

# RECLAMATION

*Managing Water in the West*

## **Integration of Water Supply and Demand - RiverWare Upper Missouri Basin system model**

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U.S. Department of the Interior  
Bureau of Reclamation

# Outline

- RiverWare Model Development
- Incorporating Inflow and Demand Scenarios
- Impacts Assessment Results
- Incorporating Basin Study Adaptation Strategies

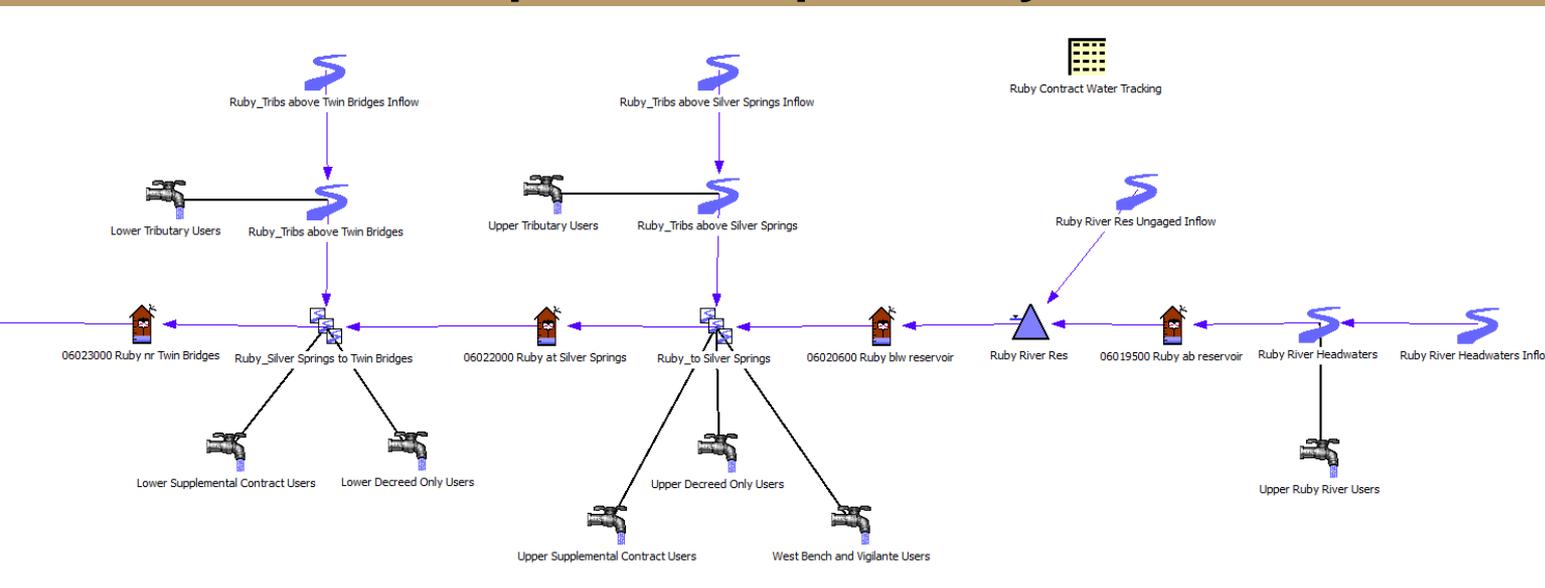


*Canyon Ferry Reservoir.*

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# RiverWare Model Development

- Daily model of the Missouri Basin and Musselshell River above Fort Peck
- Represents physical basin characteristics such as water users, reservoirs, canals, diversions, and stream reaches.
- Rules control basin policy (i.e., reservoir operations, diversions, water rights, etc.)
- Subbasins operate independently



*Ruby River subbasin model-a portion of the Upper Missouri Basin RiverWare model.*

