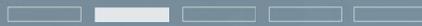


*Chapter 2*

# WATER



*Key issues facing Utah's water*

- 2.A WATER SHEPHERDING: DELIVERING SAVED WATER TO GREAT SALT LAKE**
- 2.B VARIABILITY IN UTAH'S RESIDENTIAL WATER USE**
- 2.C A CHANGING SUMMERTIME CLIMATE—IMPLICATIONS FOR WATER USE**
- 2.D MANAGING UTAH'S DIVERSE GROUNDWATER BASINS**
- 2.E TRACKING UTAH'S "VIRTUAL WATER" TRADE**
- 2.F INTEGRATED WATER PLANNING IN THE GREAT SALT LAKE BASIN**

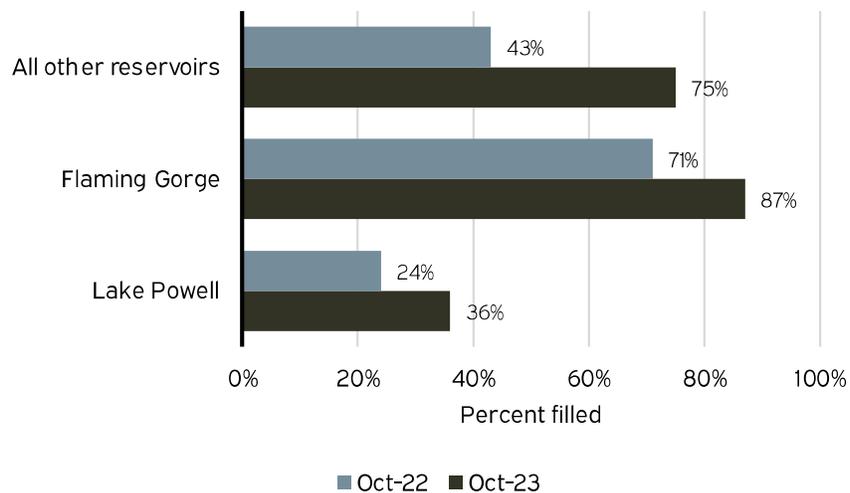
Chapter Summary *by BRIAN STEED*

What a difference one year can make! While 2022 was dominated by drought, 2023 saw the wettest winter on record, providing a temporary reprieve from the state’s water woes. As of October 2023, statewide reservoir levels remain 75% full—a remarkable place for the end of irrigation season and a huge improvement over the prior year when reservoir levels were hovering in the mid to low 40% range.

Even though major concerns remain on the Great Salt Lake, the south arm of the lake rose by 5.5 feet after runoff season. The north arm of the lake rose only about a foot. The difference between the levels on the two arms of the lake was largely due to intentional manipulation of the breach in the Union Pacific causeway to control salinity levels in the south arm. In November of last year, the state made the decision to raise a berm in the causeway breach to increase mixing of fresh water and saline water and reduce salinity in the south arm. Accordingly, salinity levels in the south arm dropped to healthier levels from highs that threatened the vitality of brine shrimp and brine fly populations in the fall of last year.

Hopefully, 2024 delivers another great winter. But even if it doesn’t, the state has continued ramping up water conservation programs to ensure that we have the water we need for ecological needs and human consumption into the future. In the remaining parts of this section, we detail approaches on how we are using, accounting, and planning for water for the future of the state.

Figure 2.I.1 Statewide reservoir storage (2022 & 2023)



