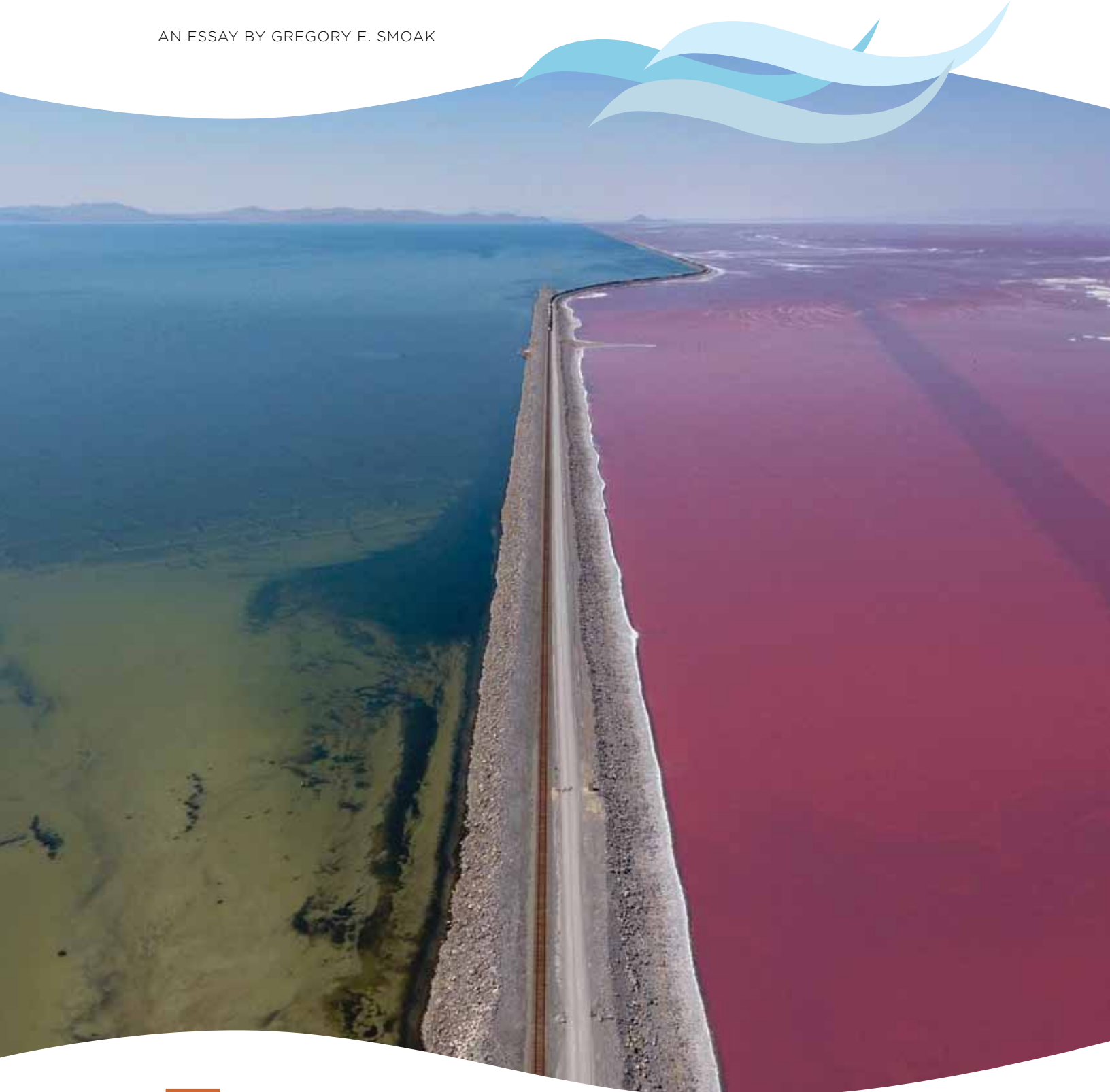


# UTAH WATER WAYS

AN ESSAY BY GREGORY E. SMOAK



BROUGHT  
TO YOU BY



**UTAH HUMANITIES**  
Ideas in Action

# WHAT'S YOUR WATER STORY?

**WATER IS LIFE.** It forms our world and our lives. It allows us to travel and blocks our paths. It determines where we live and work and what we eat and drink. It is an essential natural resource that people struggle to access and control. Water shapes human culture – our ways of life.  
LEARN ABOUT UTAH'S WATER WAYS.



*Think Water Utah* is a statewide collaboration and conversation on the critical topic of water presented by Utah Humanities and its partners. The Utah tours of *Water|Ways* and *H2O Today* are part of *Think Water Utah*.



*Water|Ways* is part of Museum on Main Street, a collaboration between the Smithsonian Institution and State Humanities Councils nationwide. Support for Museum on Main Street has been provided by the United States Congress. *Water|Ways* and *H2O Today* were adapted from an exhibition organized by the American Museum of Natural History (New York) and the Science Museum of Minnesota (St. Paul), in collaboration with Great Lakes Science Center (Cleveland), Field Museum (Chicago), Instituto Sangari (Sao Paulo), National Museum of Australia (Canberra), Royal Ontario Museum (Toronto), San Diego Natural History Museum, and Science Centre Singapore.

*Think Water Utah* is presented by Utah Humanities in partnership with local exhibition hosts: Fremont Indian State Park Museum with Snow College Library - Richfield, Kanab Museum, Swaner Preserve & EcoCenter, John Wesley Powell River History Museum, West Valley Arts, Uintah County Heritage Museum, Bear River Heritage Area with Hyrum City Museum, Frontier Homestead State Park, Canyon Country Discovery Center, Natural History Museum of Utah, and the Utah Museum of Fine Arts.

The tour would not be possible without crucial support from the State of Utah, Utah Division of Arts & Museums, Utah Division of State History, University of Utah American West Center, Utah Museum of Fine Arts, Lawrence T. and Janet T. Dee Foundation, George S. and Dolores Doré Eccles Foundation, Dominion Energy, Rocky Mountain Power, Union Pacific, KCPW Radio, and Utah Public Radio.

Author: Gregory Smoak, with thanks for contributions from the Utah Division of State History.

Editors: Nate Housley, Megan Weiss, and Megan van Frank, with thanks to Mikee Ferran, Lisa Barr, and Jedediah Rogers.

Utah Humanities *Think Water Utah* project staff: Megan van Frank, Nate Housley, Megan Weiss, and Mikee Ferran

Design: Carl Trujillo/Right Brain Design

Cover: Great Salt Lake Causeway by Justin McFarland

Utah Humanities acknowledges Utah's Indigenous communities as the original peoples of these lands. We honor their stewardship, respect their resilience, and celebrate their traditions and living cultures. We foster respectful connection to Utah lands and first peoples through our programming and call for a brighter future together – one human interaction at a time.