# RiverWare Model Development

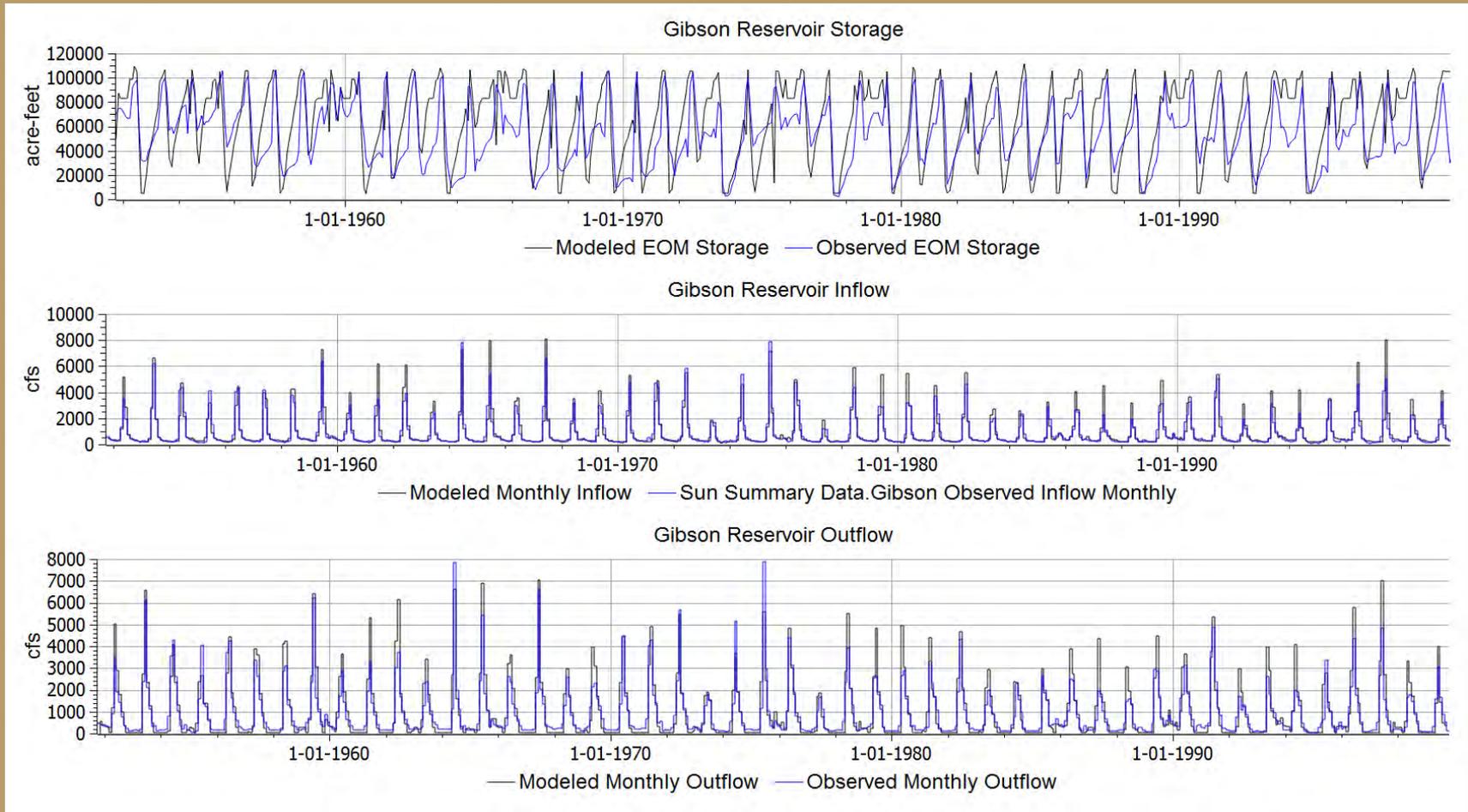
- Developed by Montana DNRC and Reclamation
- Key concept: Driving model with natural flows allows modelers to examine various alternative operational/hydrologic scenarios
- Calibrated/validated through visual examination of modeled and historical flows, diversions, and reservoir storage.
- Irrigation parameters and corrections to operations used to calibrate



*Gibson Reservoir morning glory spillway*

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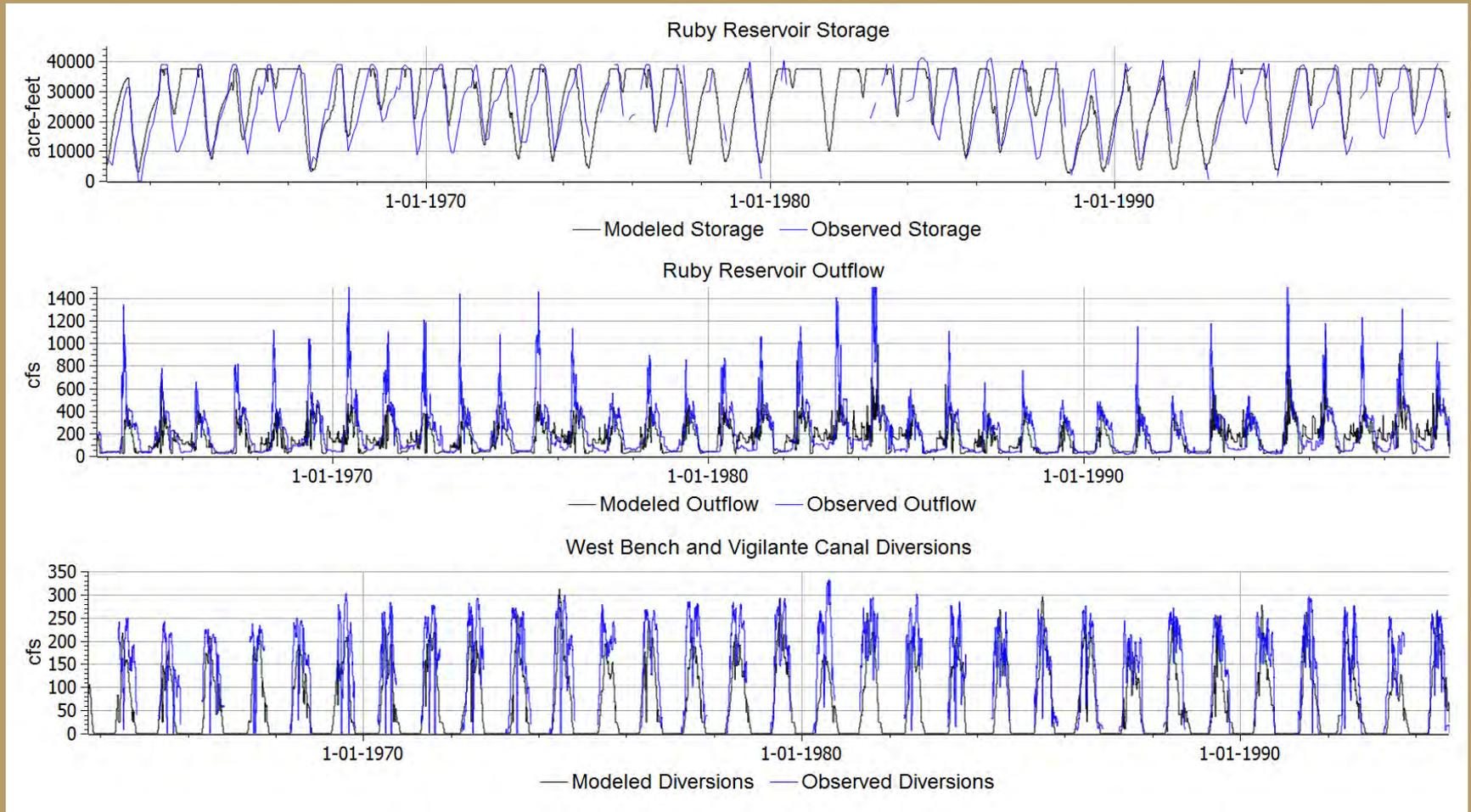
# Selected calibration/validation results



