Humboldt River Capture Study

In cooperation with Nevada Division of Water Resources

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U.S. Department of the Interior
U.S. Geological Survey

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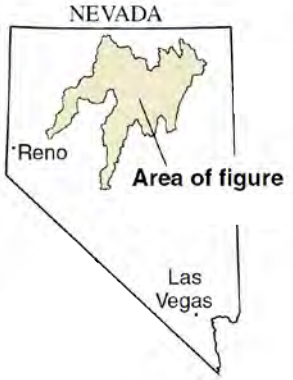
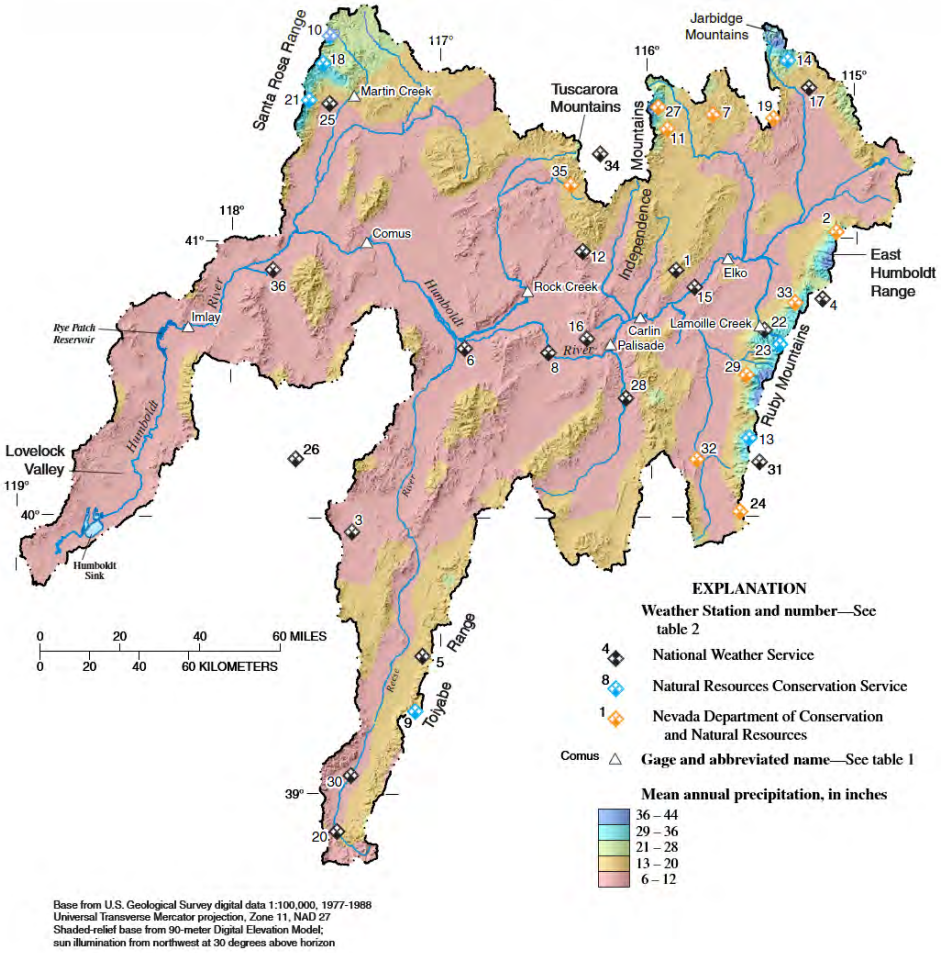
Overview of Humboldt Capture Study