Source: Utah Division of Water Resources





**TRANSPORTED WATER**

by SARAH NULL, BETHANY NEILSON  
UTAH DIVISION OF WATER RIGHTS

## 2.A Water shepherding: delivering saved water to Great Salt Lake

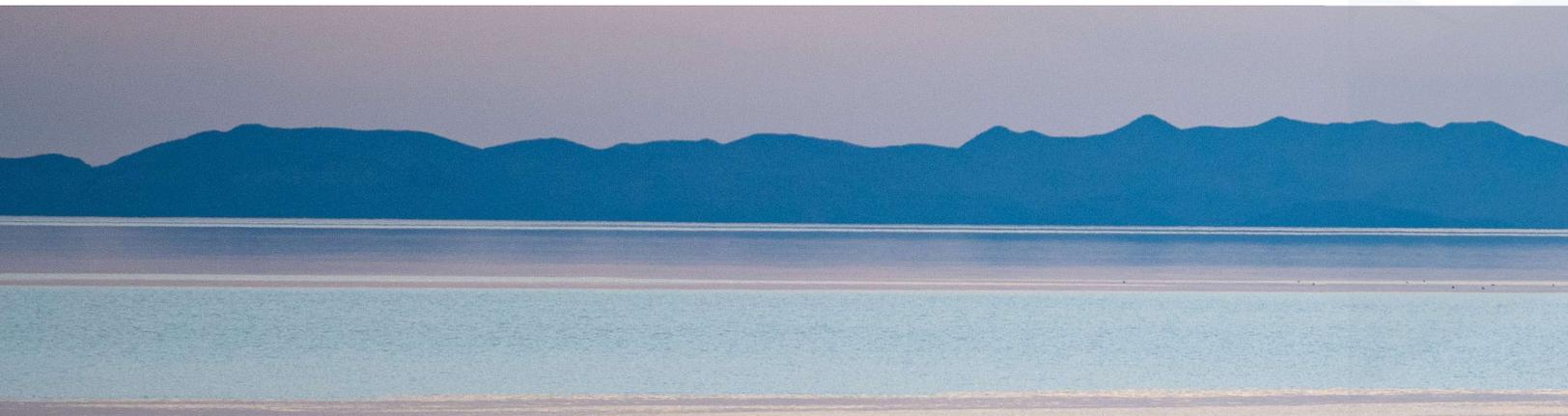
**TAKEAWAY»** Water conservation could benefit the Great Salt Lake if the water is carefully measured and tracked through rivers, canals, and other water pathways within the basin—a practice that will require adequate measurement and real-time information sharing.

Water conservation is the adoption of practices that reduce water depletion to enhance water availability and minimize impacts on water supply, water quality, and the environment. Water shepherding is the legal authority and practice of distributing water through river systems and past intervening users to fulfill demands based on water right priority. Recent legislation in Utah provides a mechanism to lease or purchase water rights and to allocate water for instream flow or Great Salt Lake (water from these transactions can now be used to preserve or enhance the natural aquatic environment).

Delivering water to specific destinations requires thorough measurement and a detailed accounting of water movement. Utah Water Commissioners on 13 separate distribution systems within the basin actively monitor about 700 total measurement sites to distribute water to existing users. This process can be improved with additional measurements and better transparency of flows and water right accounting data.

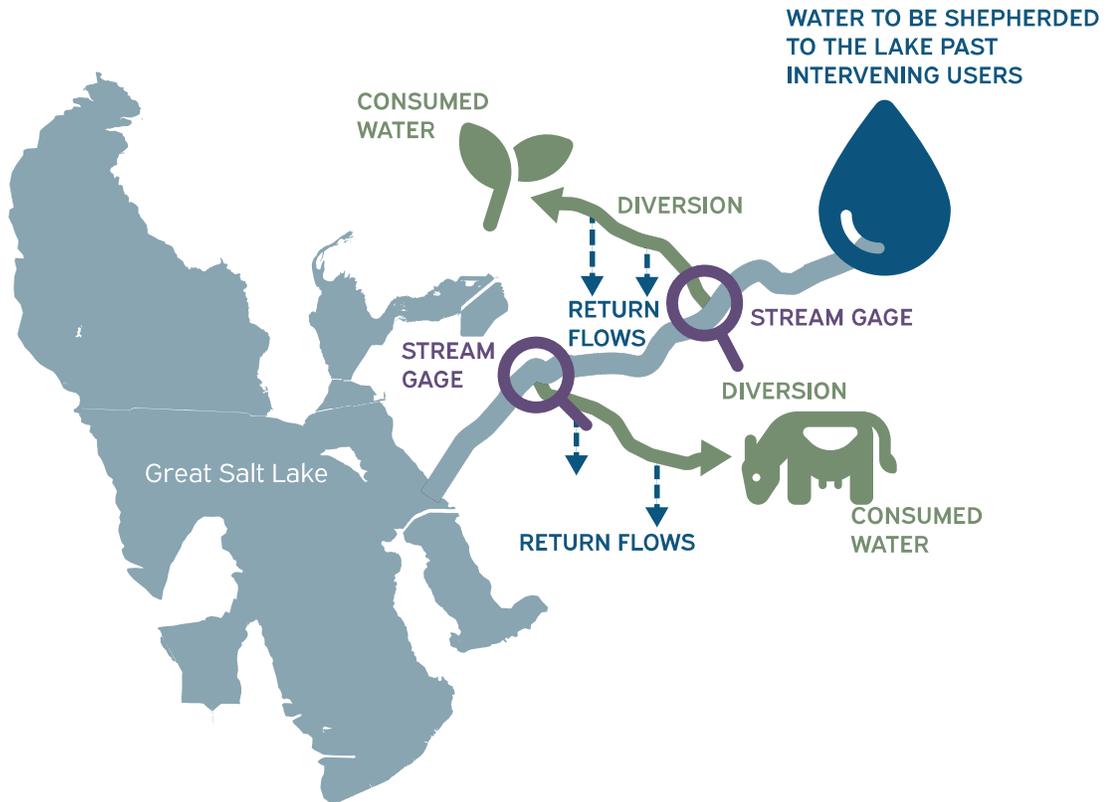
This can aid efforts to ensure saved water reaches its intended destination such as Great Salt Lake.

