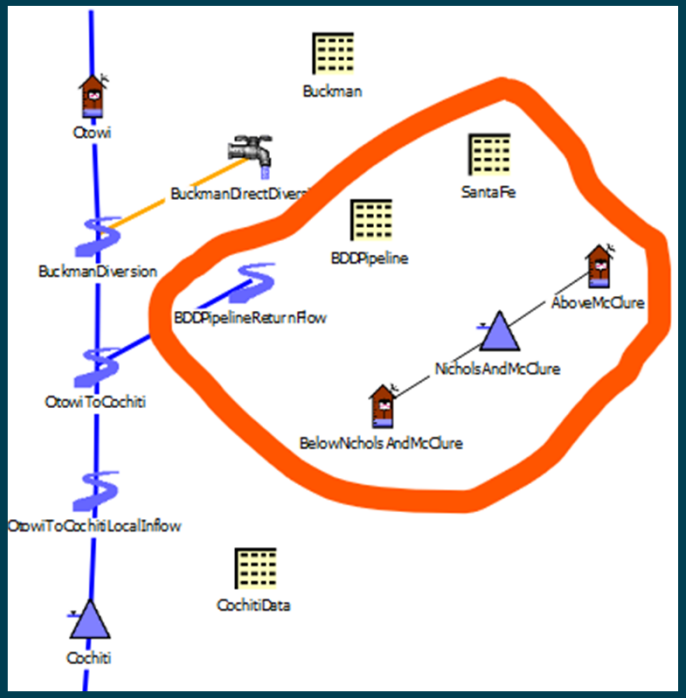
# Purpose

- To model Santa Fe and more accurately portray its impact on the Rio Grande.
- To provide alternatives and study how the different BDD Pipeline "Options" will affect Santa Fe and the Rio Grande.
- To analyze Santa Fe in the Rio Grande NM Basin Study.

# Main Additions

- BDD Pipeline Return with Option A (direct exchange) and B (Cochiti exchange)
- Santa Fe paying Article VI and VII
- Santa Fe Nichols and McClure Reservoir with city, acequia, and Living River demand
- Demand based diversions for Buckman Diversion

# Objects Added



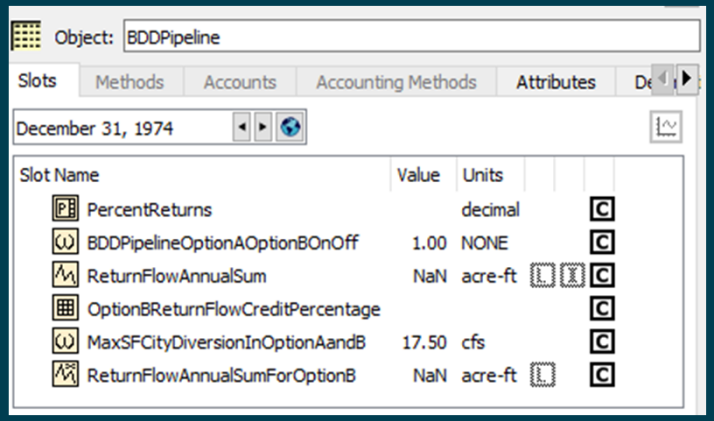
# BDDPipelineReturnFlow

- Adds return flow under Option A or B
  - Depending on which Option, the flow will come from inflow or return flow slot due to accounting
- Attached to OtowiToCochiti.Return Flow
- Flows are calculated using a monthly constant multiplied by Santa Fe City Diversion at Buckman


| | PercentReturns decimal |
|---|---|
| Jan | 0.92 |
| Feb | 0.95 |
| Mar | 0.88 |
| Apr | 0.72 |
| May | 0.60 |
| Jun | 0.49 |
| Jul | 0.53 |
| Aug | 0.55 |
| Sep | 0.58 |
| Oct | 0.73 |
| Nov | 0.93 |
| Dec | 0.96 |

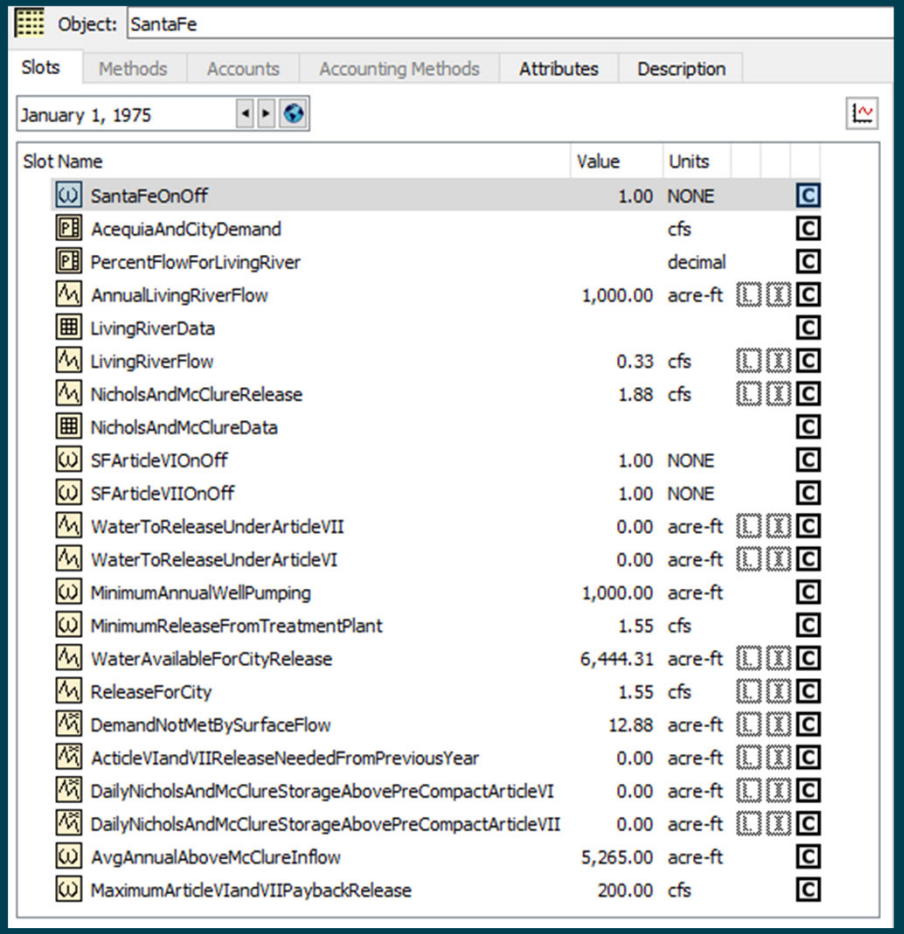
# BDDPipeline

- Data object that houses slots related to the BDD Pipeline Return Flow.



# SantaFe

- Data object that houses slots related Santa Fe City operations.

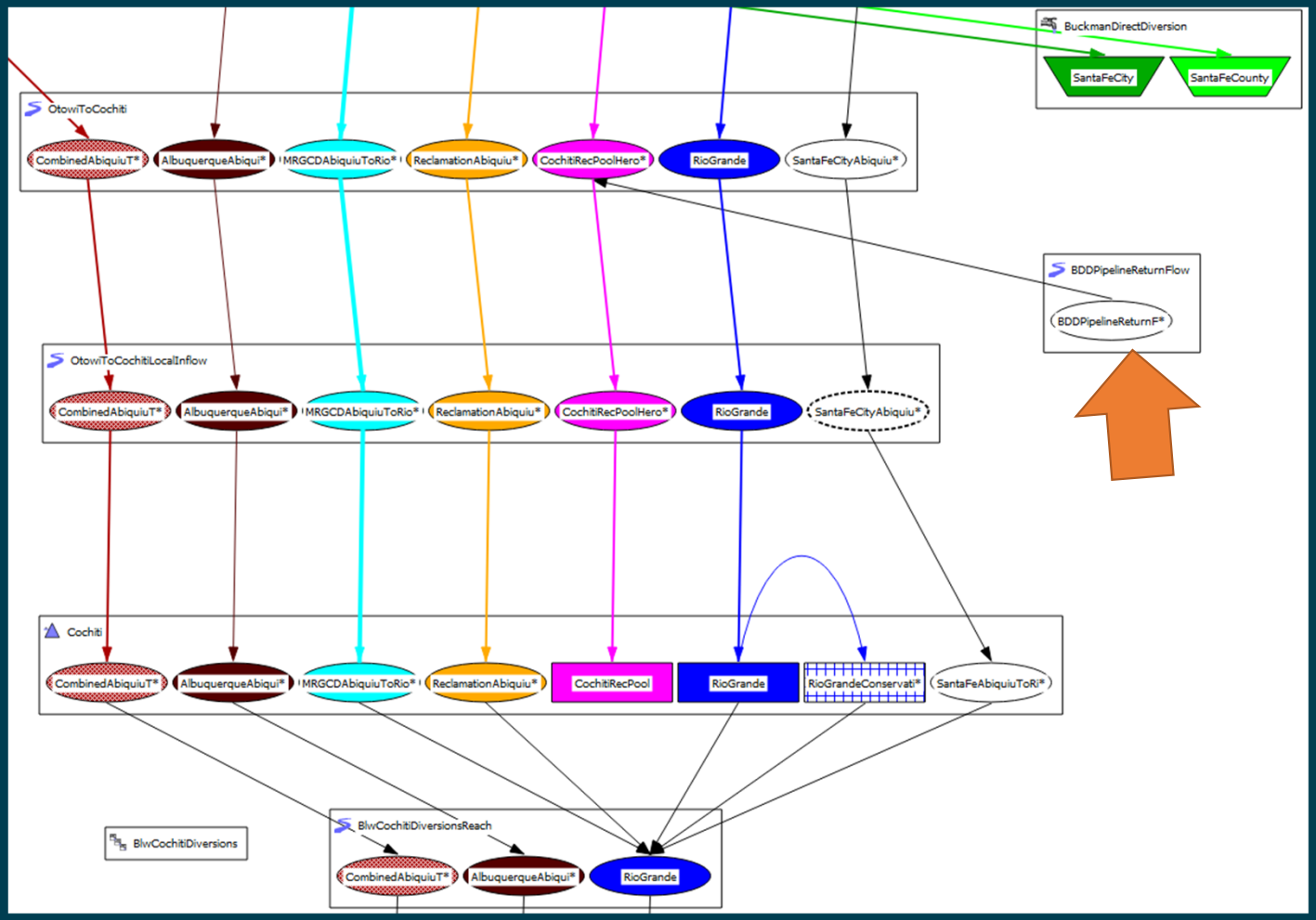


# NicholsAndMcClure

- Is assumed to act as Nichols and McClure Reservoirs Combined.
  - Because of this the elevations are incorrect and just set 1 to 1 with storage
- It is assumed that any evaporation is made up by precipitation and local inflow or groundwater recharge
- No methods are selected and there is no accounting
- Used to determine city demand for Abiquiu releases, as well as estimate Article VI and VII payback for Santa Fe