**Utah Humanities**  
202 West 300 North,  
Salt Lake City, UT 84103  
801.359.9670 | [www.utahhumanities.org](http://www.utahhumanities.org)



**#ThinkWaterUtah**  
**#MyWaterStory**  
**#IdeasInAction**



# UTAH WATER WAYS

Gregory E. Smoak

**WATER IS LIFE.** Regardless of who we are, where we live, or what we do, we cannot exist without water. This is as true in a rainforest as in the driest of deserts. Water ways include the physical world that we inhabit – all of the rivers, streams, lakes, oceans, and irrigation ditches that sustain our lives. Yet no place's or people's water ways are the same. They are a sum of all of the ways – social, cultural, historical, religious, technical – in which people engage with that life-giving resource. And so, water ways are the product of both nature and culture; they are built where human beliefs and actions meet the natural world.

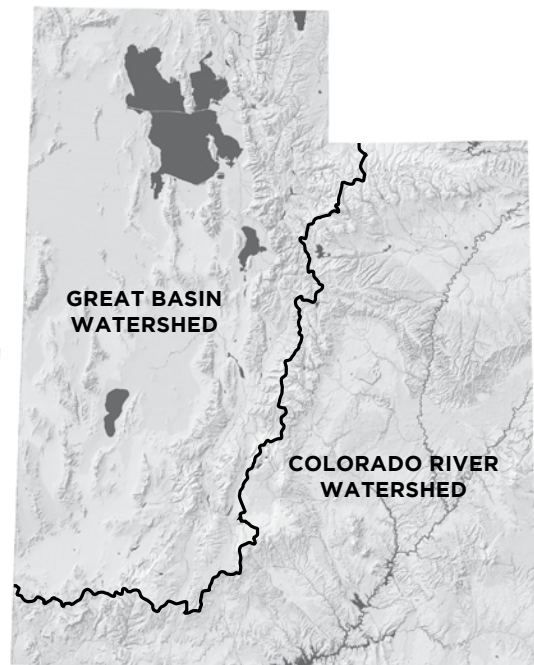
In Utah the general scarcity of water has loomed large over its peoples' lives. While natural factors have posed obstacles and presented opportunities, these factors alone have never determined how Utahns have lived. Native peoples and European-American settlers adapted to Utah's physical environment very differently. Utahns have contested, bitterly at times, the formation of Utah's water ways. It is not always a happy story, nor is it a straightforward tale of perseverance and progress. Utah's water ways are a story of challenge, adaptation, change, success, and sometimes failure.

## A LAND OF EXTREMES

**W**hen it comes to water, Utah is a land of extremes. Water is not evenly distributed throughout the year nor across the state. When and where precipitation falls matters.

Water is life. But in Utah, aridity is also a central fact of life. In any given year a meager thirteen inches of precipitation falls. Indeed, only Nevada, our parched neighbor to the west, is drier. Yet statewide averages tell just part of the story. When and where precipitation falls matters even more, and that factor is largely determined by topography and seasonal change.

Less than half of the state's annual precipitation, about six inches of rain, falls during the growing season. Utah gets most of its water in the form of snow during the winter and spring as the Pacific Storm Track pushes waves of moisture across the American West. Topography then comes into play.



Utah's Main Watersheds



Willow Heights, Wasatch Mountains, 2018. Snow that accumulates during winter makes Utah mountains the state's most important water reservoirs. Utah's water management infrastructure is designed to capture snowmelt. Courtesy John Higgins.

As winds force an air mass to rise over mountains, the air cools rapidly and loses its ability to hold moisture. This phenomenon, called the *orographic effect*, means that mountain ranges are always wettest on their windward slopes and cast rain shadows, areas of reduced precipitation, to their leeward side.

The massive wall of the Sierra Nevada wrings precious moisture from Pacific storms and makes the Great Basin the driest region in the United States. For this same reason, valleys in Utah's West Desert can see less than five inches of precipitation in a year, while the highest peaks of the nearby Wasatch Range receive ten times as much water. The same is true throughout Utah and the Mountain West.

From the Tushars to the Uintas, the Deep Creeks to the La Sals, Utah's mountain ranges are its first and most important reservoirs. This basic fact has shaped where Utahns have lived and their efforts to make use of the water that tumbles from the mountains as the snows melt.

Other natural patterns, such as the Southwest monsoon, also shape Utah's water ways. In the heat of summer, principally mid-July through early September, high daytime temperatures and prevailing winds carrying moisture from the south trigger midday thunderstorms across the Colorado Plateau. The rainfall is usually highly localized and intense! Within minutes, a raging flash flood can turn a dry wash or

a narrow canyon into a death trap, while blue skies prevail a mile or two away.

The annual monsoon – and the flash floods that it brings – reinforce the basic rule: Utah is a place of extremes where water is not evenly distributed throughout the year nor across the land.

## Utah's Watersheds

The combination of aridity and topography also lays bare the role of water in carving Utah's rugged landscape. Water is the principal agent of weathering. Pulled by the relentless force of gravity, water in solid or liquid form exploits any weakness to follow the path of least resistance downward. Along the way, it breaks down and carries away parts of the rock.

Several periods of geologic uplift, beginning some seventy million years ago, produced the state's mountains and plateaus. However, as soon as the land began to rise, weathering began to wear it down. Glacial ice scoured out the distinctive "U" shape of Little Cottonwood Canyon near Salt Lake City, while just a few miles to the north, Big Cottonwood Canyon's "V" shape indicates that it was cut by running water.

On the Colorado Plateau some two hundred miles to the southeast, water seeped into domes of Entrada sandstone, freezing and thawing over eons. This



Little Cottonwood Canyon, 1924. Looking toward the Salt Lake Valley, the canyon's "U" shape shows it was carved by a glacier. Canyons carved by running water look like a "V." Canyons carry snowmelt downstream. Utah State Historical Society.

process created Utah's famous arches while nearby rivers carved the spectacular canyonlands. Indeed, the entire Colorado Plateau is one vast testament to how water carved the physical face of Utah.

Together, geologic and climatic forces create *watersheds*: catchment basins where all of the water within ultimately funnels down to a low point, usually a lake or the sea. Mountain ranges and ridges mark off watersheds as they force water to flow in one direction or another.

Watersheds constitute natural boundaries that can expose the artificial nature of political boundaries. Utah is divided into two great natural watersheds that stretch far beyond our state's borders: the Colorado River (including the Green River) and the Great Basin. Each in turn is made up of the many watersheds of tributary streams and rivers.

Of Utah's two major watersheds, the Colorado-Green system contains more water but is more sparsely populated. "More water" is a relative term; springtime highwater in Cataract Canyon can be exhilarating – or even terrifying – for river runners, yet the Colorado does not even make the US Geological Survey's (USGS) list of the twenty largest rivers in the United States. The annual average discharge of the Colorado system is 15,000 to 17,000 cubic feet per second (cfs), while in an average year the Columbia River carries sixteen times as much water. It would take thirty-five Colorado Rivers to match the flow of the Mississippi!

