

# Agricultural Water Balance (or “Water Budget”) Example

Agricultural Advisory Group  
Sacramento, CA

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October 18, 2016

# Dauids Engineering Role

- **Technical Input**
- **Requested Tasks**
  - **Review of Selected AWMPs Relative to EO Requirements (Last Meeting)**
  - **AWMP Water Balance Example (Today)**
- **No Involvement in Preparation of Draft Framework**

# Outline

- **Water Code Requirements**
- **Water Balance Concepts and Approach**
- **Example: Oakdale Irrigation District**
- **Questions/Discussion**

# Water Code §10826(b)

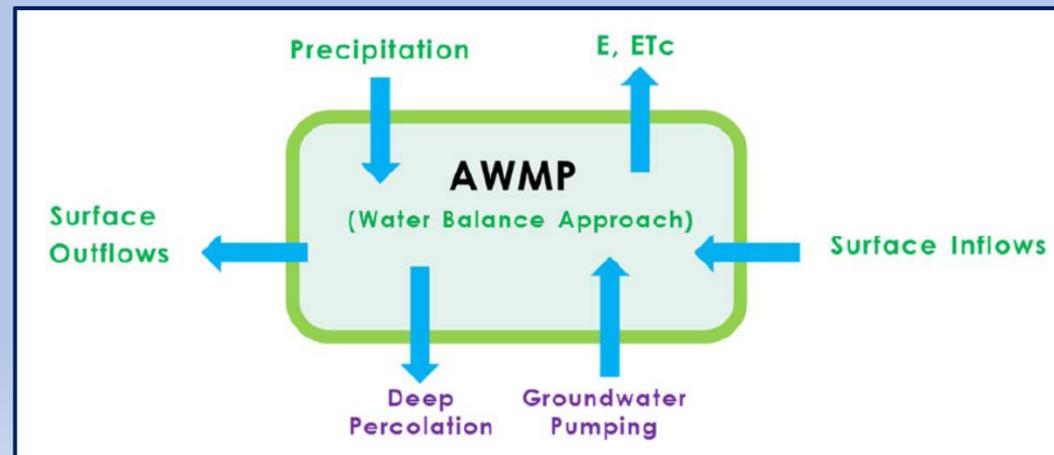
- (b) Requires description of the *quantity* and quality of agricultural supplier water resources
- Includes water supplies, water uses (i.e. demands), and drainage outflows
  - (1)-(3): Surface water, groundwater, other supplies
  - (5): Agricultural, environmental, recreational, M&I, groundwater recharge, and transfers and exchanges
  - (6): Drainage from the service area

# Water Code §10826(b) (continued)

- (7) Requires “Water Accounting”, including:
  - (A) Quantifying the water supplier’s water supplies
  - (B) Tabulating water uses
  - (C) Overall water budget

# Disclaimer

- Complexity of water balance can vary depending on supplier setting and objectives
- Water balance example provided is not intended to represent what should be required by all suppliers
- For example, draft framework recommends simple structure:



# What is a Water Balance (or Budget)?

- A complete accounting of all water flowing into and out of a defined area (the district) over a specified period (months or years)

- Basic Accounting Principle:

$$\text{Inflows} - \text{Outflows} = \text{Change in Storage}$$

- Just Like A Checking Account:

$$\text{Deposits} - \text{Withdrawals} = \text{Change in Balance}$$

# Water Balance Potential Benefits

- Assess and improve water measurement and data management practices
- Assess water supply adequacy, conservation benefits and opportunities
- Provide insights into District and on-farm water management
- Describe relationship between surface water system and underlying groundwater system
- Demonstrate stewardship of available water supplies
- Satisfy regulatory requirements

# Water Balance Components

- Monthly Time Step
- Aggregate to Calendar Years (keep most crop seasons in single year), or period appropriate for supplier
- Boundaries
- Accounting Centers
- Inflows
- Outflows
- Change in Storage

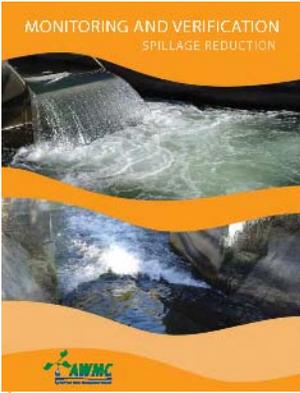


# Water Balance Development

1. Define boundaries.
2. Identify accounting centers and flow paths.
3. Select time period and time step for analysis.
4. Assemble and quality control available data.
5. Perform supporting analysis to estimate additional flow paths.
6. Assess uncertainty in individual components.
7. Select components to estimate via mass balance (“closure”).
8. Calculate closure terms and estimate uncertainty.
9. Review and refine results.

