

Chapter 2

WATER

Key issues facing Utah's water

- 2.A** Water-Saving Success: Small Changes Reap Big Benefits
- 2.B** Balancing Agricultural Water Efficiency With Healthy Groundwater and Streamflows
- 2.C** Connecting the Dots between Snowpack, Streamflow, and Water Management
- 2.D** Understanding PFAS Contaminants in Municipal Biosolids
- 2.E** Utah's Snowpack in Decline: Bracing for a Future with Less Snow

BEAR LAKE VALLEY | AARON FORTIN

Chapter Introduction

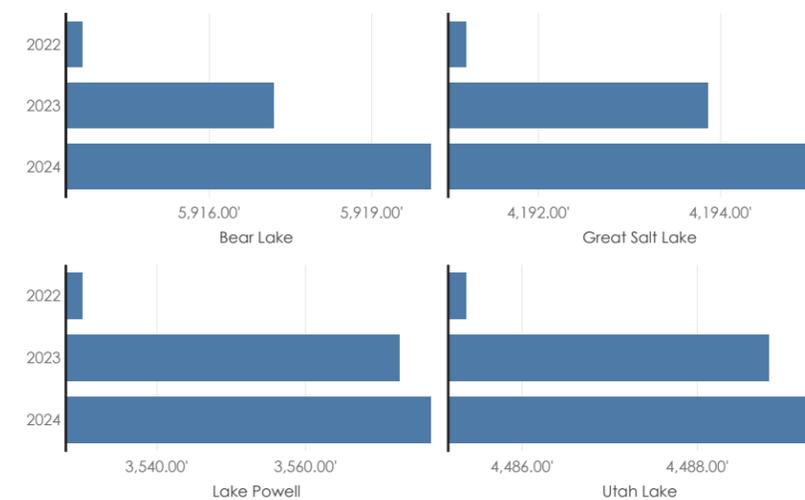
BRIAN STEED

The last two water years have been historic. After enduring some of the most severe droughts in recent history, two consecutive years of above-average precipitation have provided welcome relief to our strained water systems. Reservoirs have been the biggest winners, as water managers have been able to refill our storage systems levels that had dropped frighteningly low. Waterbodies like Bear Lake and Utah Lake, both natural lakes managed as storage reservoirs, have similarly experienced amazing recoveries, with Utah Lake spilling hundreds of thousands of acre feet of water down to the Great Salt Lake.

The South Arm of the Great Salt Lake reached a seven-year high of 4,195.1 feet above sea level this year—a significant improvement from the historical low of 4,188.5 feet in 2022. Unlike the previous year, the North Arm of the lake also saw a similar rise, peaking at over 4,192 feet above sea level and nearly equalizing with the level of the South Arm by the end of the water year. Equally important, salinity levels in the South Arm dropped from an unhealthy 180 grams per liter to a much healthier 120 grams per liter. This reduction in salinity has greatly benefited the lake's brine shrimp and brine fly populations, which have returned in abundance.

All this good news, however, came with a bit of a warning this year. The summer and fall of 2024 were unusually hot and dry, leading to increased water usage and evaporation on the Great Salt Lake. This contrast serves as a reminder of the importance of staying committed to conservation efforts. Reducing water use is essential—not only to support future growth but to preserve our vital natural systems.

Figure 2.I.1 Water levels for Utah's major lakes (2022-2024)



Source: Utah Division of Water Resources, Utah Lake Water Levels, Lake Powell Water Database, and Great Salt Lake Elevation





CACHE VALLEY COMMUNITIES | AARON FORTIN

Water-Saving Success: Small Changes Reap Big Benefits

DAVID ROSENBERG & KELLY KOPP

Utah State University Extension's Water Check Program provides effective strategies to reduce outdoor water use.

Utah State University Extension's Water Check Program offers Utah residents and landscape managers onsite evaluations of their irrigation system efficiency and provides customized sprinkler irrigation schedules that conserve water while maintaining plant health. Recommended irrigation repairs and improvements are also provided to participants. Researchers recently evaluated the program's effectiveness for reducing outdoor water use, which accounts for the greatest amount of residential use and offers the largest opportunity for conservation.

Researchers used five-second water use data collected with Flume™ Smart Water Home Monitors at participating residences before and after a water check evaluation to answer four questions.