- Problem
  - Approach
    - Analyses
      - Deliverables
        - Schedule





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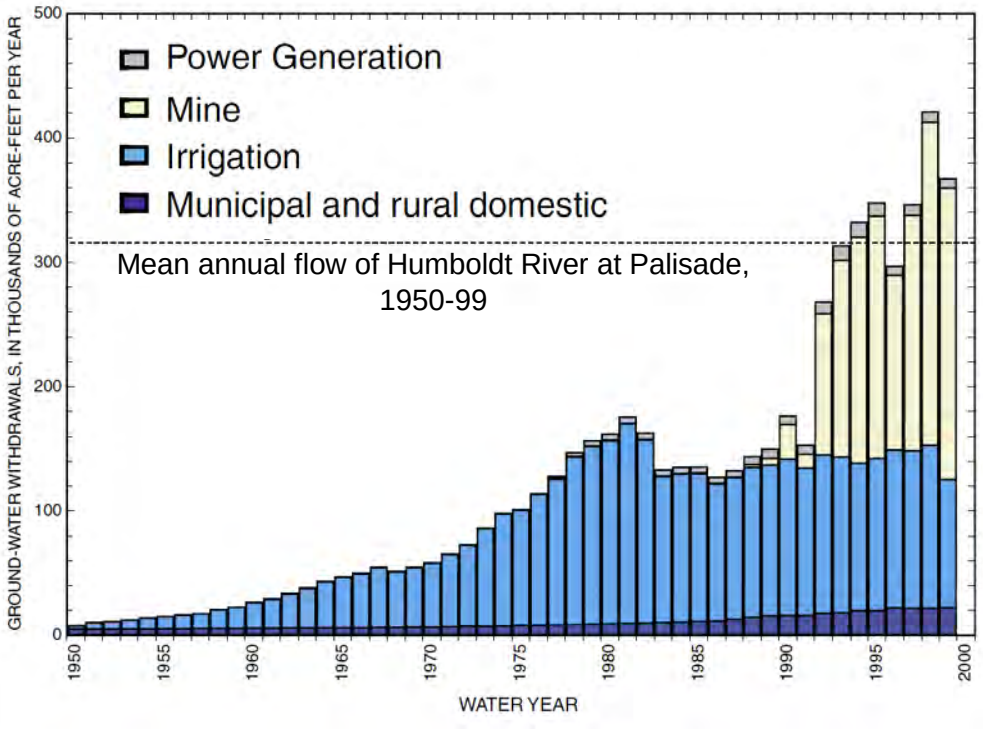
Problem

- Surface water fully appropriated.
- Surface water users most senior.
- Groundwater withdrawal = Humboldt river flow.
- Major uses: Agriculture, mining, industrial and municipal use.
- Groundwater users are junior to surface water users.
- Conflict during drought years.

Total annual pumping



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Problem (continued)

- Groundwater pumping captures flow from Humboldt River.
- How much though?
- Hydraulic properties govern interactions.
  - Permeability and storage of aquifer systems.
  - Varies with location.
  - Mostly unknown.
- Need to know how pumping effects streamflows.
  - Timing and magnitude based on location

Photo by Kyle O'Connor, 12/1/2017

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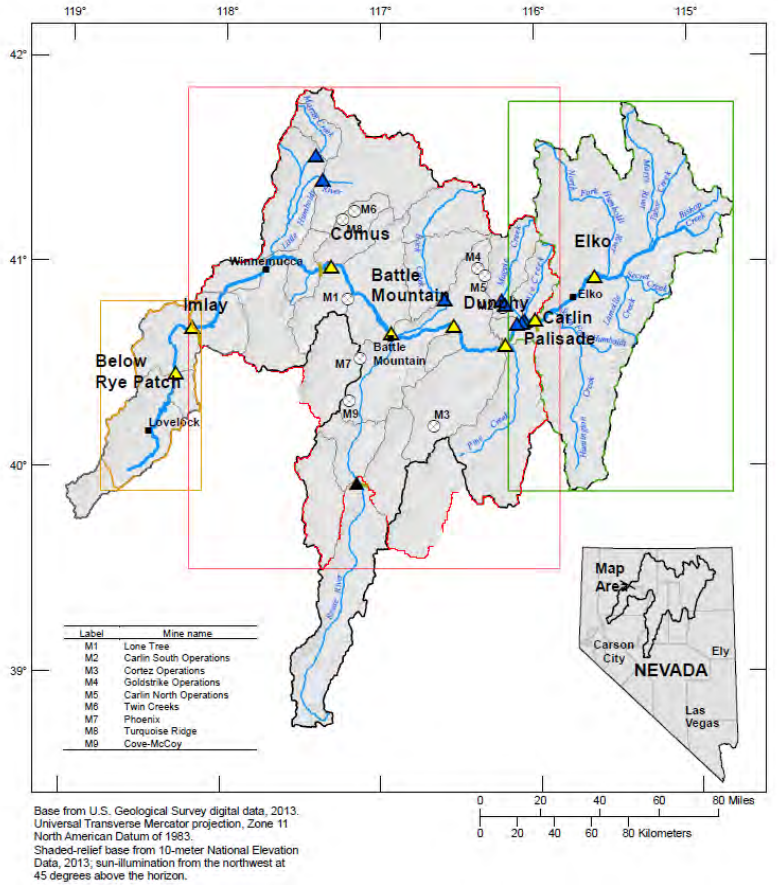
Approach – Overview

- Estimate evapotranspiration discharge of groundwater.
- Develop three numerical models.
  - Upper, Middle, and Lower Basin models.
- Use models to estimate aquifer properties based on existing hydrologic and geologic information.
- Use models to determine capture.