The historic inaccessibility of the Colorado and Green Rivers has limited their use even more than their modest flows. Elsewhere in the United States, rivers have served as critical arteries of travel and transportation. This is simply not the case in Utah, where the state's largest rivers tend to present obstacles. Along their courses they most often run at

the bottom of steep, remote canyons. Only where the canyons open up – places like the Uinta Basin, Green River, and Spanish Valley – are the rivers and their waters easily accessible.

The vast majority of our state's population lives in Utah's other watershed, the Great Basin. Encompassing nearly all of Nevada; most of western Utah; and parts of Oregon, California, Idaho, and Wyoming; the Great Basin is actually a collection of many *hydrographic* (catchment) basins that share one common characteristic – none of their waters reach the Pacific Ocean. All of the Great Basin's streams and rivers are part of *endorheic* (closed) drainage basins that end in terminal lakes or sinks such as Utah's Great Salt Lake and Sevier Lake.

## Wasatch Oasis Zone

The overriding aridity of the Great Basin and its streams' relatively short length mean that the streams carry much less water than the Colorado and its tributaries. The Bear River, the largest river feeding Great Salt Lake (as well as the longest river in North America that never reaches the sea) has an annual average discharge of just over 2,400 cfs. The other rivers that tumble from the Wasatch Range – such as the Ogden, Weber, and Provo Rivers – are even smaller. Farther south, the Sevier River averages only around one tenth of the Bear River's flow as it follows its circuitous path to the now-dry Sevier Lake in Millard County.

While this may not sound conducive to supporting large human populations, the streams' location and ability to support a diversity of life matter more than their size. While small, the many streams falling from the Wasatch Range, the Wasatch Plateau, and highlands farther south create an oasis zone at the foot of the mountains that has supported human



Bryce Canyon National Park, 2008. The "hoodoos" and strange shapes of Utah's canyon country are picturesque testaments to the power of water in shaping desert sandstone. Courtesy John Higgins.

populations for thousands of years. Today that narrow strip of land stretching from Brigham City to Nephi – the Wasatch Oasis Zone – is home to more than eighty percent of the state’s residents.

Utah’s most unique and famous body of water, Great Salt Lake, has also shaped the Wasatch Oasis Zone. Before there was Great Salt Lake, there was Lake Bonneville. At its greatest extent during the last Ice Age, Lake Bonneville covered almost 20,000 square miles of the eastern Great Basin. Lake Bonneville’s waters remained fresh despite being a terminal lake due to the inflow of rivers and streams, melting glaciers, and much greater precipitation than we see today.

About 16,800 years ago, the lake reached its greatest depth and expanse. Then, at Red Rock Pass in today’s southern Idaho, Lake Bonneville’s waters began spilling over into the Snake River drainage. Rapid erosion caused an enormous year-long flood that scoured 375 feet of earth from the pass and dropped the lake’s level an equal amount. As the climate became drier and warmer, the lake continued to recede. By the time humans arrived millennia ago in what is today Utah, Lake Bonneville survived only as a series of relict lakes – Great Salt Lake, Utah Lake, and Sevier Lake.

As the largest saline lake in the Western Hemisphere, Great Salt Lake produces important environmental and climatic effects for the Wasatch Oasis. Its vast surface area, by absorbing solar energy, moderates temperatures, raises humidity, and increases precipitation along the foot of the Wasatch Range. The



Claffin-Emerson Expedition navigates Fremont River, 1929. Desert water is a necessity and often an obstacle. Gift of Christopher Morss, 1998. President and Fellows of Harvard College, Peabody Museum of Archaeology and Ethnology (PM 998-21-10/100186.1.36.166).

*lake effect* also boosts the moisture content in winter storms, helping to produce what the state advertises as the “greatest snow on earth.”

The Great Salt Lake is not a “dead sea.” Rather, it is the keystone of an ecosystem that teems with life. The lake is especially important for birds. The wetlands along its eastern shore are vestiges of a more watery landscape that predated Euro-American colonization and serve as winter habitat for many species as well as a critical way station for millions of migratory birds making their way north and south each year.

Utah’s water ways begin with these physical realities. Utah is a land of extremes with a stark divide between where and when water is plentiful (at times far too plentiful!) and more often where and when it is scarce. But water ways are about far more than natural factors. They are also about human cultures and decisions.



*Gunnison Island*, drawing from *An Expedition to the Valley of the Great Salt Lake of Utah* by Howard Stansbury, 1852. Gunnison Island is home to one of the largest rookeries of American White Pelicans anywhere. Over 10,000 birds raise their young here each year. When surrounded by water, the island’s isolation provides a fortress from predators. Utah State Historical Society.

# NATIVE WATERS

For thousands of years, the paths of Native Americans in the West have followed water. Utah's Native history is one of adaptation and mobility.

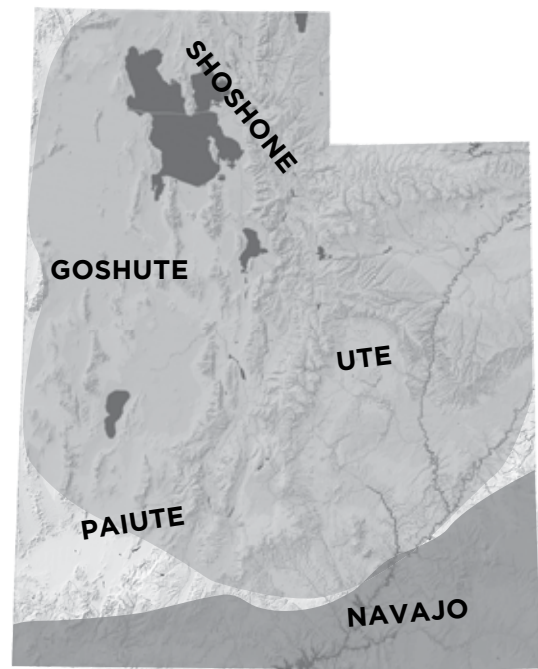
Water is life. The Native peoples who have called Utah home for at least the past twelve millennia knew that fact well. To survive and thrive in an arid and challenging landscape, they adapted to the land and its waters in diverse and dynamic ways. Lakes, rivers, springs, and seeps all sustained Native life. Some peoples used streams to grow *maize* (corn) and other crops, but mobility and a deep knowledge of where and when water could be found was essential for all. Until the arrival of Euro-American colonizers in the nineteenth century, Native water ways were Utah's water ways.

## Ancient Waterscapes

Utah's earliest peoples, called Paleoindians by archaeologists, encountered very different landscapes and waterscapes than we know today. The end of the last Ice Age – about 10,000 years ago – was cooler and wetter. Snow covered mountain peaks year-round, and lower desert ranges supported forests of spruce and pine. What are today scorched desert valleys were then seas of sagebrush, and wetlands existed both at the foot of the mountains and in places unthinkable today. Familiar animals such as deer, elk, and pronghorn grazed on the valleys, hills, and plateaus, as did now-extinct megafauna including mammoths, mastodons, and giant bison.