The Utah Division of Water Rights and Utah State University are working together to identify and prioritize locations for new measurement and telemetry equipment, improve sharing of streamflow and diversion information, and communicate water rights accounting information in a user-friendly format. The new cooperative work builds on the distribution and accounting systems developed and refined by the division beginning in 1919, which incorporates existing streamflow and diversion data, water rights information, and accounting tools. The new work provides opportunities to increase water data access and transparency for water users to change elements of their water rights, some of which may support Great Salt Lake and other ecosystems reliant on the complex water distribution systems throughout the state.



## Figure 2.A.1 Conceptual model of water shepherding

*Practices that reduce consumption cannot bring more water to Great Salt Lake unless measures are in place to monitor conserved water's movement through Utah's waterways.*



**DELIVERING WATER TO SPECIFIC DESTINATIONS REQUIRES THOROUGH MEASUREMENT AND A DETAILED ACCOUNTING OF WATER MOVEMENT.**

**RESIDENTIAL WATER**

by JEFFERY S. HORSBURGH

## 2.B Variability in Utah's residential water use

**TAKEAWAY»** Residential water use is highly variable both across households and across time. Our assumptions about and focus on per capita water use do not account for this.

Residential water use in Utah is estimated to be as high as 169 gallons per capita per day. That is the second largest volume in the U.S. Public water suppliers serve nearly 98% of Utah's population, one of the highest rates in the country. Utah has high urban density, limited water availability, and a growing population. The cost of delivering water to urban areas makes managing and reducing demand vital to continue providing a clean and safe water supply.

Collecting the right data can help water providers manage demand and plan for the future. It is important to know the total amount of water used, and also how and when people use water. Factors to consider include daily consumption patterns, common uses like showers and toilets, how the distribution of those uses varies over time, and potential savings that conservation programs might achieve. Standard water use data does not typically show water-use peak

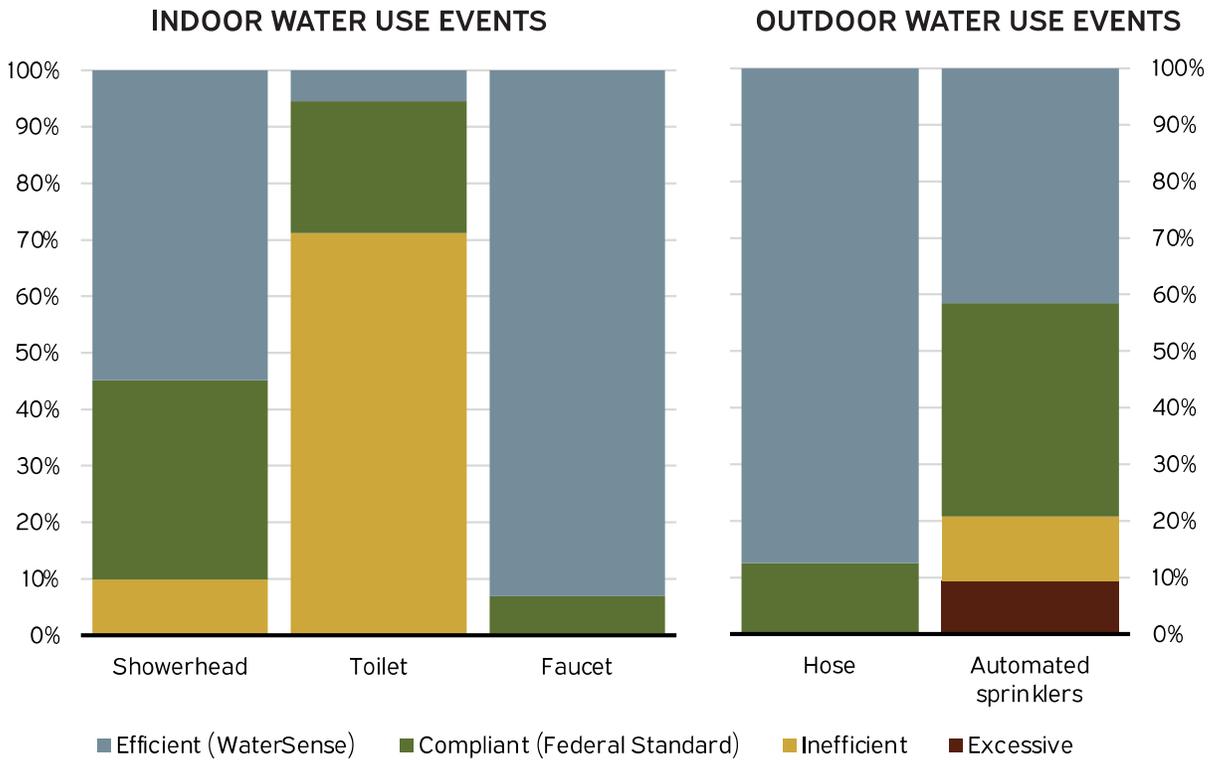
times or volume and does not quantify indoor versus outdoor water use.