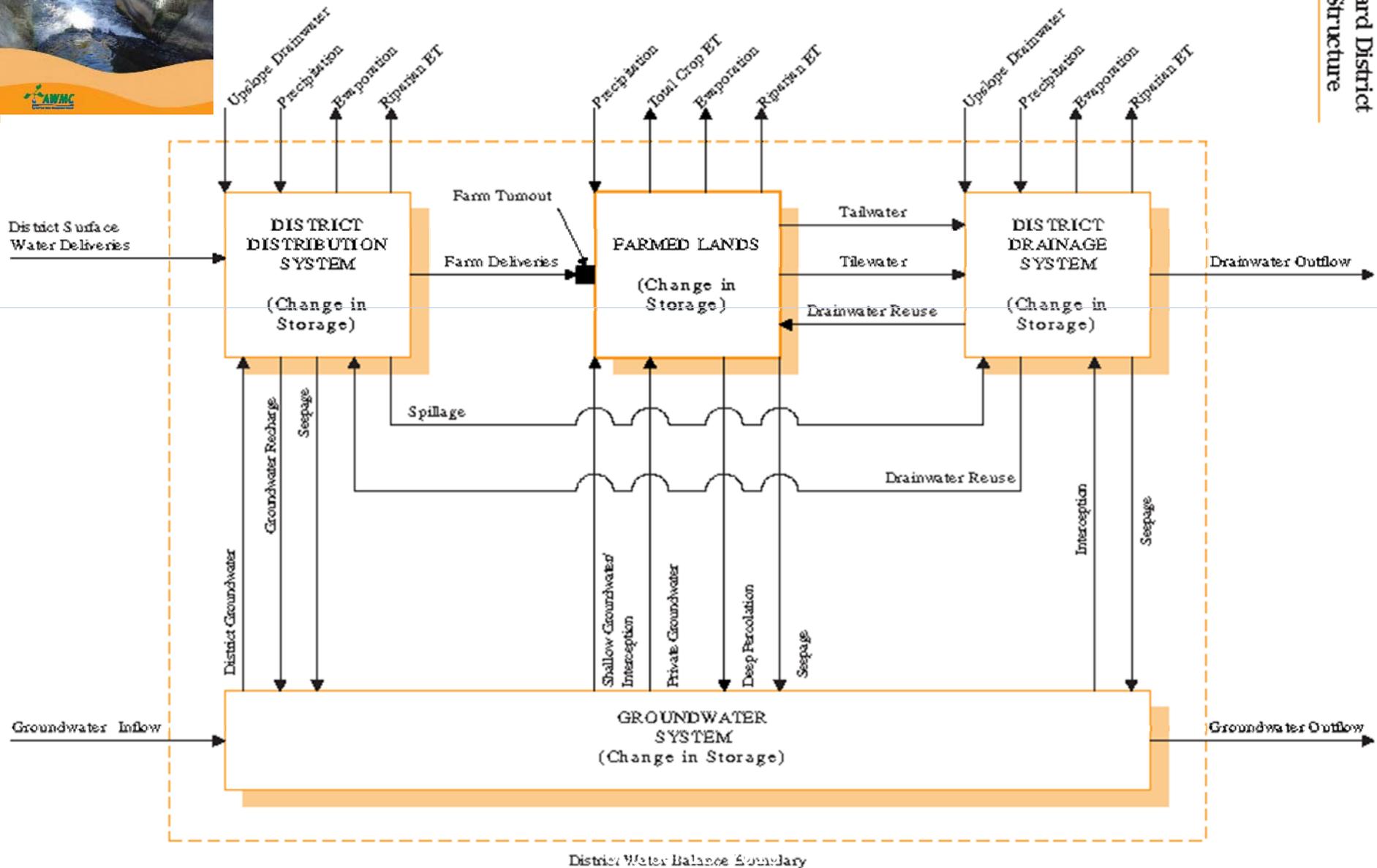
# Water Balance Data Sources

- **Estimation Techniques**
  - Direct Measurements (e.g. diversions and precipitation)
  - Calculated Estimates (e.g. seepage and runoff of precipitation)
  - Mass Balance (Water Balance “Closure”)
- **Supporting Data**
  - CIMIS and NOAA Weather Data
  - DWR Land and Water Use Surveys
  - NRCS Soil Surveys
  - Published Research
  - Other Sources



# AWMC Sample Balance Structure

Figure 1. Standard District Water Balance Structure



# Example: Oakdale ID

# Background

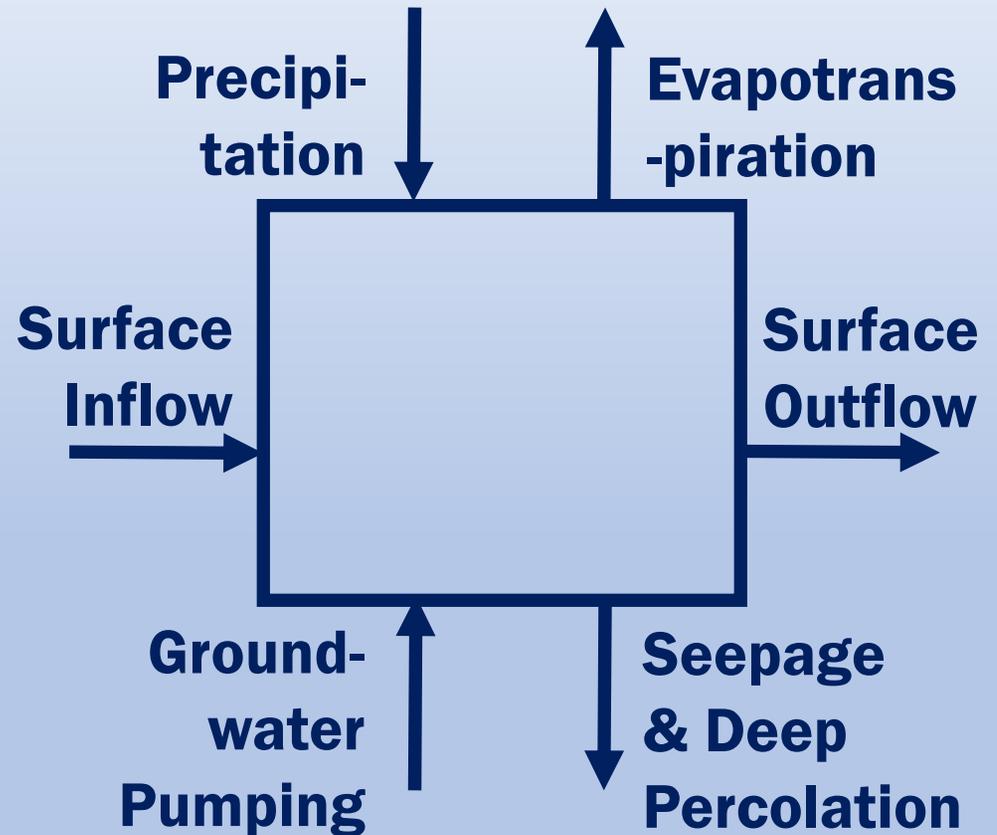
- First prepared in 2004/2005 under AWMC MOU. Updated in 2012 and 2015.
- Updated for AWMP updates or more frequently
- 3 Accounting centers, 30 flow paths, monthly time step, aggregated to calendar years
- Most recent 10 years included in 2015 AWMP (2005-2014), along with overall, dry year, and wet year averages
- Farm deliveries, deep percolation of applied water, and tailwater to drainage system estimated via mass balance (closure)

