

# A Critical Review of Reclamation's Water Yield Modeling for the New Mexico Unit of the Central Arizona Project

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## Problem Statement

Determine Reclamation's water yield model simulation bases for Reclamation's project performance summary metrics published in the draft Environmental Impact Statement (DEIS) for the New Mexico Unit of the Central Arizona Project, aka **Gila Diversion and Storage Project**, 2004 Arizona Water Settlements Act.

- Net yield of project water
- Reliability of project water yield
- Cost of project water
- Losses
- Impacts of the lowest seniority on the river of the NM Unit's Gila River diversion right

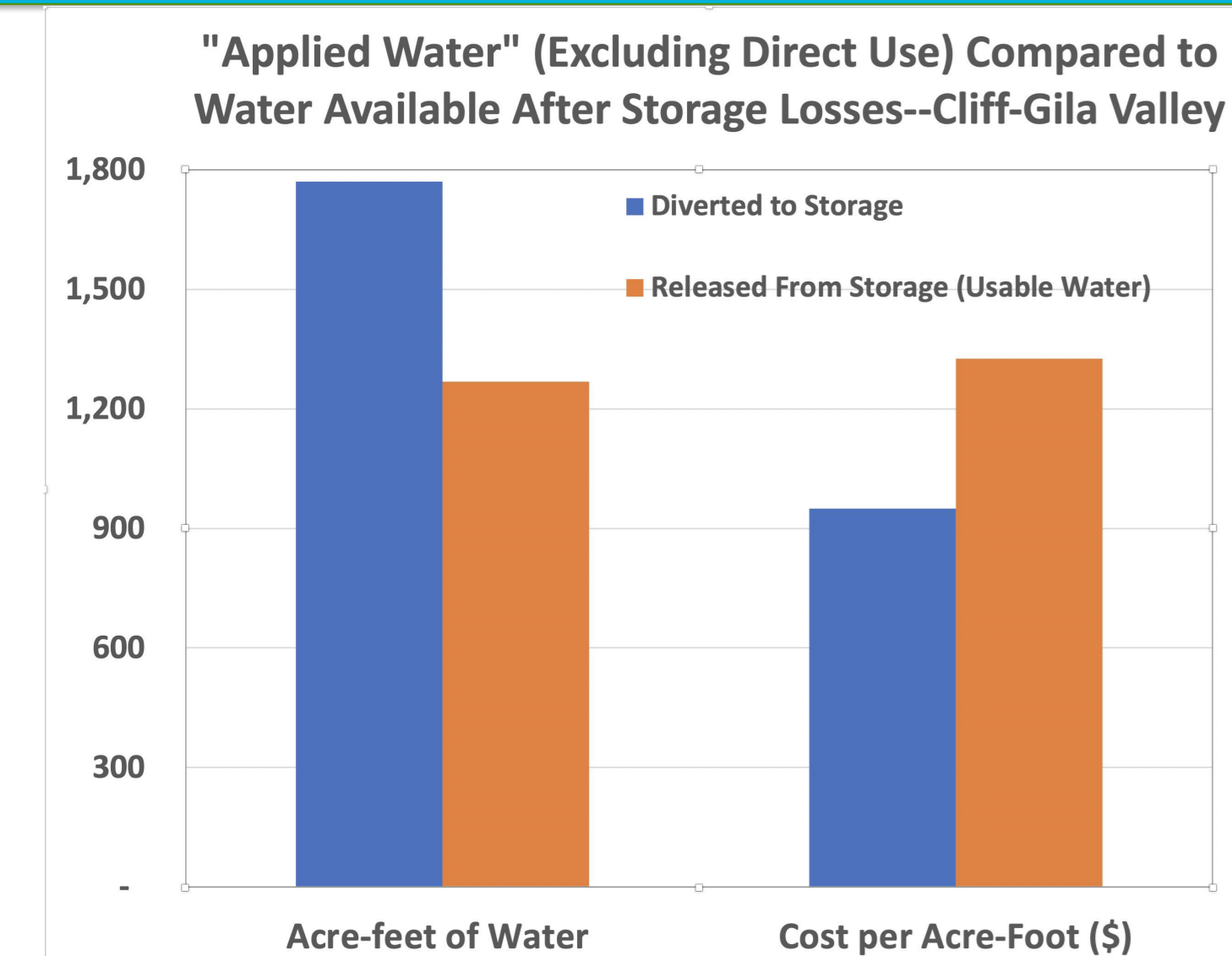
## Objective & Methods

Objective: Provide Informed public comment regarding draft Environmental Impact Statement

