



# TURLOCK GSP

## REVIEW OF GSP CHAPTER FIVE: WATER BUDGETS

TURLOCK SUBBASIN GROUNDWATER LUNCH HOUR

SEPTEMBER 16, 2021

Slides adapted from:



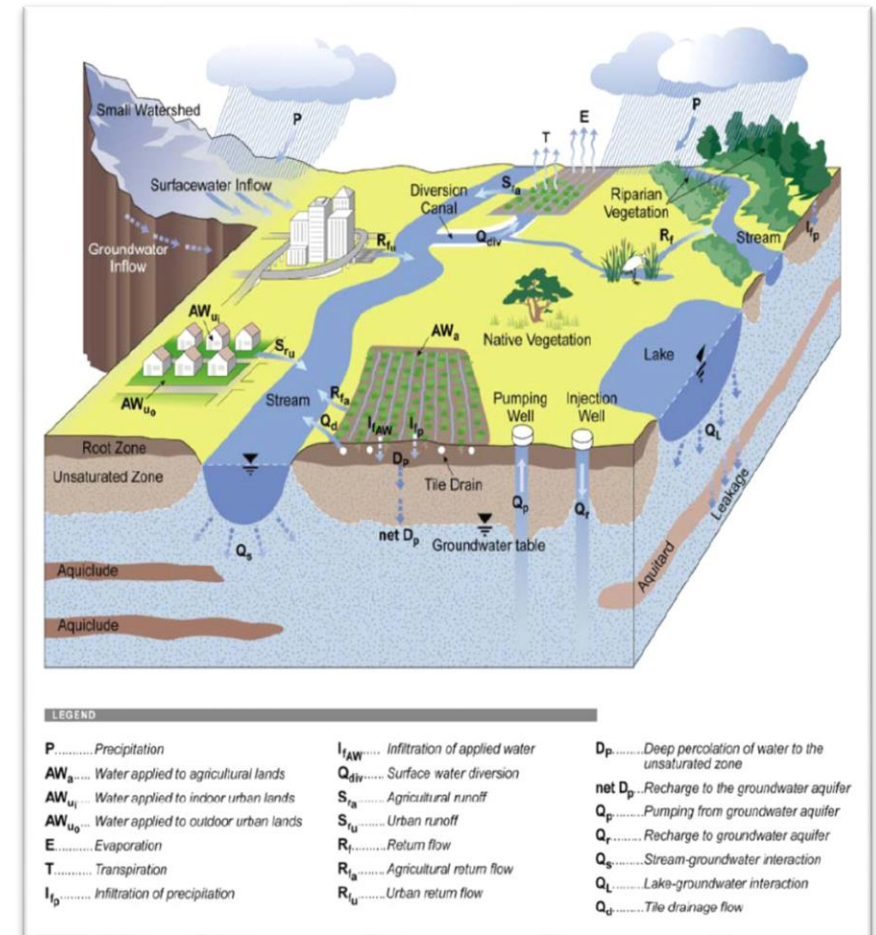
# GSP WATER BUDGETS

- Groundwater Sustainability Plans are required to include a water budget for the basin that provides an accounting and assessment of the total volume of groundwater and surface water entering and leaving the basin, including historical current and projected water budget conditions and the change in the volume of water stored.

# NUMERICAL MODEL PLATFORM

- Models are used to help inform the assessments of water budgets in many basins
- **I**ntegrated **W**ater **F**low **M**odel (IWFM)
- Developed and Supported by DWR
- Will be used by DWR to evaluate GSPs
- Used in numerous basins throughout the state including the Modesto and Merced Subbasins.

- **Recommended by DWR for SGMA and GSP Development**



# MODELING DATA GAPS AND UNCERTAINTIES

- **All models have uncertainties** **Uncertainties**
  - Simplifications of complex systems based on available data
  - Limitations need to be understood – predictions herein are a first estimate
  - Subject to future refinement during GSP implementation
- **Structural Uncertainties**
  - How the model represents natural processes
  - Model layering, element size and boundaries
- **Data Uncertainties**
  - Available input data for water budgets uncertain
  - Data regarding aquifer properties limited
  - Data regarding groundwater levels and movement limited
- **Calibration Uncertainties**
  - Variable ability to reproduce observed conditions
- **Projection Uncertainties**
  - Uncertainties regarding future demand, land use and climatic conditions