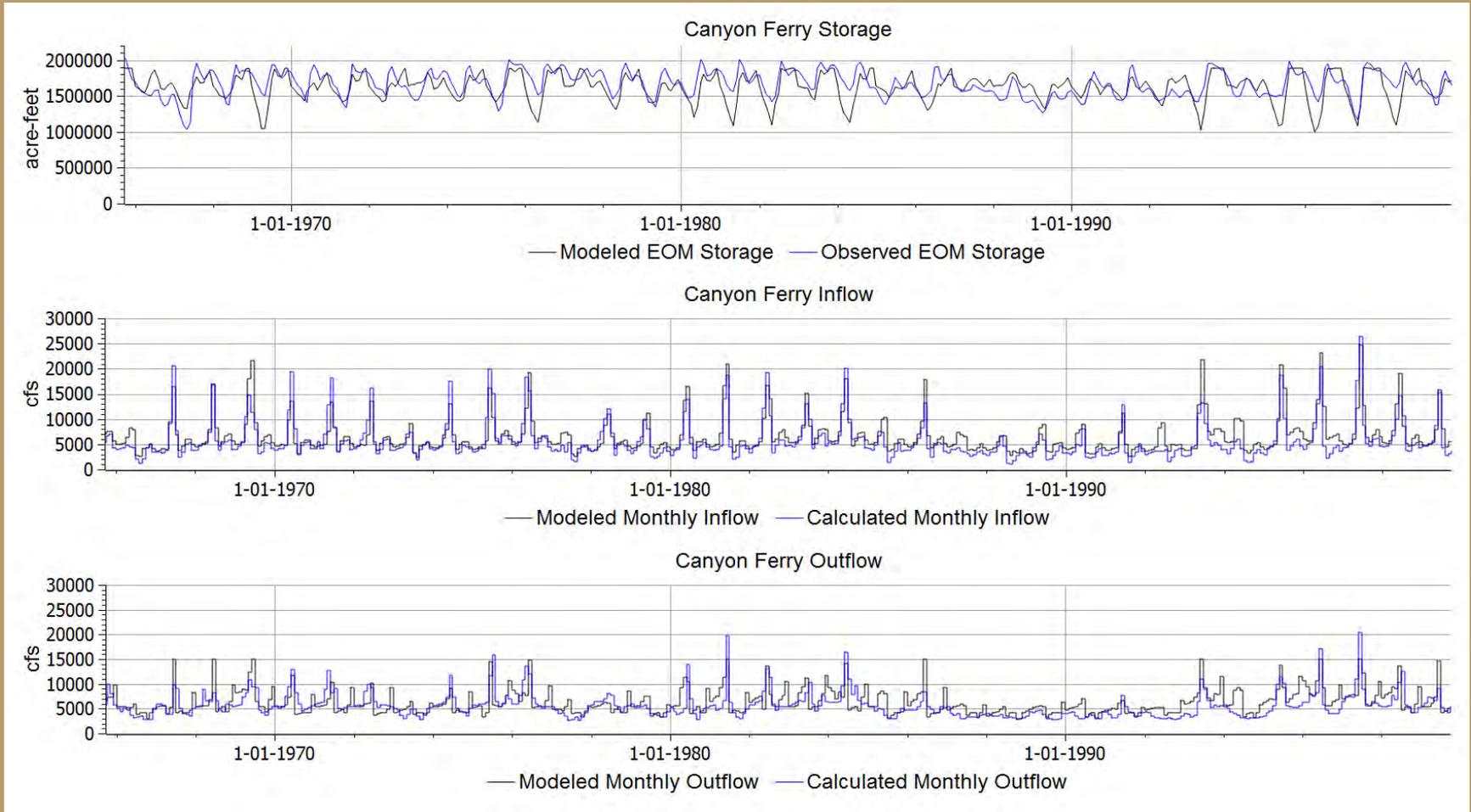
*Gibson Reservoir calibration results*

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# Selected calibration/validation results