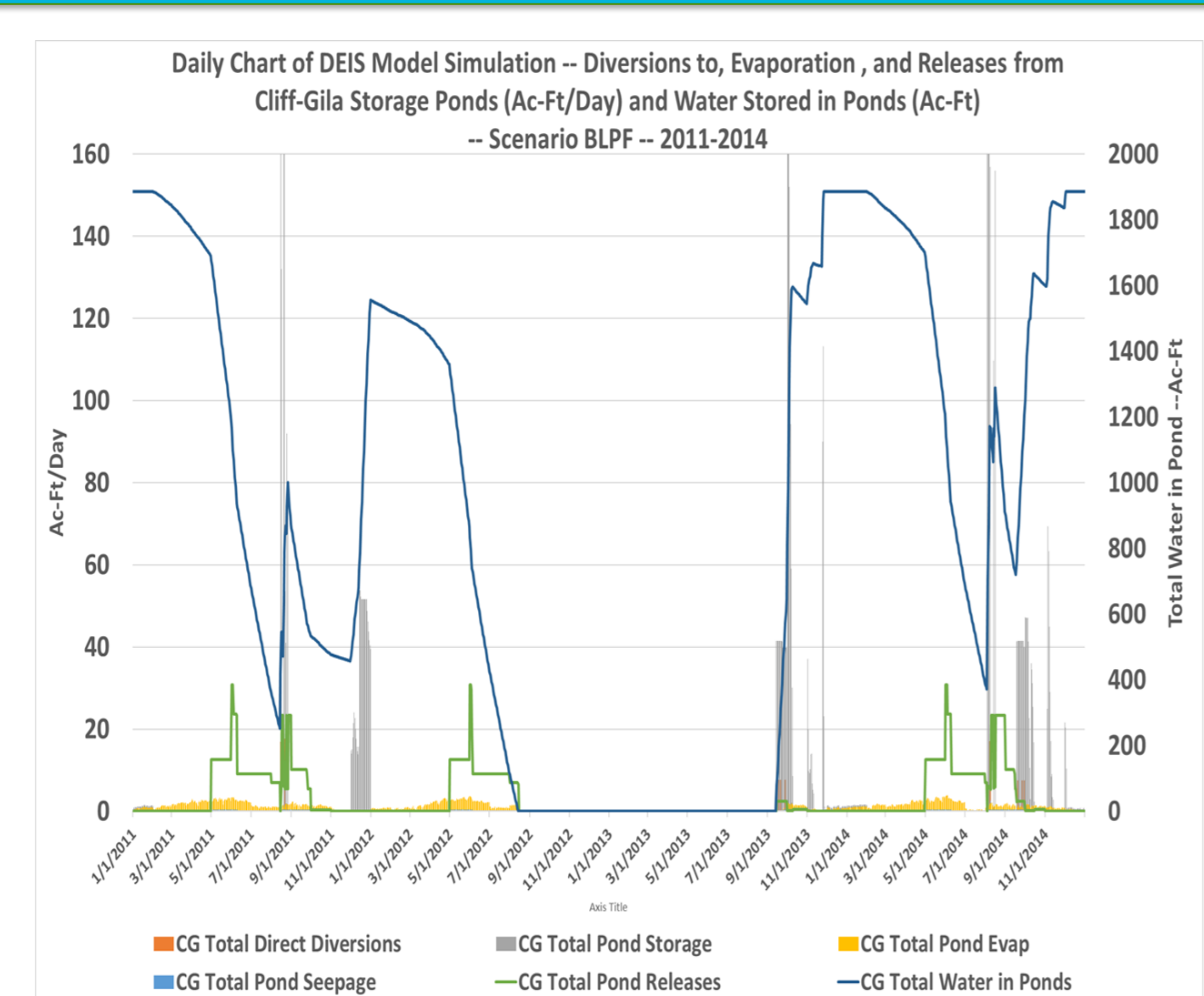
- Reviewed DEIS including appendices and associated technical memoranda
- Identified Reclamation project performance descriptions and conclusions that seemed wrong and which were unsupported by information in the DEIS and technical memoranda
- Obtained Reclamation's Excel workbook yield model from Reclamation
- Asked questions of Reclamation and received written responses
- Determined the details of model structure and operation, including macros that generated scenario simulations. One scenario matched the DEIS preferred alternative "BLPF" (Alternative B, low ditch losses, pecans in crop mix, flood irrigation)
- Compared model simulations with DEIS representations by generating daily, annual, and overall mean and median simulation graphics and data using Excel PivotTable functionality



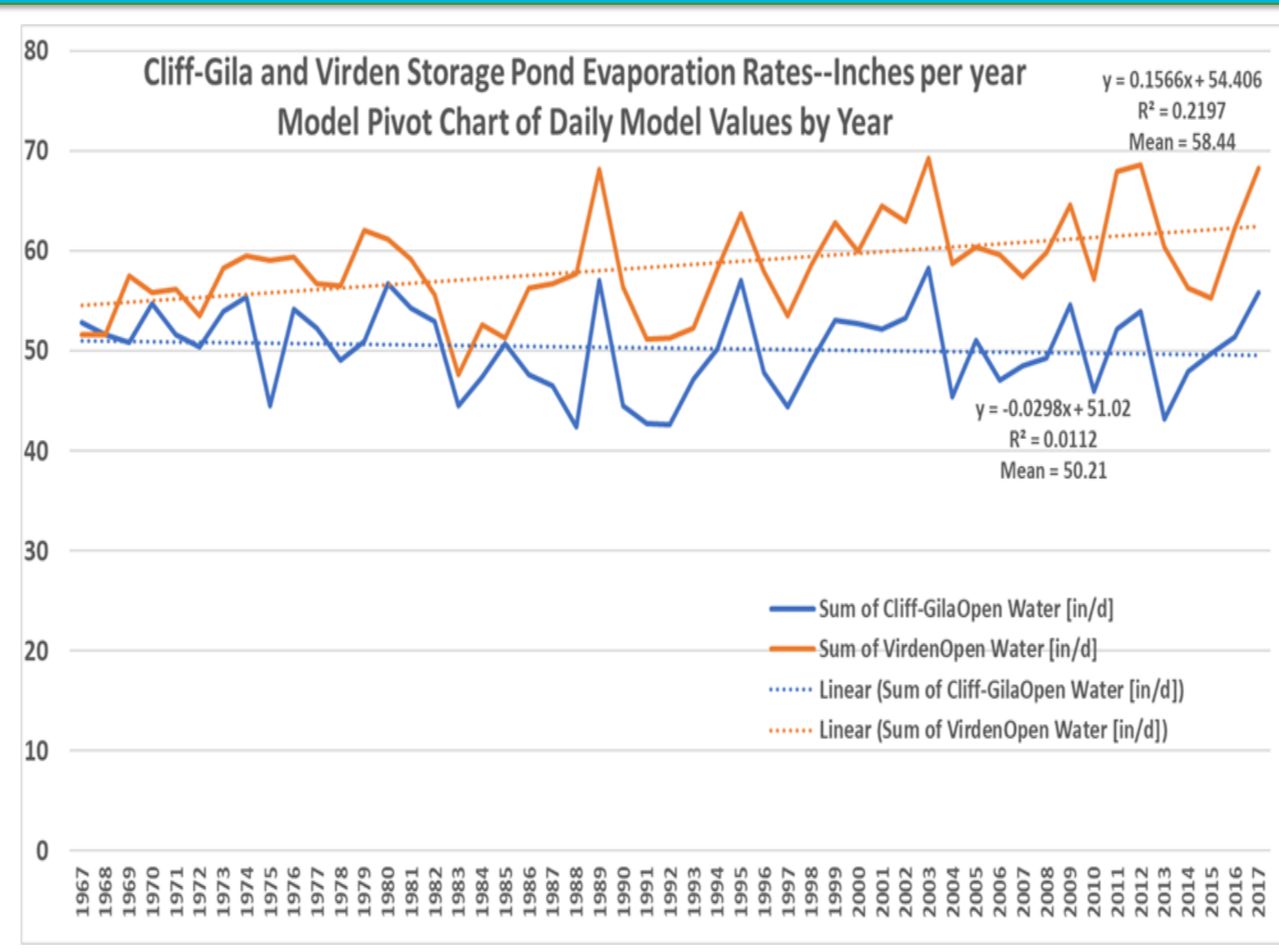
## Results (details on subsequent pages) and conclusions