Paleoindian peoples were foragers. They were mobile followers of big game but did not rely on it alone. Smaller game and plants were important, and they were plentiful. Indeed, the Paleoindian arrival marked a moment when, for a brief few centuries, Utah's first inhabitants encountered a true wilderness devoid of human alteration and “skimmed the cream from a new continent.”

Once those centuries of plenty passed, the Archaic Period – 10,500 to 2,000 years ago – began. Generally warmer and drier conditions with intermittent cycles of cooling persisted through the Archaic period. For



## Native American Peoples Since the Archaic Period

■ Fremont Culture Area ■ Puebloan Culture Area

Reliable access to water was an important factor in determining Native habitation patterns in Utah. Before Numic peoples arrived, Fremont and Ancestral Puebloan sites show the peoples' manipulation of water.

Western Archaic (also called *desert culture*) foragers, mobility and resource diversity remained critical. Small mammals, birds, and fish made up a greater share of their diets.

Despite the vast swath of time covered by the Archaic period, Native life was not static. Populations grew while material and social cultures changed. Maize agriculture spread north from Mexico and reached what is today southern Arizona and New Mexico about 4,000 years ago. Agriculture spread as farming peoples migrated and as the foragers they encountered adopted the practice. Archaeologists unearthed the oldest known maize in Utah, dated to around 2,000 years ago, from a storage pit at the Elsinore site, not far from Fremont Indian State Park. The adoption of maize farming marked a revolution in land and water use in Utah.

## Ancient Farmers

Agriculture trades mobility for a more sedentary life in areas where farming is viable. In southeast Utah were the Ancestral Puebloans (still popularly



Ute Indians at Fort Duchesne, Utah, c1890. Utes and other Native peoples historically settled in the Wasatch Oasis, but by the late 19th century, were displaced to more arid lands by white settlers. Western History Collection (Z-218), Denver Public Library.

but inappropriately called the Anasazi). To the north and west were Fremont peoples (named for the Fremont River where the culture was first identified and described). They shared important cultural characteristics but, just as the modern Pueblos, Utah's ancient farmers were not a single people and likely spoke many different languages.

While Ancestral Puebloan culture has captured the public's imagination at sites such as Mesa Verde, Fremont culture covered a far greater expanse of modern Utah, even stretching into southern Idaho and eastern Nevada. The earliest evidence of Fremont culture in Utah dates to 2,200 years ago, with farming becoming more prevalent around 1,500 years ago.

Where there was water there were Fremont people. Today, visitors trek to Fremont sites in Nine Mile Canyon and the San Rafael Swell to view spectacular rock art panels and the remains of granaries, but the true heartland of Fremont culture was farther west where streams tumbled down from the high mountains and plateaus at the edge of the Great Basin. Every modern city or town along the route of the I-15 freeway, from Brigham City to Cedar City, was built on top of Fremont villages.

The Fremont never built irrigation works on the grand scale of some of their contemporaries, such as the Hohokam in Arizona. Indeed, there is evidence only at a few dozen sites of Utah's ancient peoples irrigating crops. Rather, the Fremont exploited natural

opportunities by placing their fields in strategic locations along river and creek bottoms and near seeps where the presence of water, along with simple diversions, allowed their crops to thrive.

Fremont villages could be relatively large, supporting up to 200 or more people. The densest populations were, not surprisingly, found in the Wasatch Oasis. The eastern shores of Utah and Great Salt Lakes were ideal for farming, as lake effect conditions brought greater precipitation and moderated the climate, producing longer growing seasons. Moreover, the wetlands bordering the lakes provided a bountiful harvest of plant and animal life, including migratory waterfowl that visited each year, numbering in the millions.

### Peoples in Motion

Beginning around 1,000 years ago, great changes came to Utah's Native water ways. First, new peoples appeared on the western margin of the Fremont villages. Within several hundred years, they had supplanted Fremont farming culture.

These newcomers spoke Numic languages, and they were the direct cultural ancestors of today's Shoshone, Ute, and Paiute peoples. Numic dialects identify their speakers as "the people" – *Newe* in Shoshone, *Nuche* in Ute, and *Nuwu* in Paiute. In Numic dialects the word for water is *Paa* or *Baa*. Despite differences in language and geographic ranges, Numic peoples did not differentiate as distinct nations until quite recently,



and it would be wrong to assume modern tribal identities existed in the distant past.

Coming from the West, Numic peoples had long experience with arid lands. In what is now Utah, they developed a diverse range of adaptations to the specific environments they encountered. Several centuries later and far to the southeast another people brought their water ways to what is now Utah's San Juan River watershed. Although they spoke an Athabascan language very different from the Numic dialects, they also called themselves "the people:" the Diné. Today, this is the Navajo Nation, for whom water is *Tó*.

Mobility was a crucial strategy for survival in these arid landscapes for all of Utah's Native peoples. Each Numic group, for example, generally possessed a home range centered on winter camps, within which

the people had unquestioned rights to resources. For the Newe of Cache Valley, the Boa Ogoi or "Big River" (which Euro-Americans called the Bear River), was such a center place.

Yet each group's subsistence cycle invariably took them into the homelands of other related peoples. In these instances, Numic leaders negotiated their people's access, just as they would with visitors to their own homelands. Throughout the course of the year, Numic groups might travel hundreds of miles to access resources as they became seasonally available. Depending on where they lived, their rounds might include fishing, root digging, collecting pine nuts, gathering grass seed, small and large game hunts, and, increasingly after the acquisition of horses, bison hunting.

## Prehistoric Waterways

*Savanna Agardy & Elizabeth Hora, Utah State Historic Preservation Office*



Ancestral Puebloan Canal, Beaver Creek Agricultural Community, Glen Canyon Archaeological Survey, 1958. Dated to the Pueblo III period (1150-1350), this rock-lined irrigation canal likely had a water gate to control flow. Water engineers built ditch systems as one adaptation to severe drought during this period. Museum of Northern Arizona excavation, courtesy J. Willard Marriott Library, University of Utah.

**W**ater, and how to control it, is an age-old consideration for the people of Utah. Fremont peoples relied on water conveyances only occasionally to water their fields, while the Ancestral Puebloans oriented their pueblos around water access and retention.

The Fremont, who flourished in Utah from around 1,800-800 years ago, supplemented their foraging with agriculture. Some segments of Fremont society grew the "three sisters" – corn, beans, and squash – and utilized water sources to maximize food production. The Fremont farming motto seems to have been, "work smarter, not harder," since they would take advantage of natural slopes, drainages, and rills to transport water to their fields. But evidence shows that the Fremont also constructed

irrigation ditches to water their crops. Creating irrigation ditches, though labor-intensive, led to a significant increase in crop production, ultimately allowing the Fremont to thrive in inhospitable landscapes.

Ancestral Puebloans lived in the American Southwest from approximately 1,400-700 years ago. The region had a notoriously variable climate during the Ancestral Puebloan period, making access to and control of water essential to survival. Ancestral Puebloans often centered their towns around a spring or cistern, such as at the Sand Canyon Pueblo. Other sites, such as the Woods Canyon Pueblo, show evidence of prehistoric reservoirs; archaeologists have identified pond sediments along with constructed earthen dams. These demonstrate deliberate and successful manipulation of water in prehistory.