Utah State researchers have developed new technology to collect more accurate water-use data from residential households. This allows more detailed studies of behavior and more detailed understanding of distribution across various water uses. These studies have found that a single per capita water use estimate doesn't capture the difference between households, or even changes over time for a single household. Results also indicated that people generally are not overwatering their landscapes, indicating that saving water outdoors may depend on changing landscapes and not just watering less. Finally, researchers found significant opportunities for conservation inside homes, such as replacing inefficient water fixtures.

**UTAH STILL HAS SIGNIFICANT OPPORTUNITIES FOR CONSERVATION INSIDE HOMES THROUGH REPLACING INEFFICIENT WATER FIXTURES.**

## Figure 2.B.1 Water performance in tested residential homes (2019–2021)

Researchers studied residential water use in Logan and Providence (in Cache Valley) to determine trends. Graphs show the average percent of water use events that fell within each category across all tested homes.





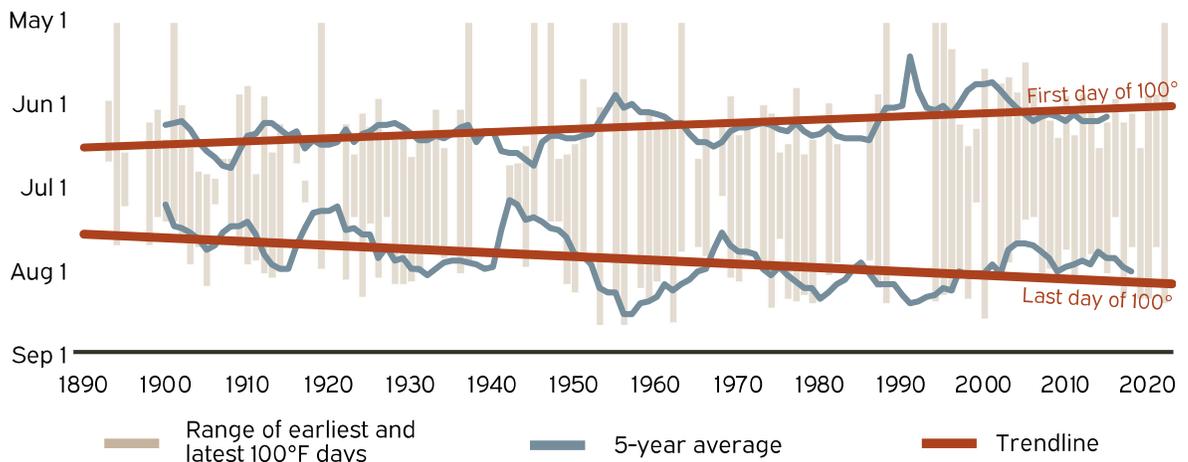
# 2.C A changing summertime climate—implications for Utah’s water

**TAKEAWAY»** An expanding and increasingly hotter warm season, coupled with a more variable monsoon seasonality, is stressing Utah’s water supply.

Utah’s summer season temperatures are expanding earlier into spring, and later into fall. At the same time, the North American monsoon—oftentimes a significant summer water resource—is becoming more variable and erratic, with recent years experiencing both failed “non-soons” and record rainfall events. In addition, the monsoon is exhibiting increasing variability, which leads to reduced predictability. The alterations in timing of summer temperatures coupled with summer monsoon’s increasing variability add greater risk to water resource management decisions. For example, limited water availability places added stress on the state’s water supply.