# Water Balance Information in OID AWMP

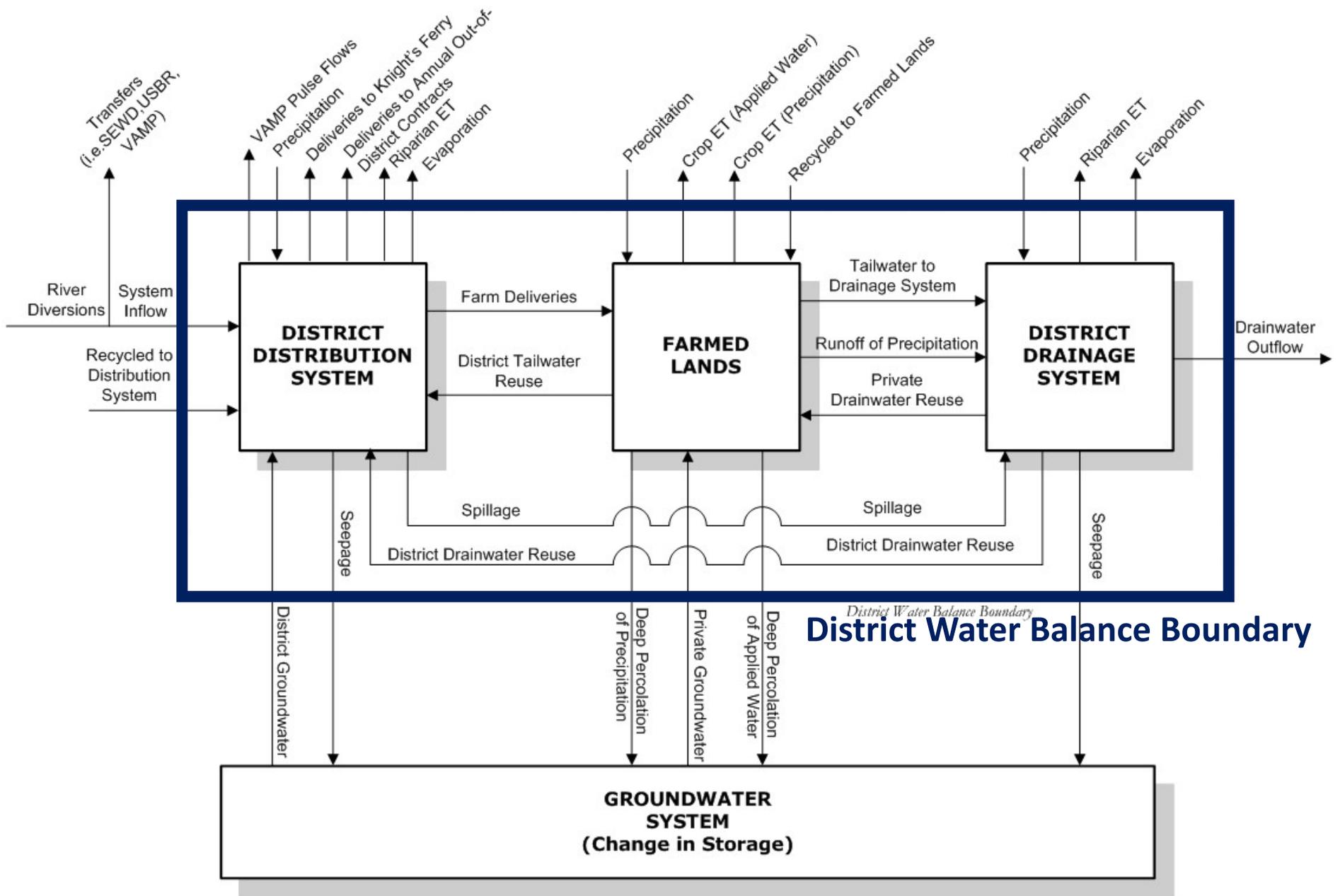
- **Inventory of Water Supplies (OID AWMP Section 4)**
  - Surface Water Supply
  - Groundwater Supply
  - Other Supplies
  - Water Quality Monitoring
- **Water Balance (OID AWMP Section 5)**
  - Introduction
  - Water Balance Overview
  - Flow Path Estimation and Uncertainty
  - Hydrologic Year Types
  - Water Uses
  - Drainage
  - Water Accounting (Water Balance Summary)
  - Water Supply Reliability

# Overall Boundary Balance

- Inflows
  - Surface Water
  - Precipitation
  - Groundwater
- Outflows
  - Evapotranspiration
  - Surface Water
  - Deep Percolation