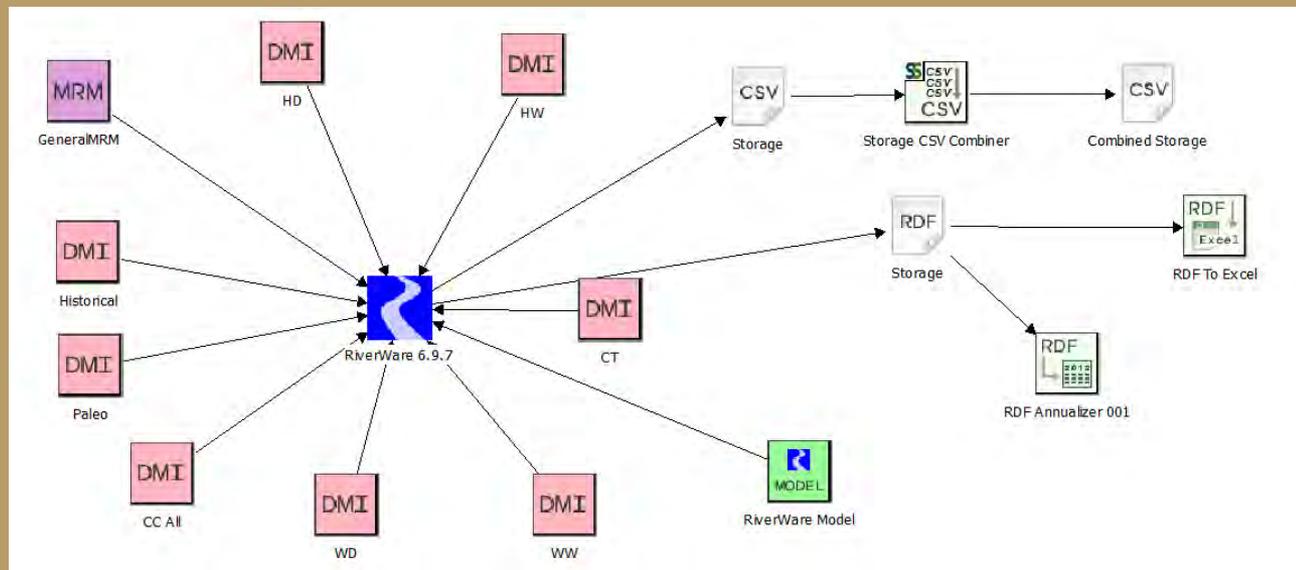


# Selected calibration/validation results



# Incorporating Supply and Demand Scenarios

- Use the RiverSMART software
- Created for complex climate change studies (i.e., Colorado River Basin Study)
- Manages a large number supply/demand/operational scenarios



# Impacts Assessment

- **Goal: Determine the impacts of future climate scenarios on water reliability under current basin management**
- **Utilizes supply/demand scenarios representing five climate scenarios in the 2020's, 2050's, and 2080's.**



*Inspecting HVID Discharge Pipe*

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# Impacts Assessment

- Evaluate changes from baseline (historical hydrology) to metrics of importance
- Examples:
  - Water supply reliability
  - Reservoir storage
  - Flood control drawdown

Key to scenarios:

Historical=VIC-generated historical climate

CT=Central Tendency

WD=Warm Dry

WW=Warm Wet

HD=Hot Dry

HW=Hot Wet

2020=2020's average climate

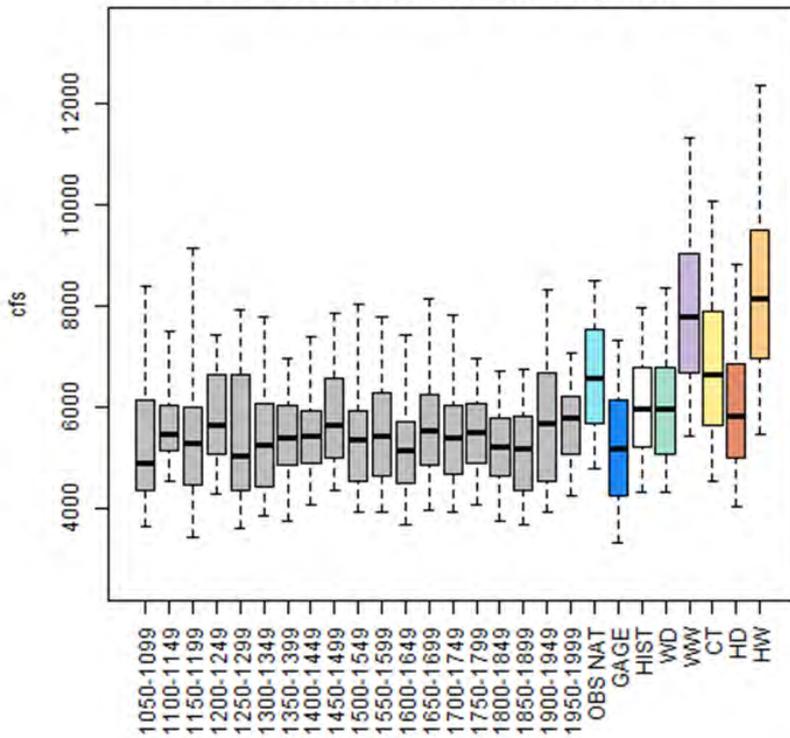


*Canyon Ferry Dam and Powerplant*

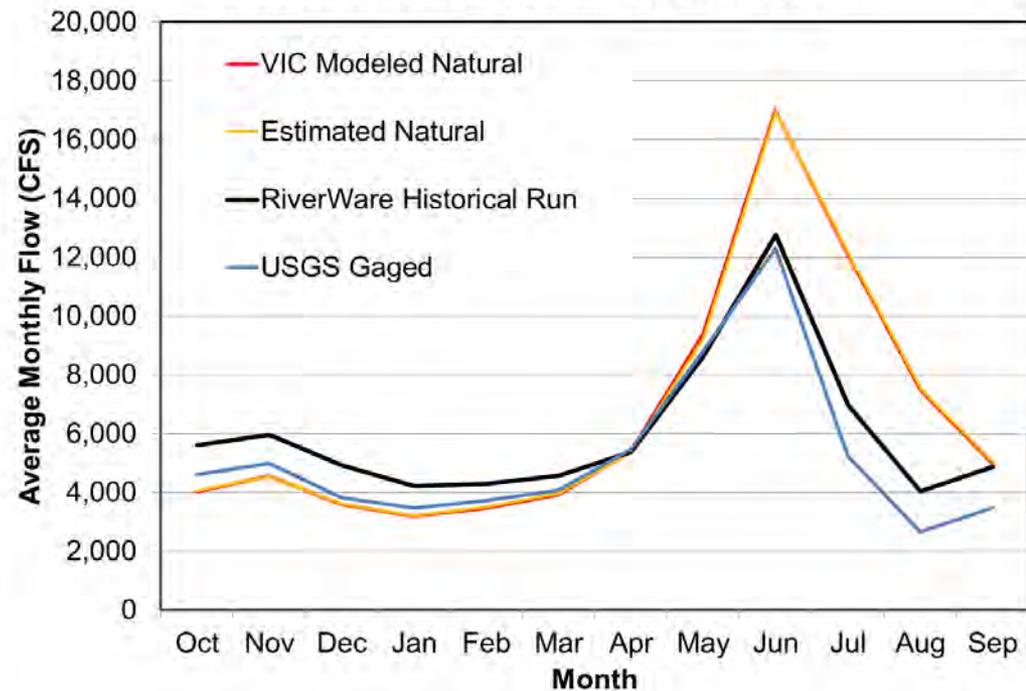
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# Selected Impacts Assessment results