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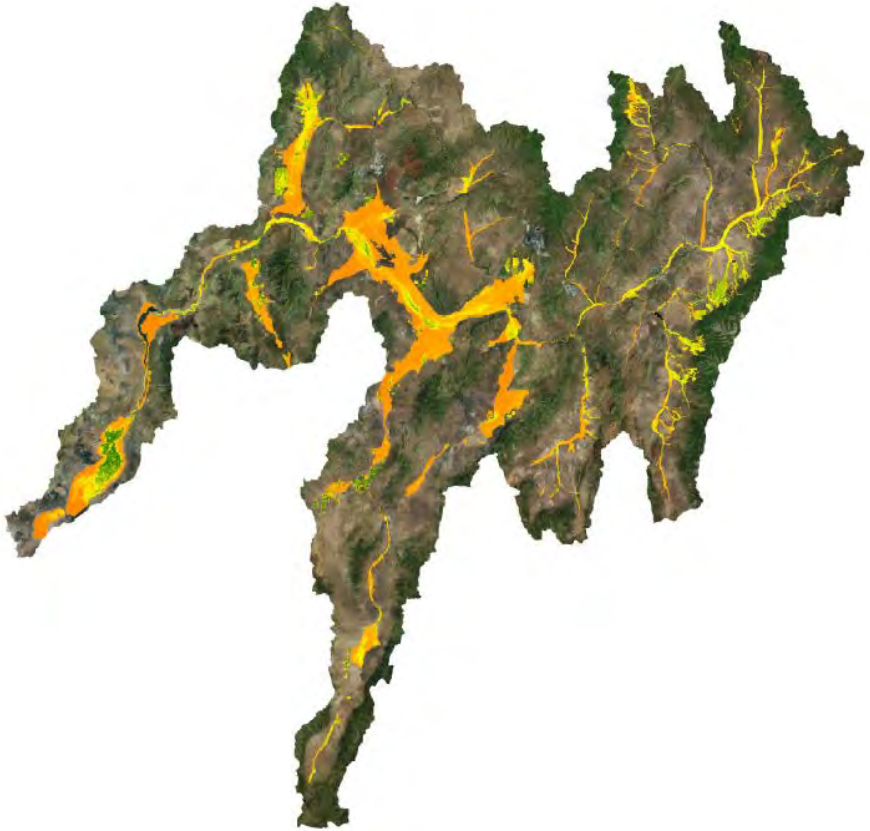
Approach – Evapotranspiration of Groundwater

- Much of the groundwater in Humboldt basin discharges by evapotranspiration.
- Important information needed by models.
- Areas, rates, and volumes of groundwater discharge being determined.
  - Using remote sensing techniques.
  - Weather station data.
  - Field verifications.



