Butte County Water Inventory and Analysis

Evaluating the County's Water Supply and Demand

Project Wrap Up **June 2016**

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Our Mission

"To manage and conserve water and other resources for the citizens of Butte County"

Project Advisory Committee

Water Commission
- George Barber
- David Skinner

Technical Advisory Committee
- Pete Bonacich
- Joe Connell
- Richard Price

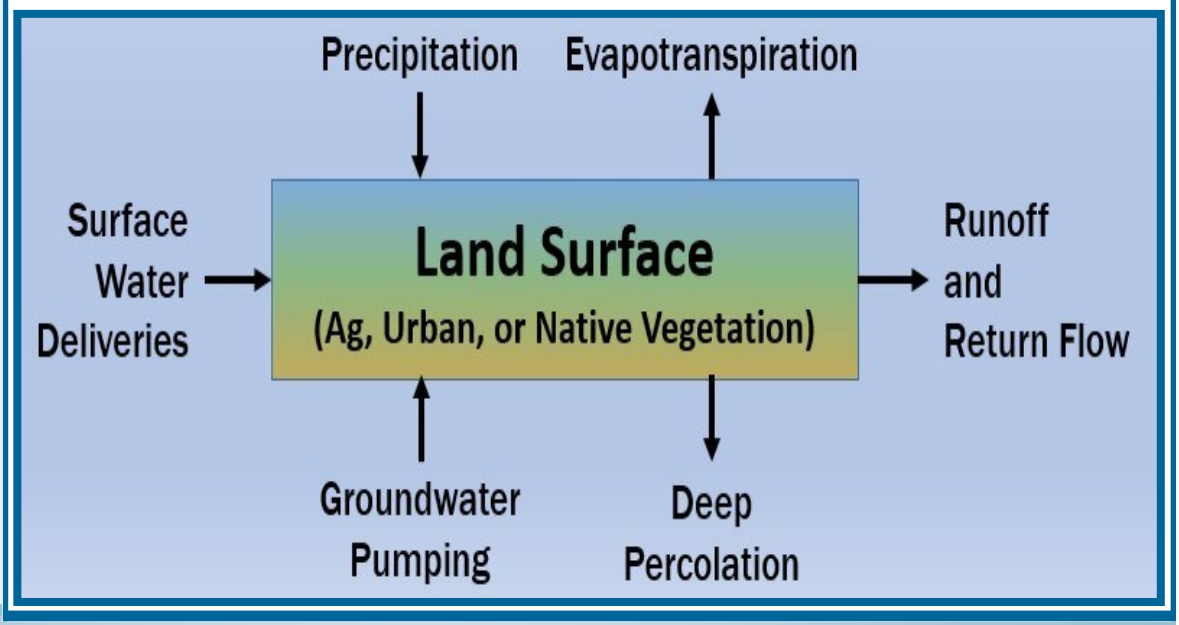
Development Services
- Dan Breedon

2016 Water Resource Inventory & Analysis Report

"You can't manage what you don't measure." That old adage sums up the purpose of the 2016 Water Inventory and Analysis Report. Determining current and future water demands is fundamental to managing water resources and to protecting area of origin water rights. As a foundational step, the Butte County Department of Water and Resource Conservation, in partnership with Davids Engineering prepared the 2016 Water Inventory and Analysis Report (WI&A). The WI&A Report provides an important update of water supply and demand analyses since the last report nearly 15 years ago. One important feature of the 2016 WI&A Report is the use of the Butte Basin Groundwater Model (BBGM) to develop and analyze data to estimate annual "water budgets" for the four inventory units in Butte County: Vina, West Butte, East Butte and North Yuba. Like a financial budget that estimates income and spending for a set period of time (i.e. inflows and outflows of money to the bank account), a water budget reflects the inflow and outflow of water through a region over a specified time period.

To better understand the entire groundwater system, the first step is to develop a water budget focusing on the inflows and outflows to the land surface. When we describe land surface, this also includes land just below the surface where roots may take water (i.e. the rootzone).

The water budgets include annual estimates of inflows to and outflows from the land surface which are made up of agricultural land, urban development, or native vegetation. Inflows into the land surface area come from three sources: precipitation, surface water deliveries, and groundwater pumping. Water that leaves the land surface/rootzone, referred to as outflows, is either taken up by plants (evapotranspiration), becomes surface water runoff, or moves out of the rootzone and potentially into the groundwater system (deep percolation). These inflows and outflows are depicted in the figure below.