- How much water did households save?
- Which water check recommendations did participants implement?
- Why did participants implement some recommendations and not others?
- What opportunities exist to further reduce landscape water use?

The program participants saw an average of 20-30% reduction in water use.

The 59 participating households implemented a variety of water-saving techniques, such as reducing water application to match the needs of their landscape plants, reducing the duration and number of irrigation events, and increasing the period between irrigation events. An evaluation of water savings during the month following each Water Check showed that participants reduced water use by 626,000 gallons (a 20-30% reduction, on average). These findings were similar across two participating cities: Logan and Hyde Park, Utah.

Based on the study's results, several actions were recommended to improve the Water Check Program, including assessing drip irrigation zones, sharing examples of water-wise landscapes, providing contact information for landscape contractors, and connecting participants to city water conservation staff.



RIGHT: FLUME™ SMART WATER HOME MONITOR

Balancing Agricultural Water Efficiency With Healthy Groundwater and Streamflows

CHRISTINA MORRISETT, SARAH NULL, & ROBERT VAN KIRK

More efficient irrigation techniques can increase groundwater depletion, but efficient irrigation can be balanced with healthy groundwater and streamflows.

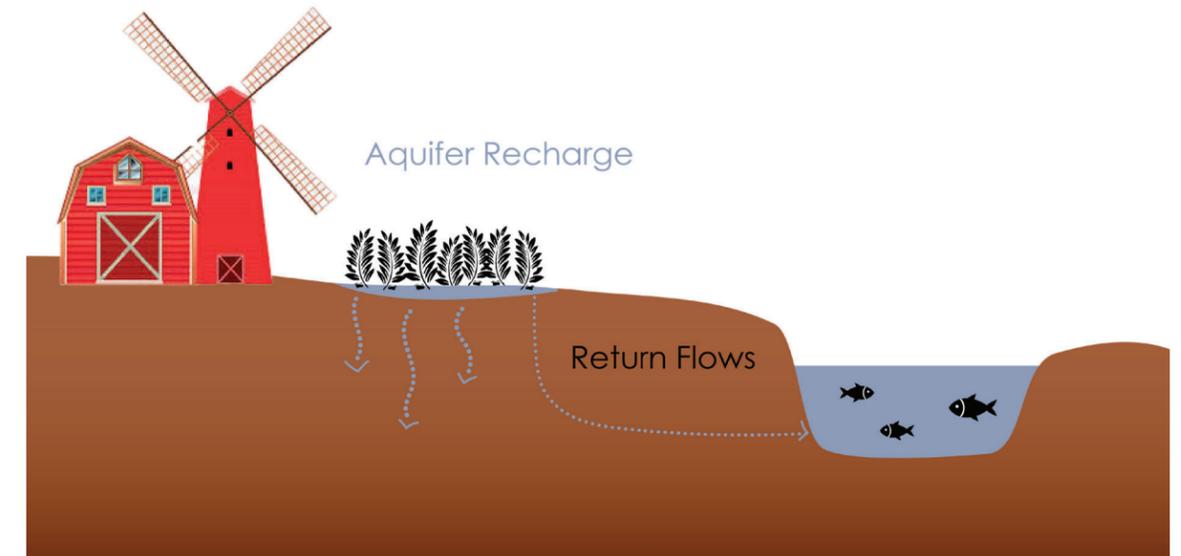
In Utah's agricultural systems, some of the water delivered through earthen canals or applied via flood irrigation seeps into the ground. In recent decades farmers have been encouraged to replace these traditional techniques with lined canals and center-pivot sprinklers to conserve water—but this practice can have unintended consequences for both water users and aquatic life. Water that seeps into the ground through less-efficient irrigation systems increases the amount of water stored in underground aquifers and flows back to the river via underground pathways. These “return flows” contribute water to the river system during seasons when river flow is low (Figure 2.B.1). Return flows increase the water available for human use and provide a source for cool water needed by coldwater trout.

In Henry's Fork of the Snake River, located in Idaho, traditional water conveyance and flood irrigation

techniques have contributed large quantities of return flow to the river for over a century. Most farmers transitioned from flood to sprinkler irrigation between 1978–2000. The large-scale change in irrigation practices decreased annual streamflow diversions by 250,000 acre-ft (23%), but also decreased annual groundwater return flow by 240,000 acre-feet. In other words, more efficient irrigation techniques contributed to more water being depleted—or consumed—in the basin, rather than conserving water for other uses.