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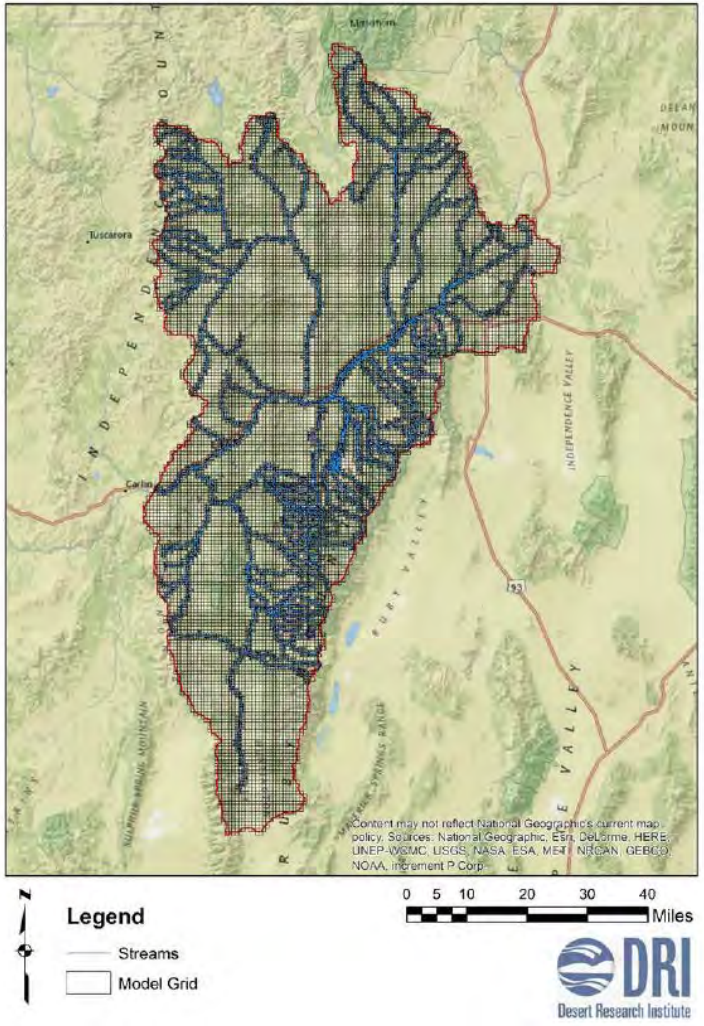
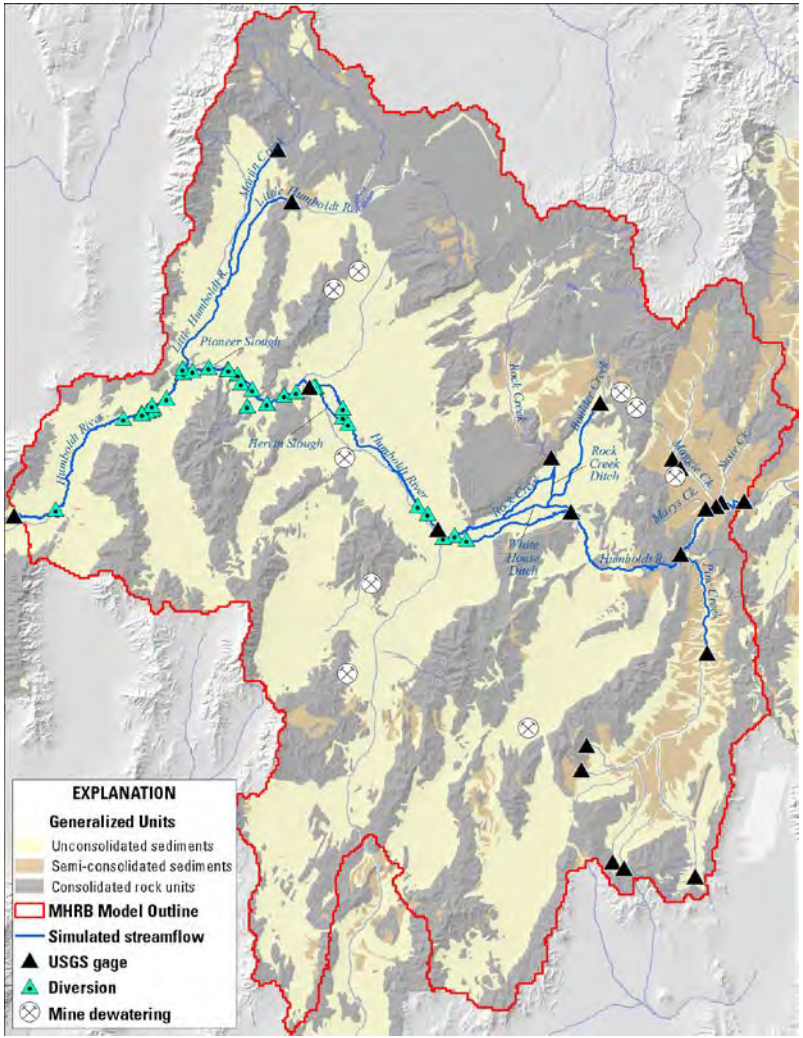
Approach – Upper Basin Model

- Unique hydrologic characteristics:
  - Many headwater tributaries.
  - Large discharging springs (> 10k AFY).
  - Moderate groundwater use (24K AFY)
- Model simulates:
  - Groundwater levels and water budgets.
  - Changing groundwater conditions.
  - Changes in streamflow.
  - Provides changes in flow to Middle Basin model.
  - Stream and River capture.