Reintroduction of June Suckers, Provo River, 2019. Before overuse and pollution decimated the fishery in the late 19th and 20th centuries, thirteen species of native fish lived in Utah Lake. Today, of the native species, only the Utah Sucker and the endangered June Sucker remain, and the lake's dominant fish is the introduced Common Carp. Laura Seitz, Deseret News.

Water was, of course, a vital consideration during these subsistence rounds. Rivers, creeks, springs, and lakes offered fish, waterfowl, and aquatic plants, not to mention drinking water. Numic groups made camps at or near water sources whenever possible, favoring river bottoms for winter camps. There they had shelter along with easy access to water, firewood, and forage for horses.

One of the greatest Native fisheries in the interior American West was located in the Utah Valley homeland of the Timpanogos Nuche. Not coincidentally, it was also the most densely populated place in the entire Wasatch Oasis. The Spanish Dominguez-Escalante expedition, the first Europeans to visit Utah Valley in 1776, marveled at the wealth of the land and waters. In their estimation, the streams feeding the lake could support many irrigated farming villages. The lake itself abounded in "several species of good fish, geese, beavers, and other amphibious creatures." Rather than farming, it was this water-borne bounty that sustained the Timpanogos.

The Timpanogos Nuche fished on the lake and its tributary streams, but their most productive fishery was at the mouth of the Timpanoquint – "stream with the rocky bed" – from which the people took their name and which white colonists later called the Provo River. There they fished with nets, spears, weirs, and fish traps. During spring spawning runs the river was

so thick with fish that Nuche could simply club them or throw them to the shore by hand.

Some Nuche remained in the area year-round, but hundreds of others made long journeys to visit during the spawning runs and take part in the bounty. Dried fish, along with roots and bulbs gathered at higher elevations, were staples of the Timpanogos diet throughout the year. By one estimate, fish accounted for nearly one third of their diet. It was little wonder that other Nuche peoples called the Timpanogos the "lake people" or the "fish eaters."

To the south, living in some of the most arid lands in North America, the Nuwu (Paiutes) developed an intricate knowledge of desert waters. The handful of perennial streams which flowed through Nuwu country were vital to life and supported the largest populations. In the best watered areas – the Virgin, Santa Clara, and Muddy watersheds – Nuwu women planted gardens of corn, squash, gourds, and beans. They also transplanted some wild plant species, such as sunflowers and amaranth. Using digging sticks, the Nuwu carved out short channels from the river to the gardens.

Most pre-contact Nuwu groups, even those who planted gardens, spent the major portion of each year traveling through their traditional ranges. There they collected wild plant foods – grass seeds and piñon nuts were most important – and hunted small game. During these rounds, springs were of the utmost importance. Water flowed to the surface at the larger springs, but in many other places Nuwu families had to dig down into the earth and wait for water to fill in the hole. Natural basins that had eroded into rock (tanks) also held life sustaining rainwater for days after a storm. Nuwu survival depended upon knowing the "location and condition of every tiny spring, seep, tank, and puddle for miles."

The members of the Dominguez-Escalante expedition rejoiced when they found a store of recently harvested corn along Ash Creek near modern Toquerville. They wrote, "On the brief bottoms and bank of the river, were three small maize fields with their well-dug irrigation ditches." The discovery gave them hope both that they would find more "familiar provisions farther ahead," and that such agricultural people easily might be "reduc[ed] to civil ways of living and to the faith."

## Colonization & Conflict

European and Euro-American colonizers upended Numic life. Beginning with the Spanish conquest of New Mexico at the end of the sixteenth century, the

impact of Spanish horses, trading, and slaving radiated through Native communities. Although few non-Natives set eyes upon what is now Utah before the nineteenth century, the impact of the Spanish in the Southwest shattered some Native communities while empowering others. Environmental conditions were an important factor in whether Numic peoples adopted equestrian life. Where water fed good pasture, generally to the north and east, horse culture was viable. Farther to the south and west, drier conditions made good pasture harder to find. Local Numic peoples also depended heavily on grass seed for their own consumption, making horses direct competitors for food.

Before they acquired horses, Nuche and Nuwu were nearly alike culturally and linguistically. The tribal distinctions between Ute and Paiute developed largely as a result of the Nuche embrace of horses and horse culture. By the 1820s, travel along the “Old Spanish Trail” brought more outsiders to Numic homelands and intensified the effects of contact. Some, such as the Timpanogos-born leader Wakara, took full advantage of the possibilities to engage in the trade for horses and captives. More vulnerable foot-going groups found themselves the target of increased raiding. Still, these changes paled in comparison to the invasion that followed.

As Euro-Americans first traversed and then colonized the land of extremes called Utah, the conflicts that emerged often came down to water. Between 1840 and 1860, over 250,000 Euro-American emigrants traversed the arid West on the Oregon and California Trails. With the exception of the members of the Church of Jesus Christ of Latter-day Saints (more commonly known as Mormons) who came to settle permanently in the Great Basin, the vast majority were headed to promised lands farther west. For these, the goal was to cross the continent as quickly and safely as possible during the six-month travel season.

Even so, the emigrants had a profound impact on the Native peoples and resources that they encountered during the journey. At least 1.5 million head of livestock accompanied the emigrants. Oxen, mules, and horses were the engines of the emigration; grass and water were the fuel. As a consequence, the narrow trail corridors followed watercourses or linked springs and other water sources. The inevitable result was overgrazing, the depletion of game and firewood, and fouled water.

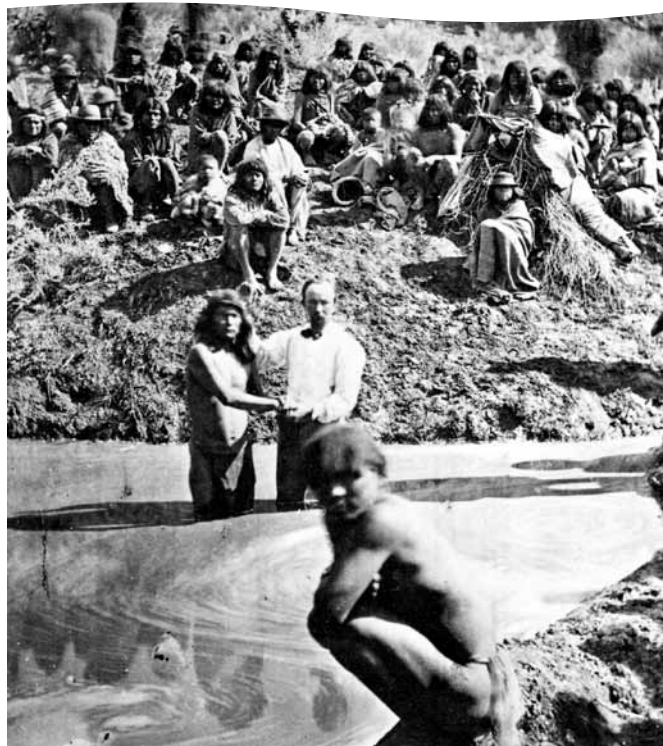
It was the Newe peoples of the Great Basin who lived closest to the trails who felt the greatest immediate impact from these emigrants. In many cases, Euro-

Americans co-opted the most important water sources. Even the more mobile and powerful equestrian bands could not escape the effects of the emigration. While they might spend the summer far from the trails, many returned to riparian winter camps only to find critical resources depleted or exhausted. With subsistence cycles disrupted for all – and some people facing outright starvation – raiding of emigrant trains increased, especially in the Newe country west of Fort Bridger.