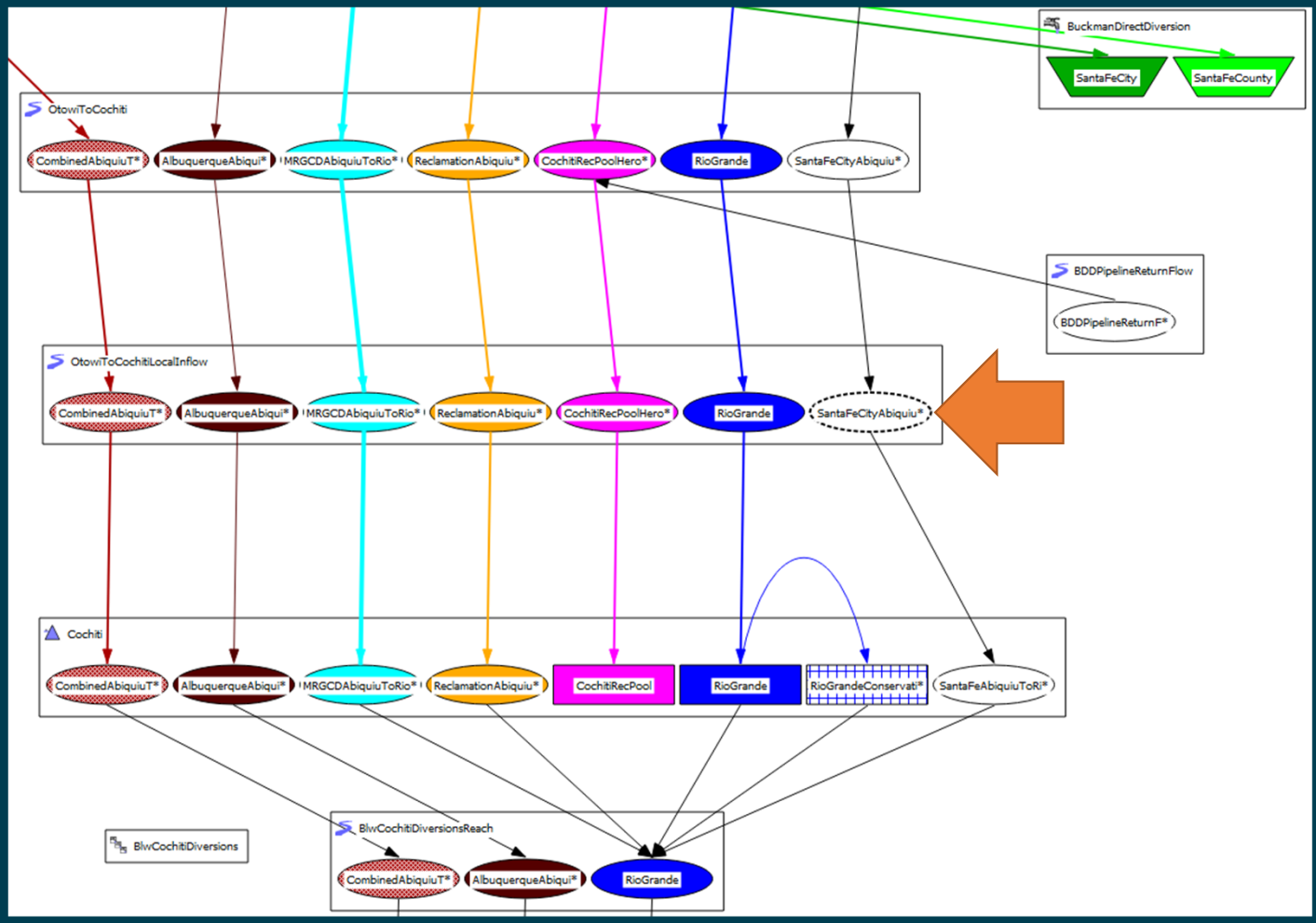
# Accounting

- BDDPipelineReturnFlowCredit Passthrough account in BDDPipelineReturnFlow object connected to Cochti Rec Pool account



# Accounting

- SantaFeCityAbiquiu ToBelowCochiti account supply from Abiquiu to Cochiti to facilitate Article VI and VII payback



# How It All Works Together

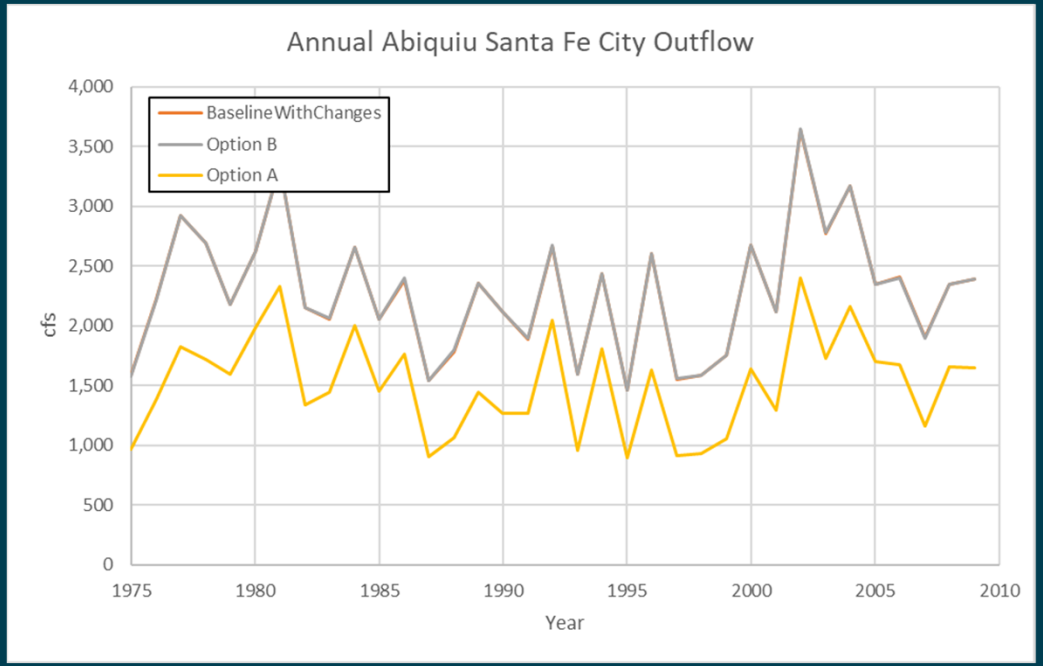
- The model can now be set up in multiple ways depending on what the user wants to simulate
  - Santa Fe City – On/off
    - On - allow the use of NicholsAndMcClure Reservoir as well as all the below functions
  - BDDPipelineReturnFlow – Option A, Option B, or off
    - Option A – Return flow will be calculated and released from the BDDPipeline object, and the flow will count as a direct credit toward releases at Abiquiu
    - Option B – Return flow will be calculated and released from the BDDPipeline object, and the flow will go into Cochiti Rec Pool
  - Santa Fe City Article VI – On/off
  - Santa Fe City Article VII –On/off

# Santa Fe On/Off

- To run the model without any of these changes and no required inflow into NicholsAndMcClure Reservoir, this switch needs to be set to any number besides 1 and the Reservoir needs to be disabled.
  - If implemented into the official model, this would likely be the default setting
- To enable any of these changes, this slot must be set to 1 and there must be a starting storage/pool elevation for NicholsAndMcClure reservoir and flows in the AboveNicholsAndMcClure.Inflow slot.
  - With just this enabled and no Option or Article VI/VII on, the only difference will be the demand-based releases.

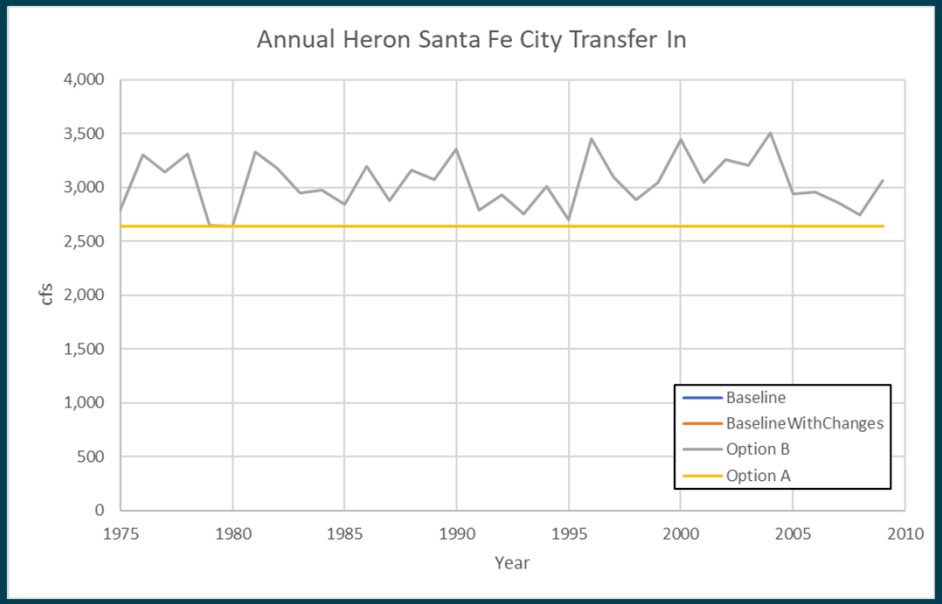
# BDDPipelineReturnFlow: Option A

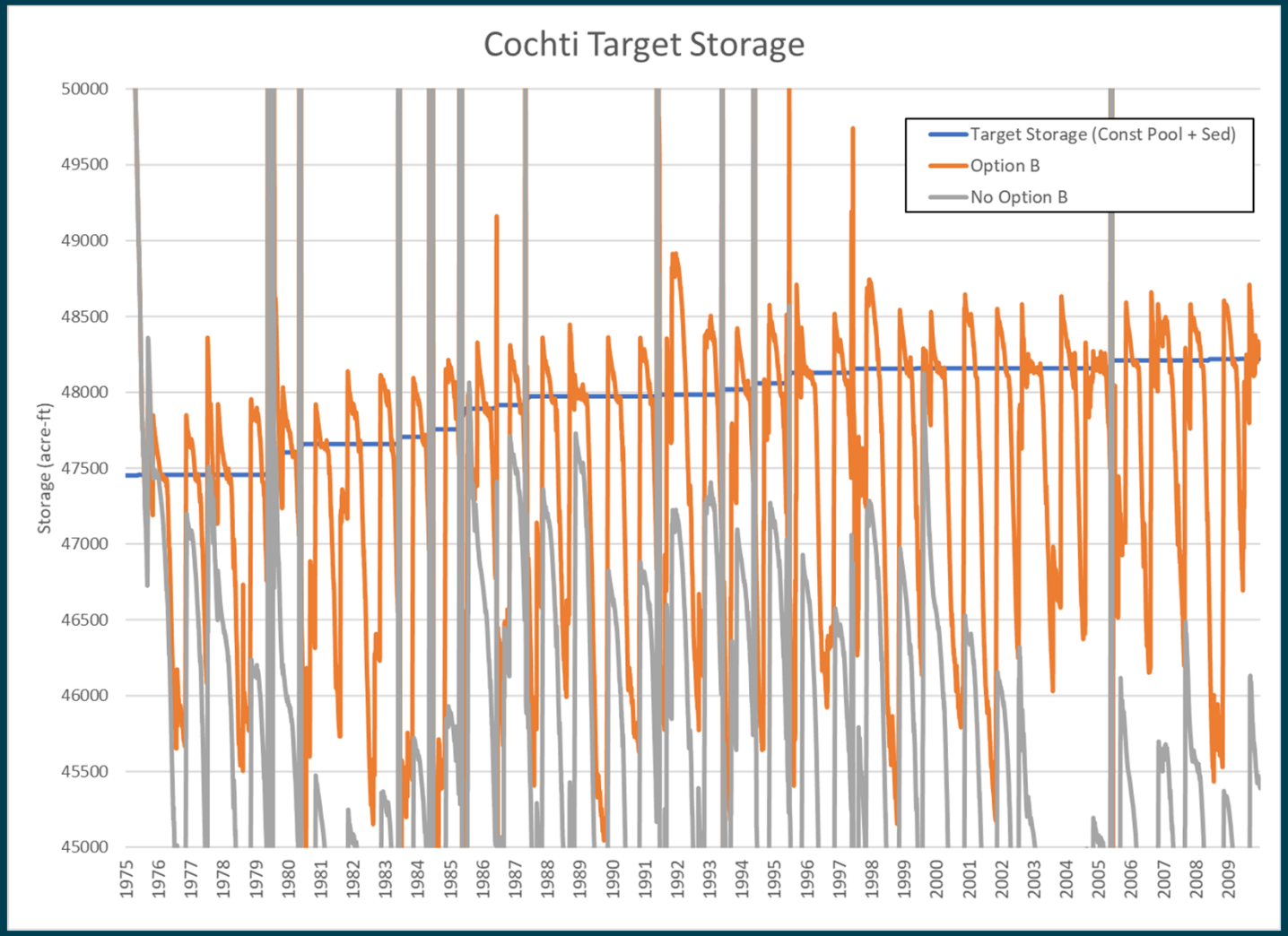
- If Option A is selected, the BDDPipelineReturnFlow.Return Flow will populate flow based on incoming Santa Fe City Buckman Diversion and a multiplier. This flow will then count towards the flow at Abiquiu requiring less Santa Fe City water to be released at Abiquiu to meet Santa Fe City Demand



# BDDPipelineReturnFlow Option B

- If Option B is selected, the BDDPipelineReturnFlow.Inflow will populate flow based on incoming Santa Fe City Buckman Diversion and a multiplier and if there is any room in Cochiti Rec Pool at Cochiti. These flows are saved and summed in an expression slot. On December 30th, the minimum of these flows and a multiplier or the amount of water in Cochiti Rec Pool in Heron and a multiplier are transferred to Santa Fe City and Reclamation accounts.



