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Water Accounting in the Economic Analysis of Water Transfer

Water is one of the most valuable and critical resources in our society. It is the basis of our survival and growth and is essential for growing the food that feeds us and for powering the economy. Water is also scarce and unequally distributed across time and space. These features pose significant challenges to efficient water management for regulators, especially in dry states such as California. This article reviews one important tool for water management: Water Accounting.

The Food and Agriculture Organization (FAO) of the United Nations defines Water Accounting as "the systematic study of the status of, and trends in, water supply, demand, accessibility and use in specified domains."[1] In simple terms, Water Accounting analyzes water inflows (where water comes from) and water outflows (where water goes).

This information helps regulators identify, in real time, shortages or surpluses in the water system and where they are occurring. It also provides the basis for water risk management (e.g., predicting a water shortage), evaluation of operational efficiency (e.g., identifying line losses), and water practices management (e.g., promoting conservation).

Analyzing water inflows starts with identifying the quantity of water diverted from all sources, including ground water, surface water, and sea water. Quantities diverted are usually constrained by applicable water rights as well as the seniority of these rights.[2] Further restrictions can come from geologic and hydrologic studies that establish *safe yield*, which is the maximum sustainable quantity that can be diverted without compromising the water system.[3]

The other side of Water Accounting—water outflows—quantifies the beneficial uses of water, including irrigation, residential use, and commercial/industrial use. It is important to distinguish consumptive from non-consumptive uses because consumptive water uses do not return water

[1] Food and Agriculture Organization. Land and Water. Water Accounting and Auditing. Retrieved from <http://www.fao.org/land-water/water/water-management/water-accounting/en/#:~:text=Water%20accounting%20is%20the%20systematic,and%20use%20in%20specified%20domains.> (Accessed March 25, 2021).

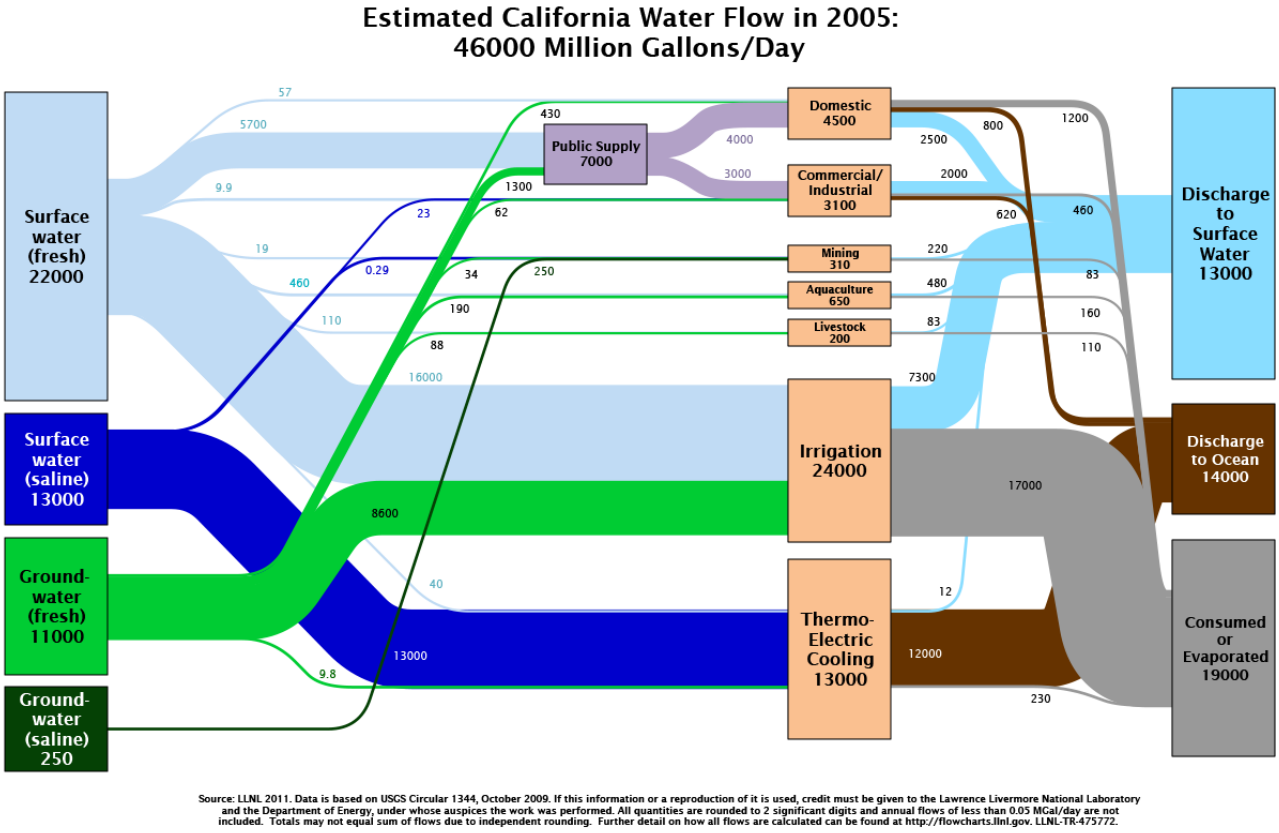
[2] Most states in western United States apply the legal doctrine of prior-appropriation regarding water rights, which grants prioritized access to water for beneficial uses to those with more senior rights.

[3] This quantity is also referred to as firm yield.

to the system, thereby reducing the stock of available water. Non-consumptive use produces discharges back to the water system, replenishing the overall stock of water.

Figure 1: *Water Flow Charts for the State of California* (2005), produced by the Lawrence Livermore National Laboratory and reprinted below, presents an illustration of Water Accounting for the State of California in 2005.[4] Surface water comprises about half of California's total water supply, making the state's water supply more susceptible to droughts. Irrigation accounts for more than 70 percent of fresh water used in California—about three times the amount of domestic and commercial uses combined. While most of the salt water diverted eventually returns to the ocean, less than half of fresh water is discharged back to surface water.

Figure 1: *Water Flow Charts for the State of California (2005)*



Vega Economics was recently engaged to evaluate the regional economic impact of a proposed transfer of water across locations, along with changes in use. Water Accounting for the relevant region is the building block of Vega's economic analysis.

[4] Lawrence Livermore National Laboratory. Water Flow Charts. LLNL Flow Charts. Retrieved from <https://flowcharts.llnl.gov/commodities/water> (Accessed March 25, 2021).

Vega was recently engaged to evaluate the regional economic impact of a proposed transfer of water using water accounting for the relevant region. To learn more, check out Vega's recent article on water accounting.

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