## Mormon Settlement

The arrival of the pioneer company of the Church of Jesus Christ of Latter-day Saints (LDS Church) in 1847 was a different matter. The Mormons intended to stay, and the Wasatch Oasis presented their only real opportunity to build a theocratic, agrarian society between the Rocky Mountains and California.

Their initial settlement in the Salt Lake Valley was possible because the area, unlike the Utah Valley to the south, was not the year-round home of a large Native population. Yet this valley was also a Native homeland, and its inhabitants questioned Mormon occupation. Within days of the pioneers’ arrival, a Newe delegation came to negotiate the newcomers’ access to Newe territory and resources. Mormon leaders interpreted the meeting simply as a demand for compensation,



LDS missionary Daniel McArthur baptizes a Paiute man, Santa Clara River, c1870. Baptism in Christian faiths is a symbolic washing and regeneration that consummates acceptance of the religion. Native peoples probably did not interpret the rite in the same way, more likely attaching their own understandings of healing and adoption. Utah State Historical Society.

## A Drowned Native Village

One of the largest of all Fremont villages was located within a twenty-five-acre area where Willard Creek flowed into Great Salt Lake north of modern Ogden. It is today buried under water in the Willard Bay marina.

The land was favorable for farming, and Mormon settlers named the area Willard

when they arrived in the mid-nineteenth century. These pioneers, following Fremont waterways, found over seventy mounds marking the remains of pit houses outlining the "Big Village." The use of plows and irrigation leveled many of the ruins, and archaeologists excavated others. Only a

handful were left by the 1950s when construction of the dikes surrounding Willard Bay used fill from the historic homes underground. The construction work of the dam unearthed at least twenty human burials. How many more went undiscovered and were simply reburied in the levees is unknown.

which they refused. The land, they asserted, "belonged to [their] Father in Heaven, and [they] calculate to plow and plant it." Mormon leaders also feared that "paying" the Nuche would set a precedent and that the Nuche would then expect the same.

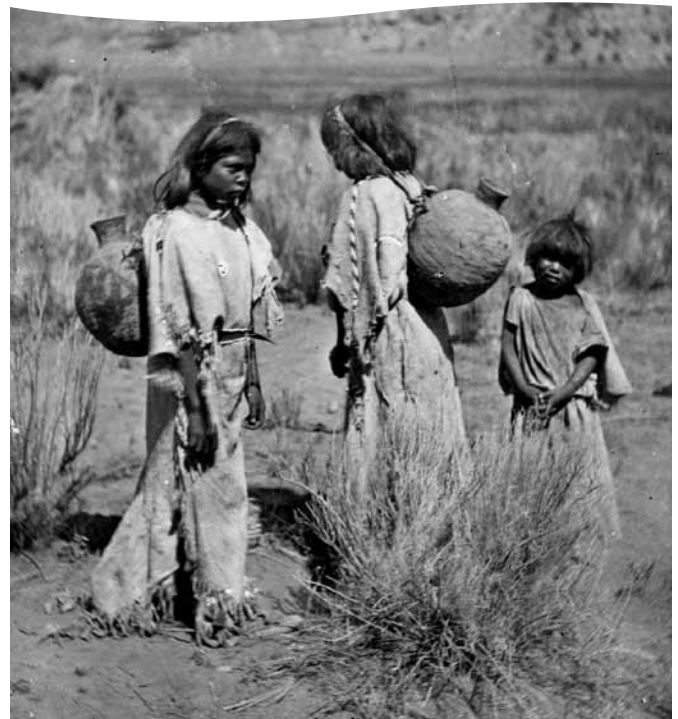
For the next year and a half, Mormon settlements expanded north from the Salt Lake Valley to modern-day Ogden, but the productive lands and waters of the Timpanogos Nuche to the south also beckoned. Brigham Young, president of the LDS Church and since 1850 territorial governor of Utah, had instructed his followers years earlier to "shed no blood" – a pragmatic policy that preserved amicable relations with Native peoples during the Mormons' overland journey. But Mormons retaliated violently after Nuche raids on their livestock. When the church sought to launch a permanent settlement in Utah Valley, the Mormons promised to never evict the Timpanogos from the valley and received reluctant permission to plant their colony on the lower reaches of the Timpanoquint (Provo River) in March 1849. They named it Fort Utah.

The following summer, three Mormons murdered a Timpanogos elder, sending already tense relations spiralling downward. The First Indian War that followed killed well over one hundred Nuche and drove many others from their homes. By the end of the fighting, the Mormons had a permanent foothold in Utah Valley. Later, Brigham Young justified the war in stark terms – "We were [told] three years ago – if we don't kill those Lake Utes, they will kill us – every man told us the same – they all bore testimony the Lake Utes lived by plunder and robbing – if we yield in this instance – we have to yield this land." The violence of 1850 was just the beginning of two decades of intermittent conflict that

ended with the forced removal of the Nuche from the Wasatch Oasis and central Utah. As Mormon populations increased, tensions remained at the surface.

### Native Displacement

Following failed experiments to "civilize" the Nuche on "Indian farms," both church leaders and the federal government agreed on Nuche removal to the Uinta Basin. The area held little interest for the Mormons. Young's survey party had deemed it "one vast contiguity of waste, and measurably valueless, except



Paiute Girls Carrying Water, 1878. Woven water carriers were sealed with pine pitch, an innovation that allowed for the preservation of each precious drop. Utah State Historical Society.

for nomadic purposes, hunting grounds for Indians and to hold the world together.”

An oasis it was not. In 1861 Abraham Lincoln issued an executive order establishing a reservation for the “Indians of Utah” in the basin. The Spanish Fork treaty of 1865 achieved legal removal, but it was the protracted

Black Hawk War, which first flared in the Sanpete Valley that same year, that truly effected Nuche removal. While the Uinta Basin seemed valueless to some at the time, it was within the Colorado River watershed. Utah’s growth and limited water supplies would lead to a renewed interest in Ute water in the twentieth century.

## Watery Creation Stories

**F**or many Native peoples, all creation began as water. The tales that explain the creation of the earth from water are collectively known as “Earth Diver” stories. According to a Shoshone telling, water originally covered the entire earth. There were no people, only the Creator and his three sons – Otter, Beaver, and Muskrat.