Utah’s summer tourism, agricultural economies, and energy use are all inextricably tied to the region’s climate. For example, an expansion of the summer season temperatures theoretically lengthens the growing season, but at the expense of irrigation demand. Higher temperatures worsen air quality problems. Earlier and longer springs and summers imply potential increases in utility bills. The summer monsoon is often responsible for “flash floods” through the development of convective systems, which also ignite wildfires. A longer drying season also exacerbates wildfire prospects. A hotter warm season has the potential to turn an even above-normal winter snowpack and spring runoff into less viable water supplies.

**Figure 2.C.1** Date range of days with 100°F or higher in Moab, Utah (1895–2022)



The graph above shows how temperature has changed in Moab, Utah over the past 130 years. The red “alligator mouth” (red lines) shows the earlier and longer springs and summers.

LEFT: NAVAJO KNOBBS TRAIL / CAPITOL REEF NATIONAL PARK / WAYNE COUNTY

**GROUNDWATER**

by DENNIS NEWELL and TOM LACHMAR

# 2.D Managing Utah's diverse groundwater basins

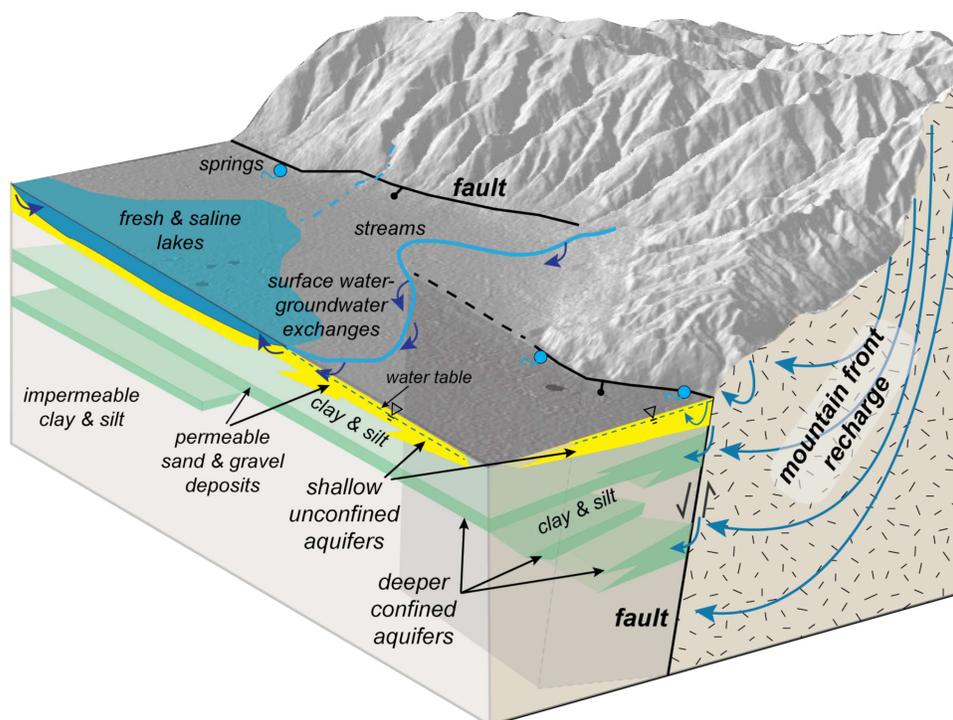
**TAKEAWAY»** Understanding groundwater is key to managing Utah's limited water resource.

Groundwater is present throughout Utah, but quantities suitable for public supply, irrigation, or industrial uses are only available in limited areas. Most of Utah's groundwater occurrences are found below valley floors in "basins" that are filled with sediments eroded from adjacent mountains. The geologic formations that readily transmit groundwater to wells or springs are called aquifers and are found at depths ranging from a few to hundreds of feet. Infiltration of

rain and snowmelt in higher elevation areas recharge aquifers, a process that can take years to millennia. Long-term groundwater use that outpaces recharge may lower water levels in wells, reduce supply, and degrade water quality.

Although groundwater only accounts for 25% of the water used in Utah, it comprises nearly 60-70% of the water used for public supply and industrial purposes.