# WATER BUDGETS: DEFINING TIME FRAMES

## Historical Conditions

### Historical

- \* Land use
- \* Water use
- \* Hydrology

## Current Conditions

### Historical

- \* 2010 Land Use
- \* 2010 Water Use
- \* 2010 Hydrology

## Projected Conditions

### Projected Future

- \* Land Use
- \* Water Use

### Historical

- \* Hydrology

## Projected with Climate Change

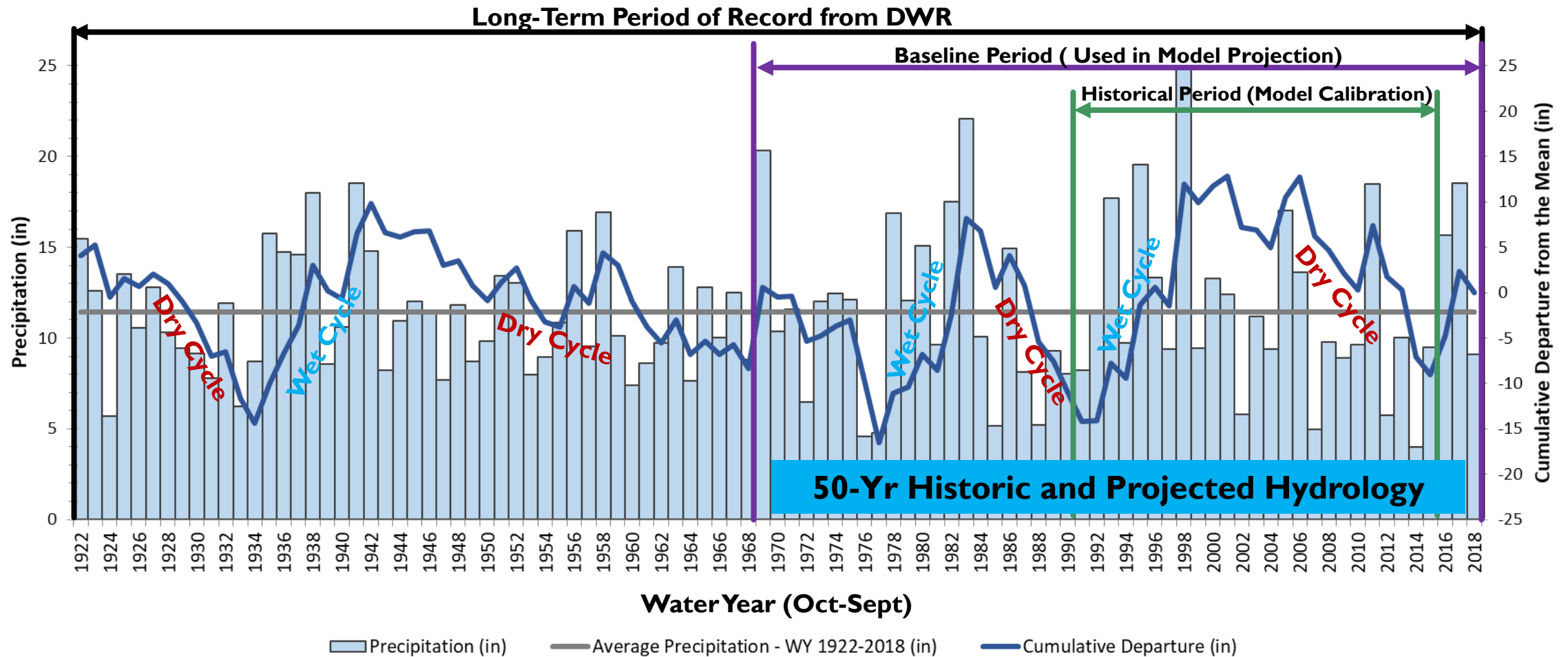
### Projected Future

- \* Land Use
- \* Water Use