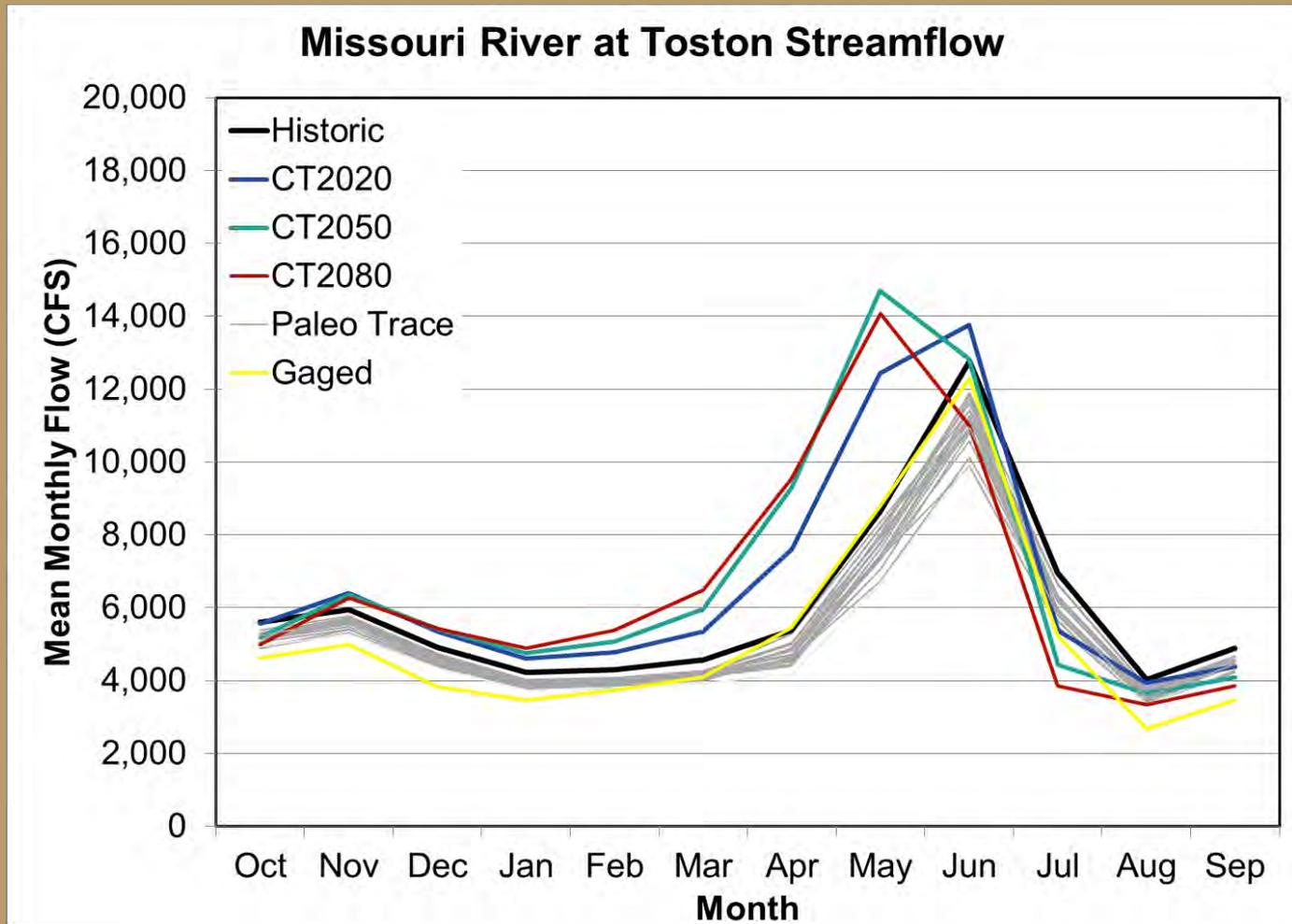
06054500 Missouri at TostonGage Inflow



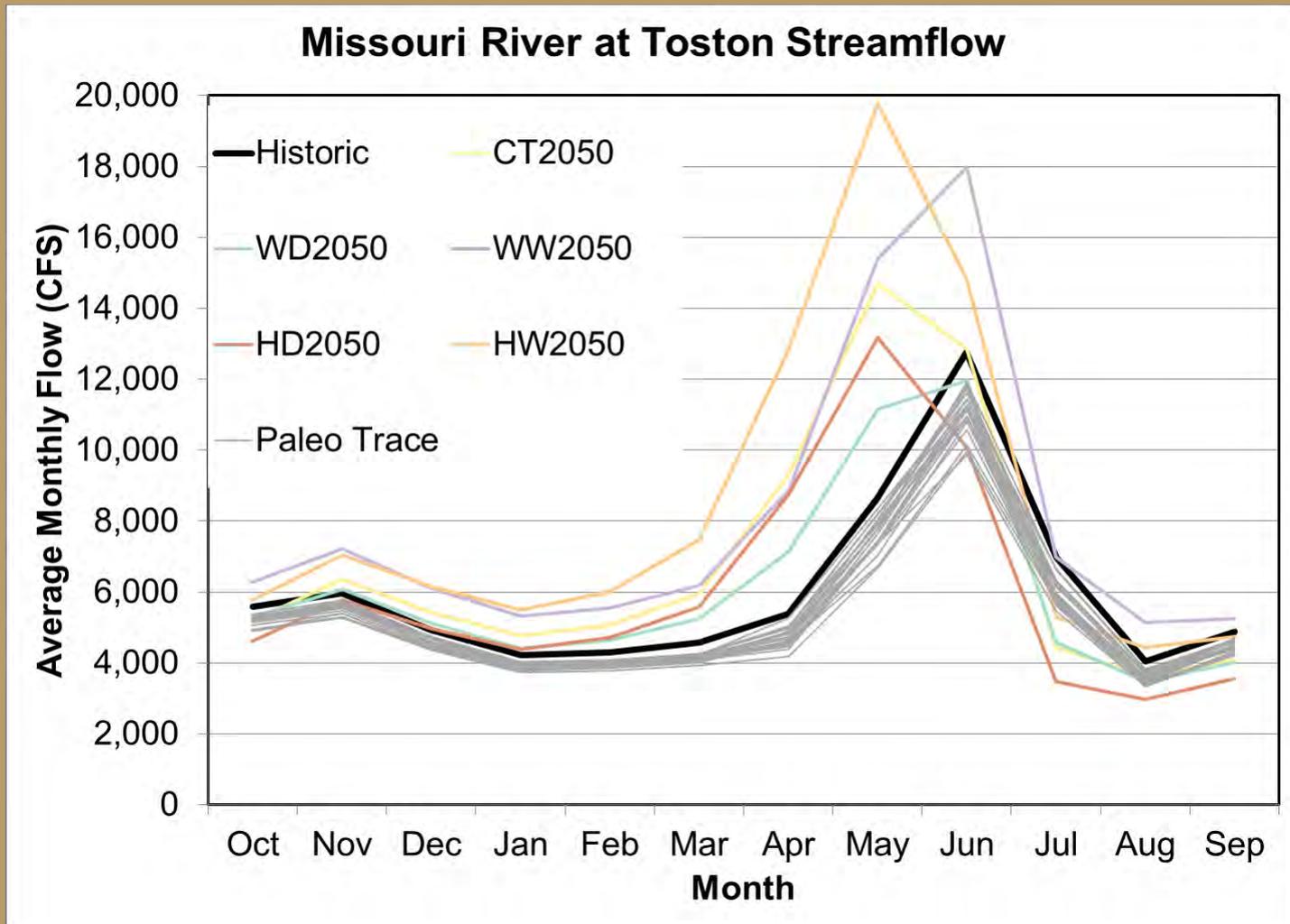
Missouri River at Toston Streamflow



# Selected Impacts Assessment results

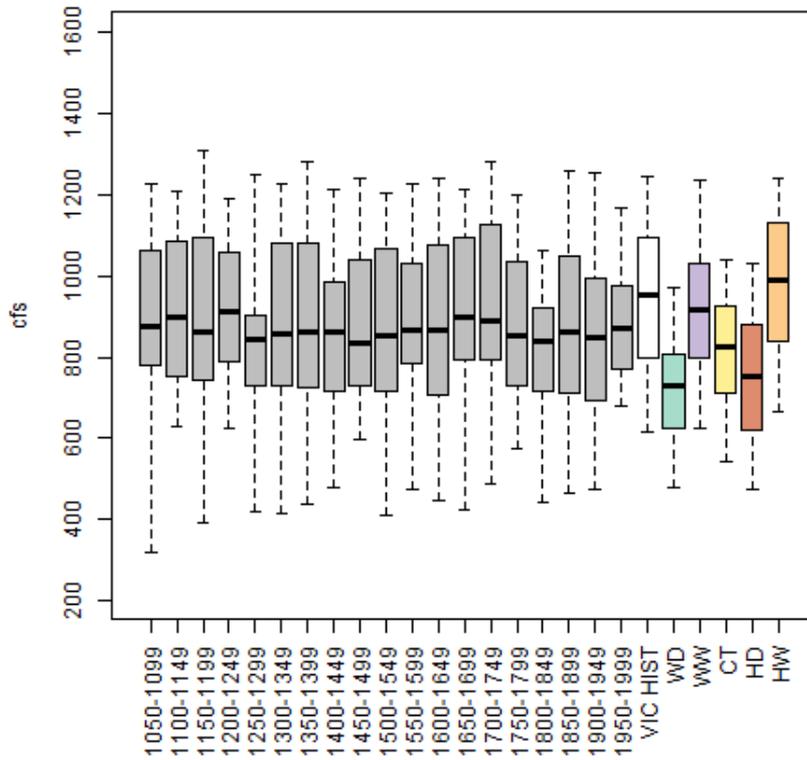


# Missouri River at Toston-Scenario results

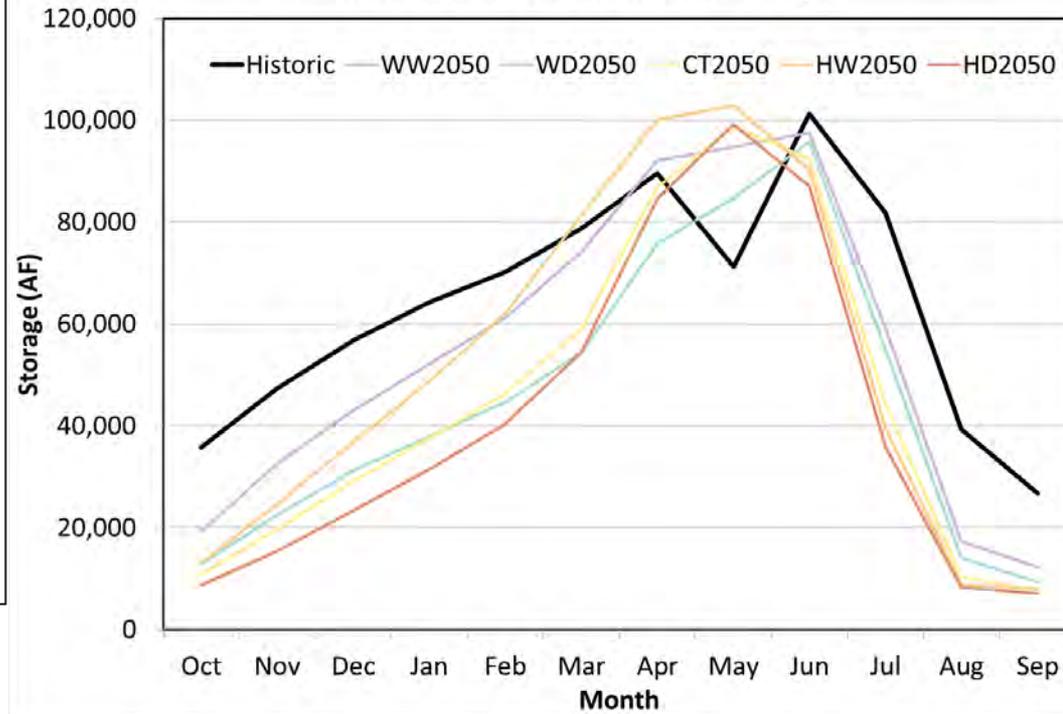


# Gibson Reservoir storage-Scenario results

### Gibson Reservoir Inflow-2050 Scenarios

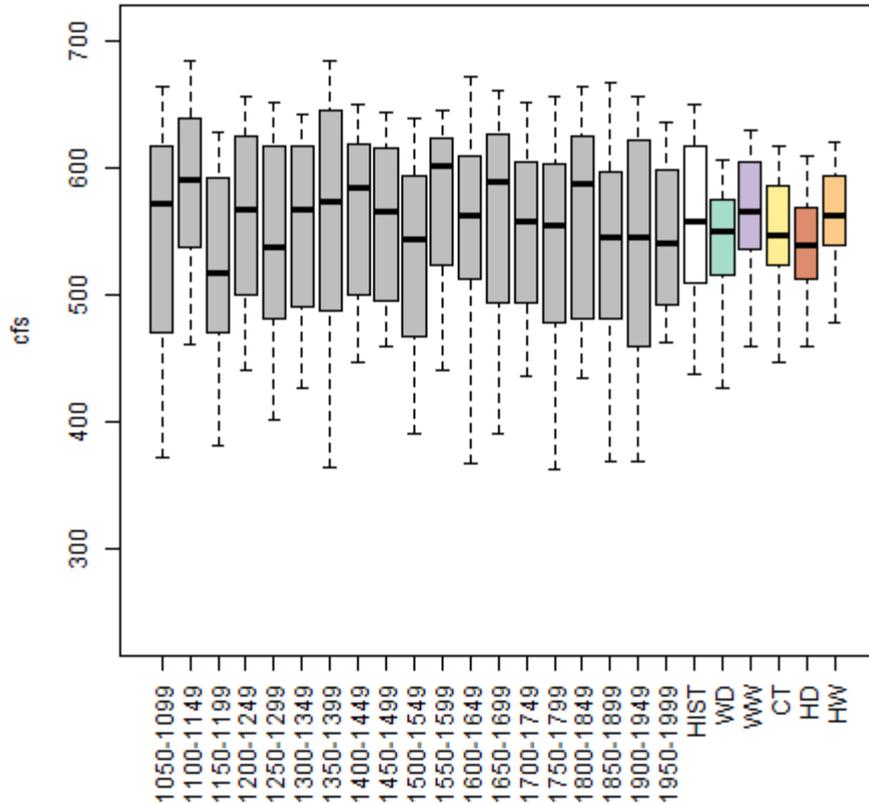