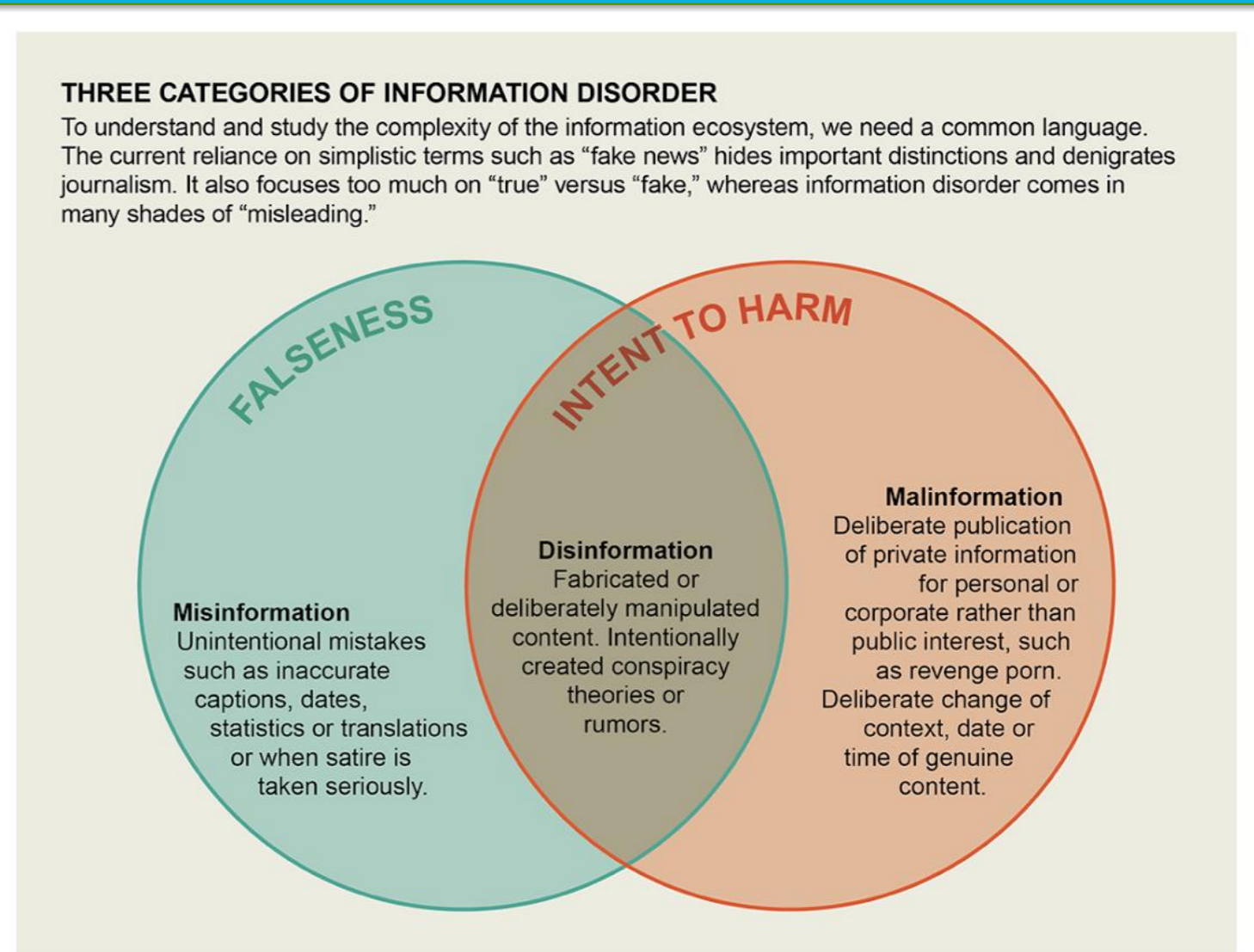
Project water yield and unit costs described in the DEIS as "applied water" included evaporation losses, overstating the yield and understating farm delivery water cost



Reclamation model shows 396 consecutive dry days 2012-13, indicating project unsuited to irrigate pecan orchards



Project evaluation disregarded climate change; model simulations improperly calculated evaporation rates (note negative annual trend)



Credit: Jen Christiansen; Source: *Information Disorder: Toward an Interdisciplinary Framework for Research and Policymaking*, by Claire Wardle and Hossein Derakhshan. Council of Europe, October 2017

The DEIS and its water yield model are an example of information disorder. Graphic from *Scientific American* Sept. 2019