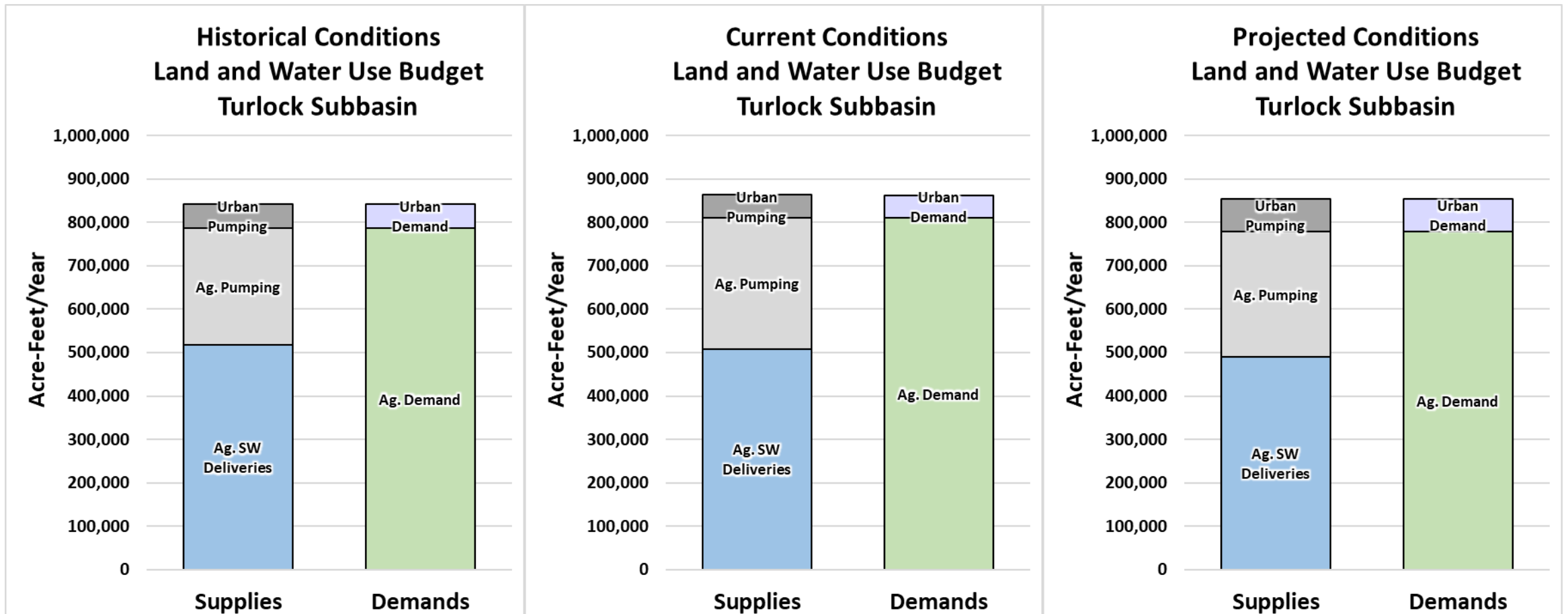
### Projected Future

- \* Hydrology

# HISTORICAL & BASELINE HYDROLOGIC PERIOD

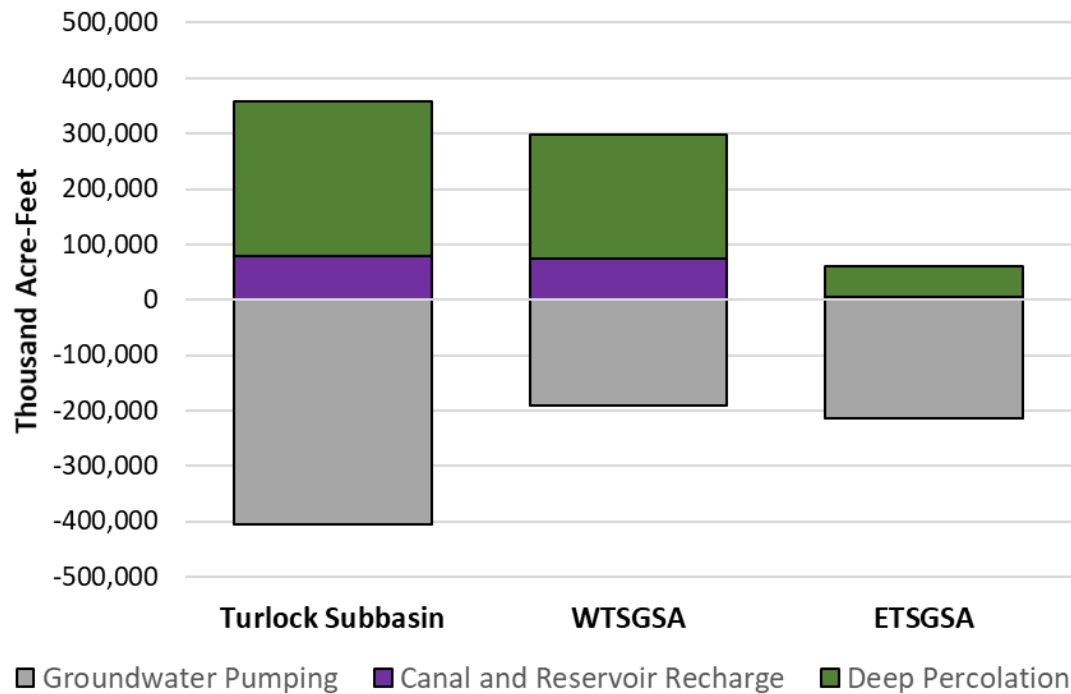


# LAND & WATER USE: TURLOCK SUBBASIN

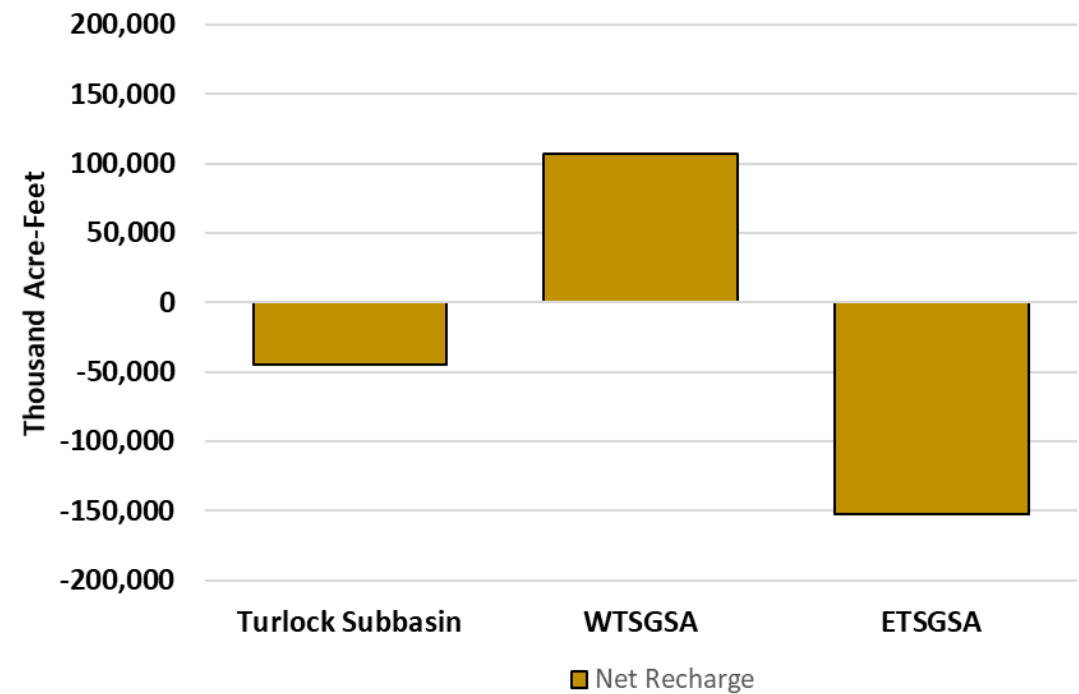


# NET-GROUNDWATER USE - HISTORICAL

**Operational Water Budget  
Groundwater Recharge and Production  
Historical Conditions**



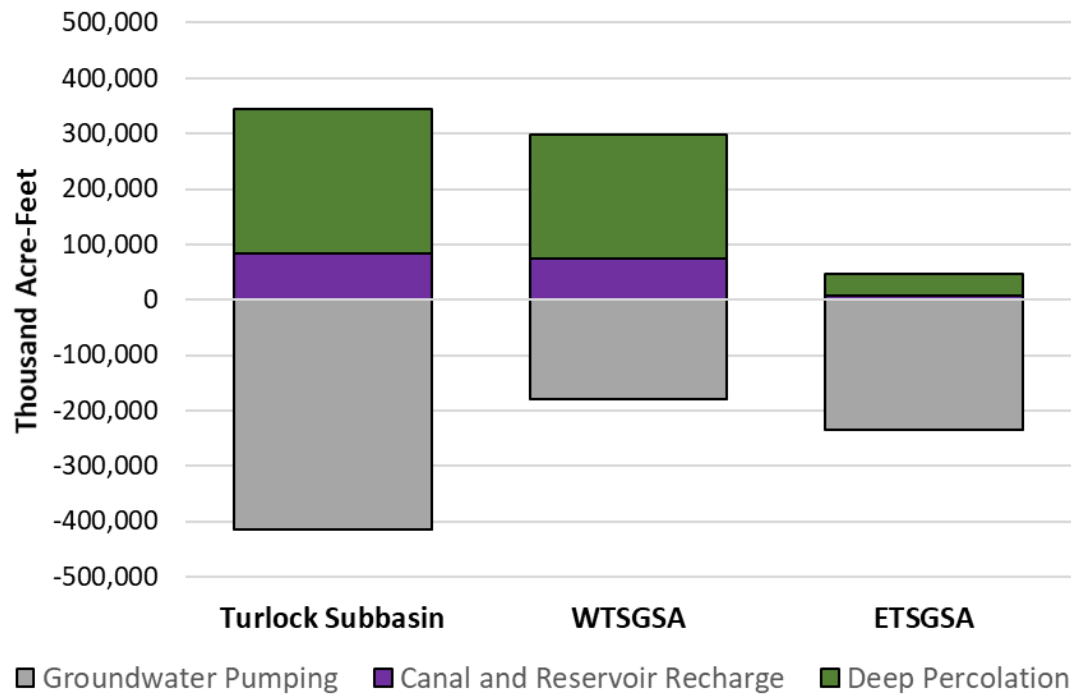
**Operational Water Budget  
Net-Recharge Use  
Historical Conditions**