One day the Creator decided that they should know what was beneath all that water. Otter, the oldest and strongest, said he would dive to the bottom and find out. Otter swam toward the bottom, but, try as he might, he could not get there. He returned to the surface exhausted and out of breath. Beaver, like his older brother, swam as hard as he could but failed to find the bottom. It then fell to Muskrat, the youngest and smallest, to try. Muskrat swam harder than he ever had before, causing him to run out of breath and pass out. After a long time, he finally floated to the surface. Creator revived Muskrat and found a chunk of mud stuck to his nose, proving he had made it to the bottom. Creator took the mud and rolled it in a ball and blew on it to dry it out. That mud became the earth and the home for all living things.



*Placing the Stars Basket*, Peggy Rock Black, 1995. Diné creation stories tell of First Man, who journeyed with his people through worlds of oceans, rivers, bubbling lakes, and floods to reach the Fourth World, where he began placing stars in the sky to provide light at night. State of Utah Alice Merrill Horne Collection, Utah Division of Arts & Museums.

Skull Valley Goshutes tell a version of another common tale among Great Basin peoples that explains how different tribes came to be. Their story reflects their affinity to Great Salt Lake as well as their relationship to water in Utah’s harsh West Desert. Coyote, the trickster protagonist of all versions of this story, came upon a young woman one day. She took him back to her home, which she shared with her mother, on an island in the middle of a big lake. Coyote stayed with the women, and soon both were giving birth to countless children.

One day Coyote wore out his welcome. The women told him to

leave and take with him a great woven basket. They warned him never to look inside. Coyote left with the basket, and as he walked it grew heavier and heavier. Unable to contain his curiosity he lifted the lid ever so slightly to peek inside. In an instant some babies sprang from the basket and ran away. As the days wore on, he kept repeating the same mistake and each time more babies escaped. Some became the Shoshones, others were Utes, and still others were Paiutes. The very last babies to escape were covered in dry dust and tougher than the other people. They were Goshutes.

# SAINTS IN THE OASIS AND IN THE DESERT

**W**ater is central to the Mormon cherished narrative of hardship, trial, and triumph.

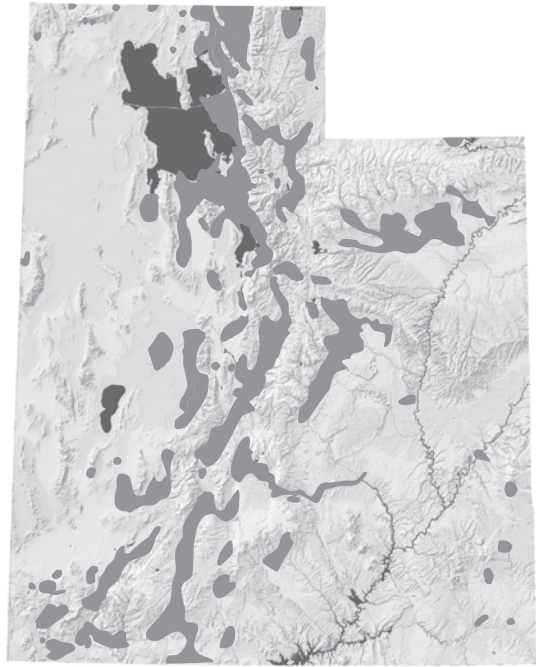
Water is life. In Utah's history and lore, the members of the Church of Jesus Christ of Latter-day Saints (who commonly refer to themselves as "the Saints" or Mormons) have had a unique and abiding relationship with water. Water is central to the faith's cherished narrative of hardship, trial, and triumph. Fleeing persecution in the East, Brigham Young led the Mormons into the desert, where they faced a new life in a hostile, unforgiving land. Through hard work and with a shared sense of purpose, they set about to control and channel the desert's limited waters to build the communal agrarian life that sustained the faith and, in the process, make the desert "blossom like the rose." The whole story is, of course, more complicated.

As we have already seen, Mormon colonization came at the expense of Utah's Native peoples. And while the scope and success of Mormon irrigation led the renowned historian Donald Worster to call them the "Lord's Beavers," hardships and setbacks have also marked Mormon water ways.

## Encountering the Wasatch Oasis

Brigham Young famously declared upon entering the Salt Lake Valley that, "This is the right place." His confidence had far more to do with the desire for isolation and independence than ideal conditions for agriculture. Still, the place that Young chose for the Mormons' "Camp of Israel" was an oasis zone, not a true desert.

In the summer of 1847 waist-high grasses covered the Salt Lake Valley. Sagebrush and oak provided ample firewood, although one would have needed to climb to higher elevations to find timber for building. Most importantly, seven perennial streams running out of the mountains laced through the valley on their way to the Jordan River and Great Salt Lake. It was surely an arid land compared to the New England homelands of so many in the pioneer company, but it had obvious potential. "This land is beautifully situated



## Settlement in Utah Since 1847

Areas of settlement most often overlap the areas with the greatest water resources.

for irrigation," remarked Mormon settler and scribe William Clayton, who also noted the richness of the soil and the "good prospect of sustaining and fatt[en]ing stock with little trouble."

These conditions did not come as a surprise to Young and other church leaders who had pored over sources like the official report of John C. Fremont's expedition, overland trail guides, and the accounts of mountain men. They knew that the oasis at the foot of the Wasatch range offered their best chance for survival and isolation. It was later generations, perhaps in awe of the pioneers' achievements and aware of the extreme hardships that Mormon settlers faced elsewhere in the true deserts of the Great Basin and Colorado Plateau, who actively re-remembered the Wasatch Oasis not as a fertile grassland but as a barren, desert wasteland.

Despite the land's promise, the pioneer company arrived at the height of summer and, with the specter of a hungry winter ahead, raced to get crops in the



1000 South Canal, Salt Lake City, 1913. Such canals were common in early Salt Lake City. The poplar trees stabilized the banks as farmers manually dredged deeper to encourage water to spread through the settlement. Utah State Historical Society.

ground. After staking out a field for potatoes, several teams went to work plowing. Others began building a dam on City Creek and scraping crude ditches to carry its waters to the field. The first potato patch was under irrigation by the time Brigham Young arrived the following afternoon, July 24, 1847. While celebrating their success, the pioneers hoped and prayed that in the coming year rains alone might sustain farming. Young, ever practical, instructed the settlers to make preparations for irrigating should their prayers go unanswered. While the valleys and benches of the Wasatch Oasis get between thirteen and twenty inches of precipitation each year, unfortunately for the pioneers only a fraction of this falls during the summer growing season when it would be able to support agriculture without irrigation.

By June of 1848, the optimism that winter and spring moisture might prove sufficient faded as crops withered in the field, and it became clear that irrigation would be a condition for survival. Wilford Woodruff, an LDS apostle at the time, recalled that nearly everyone in the advance party were New Englanders like him and, "Of course [they] had no experience in irrigation." The pioneers would have to teach themselves on the fly.