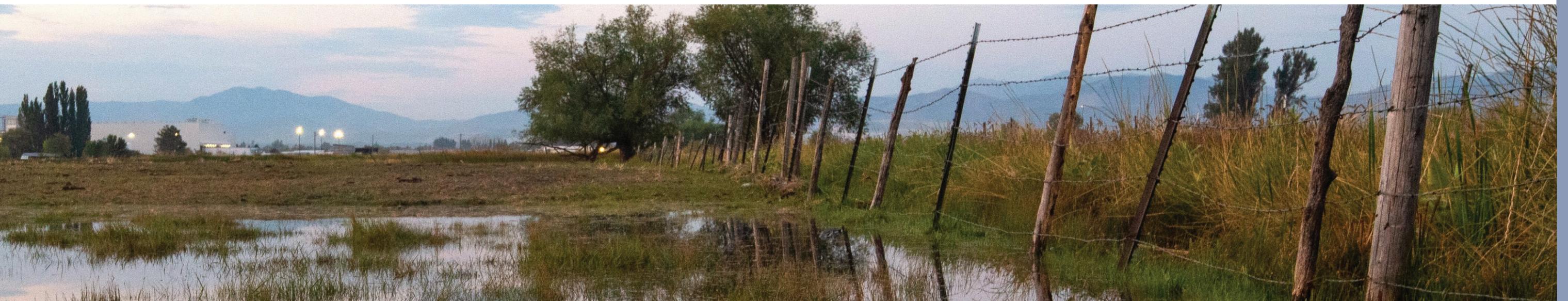
Farmers in the Teton River Basin have begun using flood irrigation early in the growing season when spring runoff is more abundant and are preserving sprinkler irrigation for use later in the year when surface water is less available. This dual irrigation practice will help agricultural growers recharge groundwater and aquifers and conserve water.

Figure 2.B.1 Water that seeps into the ground can become stored in underground aquifers and flow back to the river via underground pathways



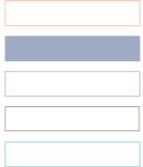
Traditional water conveyance and flood irrigation techniques have contributed large quantities of return flow to the river for over a century.

BELOW: NORTHERN UTAH FLOOD IRRIGATION | AARON FORTIN



Connecting the Dots between Snowpack, Streamflow, and Water Management

BETHANY NEILSON & JEFFERY S. HORSBURGH

 The Logan River Observatory provides critical data and insights on Utah's water resources, empowering state and local leaders to make informed, science-driven decisions for sustainable water management.



The Logan River Observatory plays a critical role in advancing Utah's understanding of water availability by studying the connections between snowpack, streamflow, and groundwater. As Utah faces growing challenges in managing its water resources, the observatory supplies essential, long-term hydrologic data to inform water management decisions statewide. Founded to support Utah-specific hydrologic research, the observatory also serves as a hands-on educational facility, training future engineers and scientists in water stewardship.

In collaboration with the National Science Foundation, the observatory has developed robust watershed modeling tools that use data from mountainous areas to predict how warming temperatures and shifting snow

patterns impact snowmelt-driven streamflow—insights crucial for managing water supplies for Utah's population and the Great Salt Lake.

The observatory's partnerships with state and local stakeholders, including the Utah Division of Water Resources, Division of Water Rights, Logan City, and Cache Water District, amplify its impact. Together, they enhance water data management, improve streamflow monitoring, and develop strategies to ensure conserved water reaches its intended destinations through Utah's managed river systems. By connecting scientific research with practical applications, the observatory's work is essential for building Utah's water resilience, helping the state prepare for future water needs with informed management practices.

LEFT: USU HYDROLOGY RESEARCH ON THE LOGAN RIVER | AARON FORTIN



STUDENTS MEASURE WATER FLOW FROM A KARST MOUNTAIN SPRING | AARON FORTIN

Robust modeling tools are being developed to predict the impact of warming temperatures and changing snow accumulation on streamflow.

Understanding PFAS Contaminants in Municipal Biosolids

RYAN DUPONT

Forever chemicals are a significant human health and environmental concern in Utah wastewater biosolids.