### Gibson Reservoir End-of-Month Storage

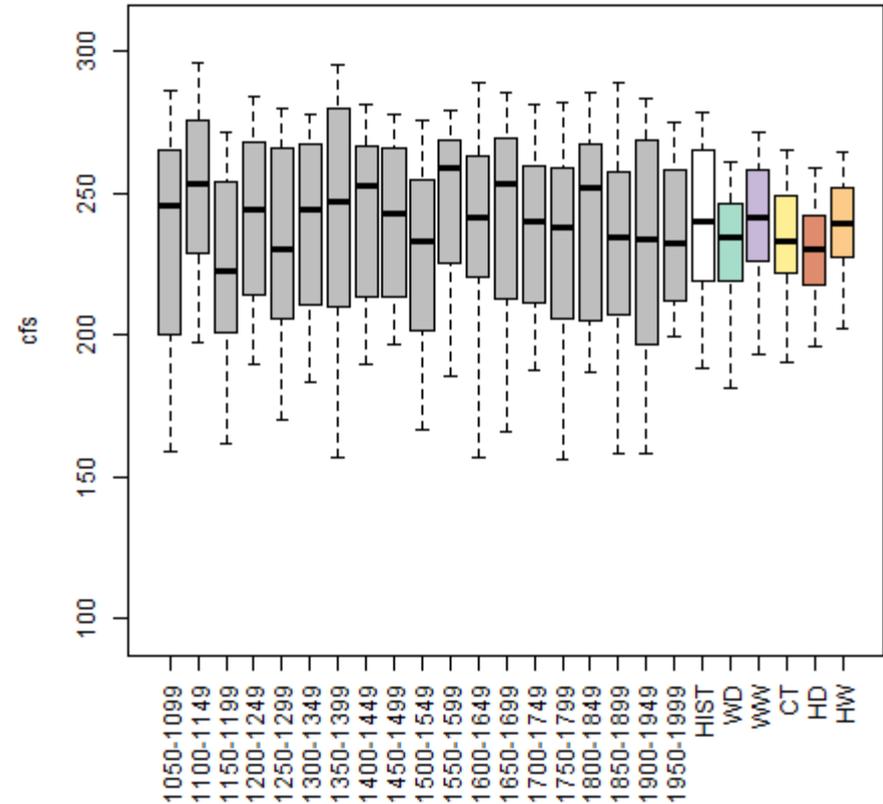


# Sun Basin Diversions and Depletions (2050 Scenarios)

10030104 Total HUC  
Diversions



10030104 Total HUC  
Depletions



# Modeling Basin Study Adaptations

- **Model adaptations in RiverWare**
  - Rulesets representing basin policy and operations;
  - Model changes to irrigated acreage, efficiency, demands, etc.
  - Physical changes (i.e., new storage)