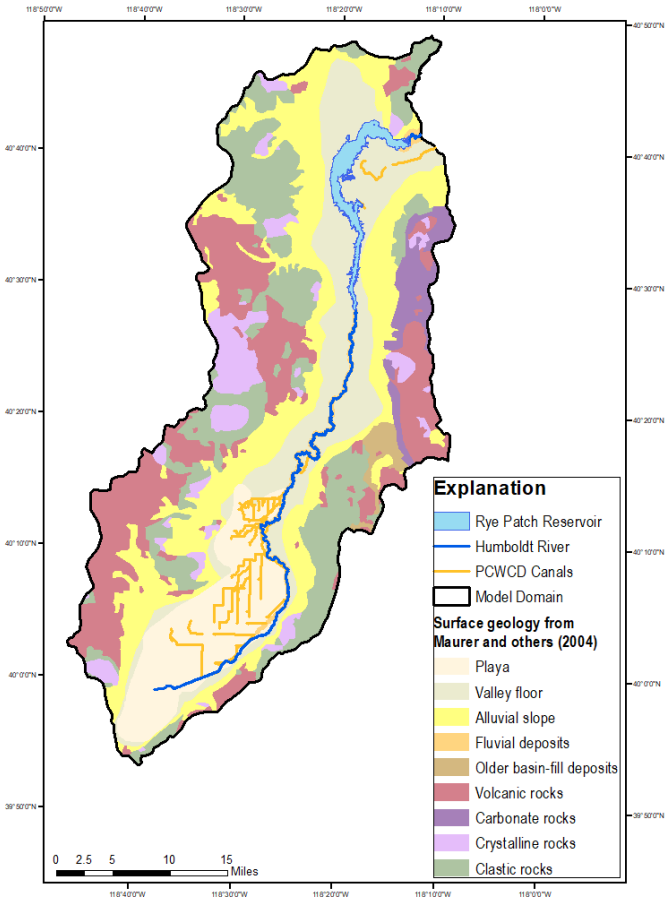
Approach – Middle Basin Model

- Unique hydrologic characteristics:
  - Many diversions from Humboldt River.
  - Large scale mine dewatering operations.
  - Major groundwater use (276k AFY).
- Model simulates
  - Humboldt River streamflow and diversions.
  - Groundwater levels and water budgets.
  - Mine dewatering.
  - Changing groundwater conditions.
  - Stream and River capture.



Approach – Lower Basin Model

- Unique hydrologic characteristics:
  - Large irrigated acreage by surface water.
  - Rye Patch Reservoir.
  - Very little groundwater use (4k AFY).
  - Required field testing for properties.
- Model simulates:
  - Groundwater levels and water budgets.
  - Changes in streamflow.
  - Stream and river capture.



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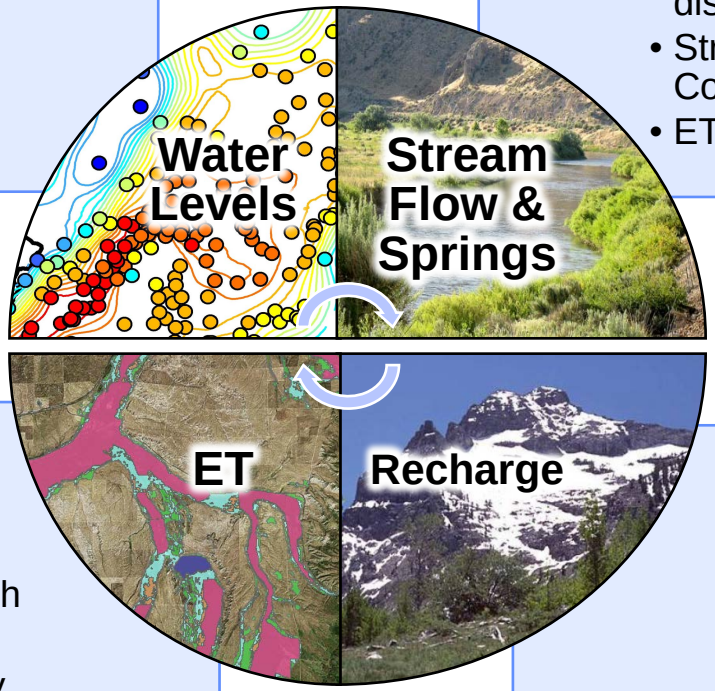
Approach – Model Calibration Strategy

- Permeability
- Recharge distribution
- Storage

- Recharge distribution
- Streambed Conductance
- ET



- Extinction depth
- Max ET
- ET provided by Huntington et al.