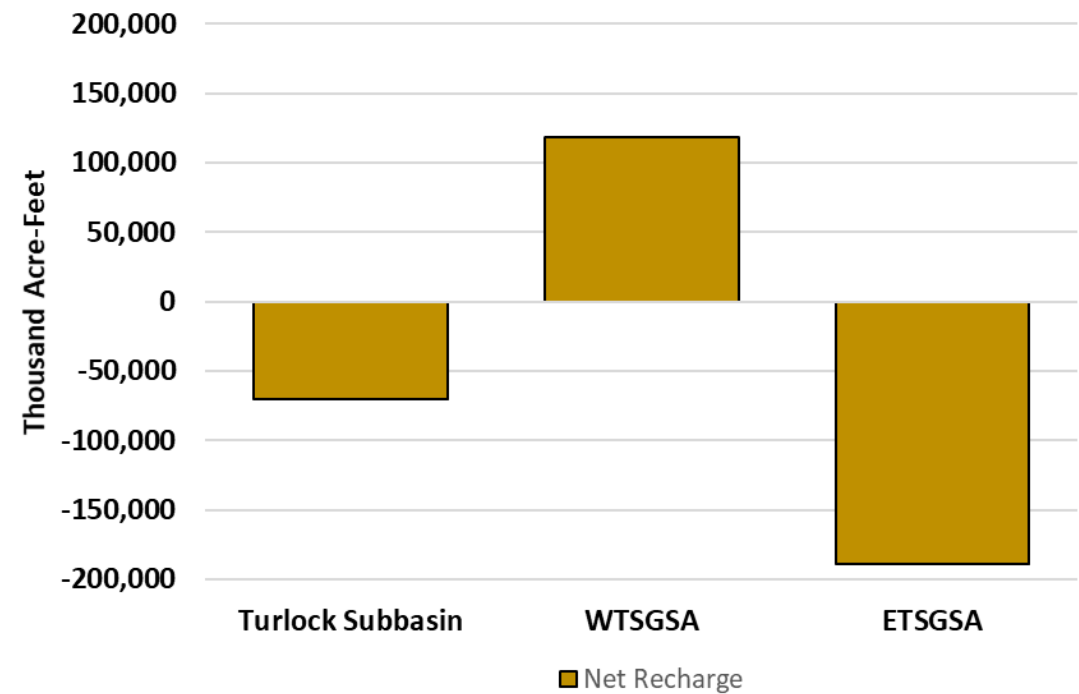


# NET-GROUNDWATER USE – CURRENT

**Operational Water Budget  
Groundwater Recharge and Production  
Current Conditions**

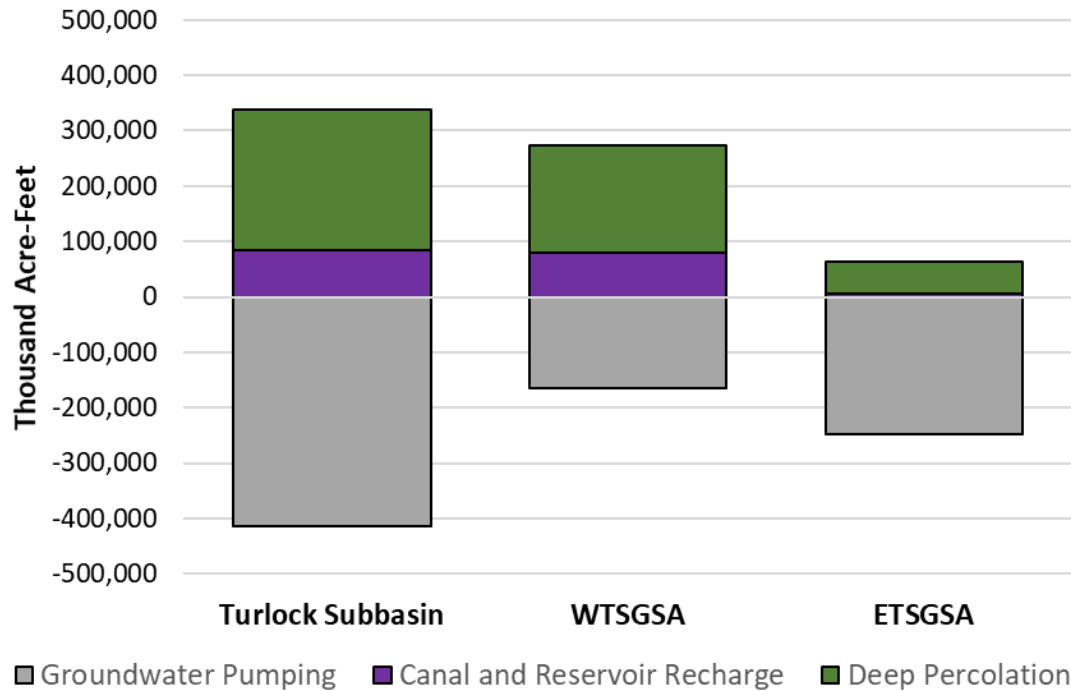


**Operational Water Budget  
Net-Recharge Use  
Current Conditions**

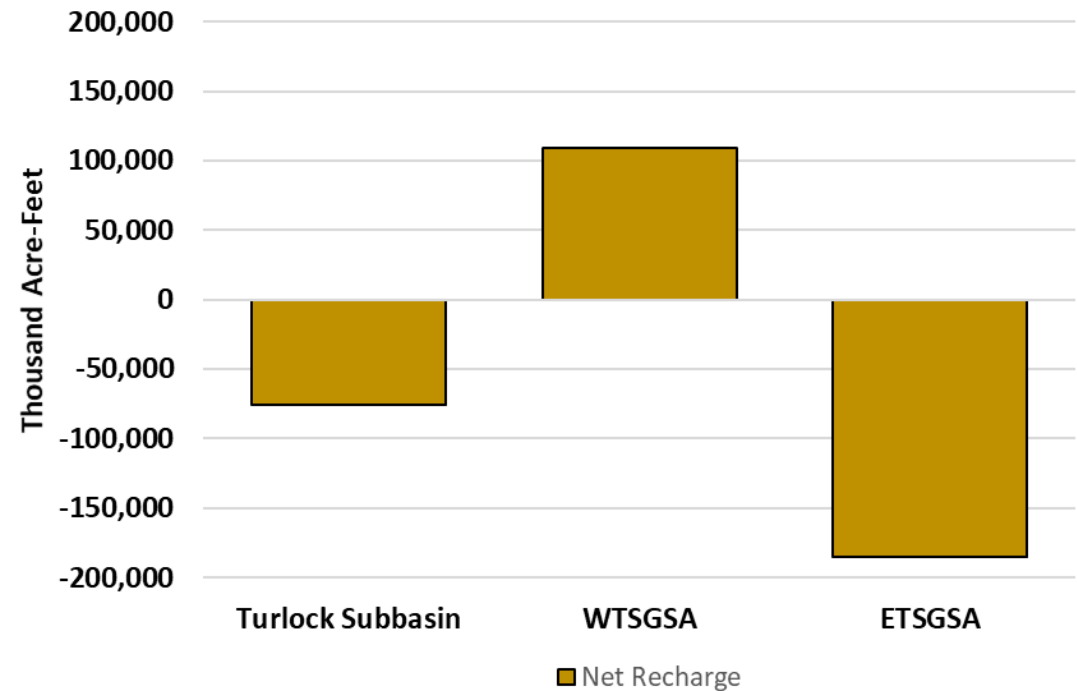


# NET-GROUNDWATER USE – PROJECTED

**Operational Water Budget  
Groundwater Recharge and Production  
Projected Conditions**



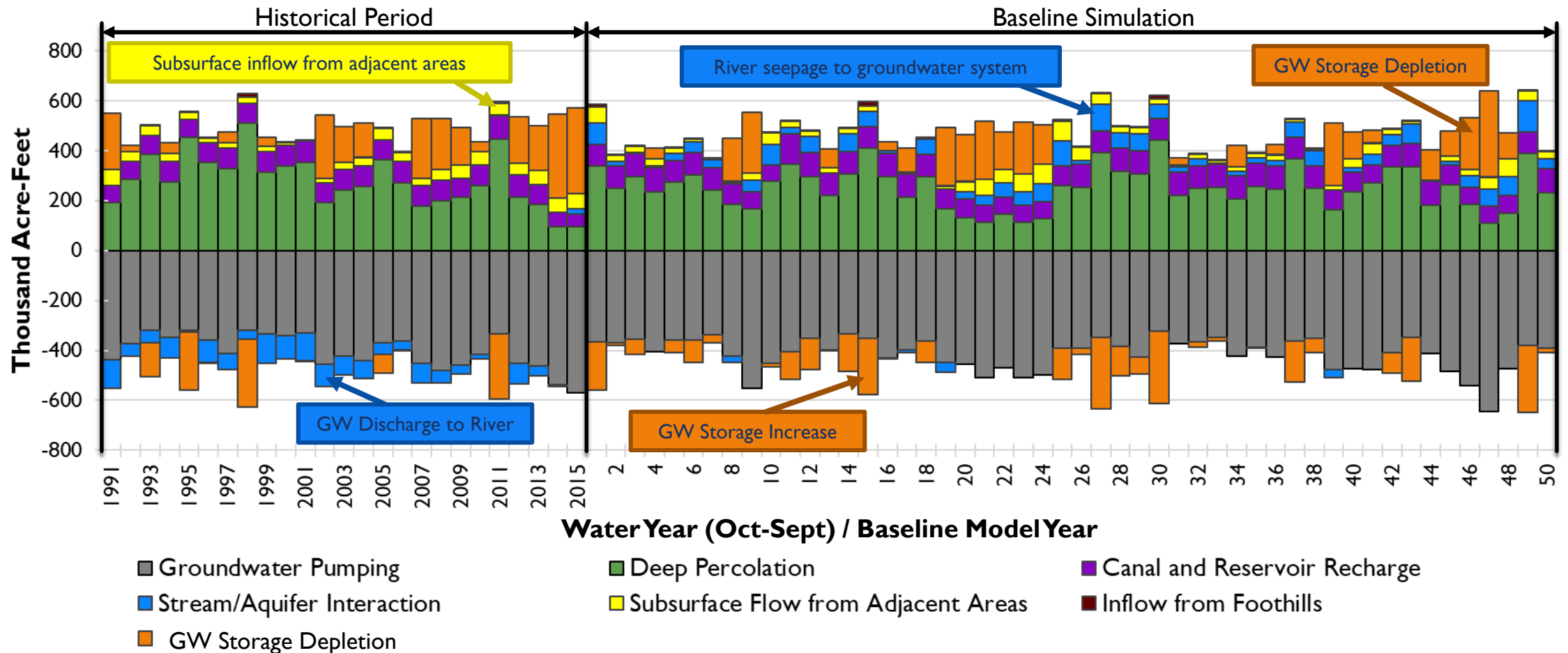
**Operational Water Budget  
Net-Recharge Use  
Projected Conditions**