What's in the Report?

⇒ Highlights in Executive Summary

⇒ Data showing how land use, hydrology, and water use change over time for the period 2000 to 2014

- ◊ *Acreages for irrigated agriculture, developed lands, wetlands, and non-irrigated land use categories
- ◊ Precipitation from gauges at the Chico State Farm and in Paradise
- ◊ Streamflows in the Sacramento and Feather Rivers, and Butte and Big Chico Creeks
- ◊ *Surface water deliveries for agricultural and urban water demands
- ◊ *Groundwater pumping for agricultural and urban water demands
- ◊ *Water budgets (Inflows: Precipitation, Applied Surface Water, Groundwater Pumping; Outflows: Evapotranspiration, Runoff and Return Flow, Deep Percolation)

* Estimates are provided for the Butte County valley floor and each of the four Inventory Units (Vina, West Butte, East Butte, and North Yuba)

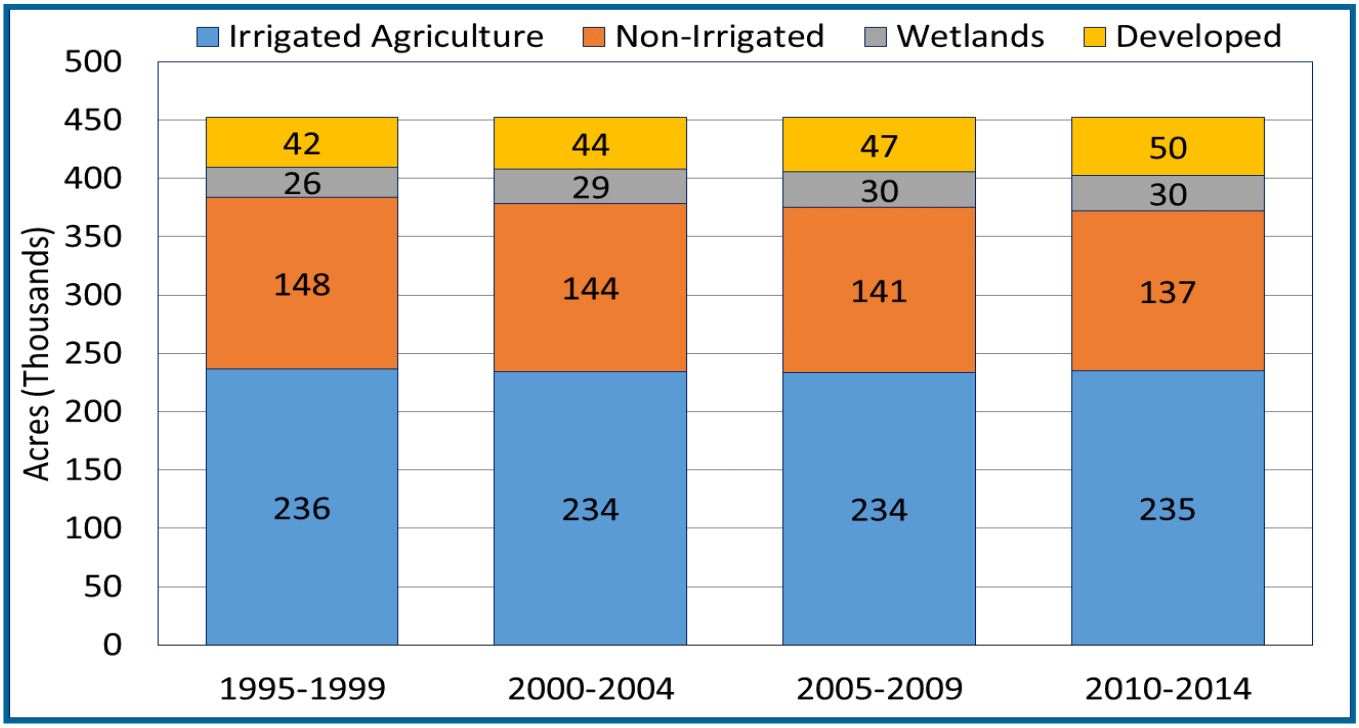
⇒ The WI&A Report includes supplemental items that help describe other related issues