- Defined as sum of outflows

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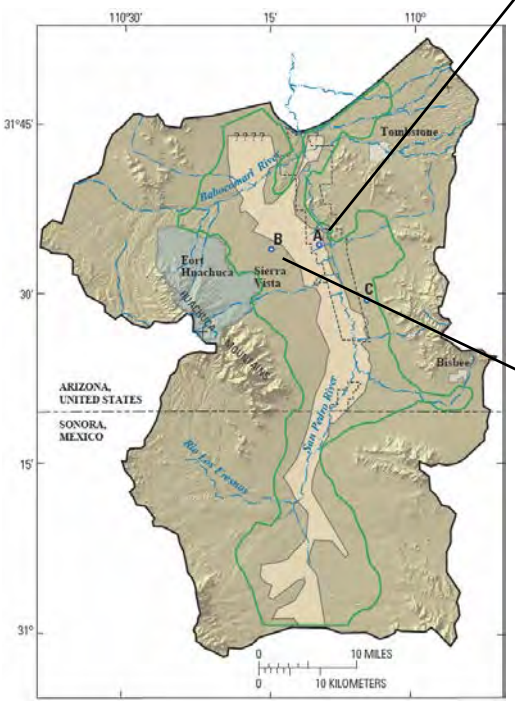
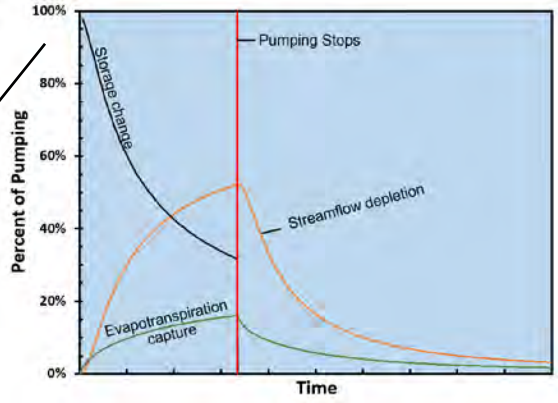
Capture Map analysis

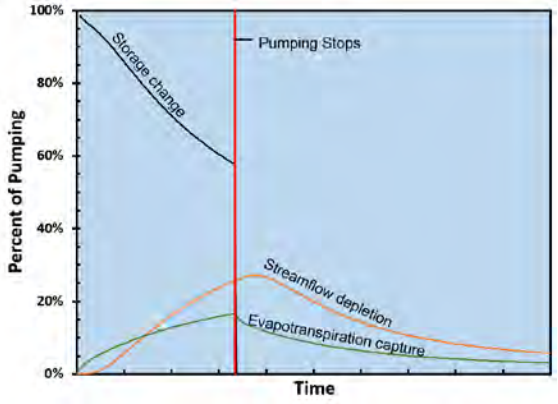
- Evaluate stream capture at each model cell location.
- For pumping durations of 10, 25, 50, and 100 years.
- Contour capture fractions to produce maps.



Location A



Location B



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Mine Dewatering Impact Analysis

- Cumulative impact of mine-dewatering on Humboldt River flow through 2015.
  - Will include periods of flow accretion.
  - May include periods of flow depletion.