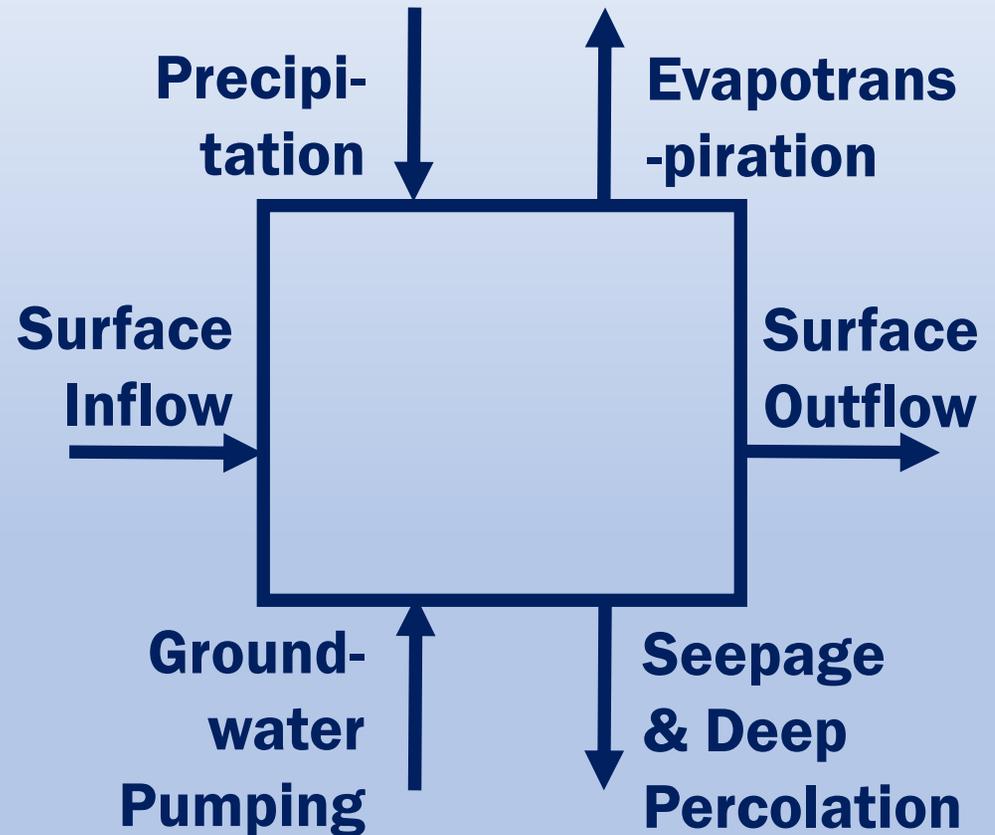


# Oakdale ID Water Balance Structure

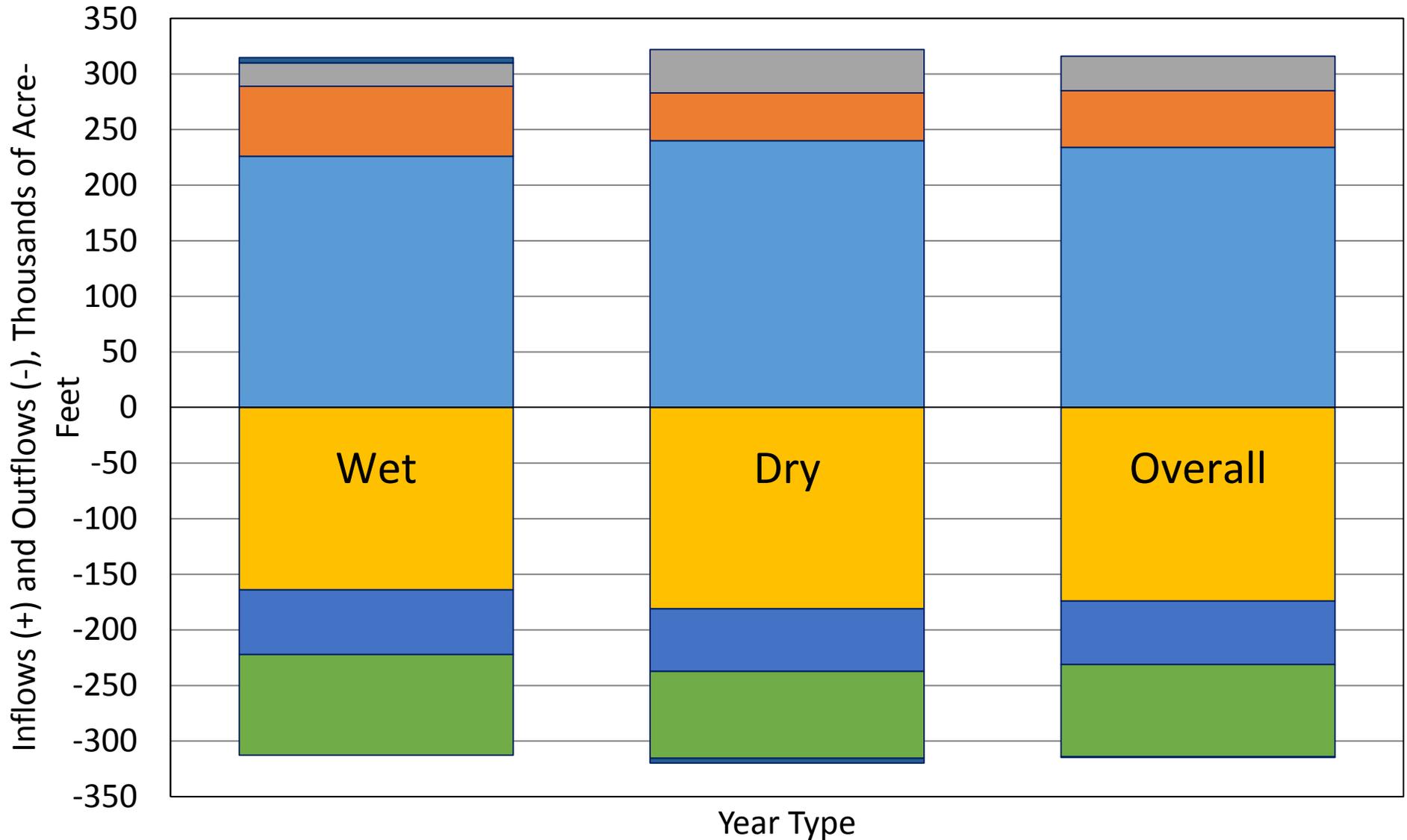
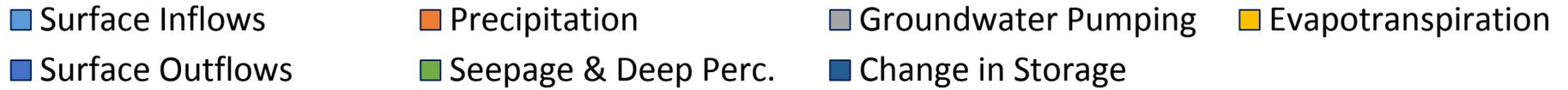