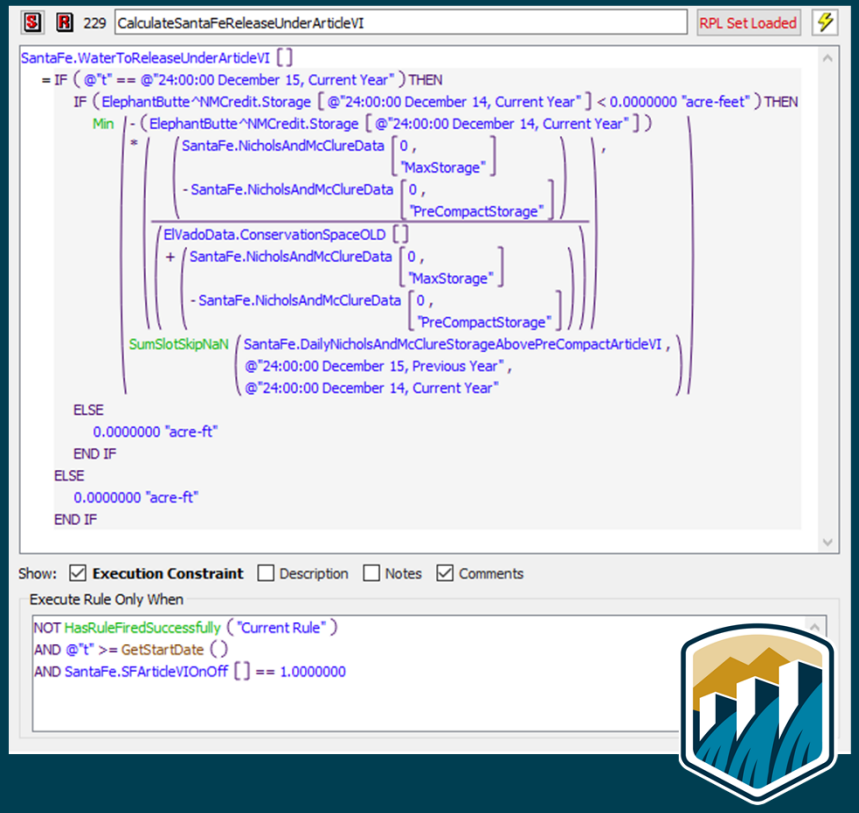

Cochti Target Storage
Storage (acre-ft)
50000
49500
49000
48500
48000
47500
47000
46500
46000
45500
45000
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Target Storage (Const Pool + Sed)
Option B
No Option B

# BDDPipelineReturnFlow No Option

- If no option is selected (i.e. BDDPipeline.BDDPipelineOptionAOptionBOnOff != 1 or 2), then no return flow occurs.

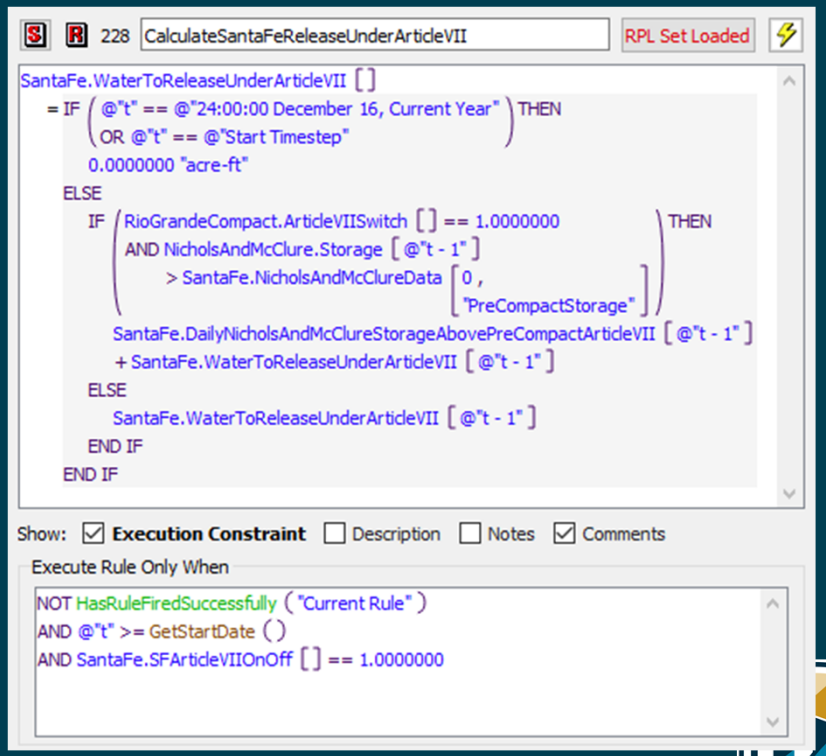
# Article VI On/Off

- When turned on, Santa Fe City will release water out of Abiquiu to fulfill any Article VI obligation for storing water in NicholsAndMcClure.
- This is calculated any year that NM is in debit status.
- The rule will calculate the proportion of post compact space in NicholsAndMcClure and El Vado multiplied by the debit. It will then take the minimum of that and how much was stored over the pre-compact storage.

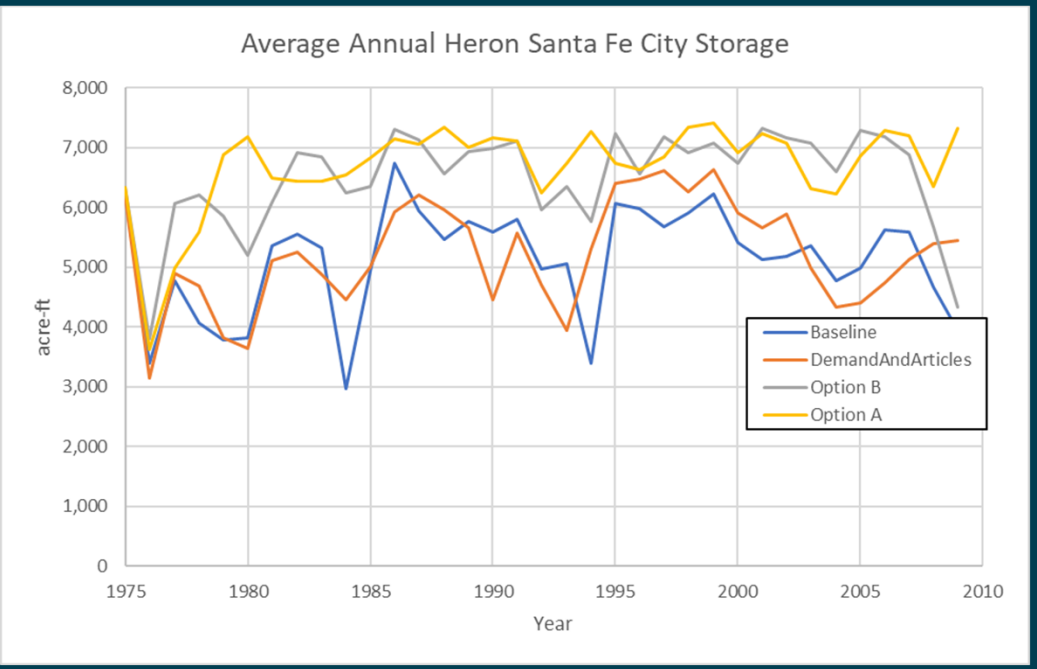


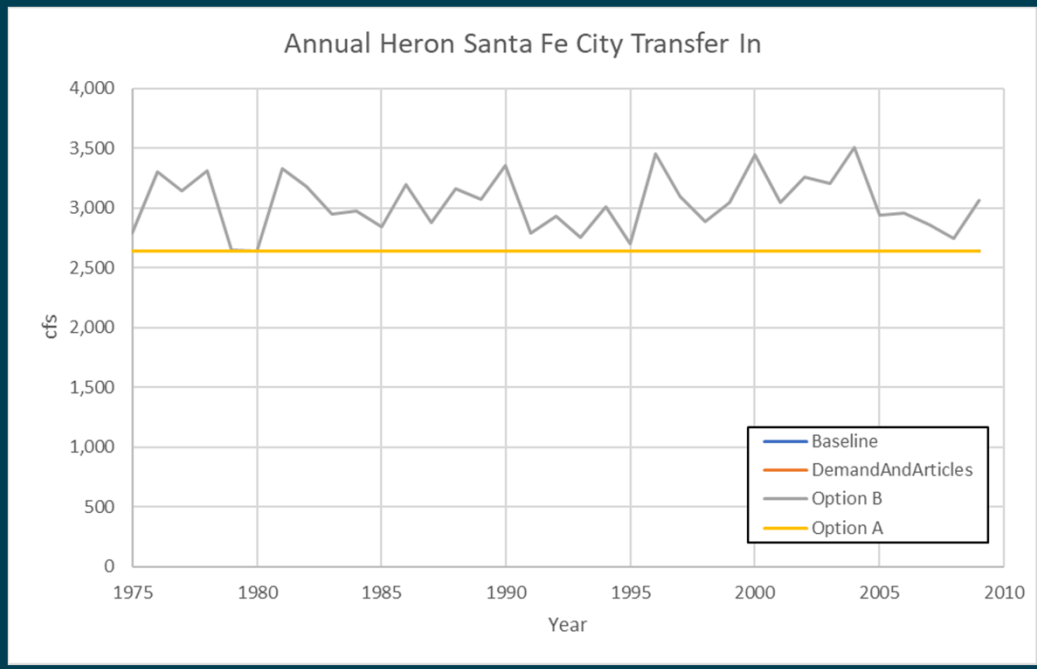
# Article VII On/Off

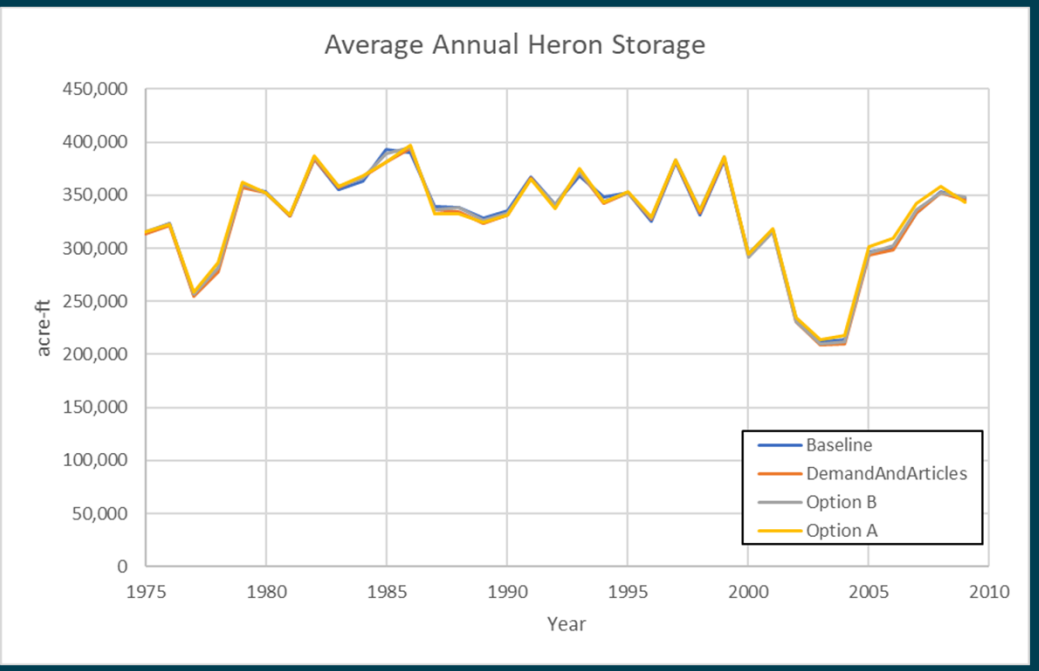
- When turned on, Santa Fe City will release water out of Abiquiu to fulfill any Article VII obligation for storing in NicholsAndMcClure.
- This is calculated whenever the model is in Article VII status and water is being stored at NicholsAndMcClure.