**Figure 2.D.1** Aquifers and surface water-groundwater connections



Most of Utah's groundwater occurrences are found below valley floors in "basins." Groundwater is transmitted to wells or springs through aquifers.

**ALTHOUGH GROUNDWATER ONLY ACCOUNTS FOR 25% OF THE WATER USED IN UTAH, IT COMPRISES NEARLY 60-70% OF THE WATER USED FOR PUBLIC SUPPLY AND INDUSTRIAL PURPOSES.**



*ABOVE: GROUNDWATER WELL | CACHE COUNTY*

Importantly, groundwater and surface water should not be considered as separate resources in many areas because groundwater and surface water are interconnected and should be managed together. In others, particularly where Lake Bonneville was present, groundwater is separated from surface water bodies by layers of impermeable clay. In these basins, groundwater may be managed separately

from surface water to maximize the amount of water available for beneficial use.

Groundwater research in Utah is necessary to understand how aquifers receive recharge and how long it takes, how much is available for beneficial use, and how increasing demands coupled with climate change will impact long-term supplies.

## VIRTUAL WATER

by CHRISTOPHER LANT

## 2.E Tracking Utah's "virtual water" trade

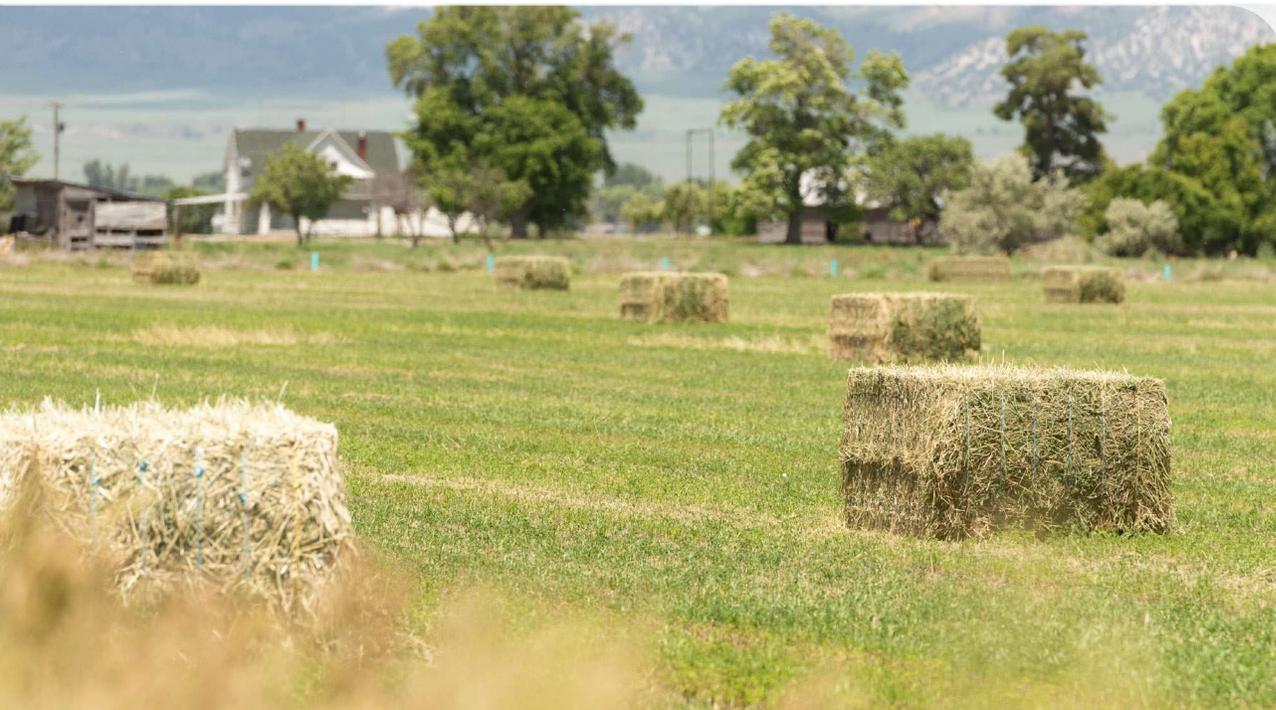
**TAKEAWAY»** Traded products add new dimensions to Utah's water balance sheet. Understanding all water gains and losses can help manage the system more efficiently.