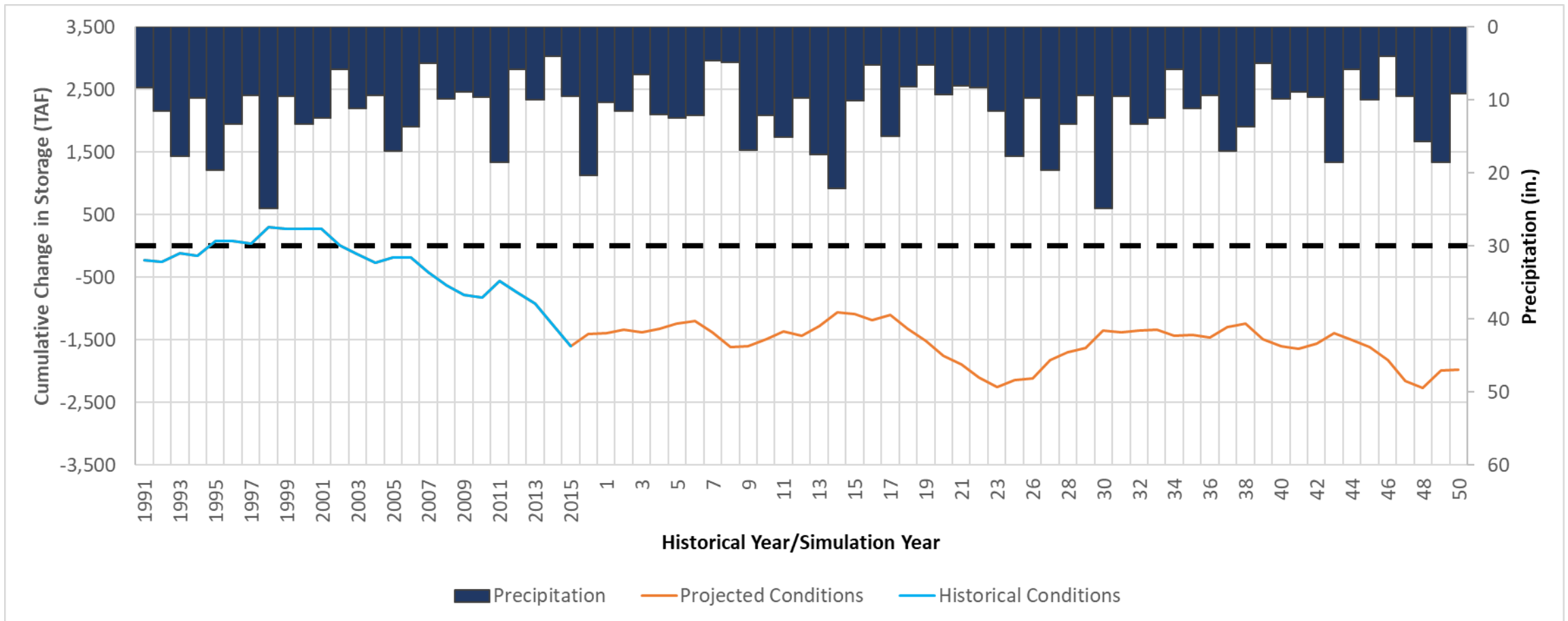
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# GROUNDWATER BUDGETS