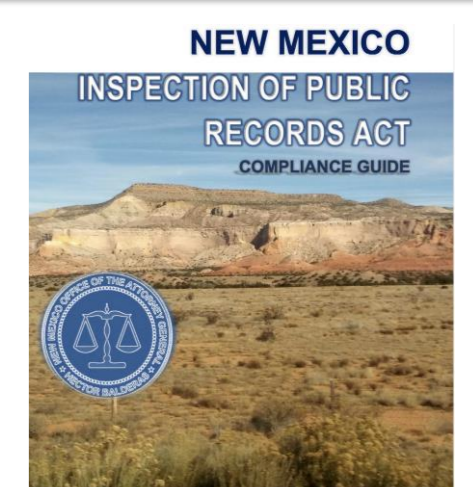
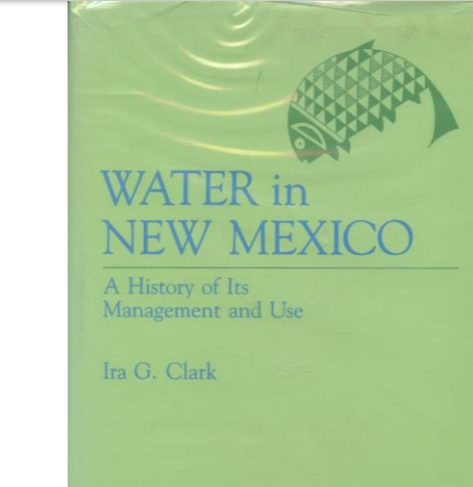
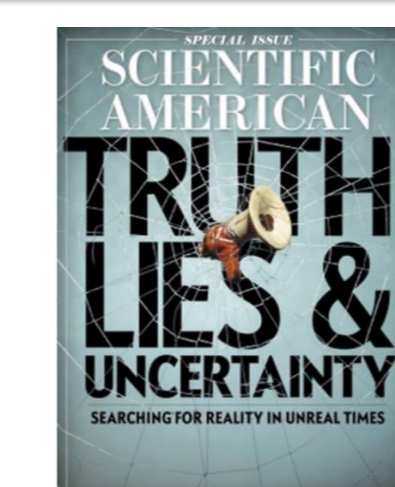
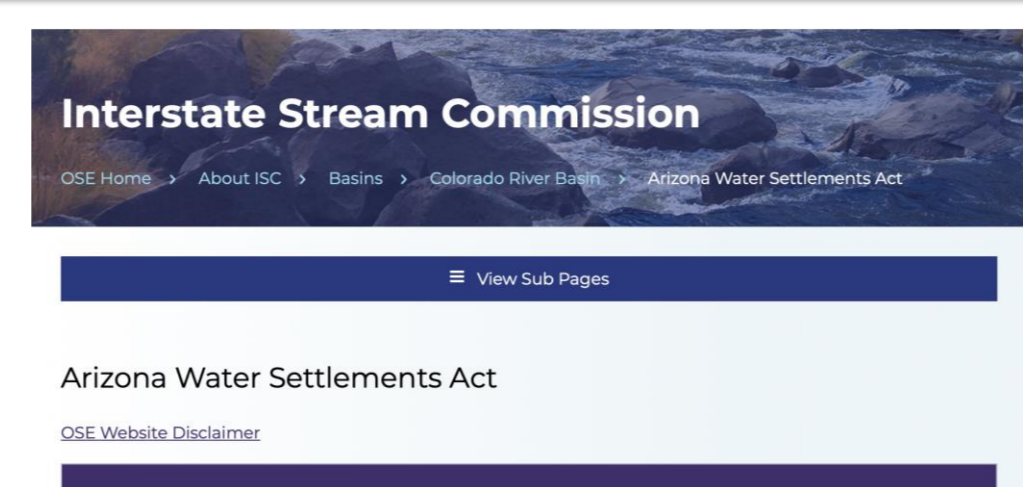
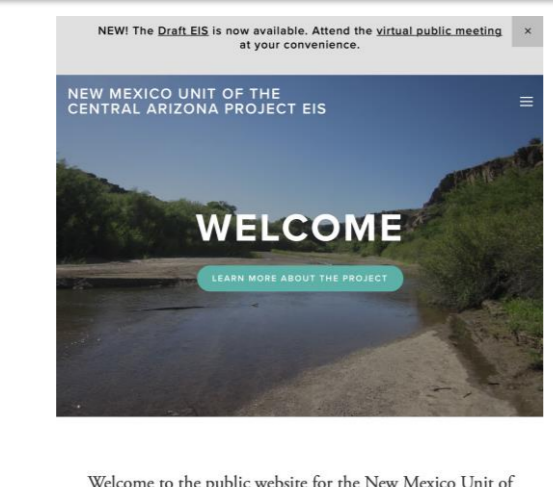
**Conclusion:** Reclamation's draft EIS and technical memoranda withheld or misrepresented pertinent modeling results, violating scientific integrity and information integrity essential to democracy and NEPA compliance.

## References (Right or control click for hyperlinked documents or websites)

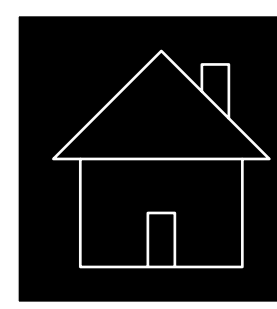
Comments of Norm Gaume, P.E. (ret.)<sup>1</sup> and Peter Coha<sup>2</sup> pertaining to the Draft Environmental Impact Statement (DEIS) dated April 2020 for the New Mexico Unit of the Central Arizona Project (NM Unit)

provided to the  
U. S. Bureau of Reclamation and the New Mexico Interstate Stream Commission  
As Joint Lead Agencies responsible for preparation of the DEIS