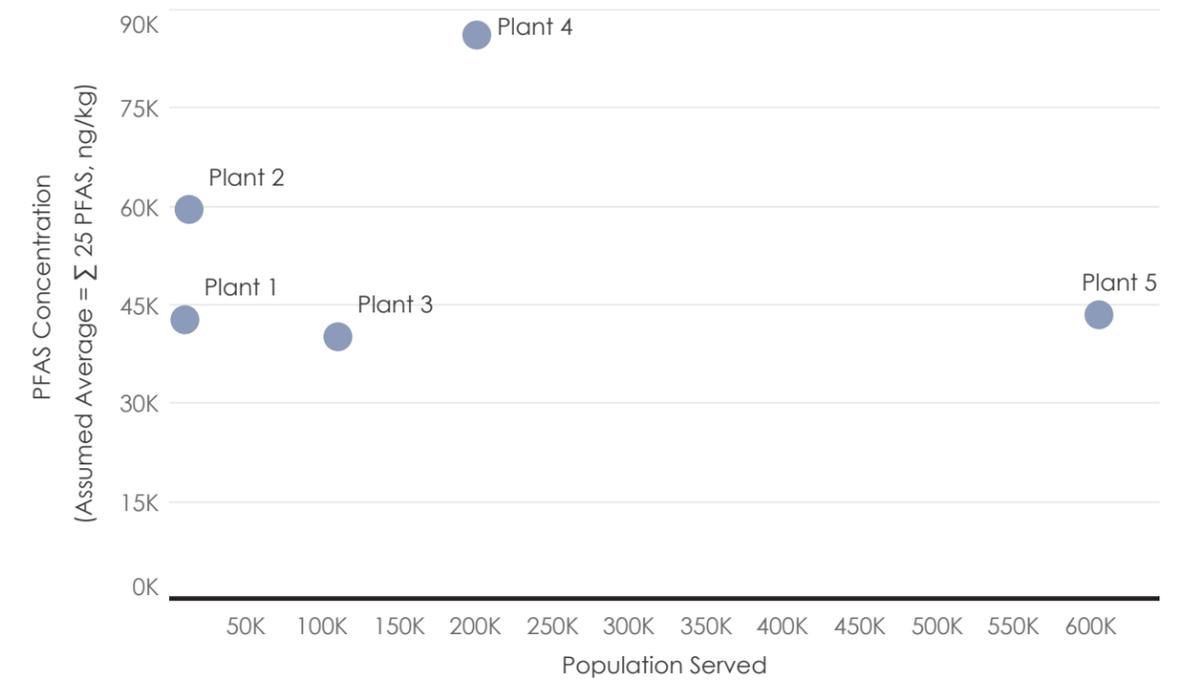
Polyfluorinated alkyl substances (PFAS) compounds are ubiquitous in our environment and have been associated with adverse effects on human health. They are a significant source of pollution in ecosystems and are often inadvertently released via land application in agriculture, mining reclamation sites, forest soils, or lawns and gardens. Biosolids, or sewage sludge, are a byproduct of wastewater treatment plants. Biosolids are considered a valuable resource because they can improve soil's water-holding capacity, organic content, and nutrient value. They do, however, contain a wide range of organic and inorganic compounds, including PFAS, that are not removed during conventional wastewater treatment.

A Utah State University study surveyed biosolids generated from a wide range of municipal wastewater treatment plants in northern Utah and central Idaho that served populations ranging from 10,000 to over 600,000 people (Figure 2.D.1). Research revealed that PFAS concentrations

are not related to community size nor residential-commercial-industrial make-up. Communities will likely be facing increasingly stringent PFAS biosolids regulations in the future because of the health and environmental risks associated with these substances. Whether biosolids produced by wastewater treatment plants can be beneficially utilized by communities with such regulations in place will depend on how well PFAS can be removed.

At Utah State University's Utah Water Research Laboratory, studies are underway to evaluate whether composting biosolids at a high temperature with and without a biochar additive will reduce the concentration and/or availability of these elevated levels of PFAS. Developing successful techniques to create safe biosolids will allow users to reap the benefits of this soil amendment without future concerns for human health and environmental harm.

Figure 2.D.1 PFAS concentrations in local municipal biosolids as a function of community size



Research revealed that PFAS concentrations are not related to community size nor residential-commercial-industrial make-up.