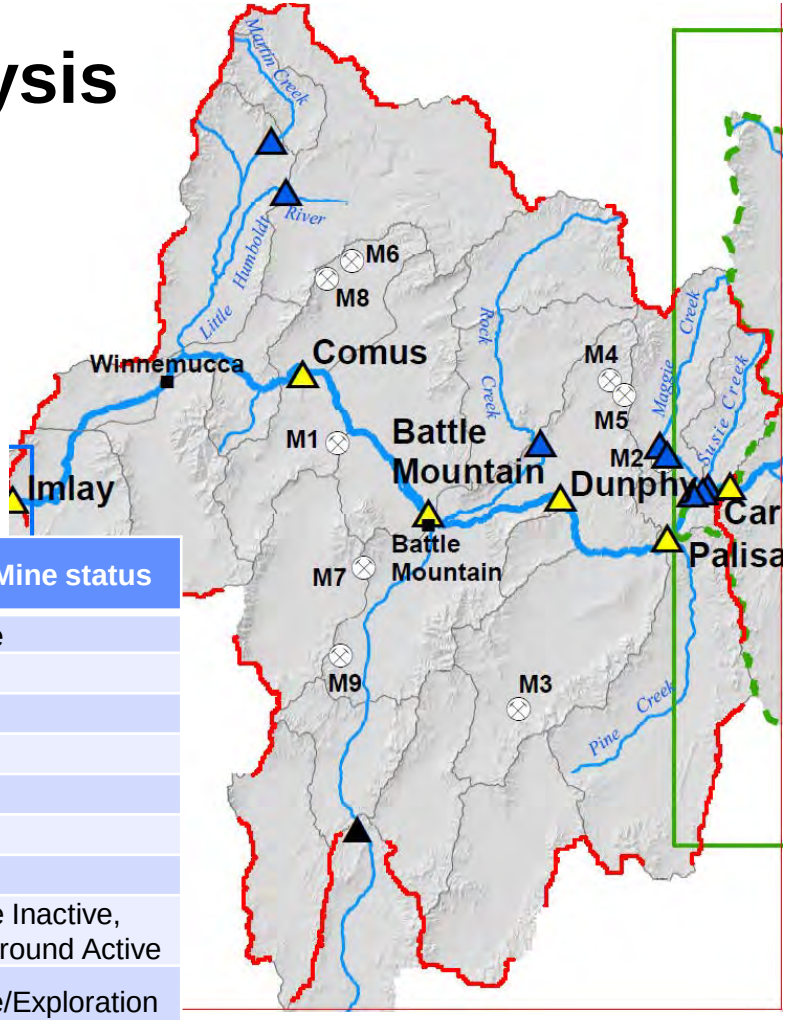

Fig. No.	Mine Operation	Basin	2015 Mine status
M1	Lone Tree	Clovers	Inactive
M2	Carlin South Operations	Maggie Creek	Active
M3	Cortez Operations	Crescent Valley	Active
M4	Goldstrike Operations	Boulder Flat	Active
M5	Carlin North Operations	Boulder Flat	Active
M6	Twin Creeks	Kelly Creek	Active
M7	Phoenix	Buffalo Valley	Active
M8	Turquoise Ridge	Kelly Creek	Surface Inactive, Underground Active
M9	Cove-McCoy	Lower Reese River Valley	Inactive/Exploration

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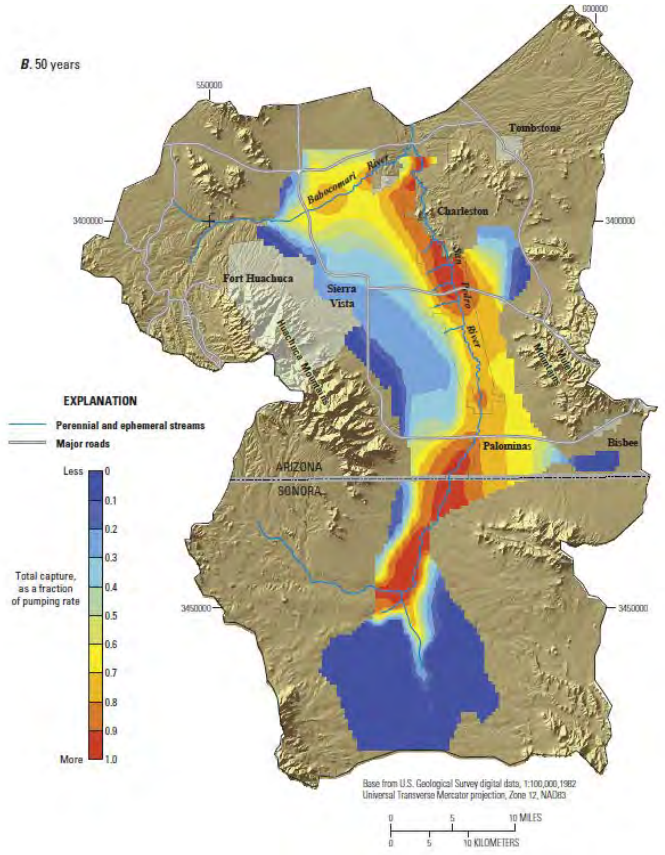
Deliverables