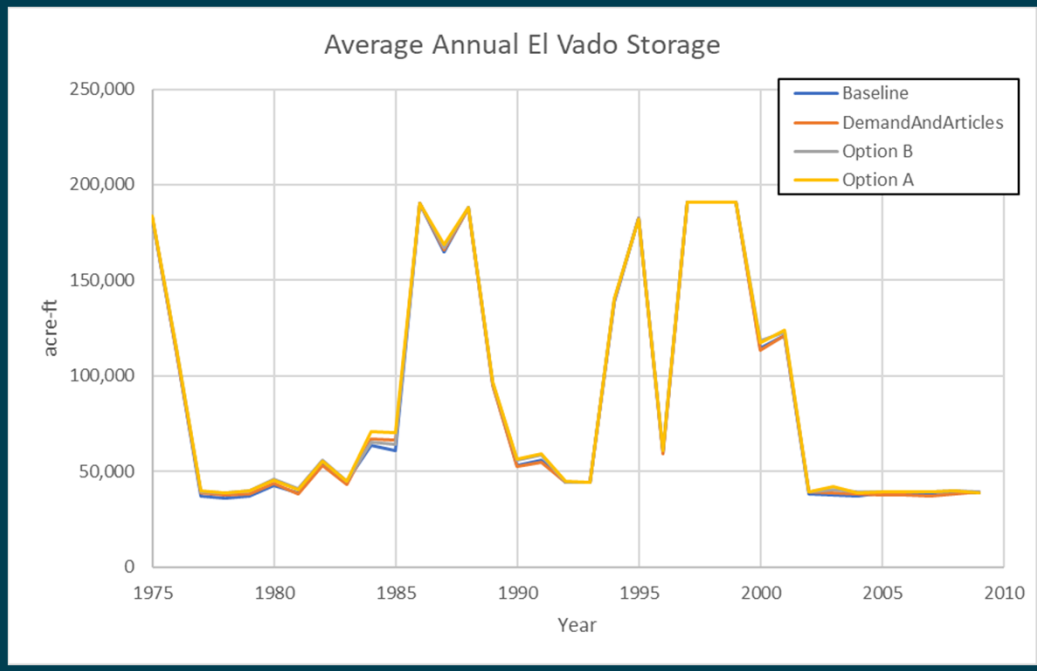


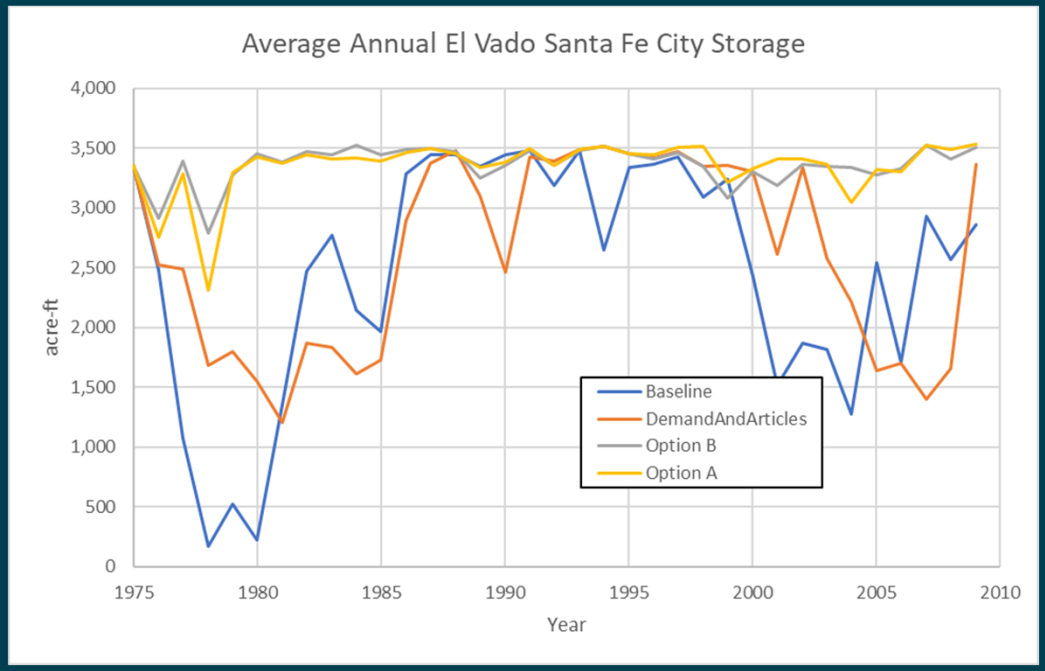
# Results of Test Runs

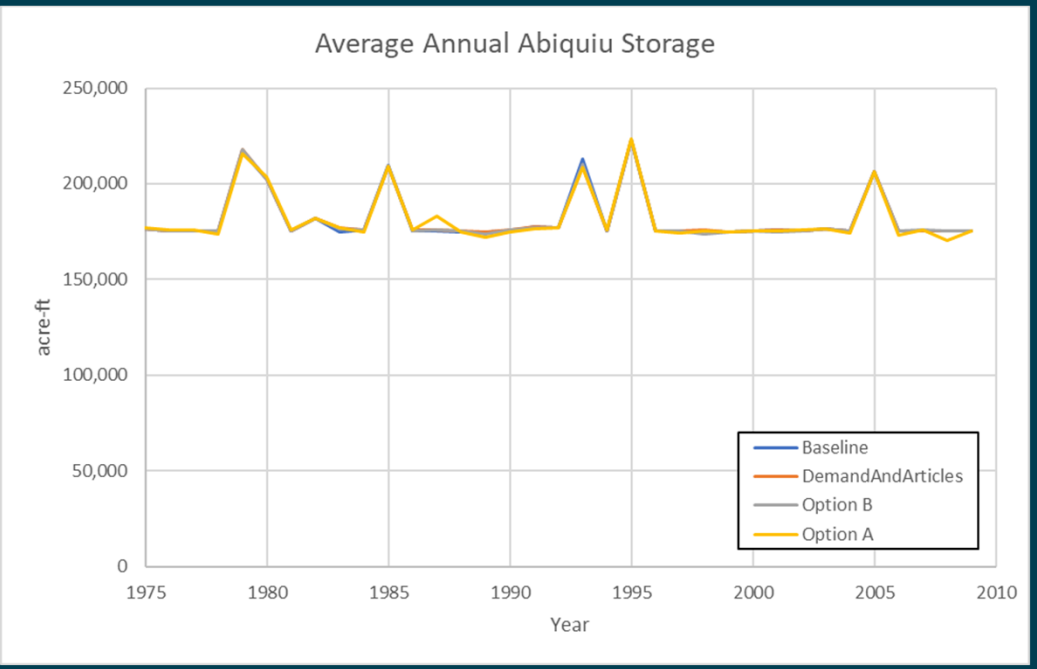

Average Annual Heron Santa Fe City Storage
acre-ft
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1975
1980
1985
1990
1995
2000
2005
2010
Year
Baseline
DemandAndArticles
Option B
Option A

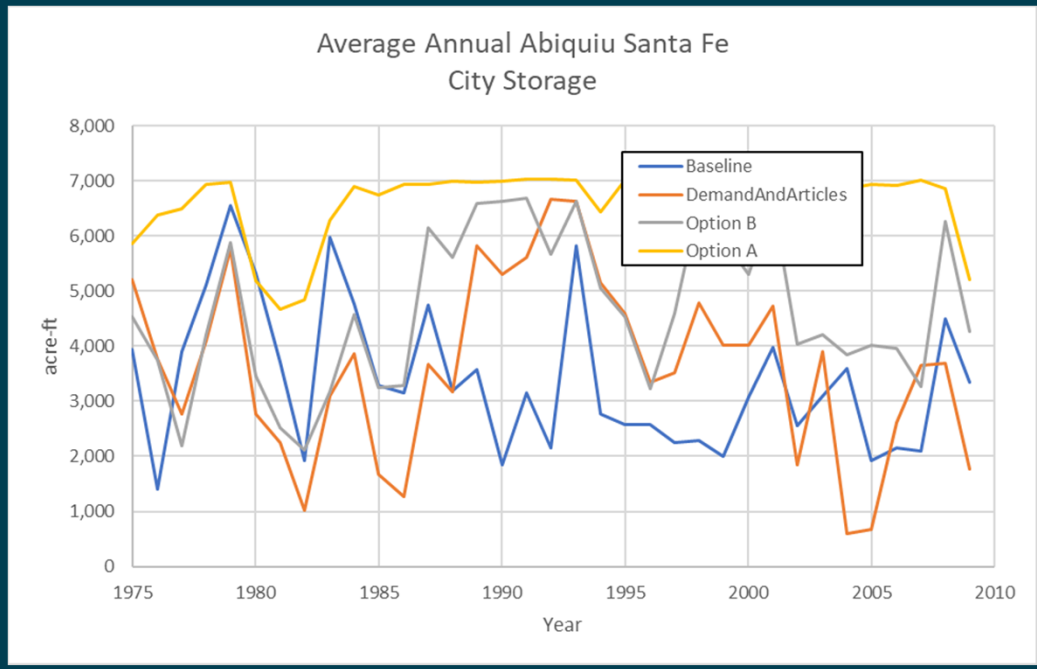

Annual Heron Santa Fe City Transfer In
cfs
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1975
1980
1985
1990
1995
2000
2005
2010
Year
Baseline
DemandAndArticles
Option B
Option A