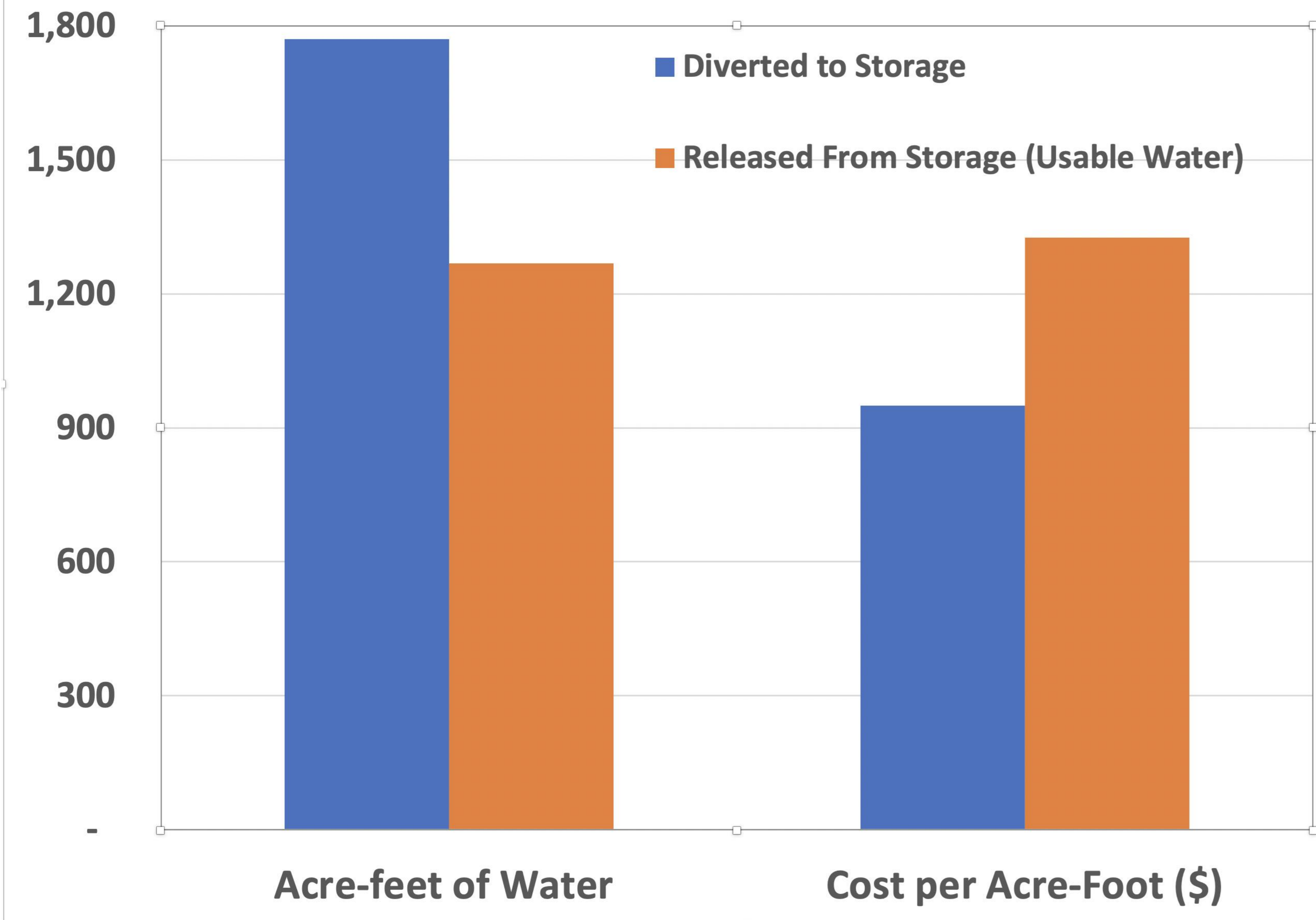
submitted via nmunitis.com



# Developed Water Yield and Cost



**"Applied Water" (Excluding Direct Use) Compared to Water Available After Storage Losses--Cliff-Gila Valley**



- The draft EIS uses the term “Applied Water” as the basis of reporting the NM Unit’s mean water yield and the cost of developed water per acre-foot. “Net yield,” the term of art, is not used.
  - “Applied Water” is defined within the draft EIS only at Appendix 1, Table 24, footnote 1. That footnote contains two contradictory sentences. The draft EIS then makes extensive use of that term in Chapter 3 in the apparent context of “net yield.”
  - Examination of Reclamation’s yield model revealed “Applied Water” is equal to the water diverted into storage plus the water directly used without storage.
  - Reclamation confirmed this in writing.
- Direct diversion and use of AWSA water is 9% of “Applied Water.” Such direct use is nonsensical because the expensive junior water occurs only when plentiful free water is already in the ditches.
- The model shows storage pond evaporation and seepage losses are 23% and 6%, respectively. The usable yield of water and cost of that water, after subtracting all losses, would have been the basis of a draft EIS intended to inform.