- ◊ Overview of groundwater conditions
- ◊ Number of wells and their type and distribution in the County
- ◊ Surface water flow and storage monitoring sites in the County
- ◊ Water storage reservoirs in the County

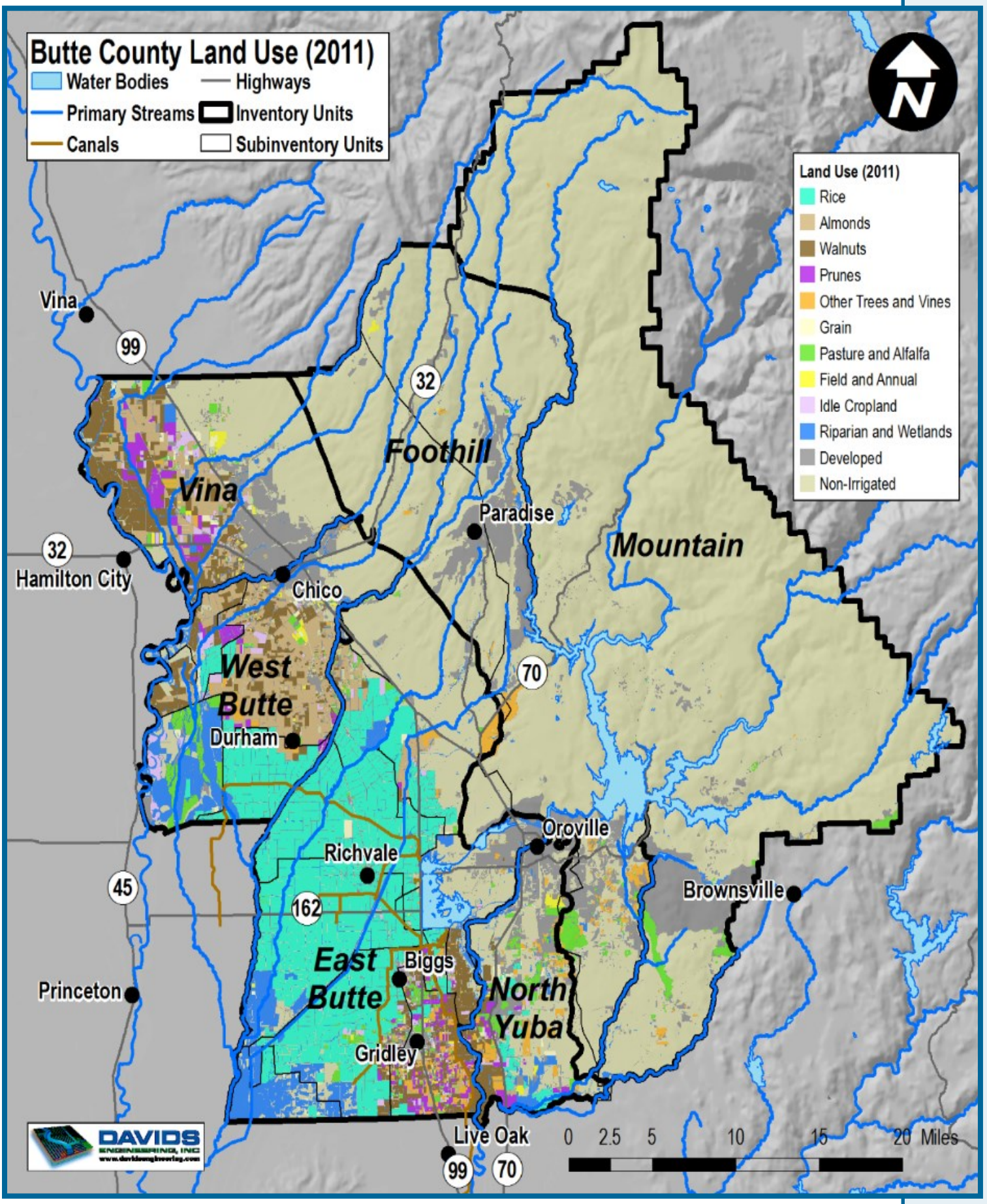
Key Findings

1. Total irrigated agricultural acreage has been remarkably stable since 2000

Significant land use changes have occurred over the past 15 years but mostly related to orchards replacing grain, and other field and annual crops. In recent years, acreage has shifted from almonds and prunes to walnuts as well. Conversion of previously non-irrigated land to irrigated agriculture has been small, mainly on the margins of the valley or as infill in existing agricultural areas. Orchard crops tend to be in the northwestern and southern central portion of the valley floor in Butte County with rice and wetlands in between where clay soils dominate.