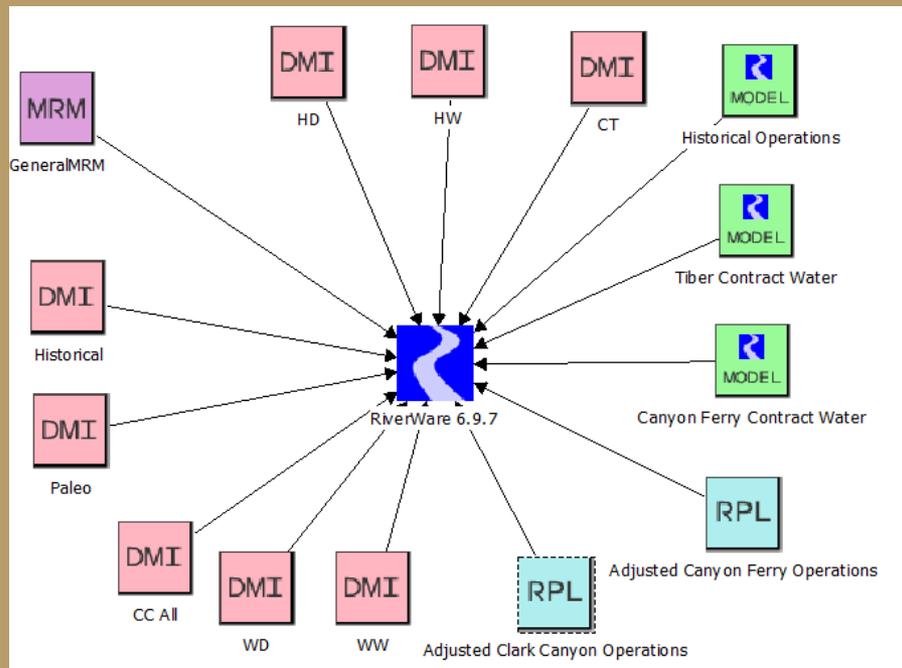


*Sun River Irrigation near Pishkun Reservoir*

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# Modeling Basin Study Adaptations

- Use the Impacts Assessment RiverSMART manager
- Incorporate existing demand/supply scenarios with adaptations models
- Evaluate level of impacts mitigation due to adaptations



*Potential basin study schematic*

# Questions?



*Swift Current Creek*

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