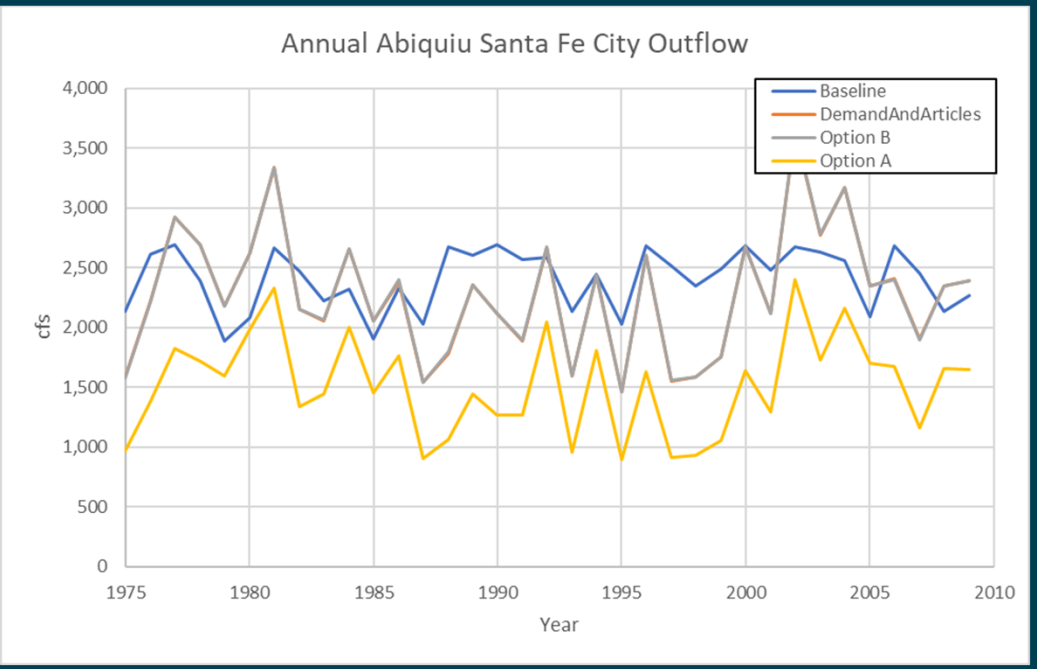

Average Annual Heron Storage
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
acre-ft
1975
1980
1985
1990
1995
2000
2005
2010
Year
Baseline
DemandAndArticles
Option B
Option A

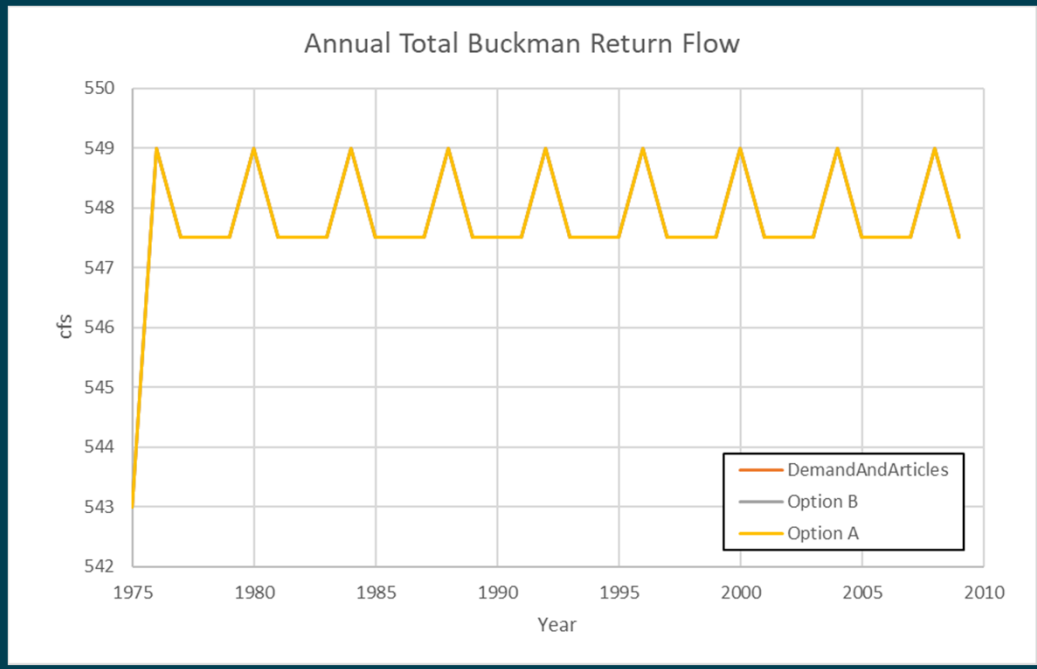

Average Annual El Vado Storage
250,000
200,000
150,000
100,000
50,000
0
acre-ft
1975
1980
1985
1990
1995
2000
2005
2010
Year
Baseline
DemandAndArticles
Option B
Option A

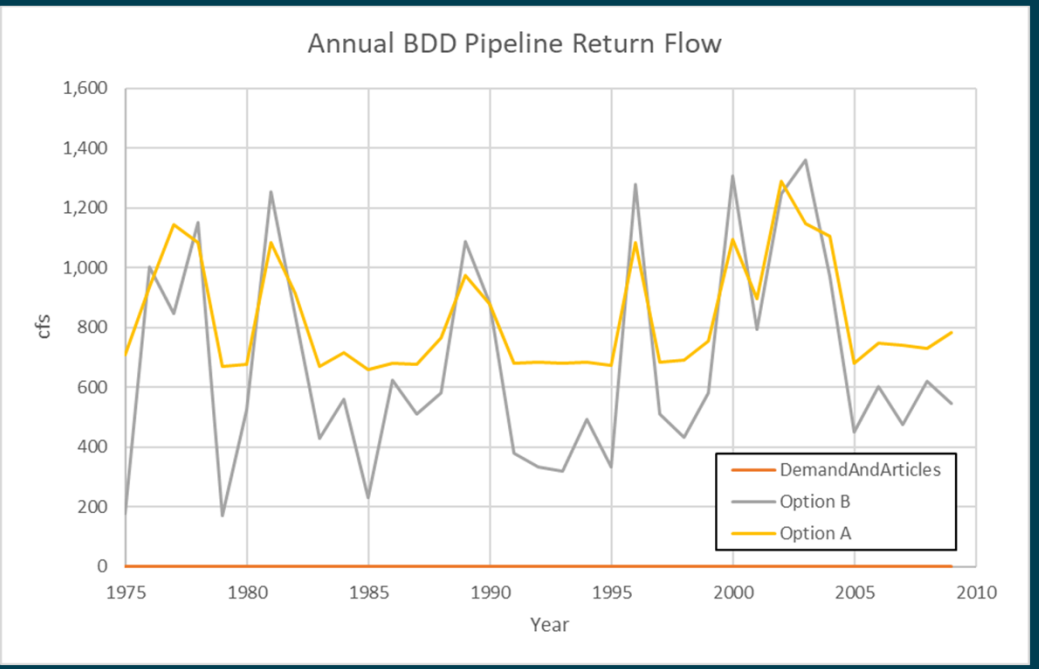

Average Annual El Vado Santa Fe City Storage
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
acre-ft
1975
1980
1985
1990
1995
2000
2005
2010
Year
Baseline
DemandAndArticles
Option B
Option A

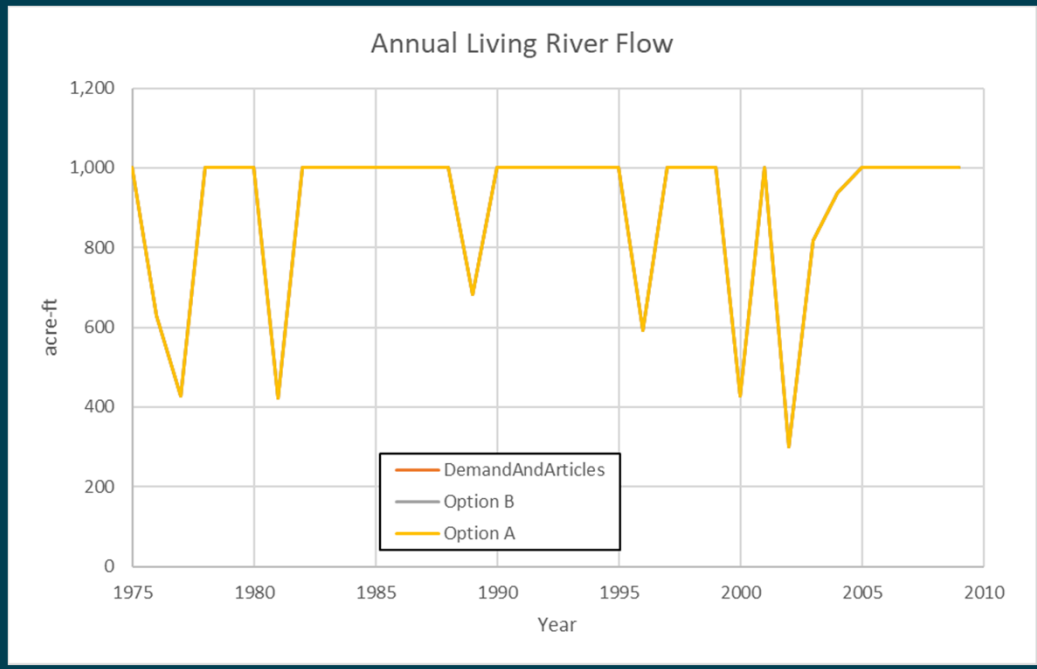

Average Annual Abiquiu Storage
250,000
200,000
150,000
100,000
50,000
0
acre-ft
1975
1980
1985
1990
1995
2000
2005
2010
Year
Baseline
DemandAndArticles
Option B
Option A

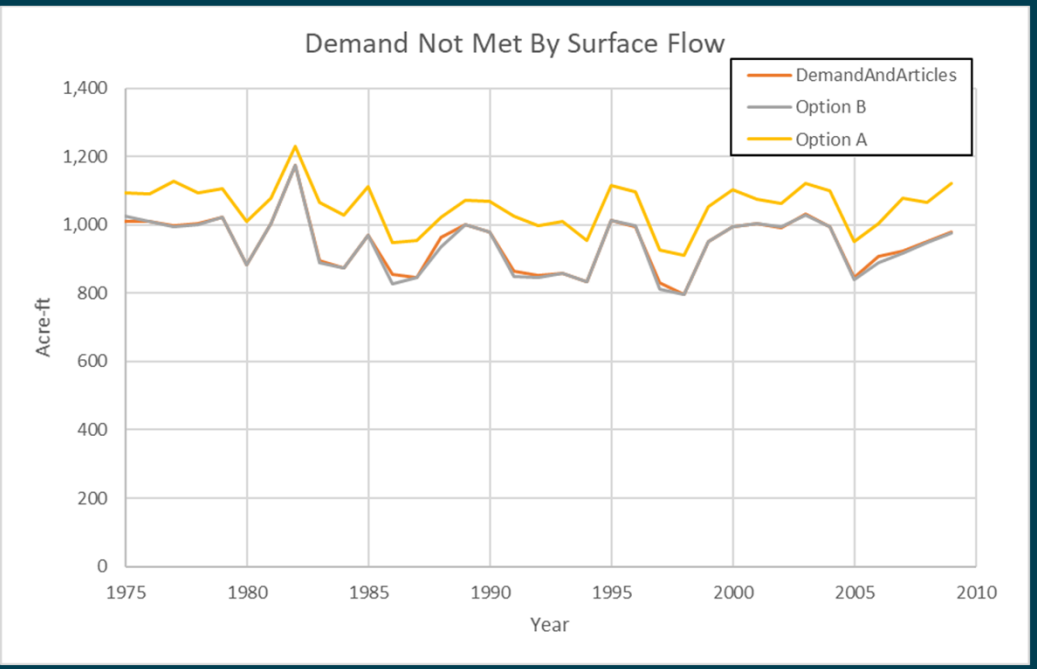

Average Annual Abiquiu Santa Fe City Storage
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
acre-ft
1975
1980
1985
1990
1995
2000
2005
2010
Year
Baseline
DemandAndArticles
Option B
Option A