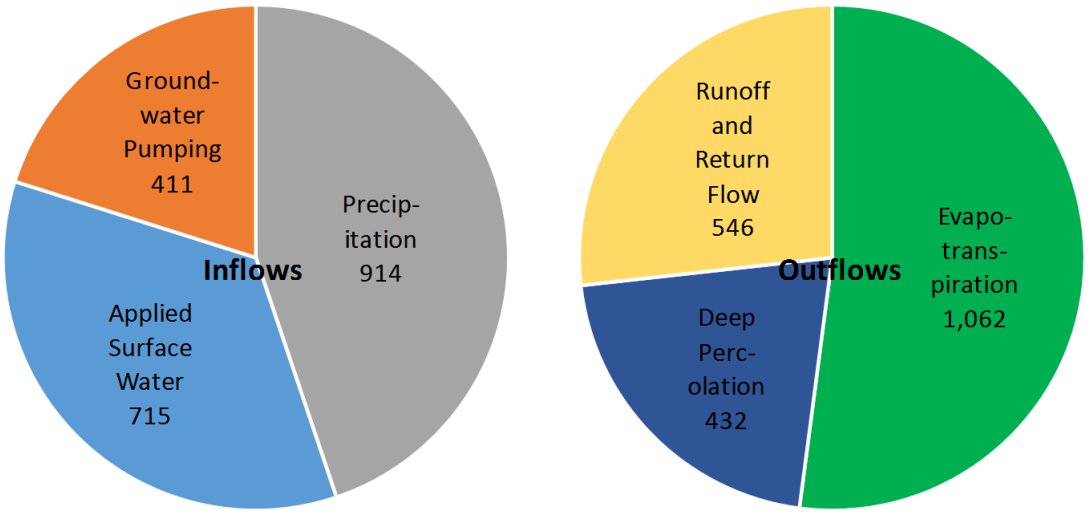
Butte County valley floor acreage by land use categories