# HISTORICAL AND PROJECTED MODEL GROUNDWATER BUDGET TURLOCK SUBBASIN

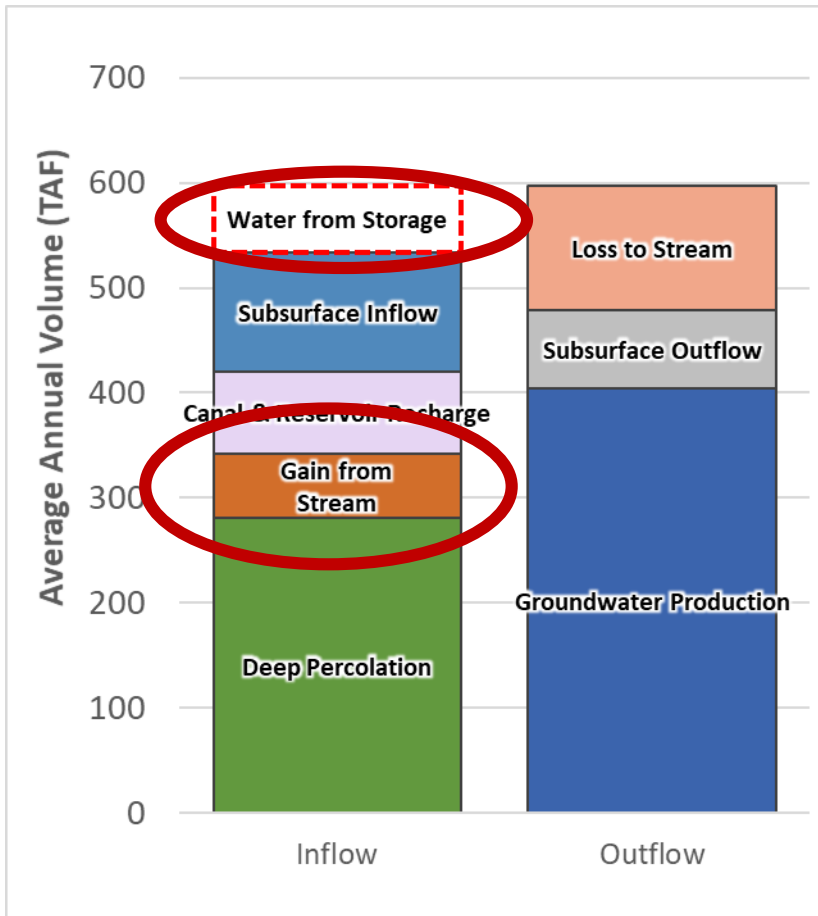


# MODELED CUMULATIVE CHANGE IN STORAGE

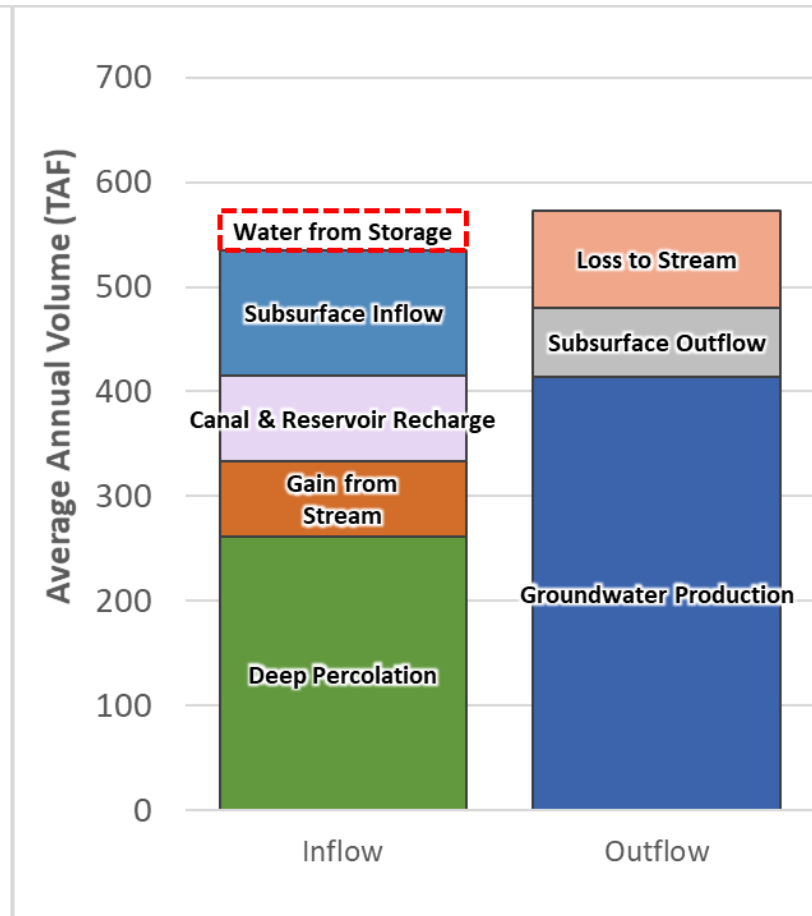


# GROUNDWATER BUDGETS: TURLOCK SUBBASIN

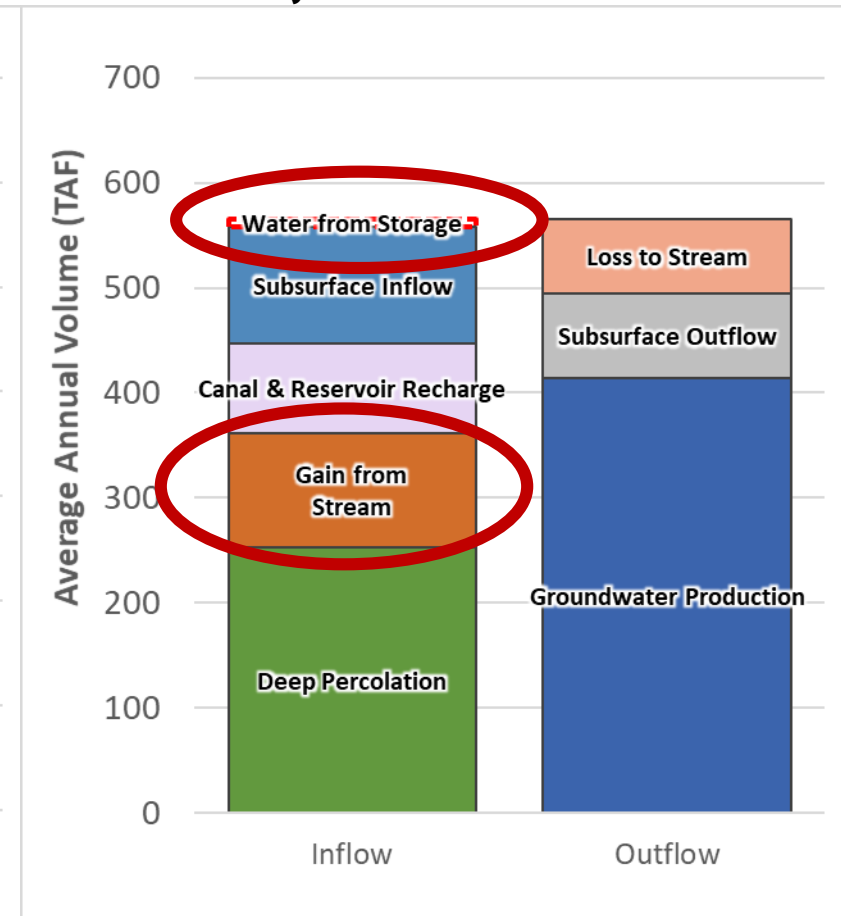
## Historical Conditions



## Current Conditions



## Projected Conditions

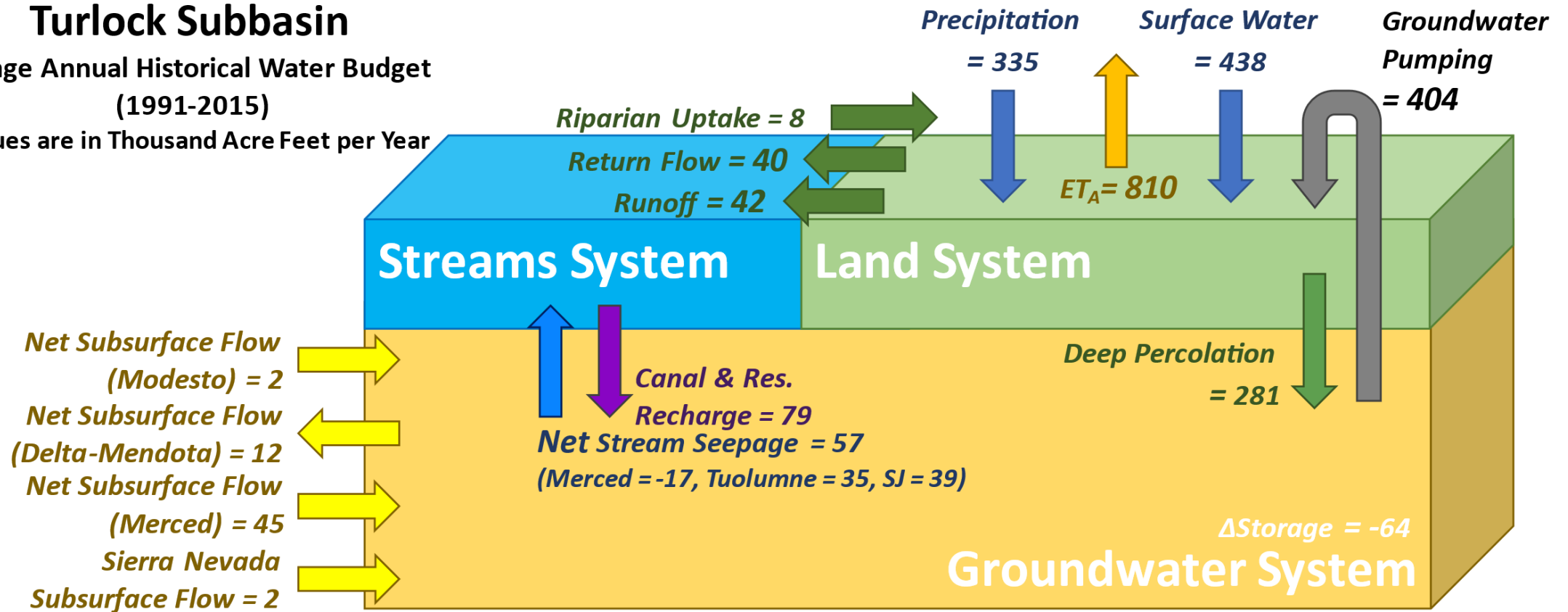


# WATER BUDGET DIAGRAM (HISTORICAL CONDITIONS)

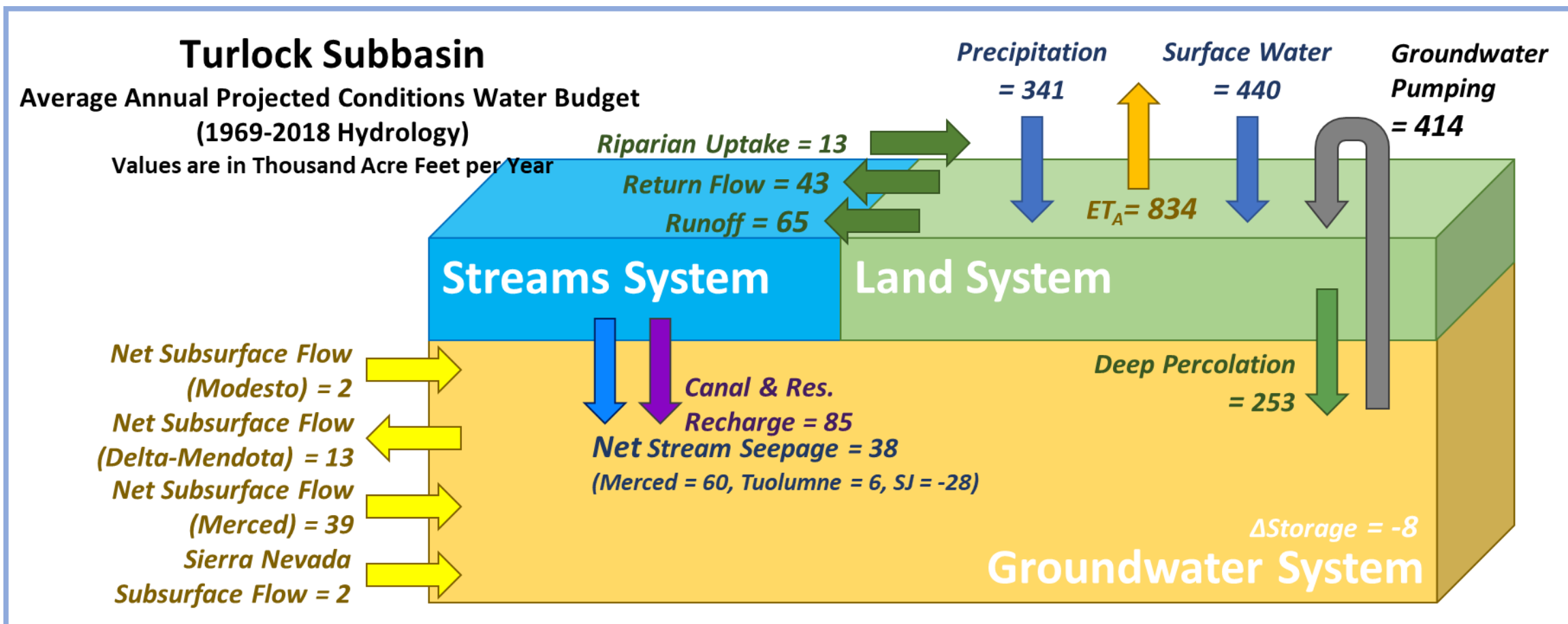
## Turlock Subbasin

Average Annual Historical Water Budget  
(1991-2015)

Values are in Thousand Acre Feet per Year



# WATER BUDGET DIAGRAM (PROJECTED CONDITIONS)





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# CLIMATE CHANGE

# DWR SGMA REGULATIONS FOR CLIMATE CHANGE

§ 354.18. (c) Each Plan shall quantify the ... projected water budget for the basin as follows:

(3) Projected water budgets ... shall ... estimate future baseline conditions concerning hydrology, water demand and surface water supply availability or reliability over the planning and implementation horizon:

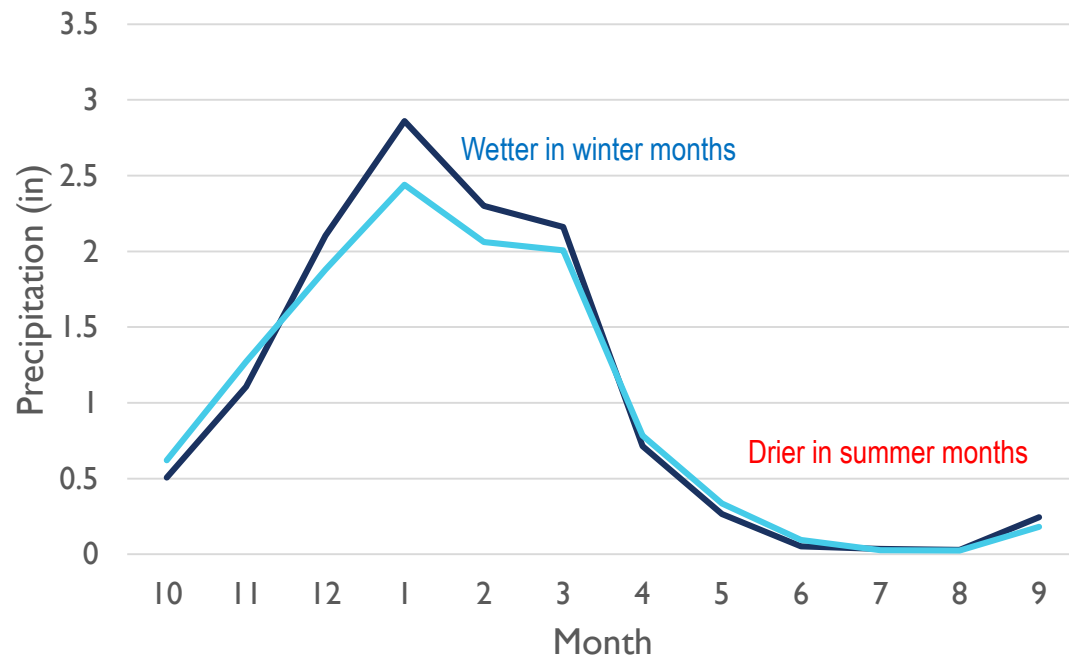
(A) Projected hydrology shall utilize **50 years of historical precipitation, evapotranspiration, and streamflow information** ... (and) shall also be applied ... to evaluate future scenarios of hydrologic uncertainty **associated with projections of climate change** and sea level rise.

(B) Projected water demand shall utilize **the most recent land use, evapotranspiration, and crop coefficient information** ... (and) shall also be applied ... to evaluate future scenarios of water demand uncertainty associated with projected changes in local land use planning, population growth, and **climate**.

(C) Projected surface water supply shall utilize **the most recent water supply information** as the ... (and) shall also be applied ... to evaluate future scenarios of surface water supply availability and reliability as a function of the ... projected changes in local land use planning, population growth, and **climate**.