Utah's Snowpack in Decline: Bracing for a Future with Less Snow

SCOTT HOTALING

Utah's snowpack is in steady decline, dropping 16% since tracking began in 1979, with economic and ecosystem consequences on the horizon.



In many ways, snow defines Utah. Winter snowpack offers culturally and economically important opportunities for recreation and tourism, and acts as a giant natural reservoir for the state, feeding streams and rivers, irrigating fields and filling reservoirs as it melts. Utah's snowpack, however, is in decline. Since 1979, when the first SNOw TELelemetry (SNOTEL) sites were installed in the state, peak snowpack has decreased by 16%. Although the exceptional winter of 2022-23 offered a reprieve, the trend is clear: an increasing portion of the state's precipitation is falling as rain instead of snow. These conditions will likely continue into the future.

It is critical that Utahns prepare for a future with less snow, longer and drier summers, and higher temperatures in all seasons. Diminishing snowpack will shorten the season for skiing and other forms of winter tourism and recreation, which could lead to lost revenue. More importantly, less snow in the longer term means less water available for multiple uses, including

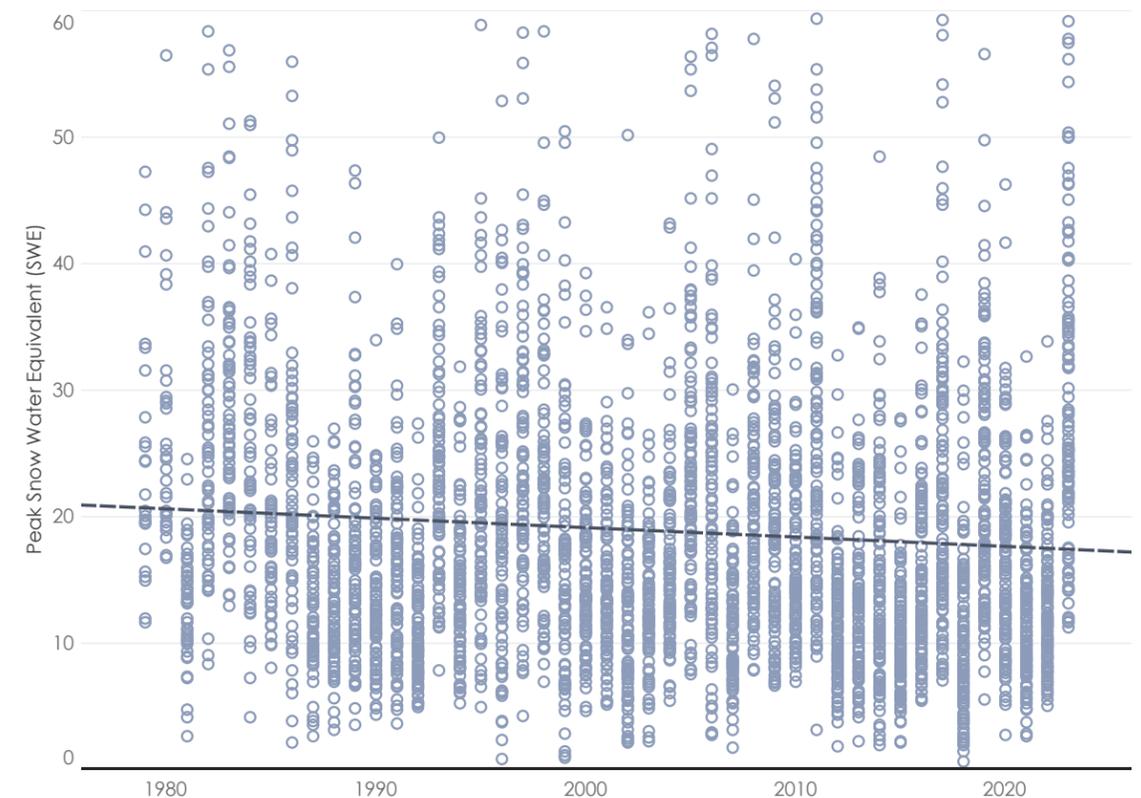
drinking water and agriculture. Rain is harder to capture than snow, and it's impossible with our current infrastructure to store anywhere near the volume of water that currently is naturally stored in early spring snowpack. So even if Utah continues to receive the same amount of precipitation under a warming climate, or even more precipitation as some models suggest (Figure 2.E.1), we'll still grapple with water shortages and droughts, threatening communities' health and safety.