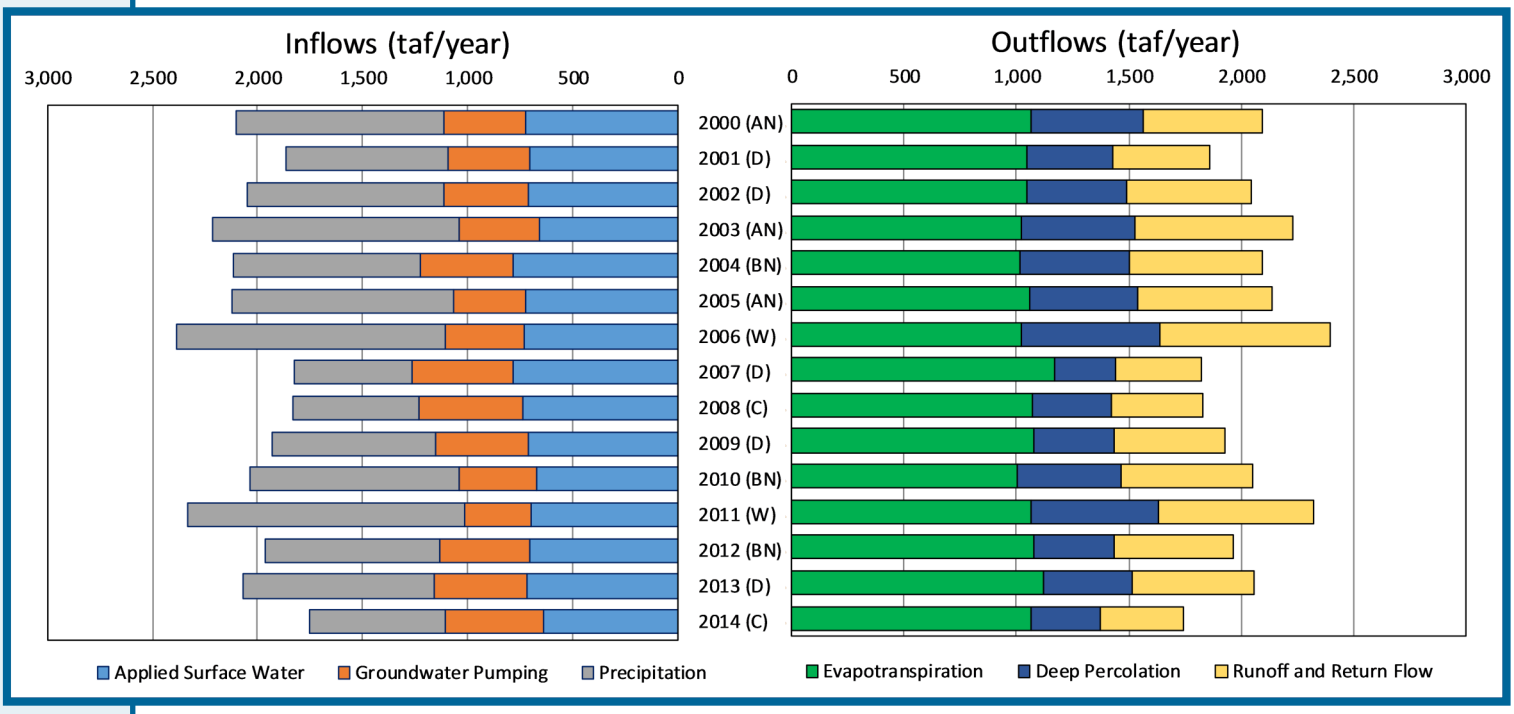

Butte County Land Use (2011)
Water Bodies
Primary Streams
Canals
Highways
Inventory Units
Subinventory Units
Land Use (2011)
Rice
Almonds
Walnuts
Prunes
Other Trees and Vines
Grain
Pasture and Alfalfa
Field and Annual
Idle Cropland
Riparian and Wetlands
Developed
Non-Irrigated
N
Vina
99
32
Foothill
Vina
Paradise
Mountain
32
Hamilton City
Chico
West Butte
70
Durham
Oroville
Richvale
45
162
Brownsville
East Butte
Biggs
North Yuba
Princeton
Gridley
Live Oak
99
70
DAVIDS ENGINEERING, INC
0 2.5 5 10 15 20 Miles

2. Water Budgets Reported through 2014

On average, the overall water supply (precipitation, surface water and groundwater) for the valley floor portion of Butte County is 2.04 million acre feet (maf). Precipitation provides the largest portion (914 thousand acre feet (taf)) followed by applied surface water (715 taf) and groundwater pumping (411 taf). Approximately 95% of surface water diversions and groundwater pumping are used for irrigated agriculture and managed wetlands, with the remaining 5% for developed lands. Precipitation is a major contributor and is the most variable. Precipitation varied from 562 taf in 2007 to 1.314 maf in 2011 (133%). Groundwater pumping varied from 316 taf in 2011 to 489 taf in 2008 (54%). Applied surface water varied from 641 taf in 2014 to 782 taf in 2007 (22%).

These inflows and outflows at the land surface related to land use and water management are major drivers to components of inflows and outflows to the groundwater system, like pumping and recharge. The report presents overall average land surface water budgets and annual water budgets for the valley floor area and each of the four Inventory Units. It also breaks down the water budgets for different land use categories: irrigated agriculture and wetlands, developed lands, and non-irrigated lands. This helps identify how different dynamics in the system affect the overall water budget and how those change in time due to different drivers. Understanding and quantifying what happens at the land surface helps us better interpret and understand groundwater conditions. It's an important foundation and first step toward managing groundwater.