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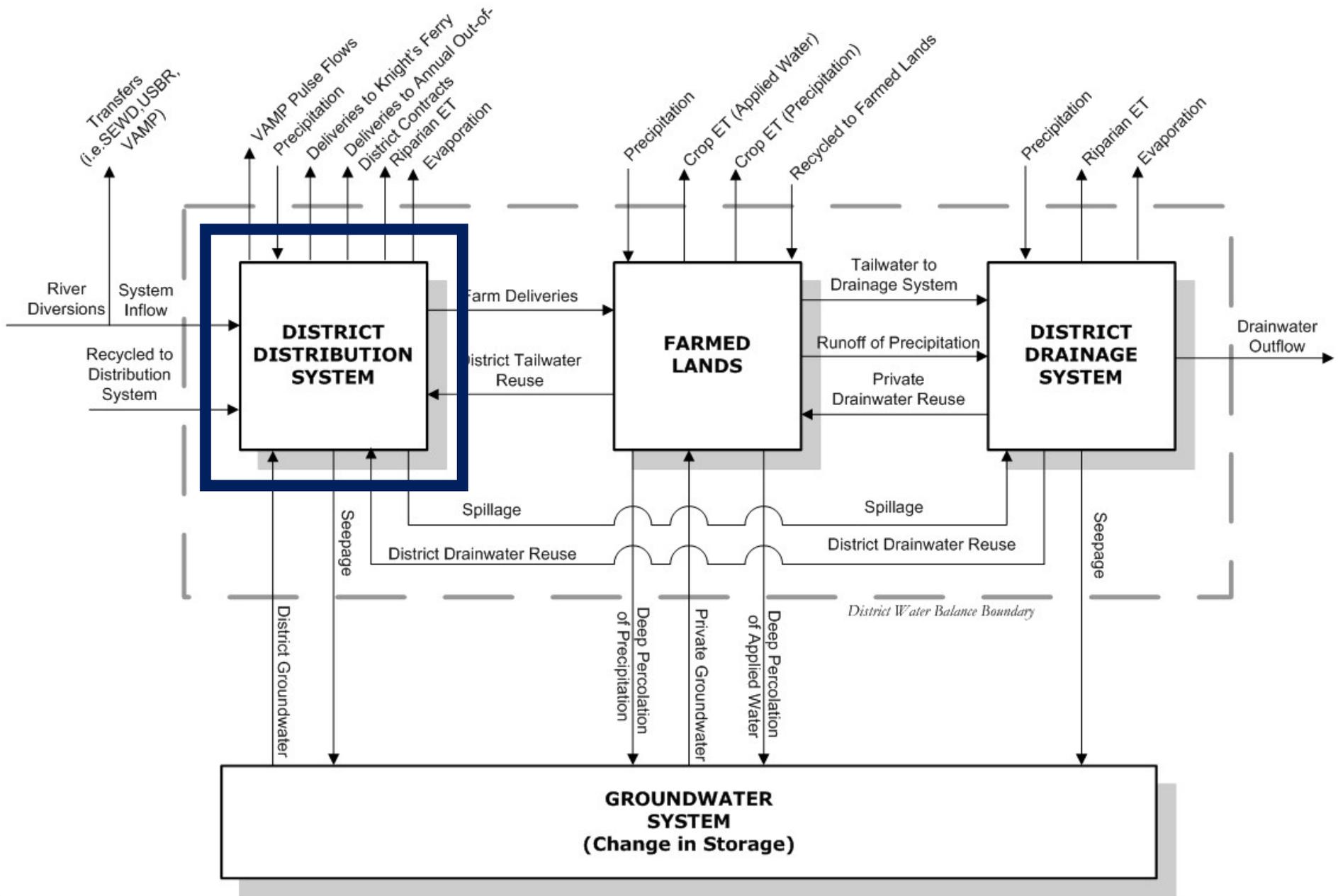
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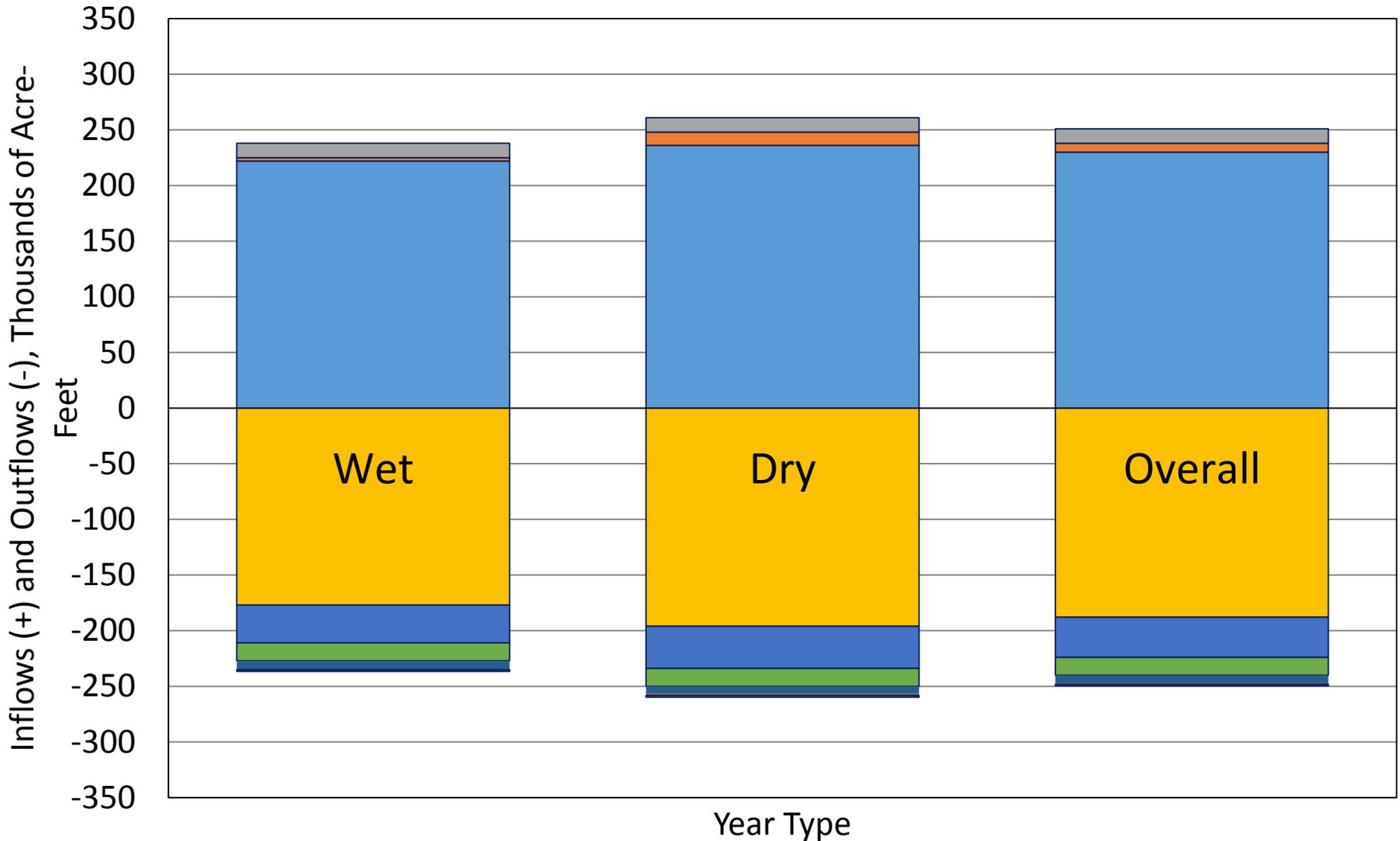
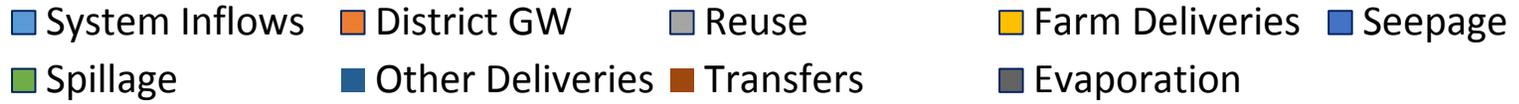
# Oakdale Overall WB Summary