Less water will also be harmful and disruptive to ecosystems, fish, and wildlife, and could threaten biodiversity. For example, the state fish—the Bonneville cutthroat trout—relies on cold, reliable streamflow to survive. Less snow will impact this species. There is also potential for the tree line to shift, as subalpine fir and other high-altitude trees adapt to growing at higher elevations. A higher tree line would decrease the extent of alpine tundra ecosystems, which could threaten some tree and wildlife species.



SNOWPACK IN THE BEAR RIVER MOUNTAIN RANGE | AARON FORTIN

Figure 2.E.1 The long-term trend in peak annual snowpack in Utah



LEFT: EARLY SPRING AT CUTLER RESERVOIR | AARON FORTIN

Utah's WATER *in the news*

As we've tracked Utah and national news through 2024, we have compiled some of the key water issues and topics that have appeared in media outlets this year.

1. COLORADO RIVER ALLOCATION NEGOTIATIONS

In 2024, negotiations over the Colorado River's future continued as states, including Utah, prepared for key agreements set to expire in 2026. The Colorado River Collaborative has brought heightened media attention to these discussions, emphasizing the need for sustainable solutions. Utah is closely monitoring developments as water from the river remains critical to the state's agricultural, urban, and industrial needs.

2. GREAT SALT LAKE WATER ELEVATION

In 2024, the Great Salt Lake reached a high point of 4,195.1 feet in the spring, thanks to increased snowmelt and rainfall. However, by fall, its elevation had dropped to 4,188.5 feet due to hot, dry conditions and continued water diversions.

3. ANOTHER WET WINTER

Utah experienced its second consecutive wetter-than-normal winter in 2024, with record snowpack and heavy precipitation helping to maintain reservoirs and boost the Great Salt Lake's elevation. However, a hot and dry summer and fall quickly reversed some of these gains, with higher temperatures accelerating snowmelt and increasing water demand across the state. These fluctuations remain a critical concern for Utah's ecosystem and water management strategies.

4. WATER CONSERVATION EFFORTS

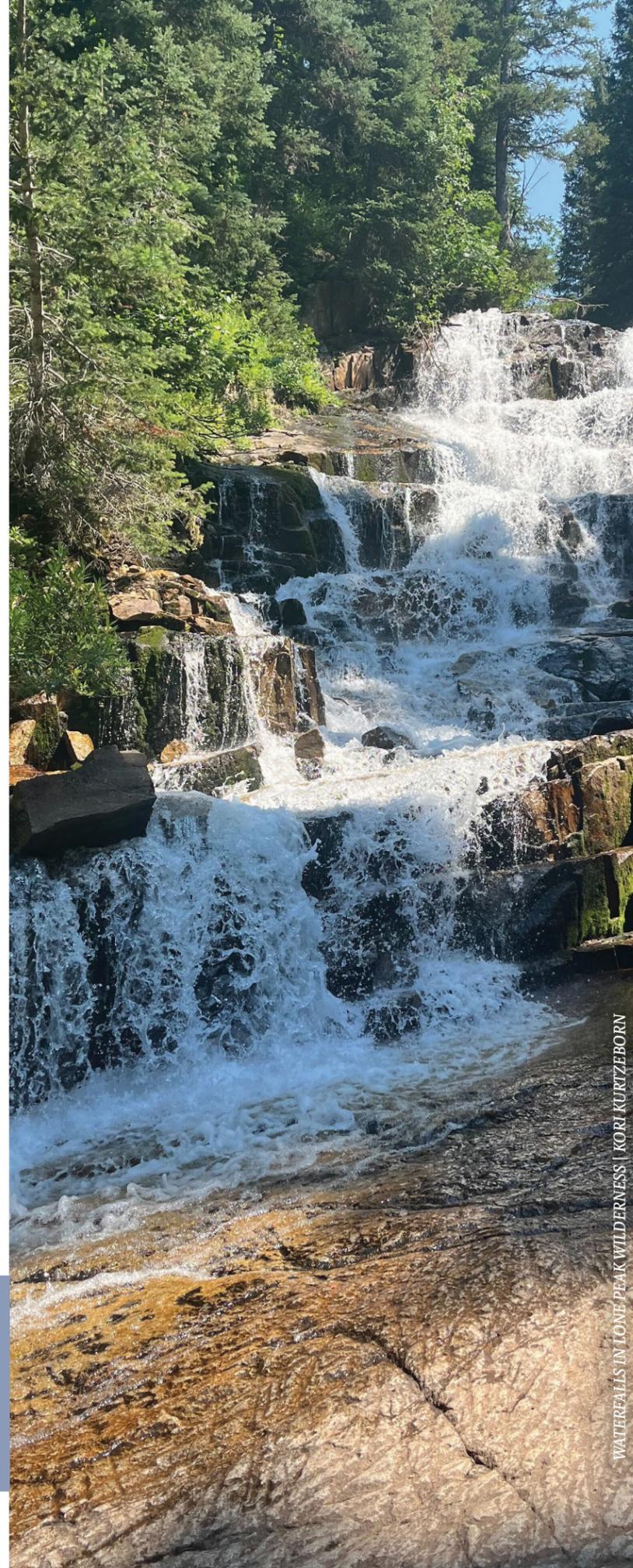
In 2024, Utah intensified its water conservation efforts, particularly in optimizing agricultural irrigation. Farmers adopted advanced technologies like drip irrigation and soil moisture sensors to reduce water use. Further work is needed to quantify the total water savings. These initiatives are part of broader efforts to improve water efficiency amid ongoing drought conditions.