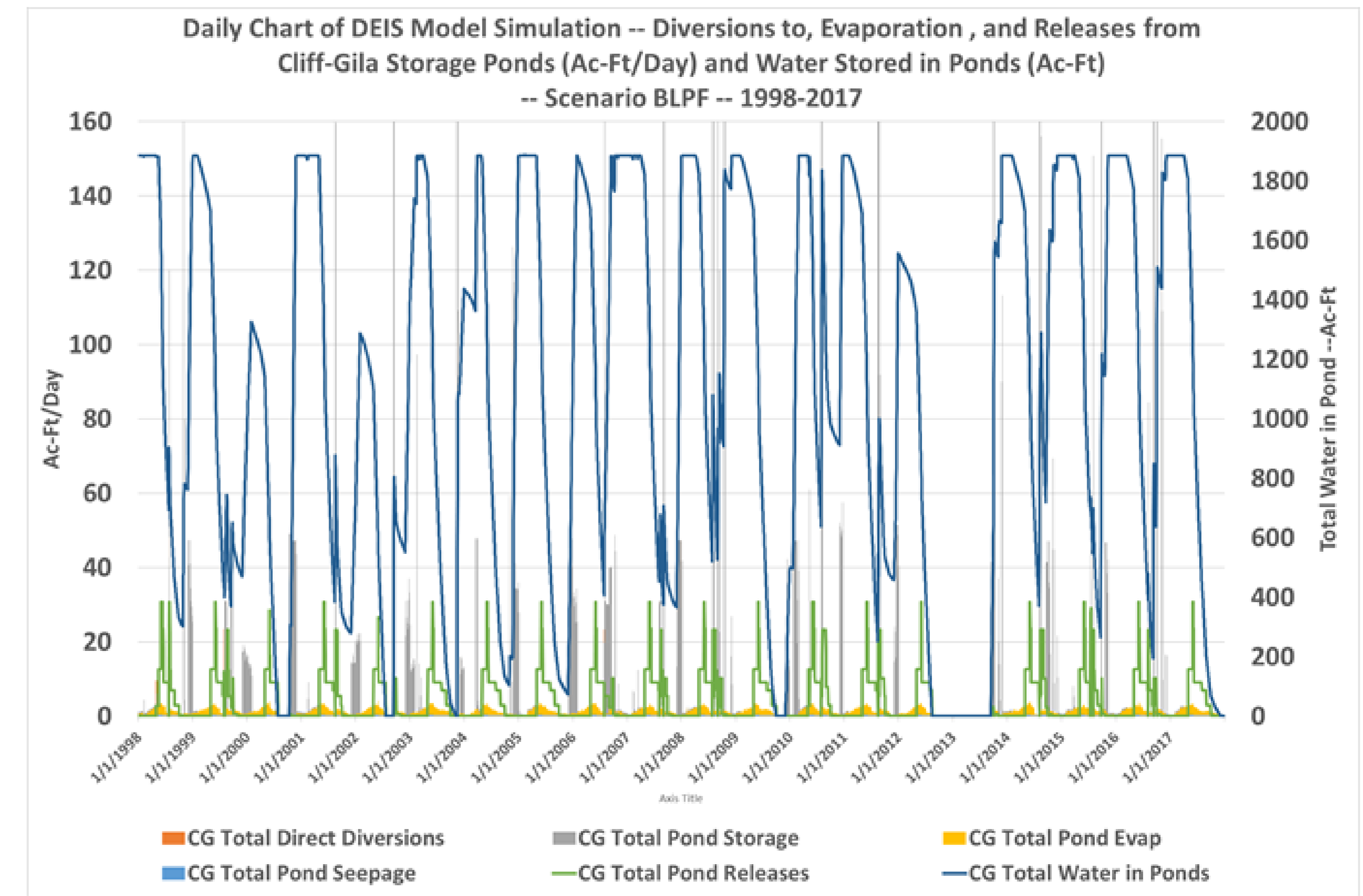
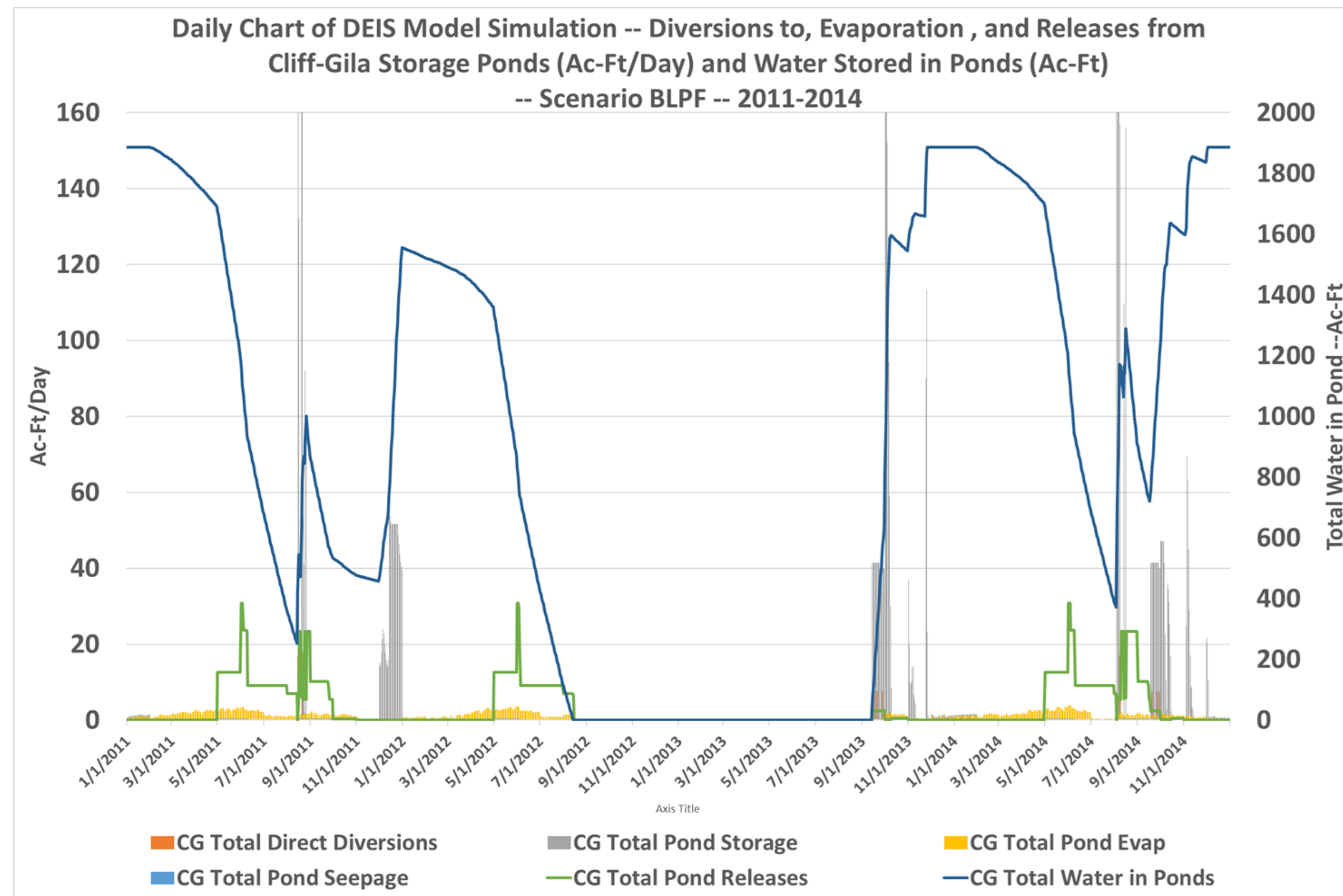
# Daily Graphics Generated with Reclamation's Yield Model