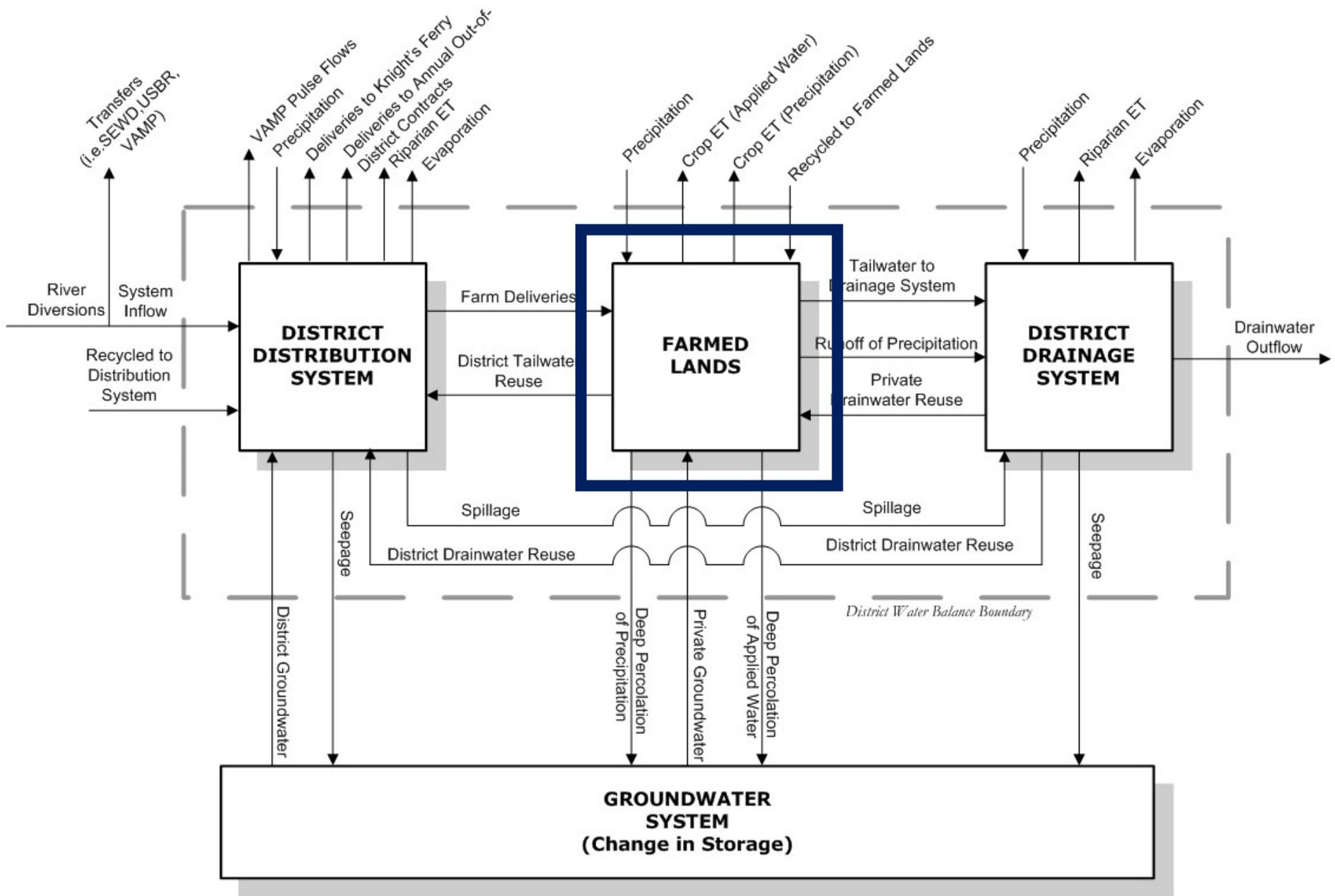
# Oakdale ID Water Balance Structure



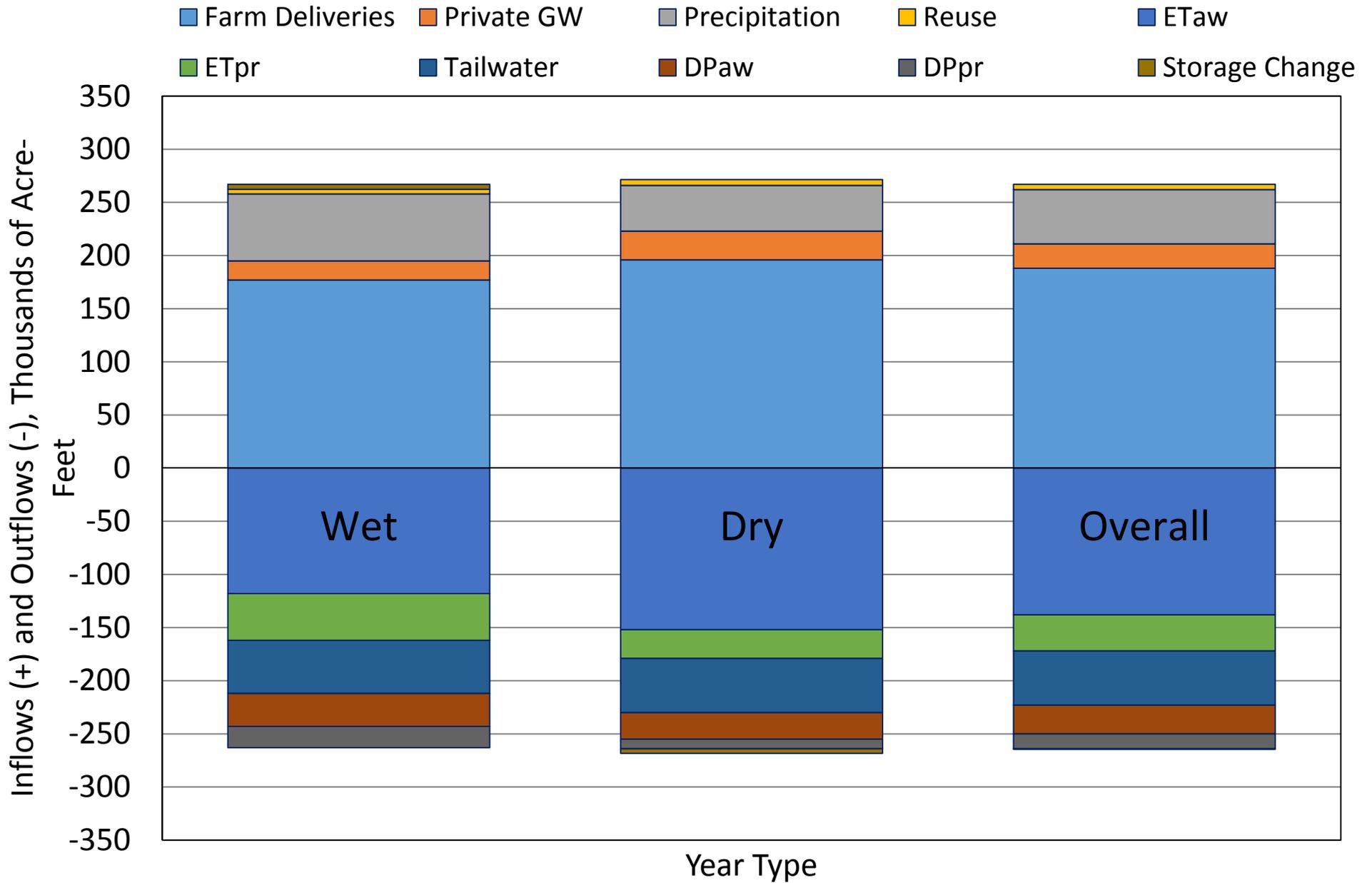
# Oakdale Distribution System WB Summary