5. DAM SAFETY CONCERNS

In 2024, dam safety became a growing concern in Utah, particularly at Panguitch Dam, where structural issues prompted increased monitoring and maintenance. Heavy runoff from consecutive wet winters heightened worries about potential overflows and the dam's capacity to manage high water levels. Repairs and upgrades are being planned to address these vulnerabilities.

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

We publish a weekly email newsletter containing a roundup of stories in the media related to Utah's land, water, and air. This year, we shared nearly 2,000 stories, primarily from local media, with additional coverage from national outlets. Subscribe to our weekly email news roundup at: usu.edu/ilwa/newsletter.



WATERFALLS IN LOWE PEAK WILDERNESS | KORI KURTZBORN

CHAPTER 2 REFERENCES

2.I Utah Division of State Parks. (2024). Bear Lake State Park - Current Conditions. Utah Department of Natural Resources. <https://stateparks.utah.gov/parks/bear-lake/current-conditions/>

Lake Powell Water Database. (2024). Water Summary. [Data set]. Water-Data.com <https://lakepowell.water-data.com/>

Utah Lake Authority. (2024). Water Levels. <https://utahlake.gov/water-levels/>

Utah Division of Water Resources. (2024). Great Salt Lake Elevation. Utah Department of Natural Resources. <https://water.utah.gov/great-salt-lake-elevation/>

2.A Aweek, M., Rosenberg, D.E., Bastidas, C., Horsburgh, J.S., Lane, B.A., Kopp, K., Mayer, P., and Fazio, J. (2023, July 6). Increasing the Impact of Utah State University's Extension Water Check Program With 5-Second Metering. Digital Commons. https://digitalcommons.usu.edu/water_rep/681/

2.B Morrisett, C. N., Van Kirk, R. W., Bernier, L. O., Holt, A. L., Perel, C. B., & Null, S. E. (2023). The irrigation efficiency trap: rational farm-scale decisions can lead to poor hydrologic outcomes at the basin scale. *Frontiers in Environmental Science*, 11, 1188139. doi.org/10.3389/fenvs.2023.1188139

O'Connell, J. (2019, December 3). Teton Basin launches aquifer recharge pilot. Intermountain Farm and Ranch. https://www.postregister.com/farmandranch/eastern_idaho/teton-basin-launches-aquifer-recharge-pilot/article_ba40be3e-a4d2-5c12-8584-849e7a260036.html

2.D Environment Canada. (2024). Objective for Canadian drinking water quality- per-and polyfluoroalkyl substances. <https://www.canada.ca/en/health-canada/services/publications/healthy-living/objective-drinking-water-quality-per-polyfluoroalkyl-substances.html>

European Union. (2023). Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food and repealing Regulation (EC) No 1881/2006. Official Journal of the European Union, L 119, 103-157. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023R0915>