Understanding how we use water in Utah is more complicated than just streamflow. For example, virtual water is the water used to produce something, such as electricity or a crop, that is then traded—sometimes to other countries, but far more often among neighboring states. In fact, over 90% of the 1,700 gallons of water the average American uses each day is virtual water used to produce the food and energy they use. It need not be directly delivered through pipes from a local river, reservoir, or well. Rather, virtual water comes to us over the electrical grid or by truck or railroad car carrying lumber or one of America's primary crops—like corn, soybeans, wheat or hay—through numerous business transactions.

We can track the volume and direction of virtual water flows just like we do for rivers. Utah's virtual water exports (mostly to other western states, but some to

China) exceed its imports (mostly from western and midwestern states). The difference between exports and imports is about equal to the combined flow of the Bear, Weber and Jordan Rivers to Great Salt Lake. American states trade huge quantities of virtual water with each other—20 times the volume that flows from Glen Canyon Dam to the Lower Colorado River each year.

It is possible for Utah to access a larger share of this virtual water trade. For example, through the Utah Water Banking Act of 2020, farmers, acting voluntarily and in their own self-interest, could choose to lease out a part of their senior water rights instead of growing livestock feed, and instead buy it from the Midwest at a profit. In this way, farmers could import even more virtual water to meet Utah's growing needs.



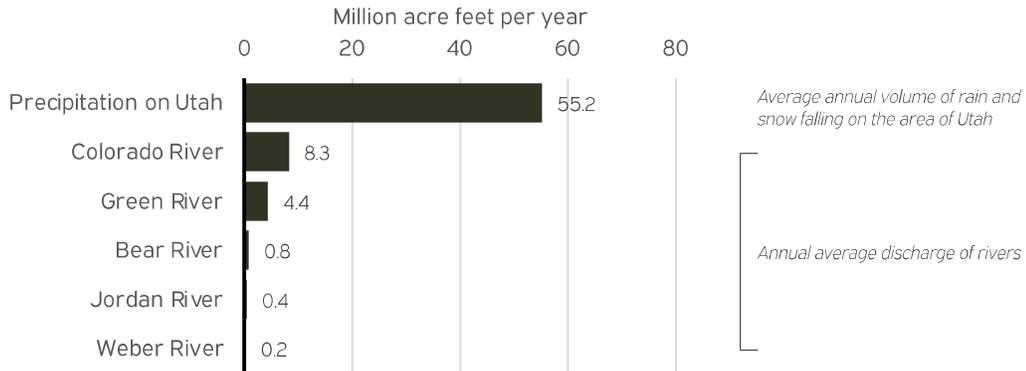
LEFT: BALED ALFALFA | CACHE COUNTY

# UNDERSTANDING HOW WE USE WATER IN UTAH IS MORE COMPLICATED THAN JUST STREAMFLOW.

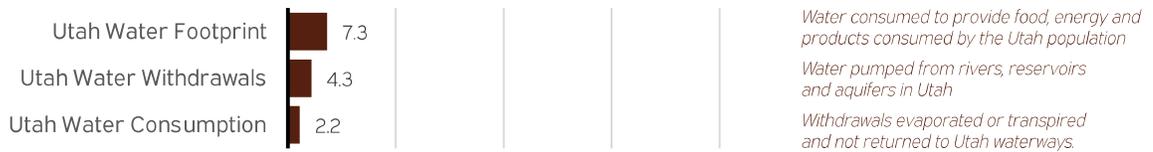
**Figure 2.E.1 Comparative annual flows of Utah rivers and virtual water trade**

When it comes to Utah water use, there are a number of different ways that water enters and leaves the state. The figure below shows some of them. Green water imports and export numbers are not yet available for Utah, but future calculations will determine how the state could leverage them more fully.