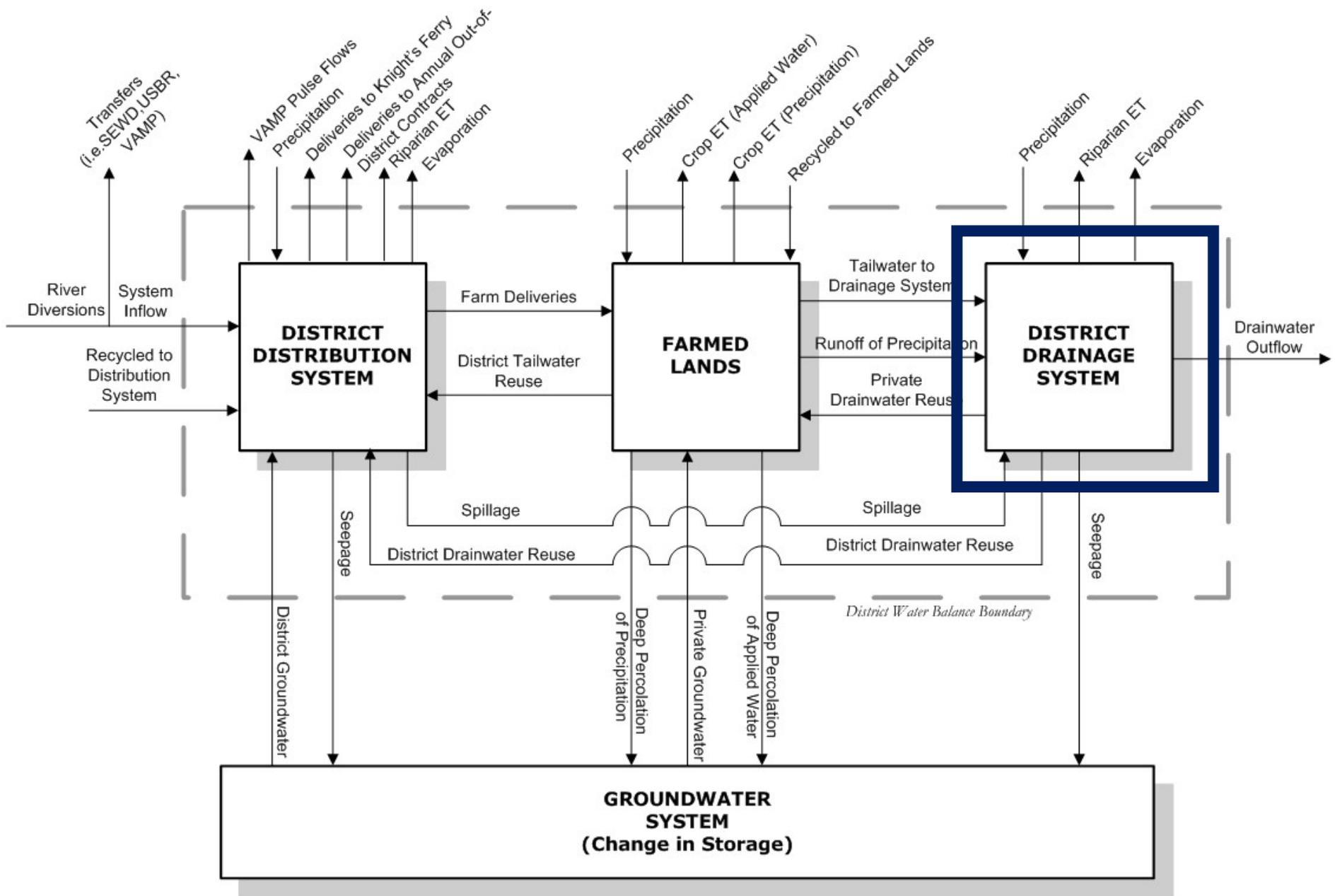
# Oakdale ID Water Balance Structure



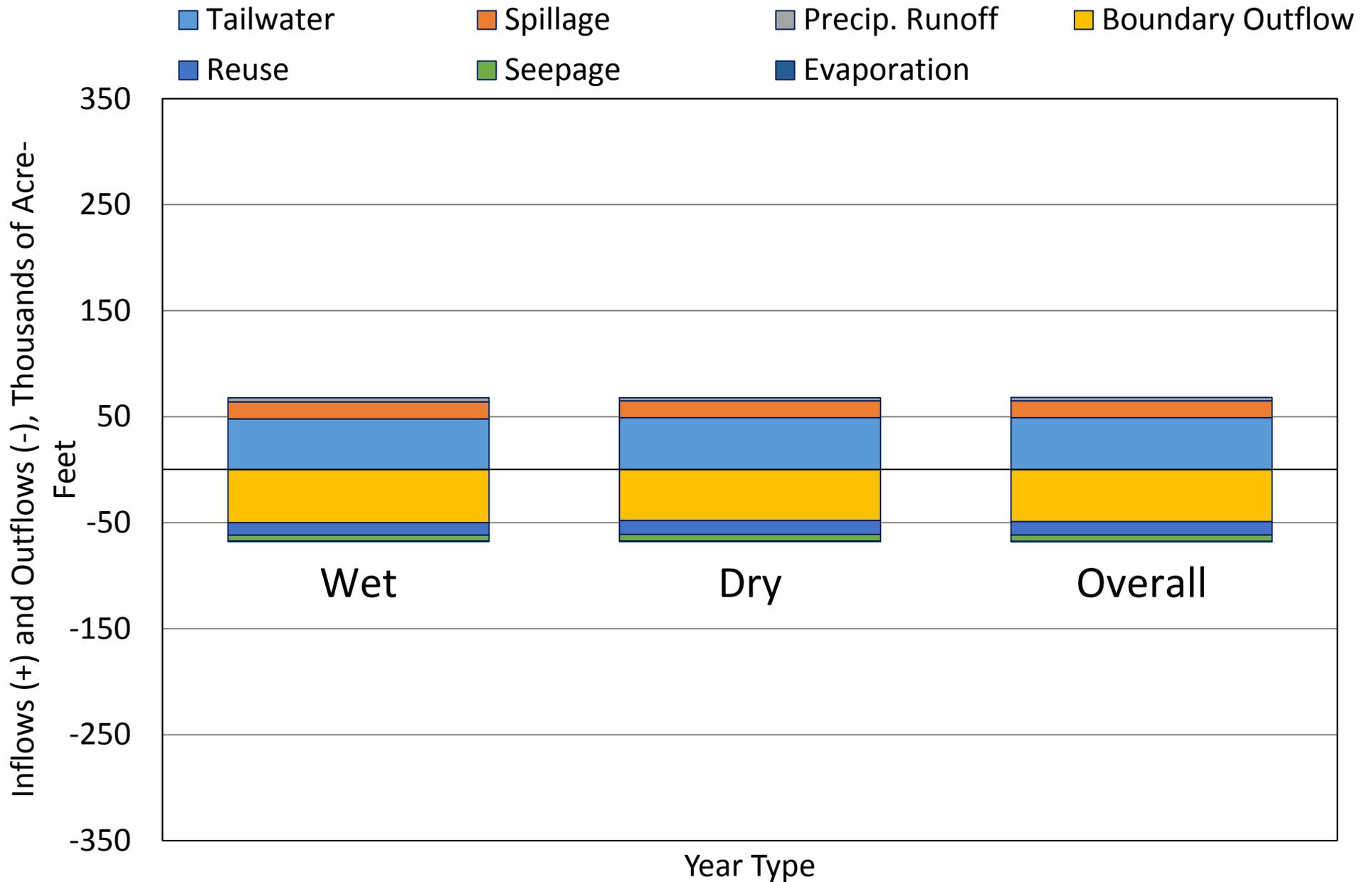
# Oakdale Farmed Lands WB Summary



# Oakdale ID Water Balance Structure



# Oakdale Drainage System WB Summary



# Water Balance Context: OI

- Water balance developed as part of 2005 AWMP and 2006 comprehensive Water Resources Plan (WRP).
- Current and potential future customer needs considered in WRP, as well as financing for improvements.
- WRP led to identification of improved operational efficiency and level of service as water management objectives, among others.
- Water balance updates allow for periodic review of WRP implementation progress (and other management indicators).
- Water balance updates support refinement of planned projects to further achieve water management objectives.

# Discussion