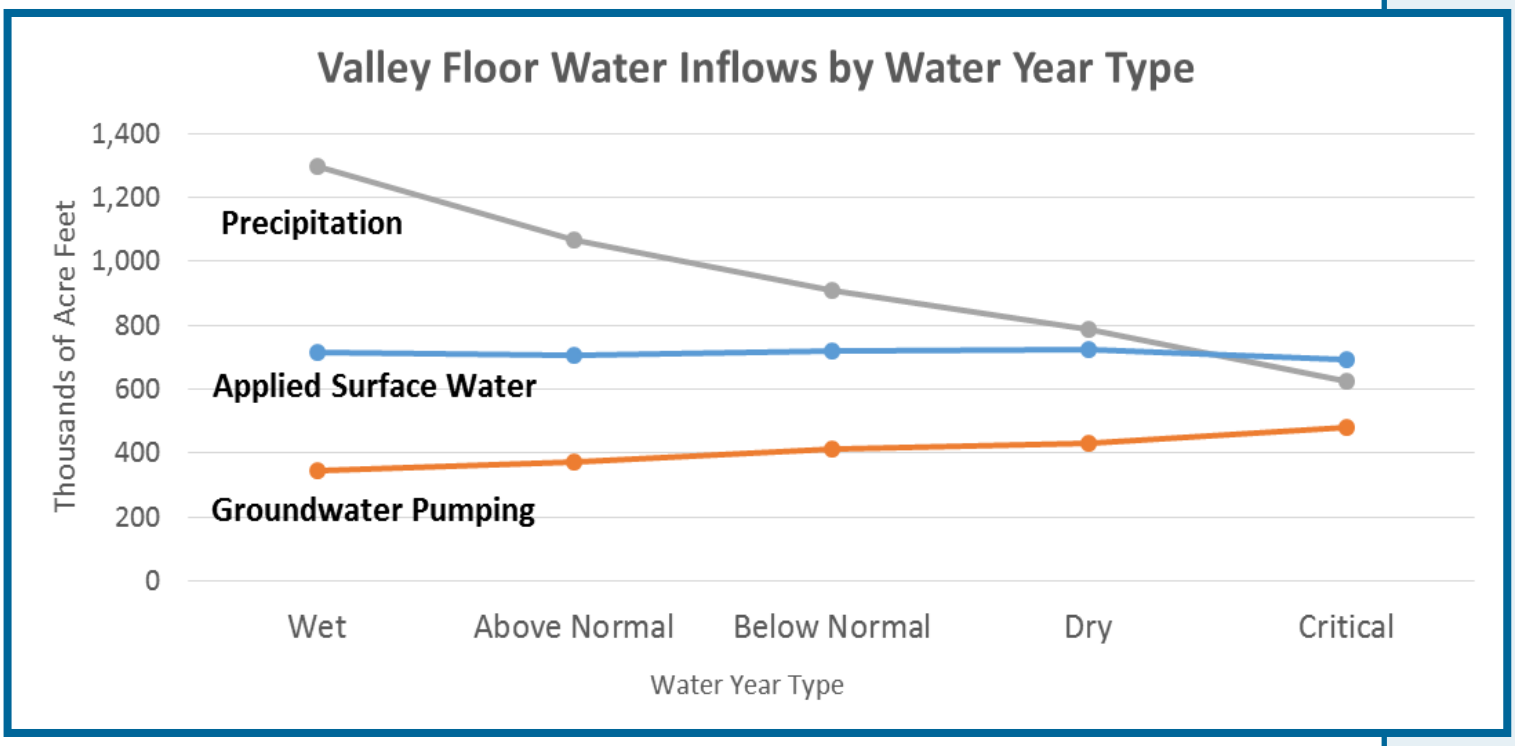


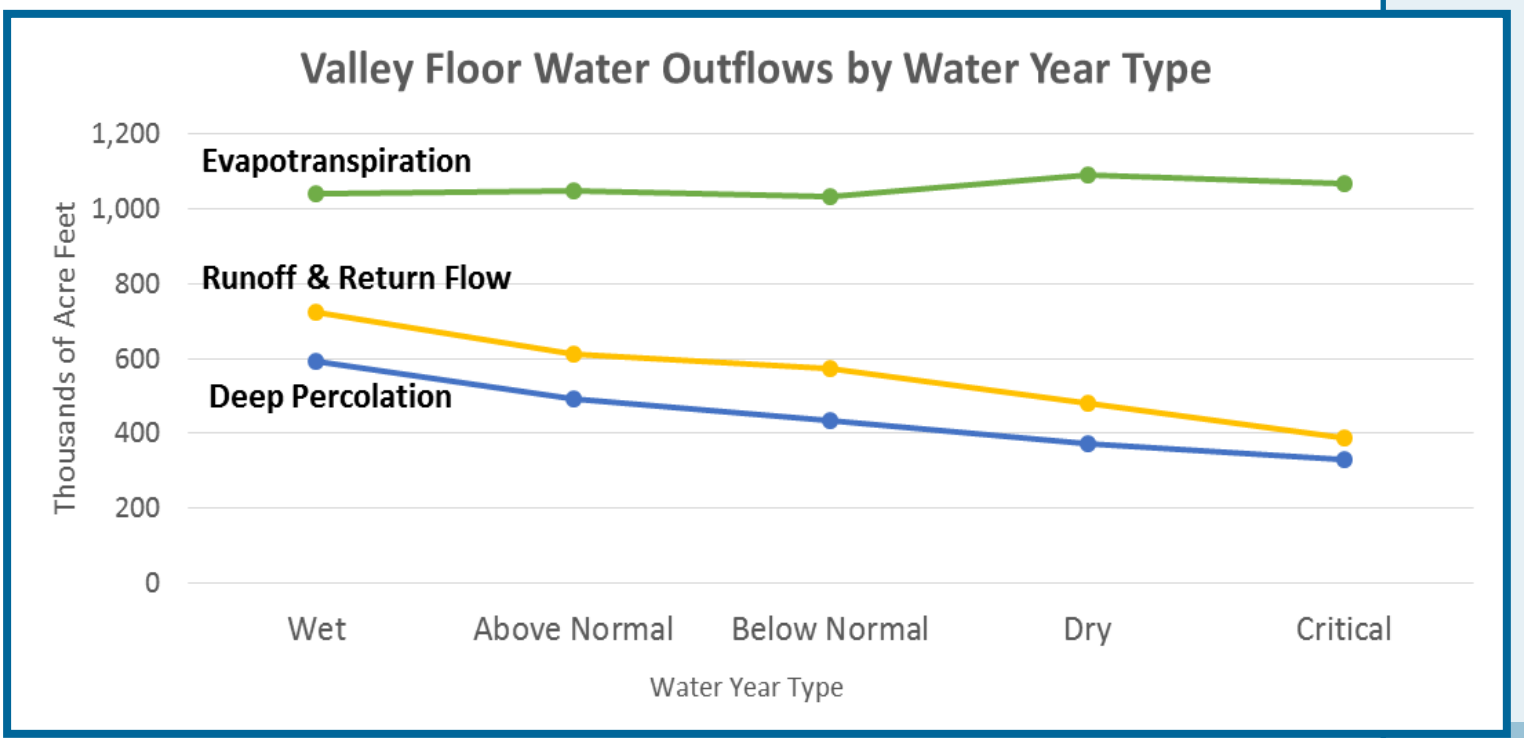


Valley Floor Overall Water Budget. 2000-2014 Annual Inflows and Outflows (thousands of acre-feet)

3. Variations between wet and dry years have a big impact on the water budgets

Precipitation is an important source of supply for crop water needs and can vary by a factor of two between wet and critical years. The variability of precipitation has a direct influence on groundwater pumping. Pumping generally increases during dry and critical years to make up for the lack of precipitation. In addition, the timing of precipitation (occurrence of a dry fall or wet spring) can directly impact the need for irrigation and therefore groundwater pumping. Deep percolation decreases by almost a factor of 2 between wet and critical years whereas groundwater pumping increases only by about 1/3. Therefore dry year impacts on the groundwater system are primarily driven by large reductions in potential recharge from precipitation rather than large increases in groundwater pumping. Generally, surface water supplies are relatively steady despite large year-to-year differences in precipitation.





For more information about this project visit us at:
www.buttecounty.net/waterresourceconservation/WaterInventoryandAnalysis.aspx

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Recommendations and Next Steps

- While data in the WI&A rely on the best available information, all data and estimates are subject to uncertainty. The analysis would benefit from working with local stakeholders to better document surface water diversions and by looking for opportunities to verify or refine groundwater pumping estimates by obtaining pumping data from cooperative landowners.
- An important next step is to develop Groundwater Budgets for each subbasin. This is important because deep percolation from the land surface system in some areas may return to the surface layer through accretion in drains and natural waterways or may be consumed by phreatophytic vegetation. Through modelling of specific waterways and shallow groundwater, the Butte Basin Groundwater Model (BBGM) will provide Groundwater Budgets that can help better understand the ultimate fate of deep percolation from agricultural lands.
- Continue the process of updating and calibrating the BBGM through further refinement of input datasets and calibration of aquifer parameters to simulate historical water levels and streamflows.
- Continue public outreach regarding the WI&A and water budgets to educate and inform the public regarding water resources in the County and to gather additional insights to support future water management efforts.
- Continue implementation of SGMA, including assessment of the use of WI&A information to support development of GSPs.

Butte County Department of Water & Resource Conservation

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