Reclamation's yield model shows 396 consecutive dry days 2012-13, indicating project unsuited to irrigate pecan orchards or other permanent crops.

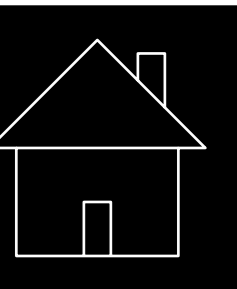
- Variable names are from the yield model and are self-explanatory except for "GC Total Pond Storage," which is the model variable name for Cliff-Gila Valley water diverted into storage.
- The blue line shows the daily total of water in the storage ponds. The yellow and green lines show evaporation losses and releases from the storage ponds. These releases would be inadequate for irrigation of any crop on 588 acres in the Cliff-Gila Valley per the draft EIS conclusions.
- The charts graphically illustrate simulated daily values for four years that include the longest period with no useable project water and 20 years that include four years when the junior diversion rights from the Gila River in New Mexico could not fill the storage ponds.

The \$5 million draft Environmental Impact Statement contains no graphics or language pertaining to these project performance faults.



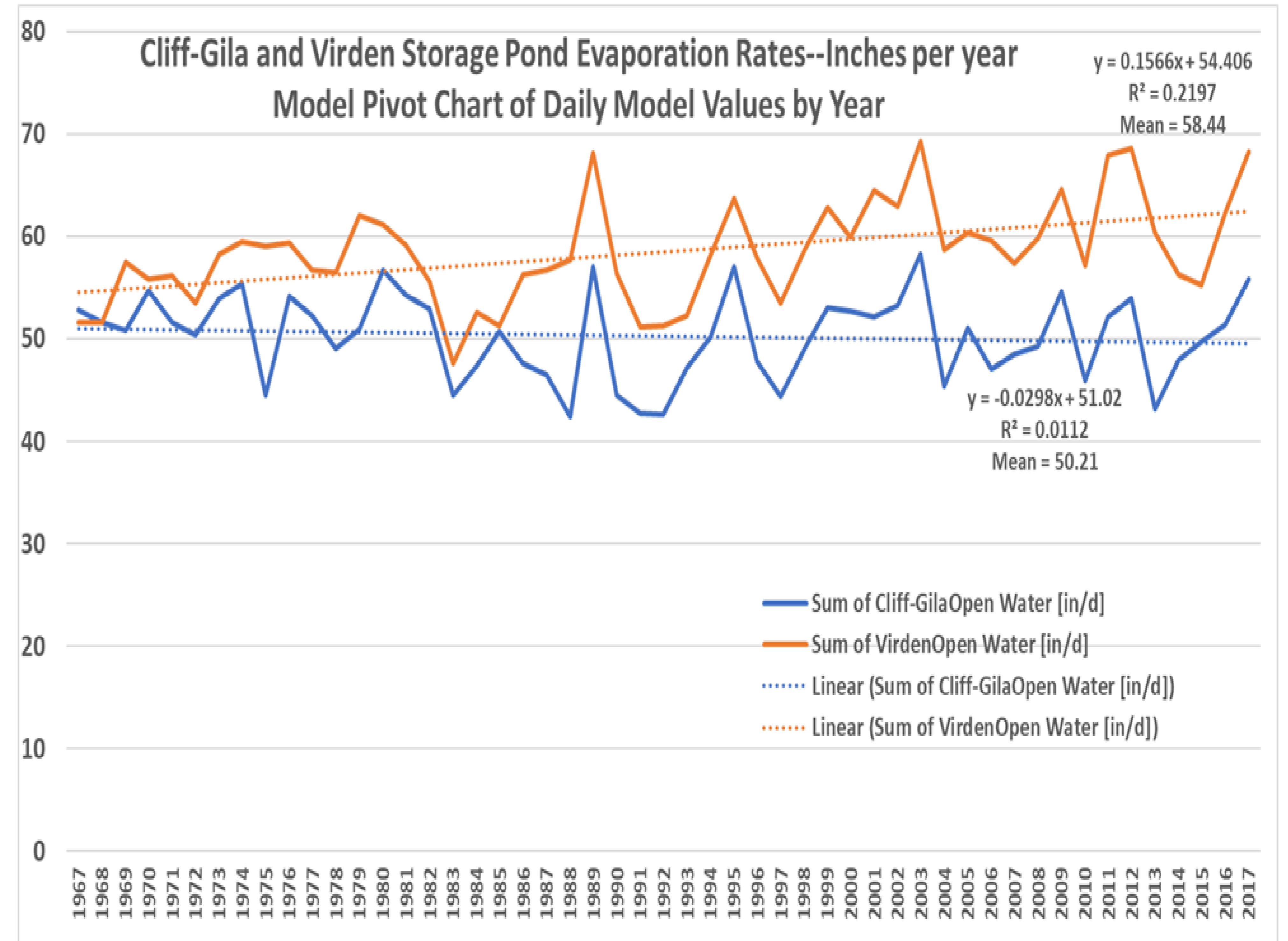
# Evaporation Rates From Shallow Storage Ponds Filled from Existing Ditches