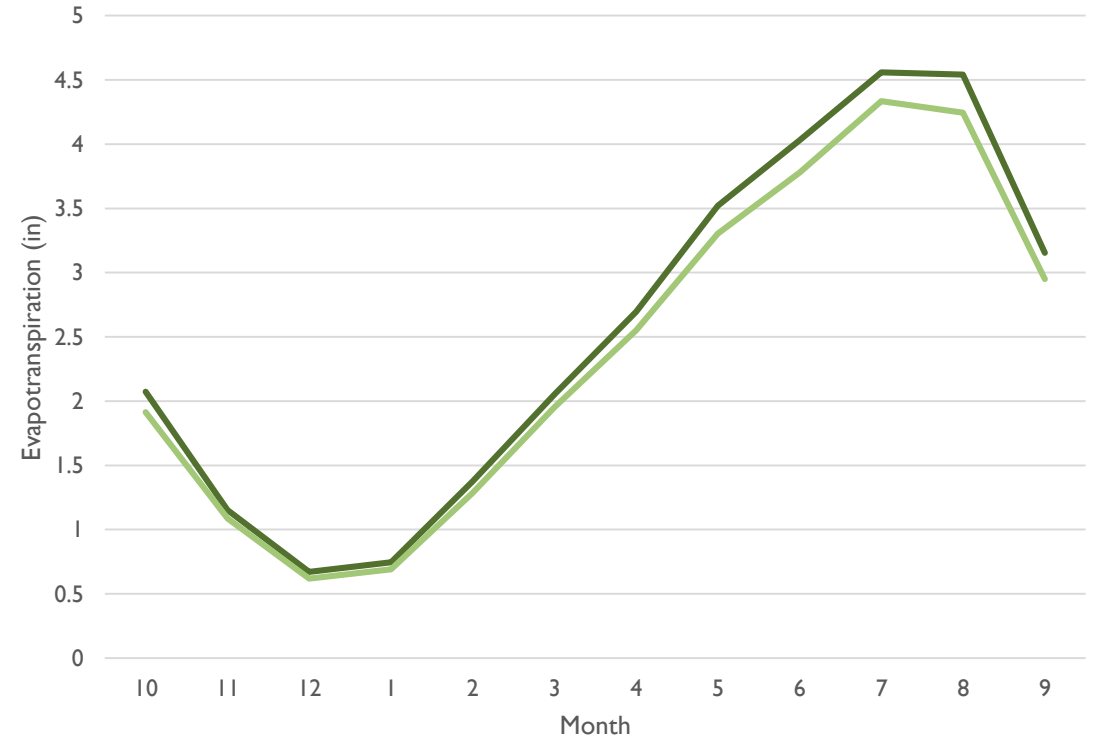
# CLIMATE CHANGE EFFECTS

## Average Monthly Precipitation (Turlock Subbasin)



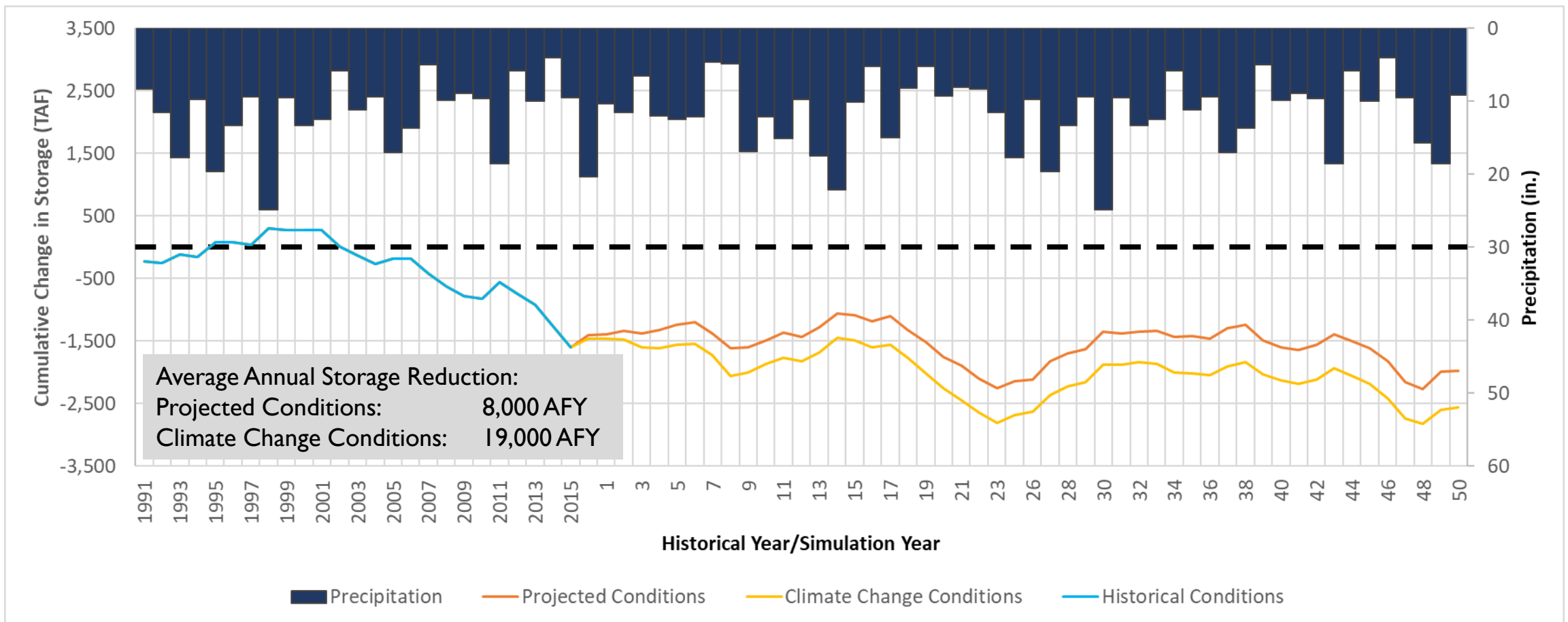
— Climate Change 2070 — Projected Conditions Baseline

## Average Monthly ET - Turlock Subbasin



— Climate Change 2070 — Projected Conditions Baseline

# CLIMATE CHANGE IMPLICATIONS



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# SUSTAINABLE YIELD

# INTRODUCTION TO SUSTAINABLE YIELD

- **Goal:** Estimate volume of groundwater production available under “sustainable conditions” as defined by SGMA.
- **Objective:** Use the C2VSim™ Baseline to assess various minimum thresholds (MTs) selected for:
  - Groundwater in Storage – mitigation of overdraft conditions
  - Groundwater Levels
  - Interconnected Surface Water
  - Land Subsidence (Proxy: Sub-Corcoran Groundwater Levels)

# SGMA SUSTAINABILITY INDICATORS

Undesirable results are significant and unreasonable conditions for one or more of the following :

- 1. Chronic lowering of groundwater levels**
- 2. Reduction of groundwater in storage**
3. Seawater intrusion – not applicable to Turlock Subbasin
4. Degraded water quality
5. Land subsidence
- 6. Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water**

# RESULTS

- Sustainable Yield of Turlock Subbasin is estimated to be 311,000 AFY
- Projected GW Pumping is estimated to be 414,000 AFY
- Sustainable Yield will be refined as more data become available
- Sustainable Yield must be achieved and maintained over wet and dry periods within 20 years
- Compliance will be measured by managing to Minimum Thresholds and Measurable Objectives at Representative Monitoring Sites
- Opportunities to meet sustainability conditions:
  - Develop and implement Projects and Management Actions
  - Demand reduction



# QUESTIONS?