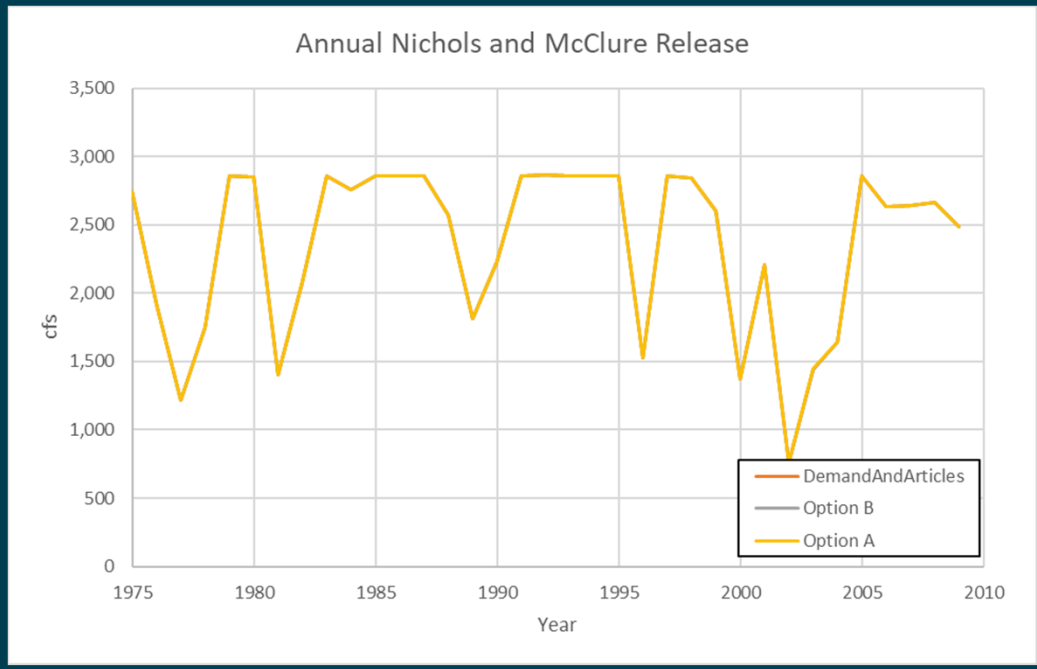

Annual Abiquiu Santa Fe City Outflow
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
cfs
1975
1980
1985
1990
1995
2000
2005
2010
Year
Baseline
DemandAndArticles
Option B
Option A

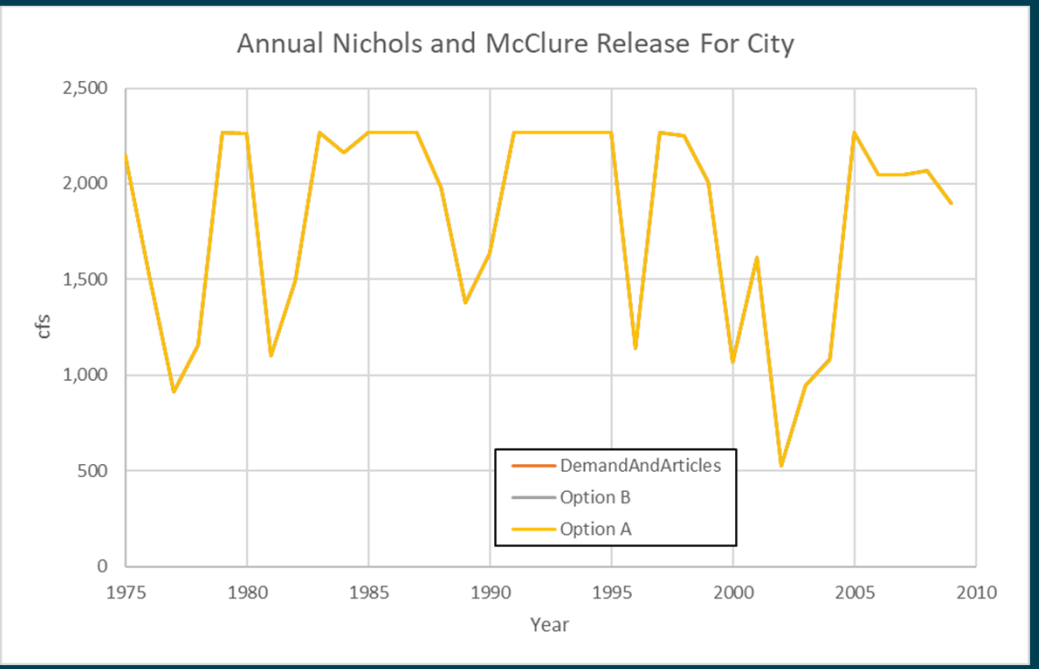

Annual Total Buckman Return Flow
550
549
548
547
546
545
544
543
542
cfs
1975
1980
1985
1990
1995
2000
2005
2010
Year
DemandAndArticles
Option B
Option A

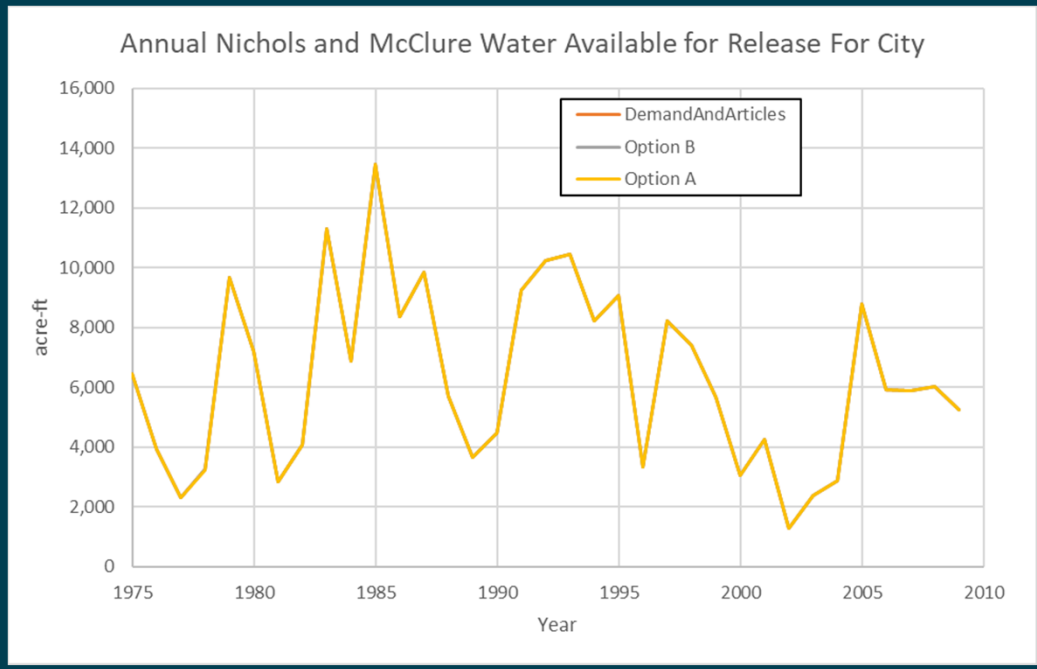

Annual BDD Pipeline Return Flow
cfs
1,600
1,400
1,200
1,000
800
600
400
200
0
1975
1980
1985
1990
1995
2000
2005
2010
Year
DemandAndArticles
Option B
Option A

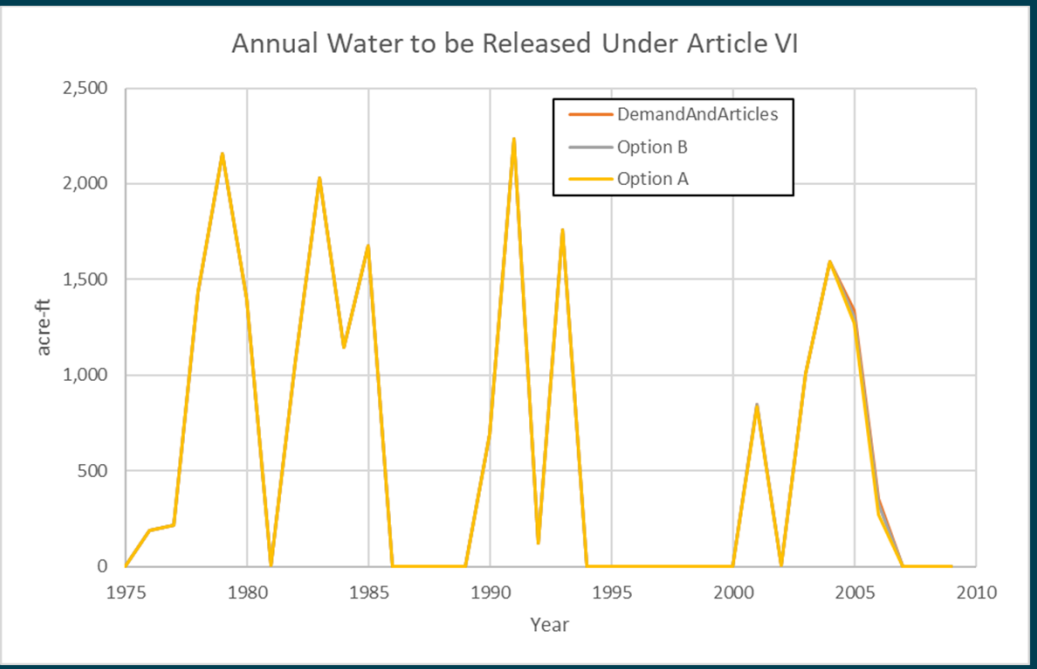

Annual Living River Flow
acre-ft
1,200
1,000
800
600
400
200
0
1975
1980
1985
1990
1995
2000
2005
2010
Year
DemandAndArticles
Option B
Option A

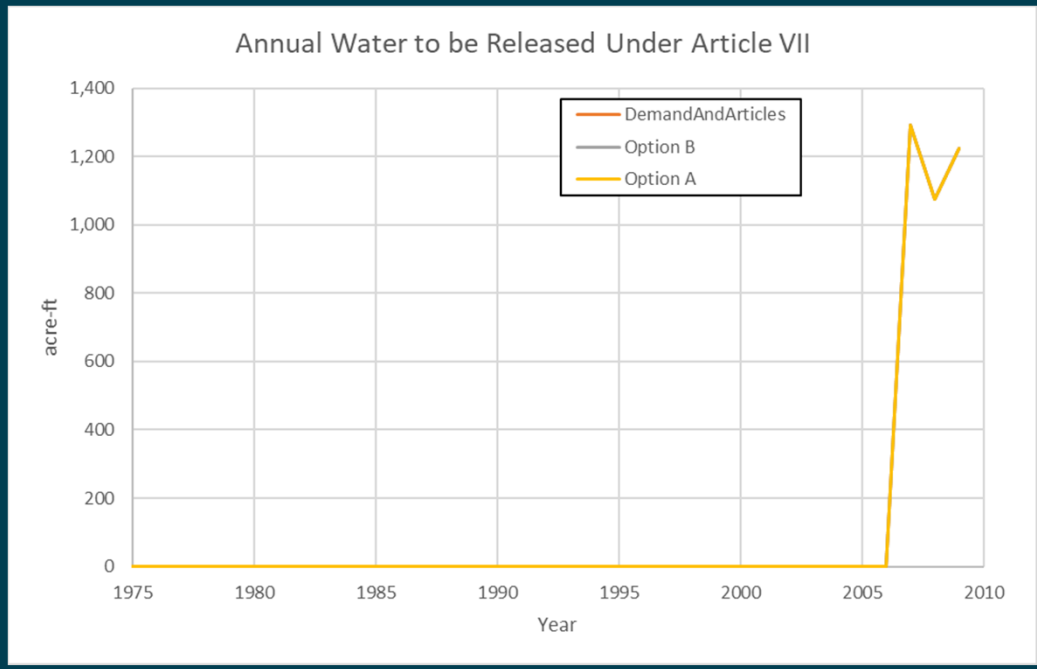

Demand Not Met By Surface Flow
DemandAndArticles
Option B
Option A
1,400
1,200
1,000
800
600
400
200
0
Acre-ft
1975
1980
1985
1990
1995
2000
2005
2010
Year