## HYDROLOGIC FLOWS IN UTAH



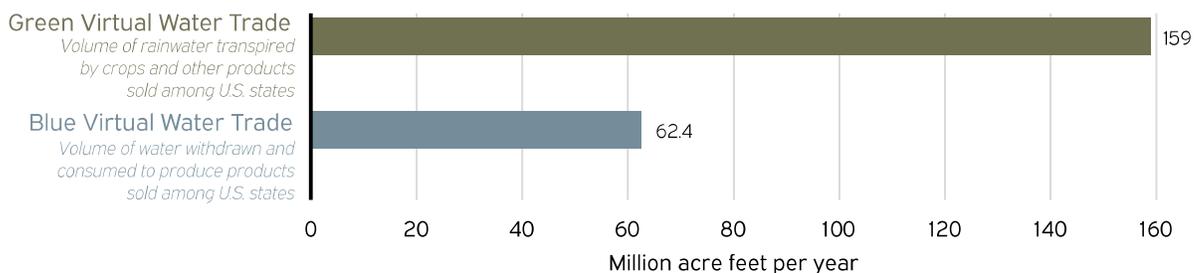
## UTAH WATER-USE FLOWS



## UTAH VIRTUAL WATER FLOWS



## U.S. VIRTUAL WATER FLOWS



## GREAT SALT LAKE

by LAURA VERNON, Utah Division of Water Resources

## 2.F Integrated water planning in the Great Salt Lake Basin

**TAKEAWAY»** Ensuring a resilient water supply for Great Salt Lake and water users throughout the basin.

Attaining long-term water supply resiliency for water users in the Great Salt Lake basin—including the lake—requires a plan. For this reason, the Utah Division of Water Resources is working with federal, state, and local partners to complete the Great Salt Lake Basin Integrated Plan.

The first-ever water resources plan for the entire Great Salt Lake Basin integrates surface and groundwater modeling; existing plans, studies, research, data, models, tools, and strategies; and water user collaboration at an unprecedented scale. The plan provides a holistic understanding of current and future water supplies and demands throughout the basin, then identifies and evaluates actions that reduce water supply risks, minimize harm to future generations, and preserve ecosystems. The plan will:

- Assess current surface and groundwater supply in the basin
- Predict future water supplies and demands
- Coordinate efforts to gather and utilize data throughout the basin

- Investigate possible adaptation and mitigation strategies
- Analyze trade-offs between water users in the system
- Recommend actionable strategies to ensure a resilient water supply

Through the planning process, water users and policymakers in the basin gain a comprehensive foundation for sound water management and decision-making. They also obtain tools and guidance for updating the plan into the future.

The complex nature of this effort calls for a workplan to detail how to fulfill the integrated plan within three years. The workplan is being developed by engaging stakeholders, building consensus, and prioritizing tasks that comprise the plan.

For more information, visit <https://water.utah.gov/gsl-basin-integrated-plan/>

BEAR RIVER BIRD REFUGE | BOX ELDER COUNTY





MIGRATORY BIRDS | GREAT SALT LAKE | DAVIS COUNTY

Figure 2.F.1 Great Salt Lake Basin Integrated Plan timeline



# UTAH'S WATER

## *in the news*

As we've tracked Utah and national news through 2023, we have compiled some of the key water issues and topics that have appeared in media outlets this year.

### 01. AN UNPRECEDENTED WET WINTER

After a remarkably snowy winter, for the first time in three years, no area in Utah is in severe or extreme drought. This resulted in some flooding throughout the state. Most of Utah's reservoirs re-filled, and Utah's water situation was much improved. Wetter-than-normal spring and summer seasons continued to improve Utah's water supply.

### 02. ADDRESSING WATER LEVELS AT GREAT SALT LAKE

This winter, the berm separating the north and south arms of the lake was raised, to help address dangerous salinity levels in the south arm. As a result, lake levels increased 5.5 feet on the south arm, but only about a foot on the north arm. Legislation was passed to create better outcomes on the lake, including the creation of a Great Salt Lake Commissioner. Non-profits stepped in to bring water to the lake.

### 03. WATER QUALITY CHALLENGES

States must now take a more significant role in managing water quality, as the Supreme Court narrowed the scope of the Clean Water Act. PFAS, or "forever chemicals," caused policy changes in use of certain ski waxes in Park City and received additional funding to help decontaminate Utah's drinking water. An E. Coli outbreak in Lehi was caused by contaminated irrigation water, and harmful algal blooms still appeared in Utah lakes and reservoirs this year.

### 04. WATER CONSERVATION EFFORTS STILL NEEDED

Some small towns still experienced water shortages this year. Francis City and Apple Valley saw critically low water tanks, causing a halt on all outdoor watering and a boil water order, respectively. Even with increased water supply, conservation programs and efforts by the state and cities are creating more resources and incentives for using less water.

### 05. AGRICULTURAL IRRIGATION OPTIMIZATION

Programs were established to save water used by farmers and ranchers in the state. Ag optimization grants offered by the Utah Department of Agriculture and Food hope to save more than 60,000 acre-feet of water. A federal Conservation Reserve Enhancement Program is also providing farmers in the West more options for water conservation.



### What's going on in Utah's land, water and air?

We publish a weekly email newsletter, containing a categorized roundup of about 30 stories in local and national media outlets related to Utah's land, water, and air. Subscribe at: [usu.edu/ilwa/newsletter](https://usu.edu/ilwa/newsletter).





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