- Digital capture maps application
- 2 USGS Scientific Investigations Reports
- 2 DRI Agency reports
- 1 Journal article
- Data Releases

Example Capture Map: San Pedro River basin AZ/Mexico – after 50 years pumping



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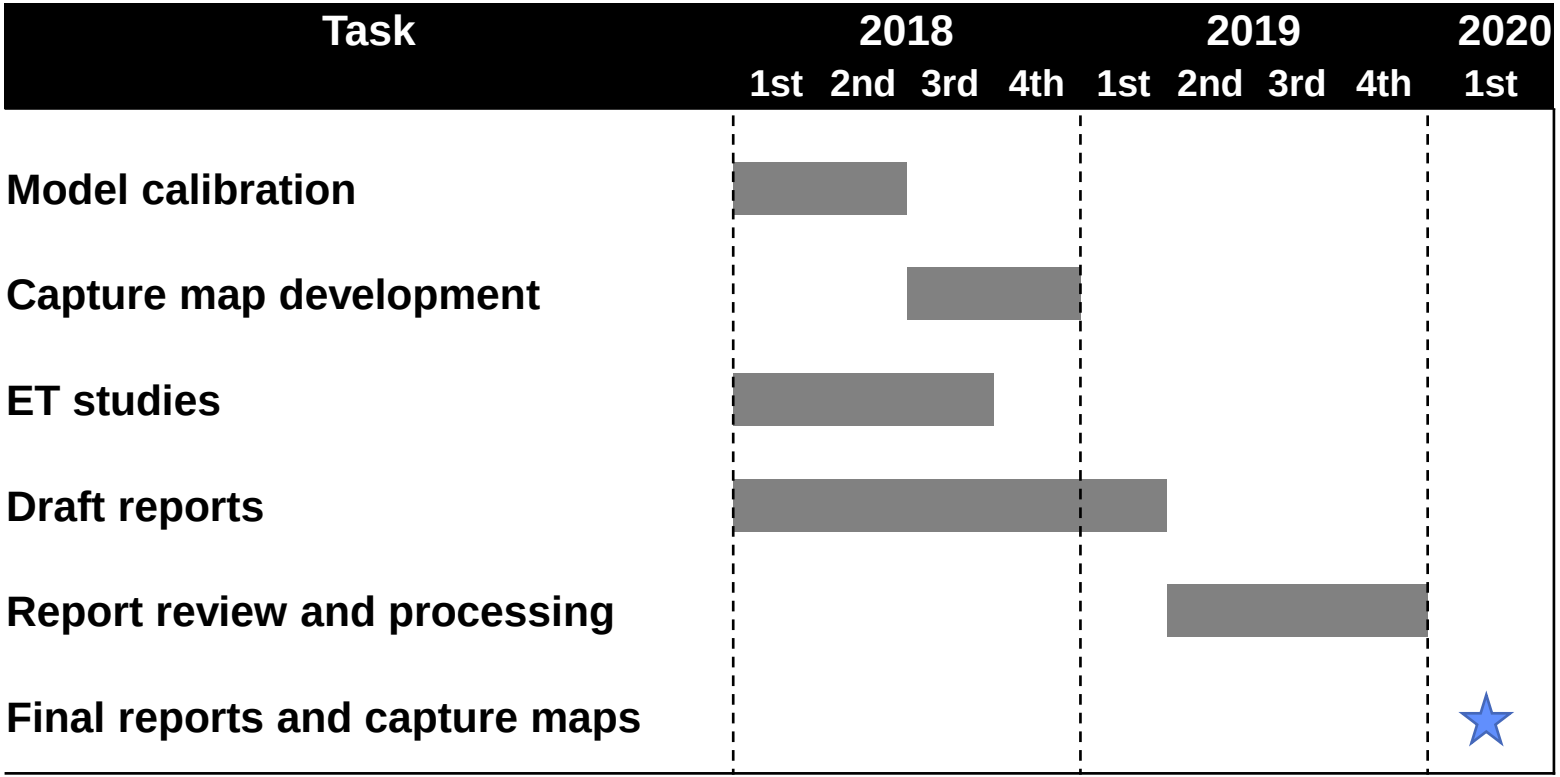
Project Schedule




Questions