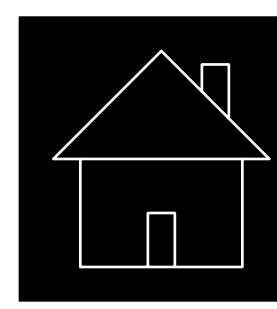
## (Use of water requires pumping back to the ditches)



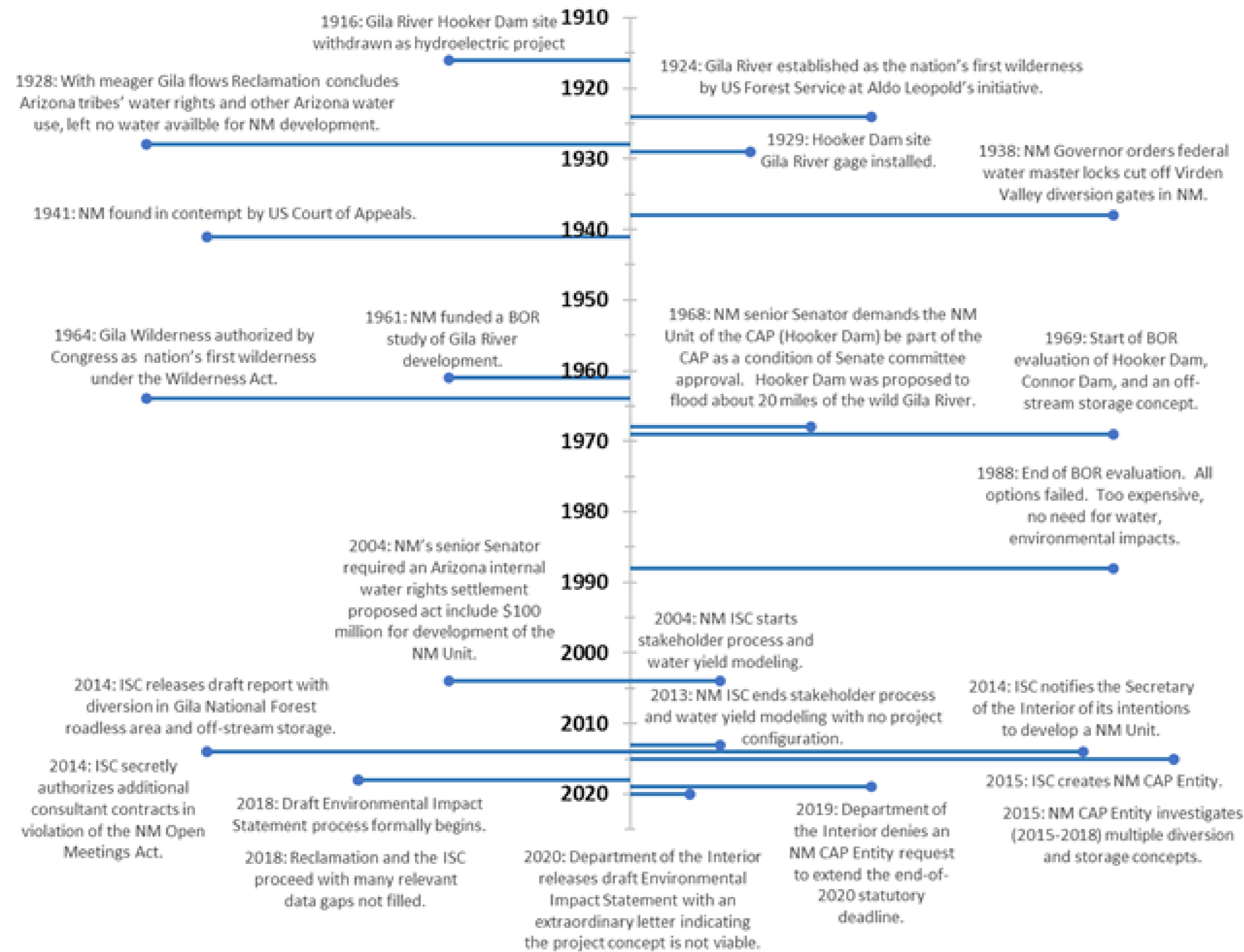
### Reclamation's Yield Model Relied on Unsupportable Low Evaporation Rates

- Reclamation's evaluation of the Gila River diversion and storage project disregards climate change.
- Reclamation's Surface Water Technical Memorandum contains a literature review pertaining to applicable evaporation rates from shallow storage ponds but does not document the evaporation rates used in yield modeling.
  - Reclamation's literature review describes corrections needed to simulate evaporation from shallow ponds.
  - It describes adjustments required to simulate evaporation rates when the depth of stored water is two feet or less.
  - It cites the evaporation rates used by the ISC for its annual reports of consumptive use in the Gila River basin pursuant to the *Arizona v California* decree.
- Reclamation's yield model simulates evaporation rates for open water with no correction factors for shallow ponds or water depth. The model annual rates are illustrated as right.
  - The mean annual simulated evaporation rate for the Cliff-Gila Valley is less than the rate adopted in 1968 by the ISC for consumptive use reporting.
  - The annual trend line has a slight negative trend, as illustrated.





## Gila River Diversion Timeline



**2020: After spending \$16 million and 16 years on 4th major effort to define a viable NM Unit of the Central Arizona Project, the NM ISC voted June 18, 2020 to stop its unproductive expenditures.**



Gila near Gila, NM USGS stream gage (1929), also Hooker Dam site (1968), also site of diversion dam proposed in 2016 by the NM CAP Entity. The surrounding area is co-owned by the State of New Mexico. It was purchased in the 1990s to preserve its outstanding, unique riparian habitat values. Norm Gaume photo, November 2016.