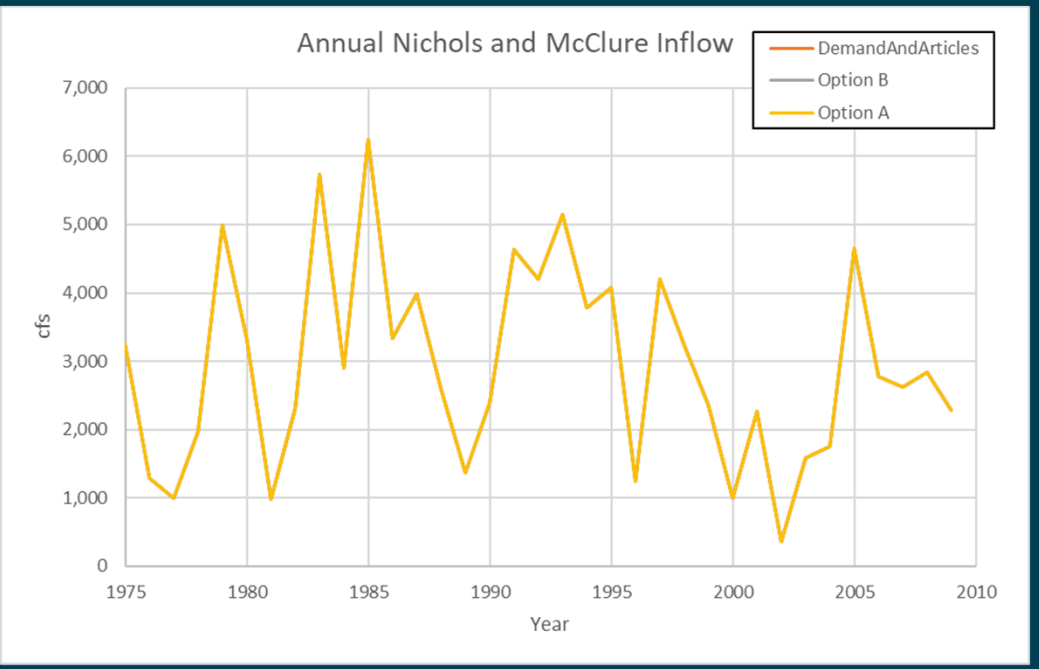

Annual Nichols and McClure Release
3,500
3,000
2,500
2,000
1,500
1,000
500
0
cfs
1975
1980
1985
1990
1995
2000
2005
2010
Year
DemandAndArticles
Option B
Option A

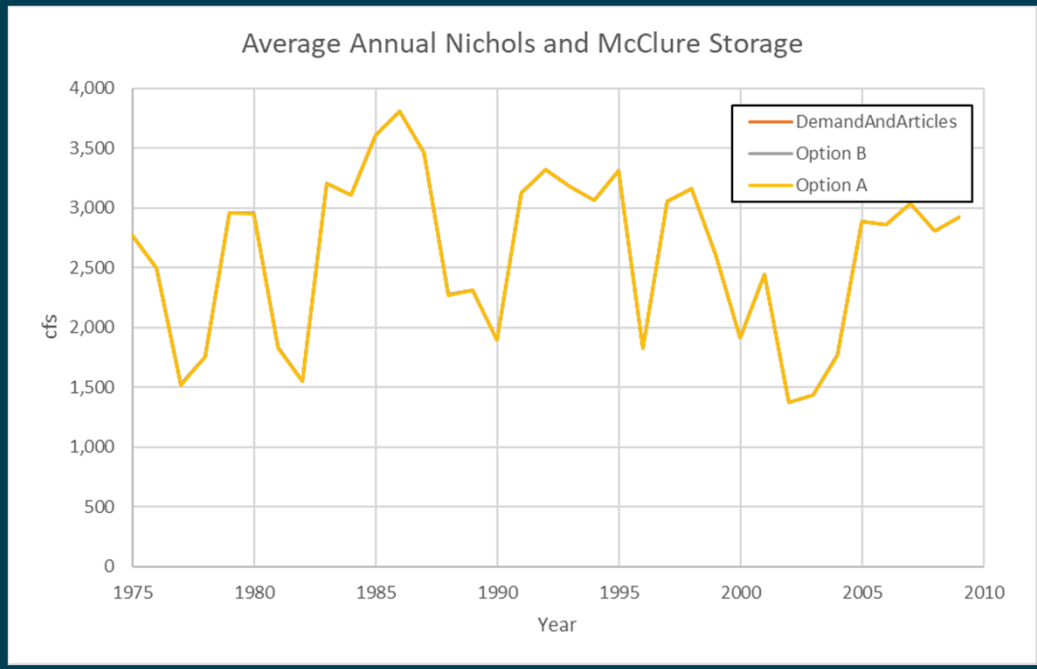

Annual Nichols and McClure Release For City
2,500
2,000
1,500
1,000
500
0
cfs
1975
1980
1985
1990
1995
2000
2005
2010
Year
DemandAndArticles
Option B
Option A


Annual Nichols and McClure Water Available for Release For City
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
acre-ft
1975
1980
1985
1990
1995
2000
2005
2010
Year
DemandAndArticles
Option B
Option A


Annual Water to be Released Under Article VI
2,500
2,000
1,500
1,000
500
0
acre-ft
1975
1980
1985
1990
1995
2000
2005
2010
Year
DemandAndArticles
Option B
Option A


Annual Water to be Released Under Article VII
1,400
1,200
1,000
800
600
400
200
0
acre-ft
1975
1980
1985
1990
1995
2000
2005
2010
Year
DemandAndArticles
Option B
Option A


Annual Nichols and McClure Inflow
DemandAndArticles
Option B
Option A
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
cfs
1975
1980
1985
1990
1995
2000
2005
2010
Year

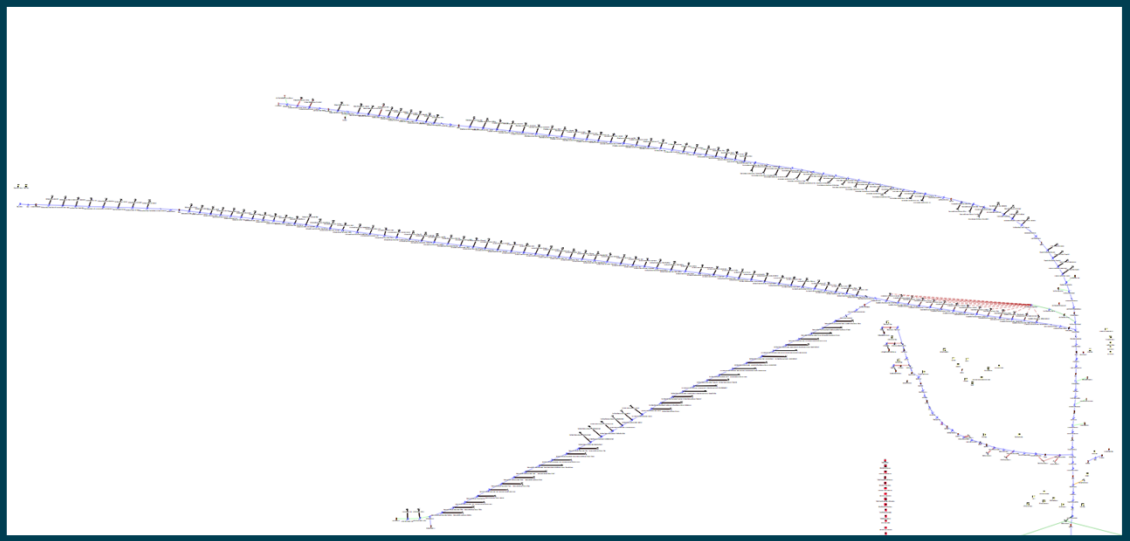

Average Annual Nichols and McClure Storage
DemandAndArticles
Option B
Option A
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
cfs
1975
1980
1985
1990
1995
2000
2005
2010
Year

BUREAU OF RECLAMATION

# Simplifying Colorado Portion in URGWOM

# Simplifying Colorado

- Is it necessary to still have the Colorado portion of the model as built out as it is?
- The main purpose of the CO portion is to calculate how much needs to be sent to NM for the compact.

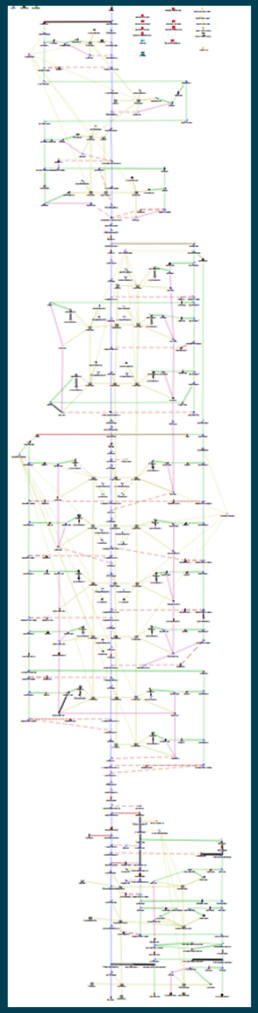


BUREAU OF RECLAMATION

# Modifying Scripts for When Not Using LRG and Add Simplified LRG Demand

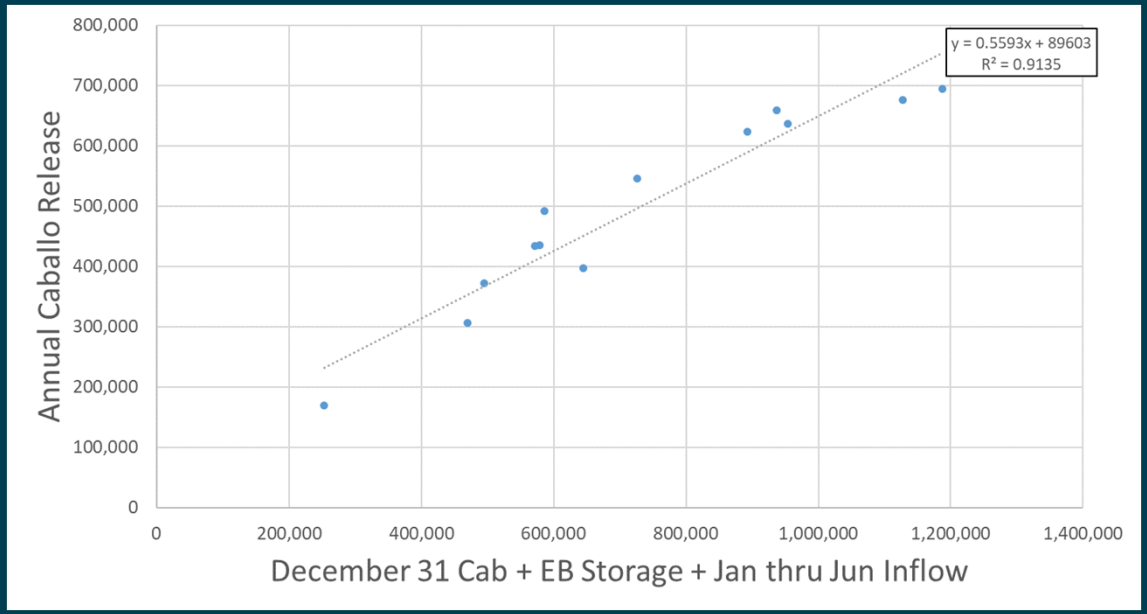
# Disable LRG when not used

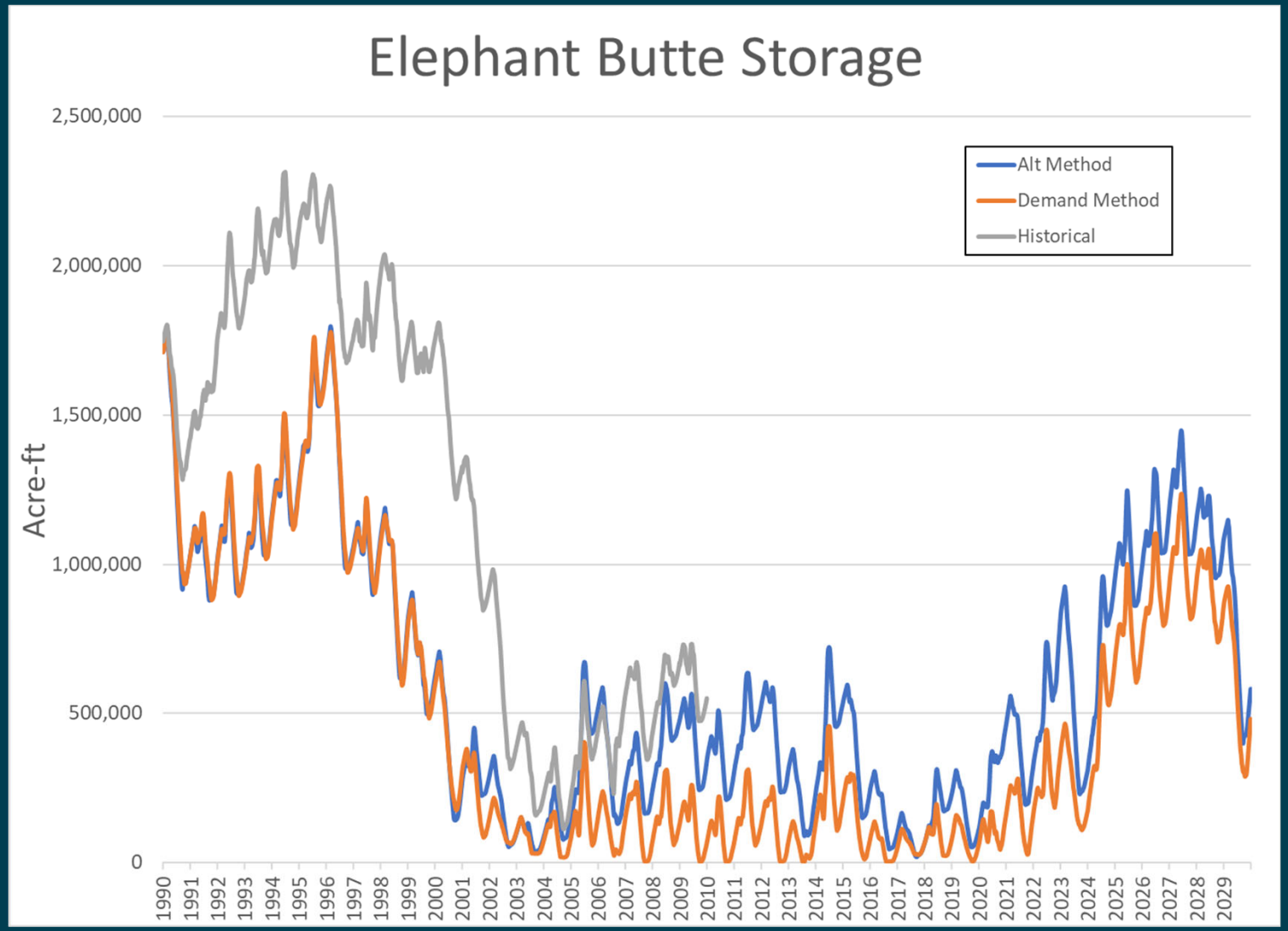
- Instead of having it on even when it isn't used like in most AOP runs, why not disable that portion as well as not bring in all that extra data to the model
  - Help reduce model size and possibly run time



# Adding Simplified LRG Demand

- Provide the option to use a simplified LRG Demand within URGWOM if LRG is not a priority within a specific run
  - Could help reduce model size and possibly run time
  - Less data needed to run if no data is available for LRG




Elephant Butte Storage
Acre-ft
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Alt Method
Demand Method
Historical
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
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2028
2029

# Other

- Encourage everybody who hasn't already, to update to RiverWare Version 8.3
  - This version requires an updated version of OpenSSL to use the Webservice DMI that connects to HDB and I can provide instruction like I did with the previous version for anyone that is interested.


Center for Advanced Decision Support for
Water and Environmental Systems (CADSWES)
UNIVERSITY OF COLORADO **BOULDER**

# RiverWare Updates for USACE and Reclamation

Presenter: David Neumann

URGWOM Tech Team Meeting

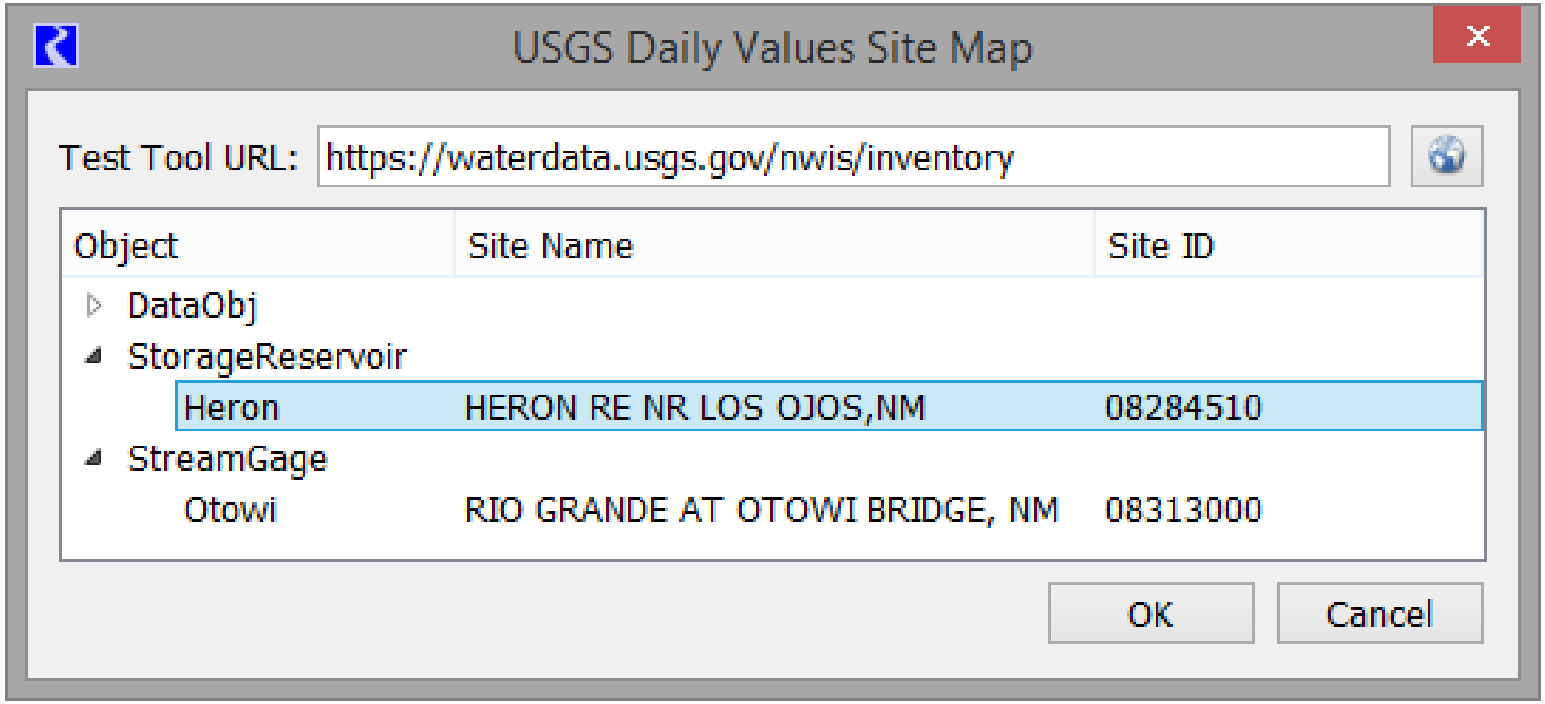
August 10, 2021

# 8.3 Highlights

- Scalar Data Viewer
- Undo and redo on the SCT.
- Improvements to the Model Comparison Tool
- A new Ensemble Data Tool and associated script actions for MRM ensemble analysis.
- More compact display of scripts and groups in the workspace Scripts menu.

# DMIs – USGS Site Maps

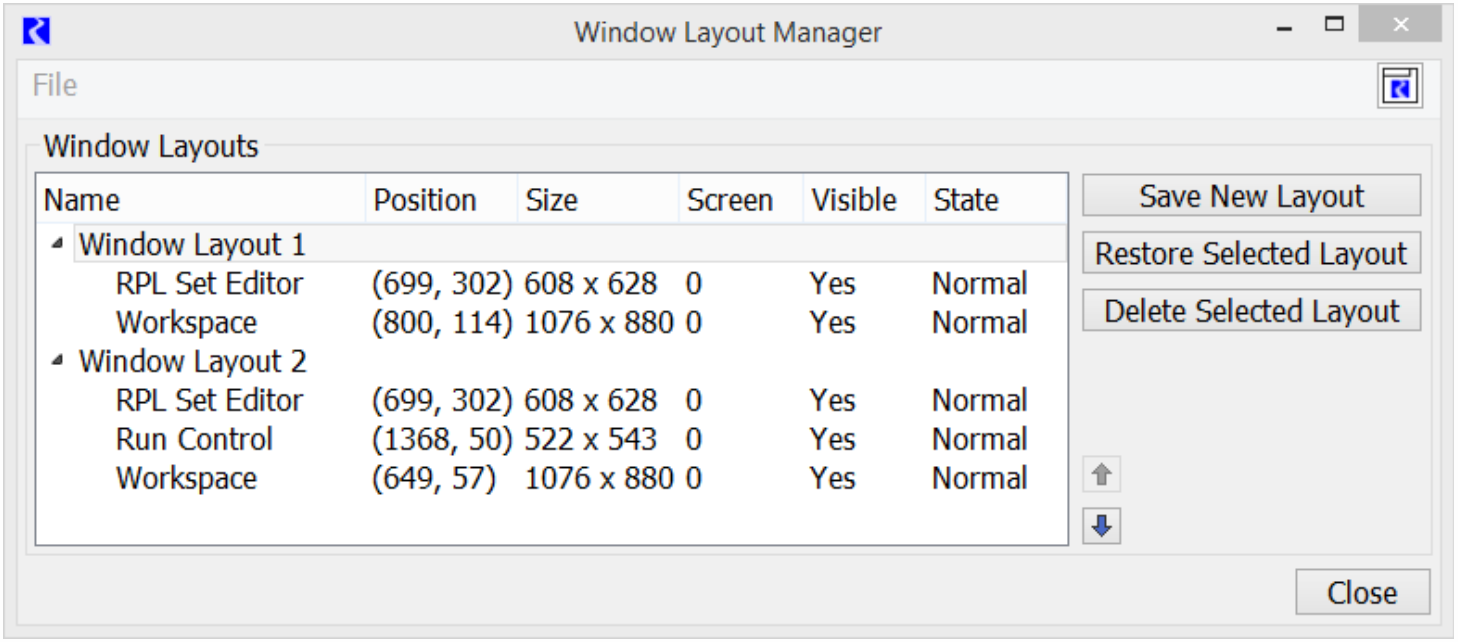
- Demo: New Web Service DMI Site Maps




- Open SSL version 1.1.1

# Upcoming Windowing Enhancements

- Survey performed in April 2021
- Layout Management: Utility to preserve and restore window layouts




- Initial release = 8.4