Early Mormon irrigation efforts in the Wasatch Oasis fit into the same general mold: simple works built with communal investment and labor. The Mormons were short on surveying equipment and engineering

experience, leading them to carry out their plans through improvisation – bottles or pans filled with water served as rudimentary levels – and trial by error. They hastily built dams, like those on City Creek, out of piles of rock, earth, and brush that raised water levels just enough to allow diversion; spring floodwaters regularly swept them away. Even if a dam survived,



Addie Miles sits on a "go-devil" used to haul water, Brown's Park, c1920. "Go-devils" were improvised farm tools used to haul heavy loads or even plow canals. A crude substitute for (often) unavailable purpose-built equipment, go-devils were finagled from materials at hand. This approach to water control reflected community problem-solving and material resourcefulness. Uintah County Library Regional History Center.

## Cultural Landscape

In 1861, Samuel Clemens, better known as Mark Twain, passed through Salt Lake City, and later immortalized his visit in the pages of *Roughing It* (1872). Twain marveled at the tidy, orderly city, and his description of Salt Lake City was quite idyllic due in large part to water.

*“Next day we strolled about everywhere through the broad, straight, level streets, and enjoyed the pleasant strangeness of a city of fifteen thousand inhabitants with no loafers perceptible in it; and no visible drunkards or noisy people; a limpid stream rippling and dancing through every street in place of a filthy gutter; block after block of trim dwellings, built of “frame” and sunburned brick – a great thriving orchard and garden behind every one of them, apparently – branches from the street stream winding and sparkling among the garden beds*



*Home Main Street*, Carlos Anderson, 1934, pencil on paper. This illustration of Salt Lake City in the 1870s depicts the orderly grid layout that Mark Twain would have observed when he visited. State of Utah Alice Merrill Horne Collection, Utah Division of Arts & Museums.

*and fruit trees.”*

Cultural landscapes are an enduring combination of natural and built elements that reflect a people’s values as well as their material practices. Although

urban development along the Wasatch Front has largely, but not completely, erased the world that Twain saw, the image of water flowing through small towns remains in rural Utah.

it required annual rebuilding and maintenance. The settlers employed a combination of standard farm implements and make-shift tools, along with copious amounts of animal and human muscle power, to move dirt and rock.

Failures were not uncommon. In one case, the settlers of Portage invested considerable time and money building a canal to carry water from the Malad River to their fields only to discover that the completed canal actually sloped uphill, making it useless. Yet, if they lacked technical skill and equipment, the settlers had the advantage of working within a system of religious hierarchy and group discipline that, although often overstated, helped mobilize communal labor. In the early 1850s, the territorial legislature would pass the first in a series of laws to organize canal companies, providing for the continuing expansion of irrigation in Utah.

Irrigation ditches quickly became part of Utah’s cultural water ways even beyond their material necessity. They are a central element in the distinctive Mormon cultural landscape that is still evident in many Utah communities. Setting out to build compact farming villages reminiscent of those in New England reflected the religious communalism of the early LDS Church and meant that Utah’s settlements would look different from those in other parts of the American West, where isolated homesteads became the norm.

The camp which became Salt Lake City set the pattern. Two weeks after the pioneer company had turned the waters of City Creek onto the fields, a second dam was built a short distance downstream to supply the camp with water. William Clayton recorded, “we now have a pleasant little stream of cold water running on each side of the wagons all around camp.”



## Oasis in the Desert

While the Mormons enjoyed considerable early success – by 1850 there were already over 16,000 irrigated acres in Utah – the geography of the Wasatch Oasis constrained the scope of irrigation. Captain Howard Stansbury, the US Army engineer who arrived in Utah in 1849 to survey Great Salt Lake, noted that the settlements lay within “very narrow limits being restricted to a strip from one to two miles wide, along the base of the mountains beyond which the water does not reach.”

Communities could build and maintain viable, small-scale, irrigation systems in the oasis zone. For this reason, Mormon communities focused their expansion on river valleys such as the Sanpete and Sevier – where the snowpack of adjacent highlands created perennial streams – and on higher valleys such as the Cache Valley and what is now known as the Wasatch Back (the Heber, Ogden, and Weber Valleys), where stock raising preceded irrigated agriculture. Away from these well-watered areas, challenges proved far greater and success more uncertain.

However, an adequate water supply, while certainly a critical factor in shaping settlement patterns, did not alone determine them. Political, economic, and religious concerns also played important roles. Mormon expansion took place in an atmosphere of mistrust and antagonism between the church and the federal government. Building strong relationships with



City Creek Iron and Brass Foundry, Salt Lake City, 1869. Water was useful for more than growing crops. Mormon settlers used water mills to generate power. Utah State Historical Society.

## Pioneer Winter Sports



*Silver Lake Winter Sports*, E. Merrill Van Frank, Centennial Mural Series, 1947, oil on canvas. Utahns have long enjoyed skating, sledding, sleigh-riding, and other winter recreation, just like this crowd at Silver Lake in Big Cottonwood Canyon, c1900. State of Utah Alice Merrill Horne Collection, Utah Division of Arts & Museums.

**W**ater is a key part of Utah’s recreation scene, whether you’re skiing, snowboarding, sledding or ice skating. These days,

snowy roads in Utah are paved and salted, but around the turn of the century, streets across the Wasatch Front were closed to traffic just to be a hot spot for winter fun. Any winter night produced laughing, yelping, and screaming as Utah’s pioneers and their children raced down icy hills, ice skated across the homemade rinks, or sang carols while sleighing city streets bundled up in warm quilts.

Some cities utilized natural wonders for their winter activities, like the ice skating on the frozen-over Bear River. Oftentimes the place to cool off in the summer was also the place to play in the winter, like the Kimball Mill in Bountiful or Silver Lake up Big Cottonwood Canyon. During long winter nights, ice rinks were often

illuminated with burning tires to create a romantic atmosphere.

Perhaps the most popular winter sport during the early twentieth century was sledding. Also known back then as “coasting” or “shinning,” it was most common on steep snow-covered city streets and eventually had to be regulated after a series of accidents. Some cities levied a twenty dollar fine for “coasters” caught in the act, and other cities set aside entire neighborhoods as sledding areas. In Park City, coasters had to skirt around regulations to get their fun in. They developed a code system for signaling each other. “Chisel” meant law enforcement was coming, “Shovel” meant pause the fun for a moment, and “Pick” meant all was clear to keep coasting.

Utah's Native peoples and creating economic self-sufficiency were twin pillars of Brigham Young's plans to preserve Mormon autonomy in Utah. As a result, Mormons would establish communities in more arid environments.

Beginning in 1854, the LDS Church founded five missions to Native peoples within its far-flung domain. The church later founded other strategic settlements to produce critical commodities such as iron, lead, coal, and flax. The largest, and among the most risky, of these efforts brought Mormon colonists to the northeastern margin of the Mojave Desert, the driest desert in North America.

Permanent Mormon settlement in "Utah's Dixie" began with Fort Clara on the Santa Clara River as part of a mission to the local Paiutes. In addition to their missionary duties, the colonists also experimented with planting cotton and other warm weather crops, such as grapes, that might potentially decrease Mormon reliance on outside trade. The results were less than

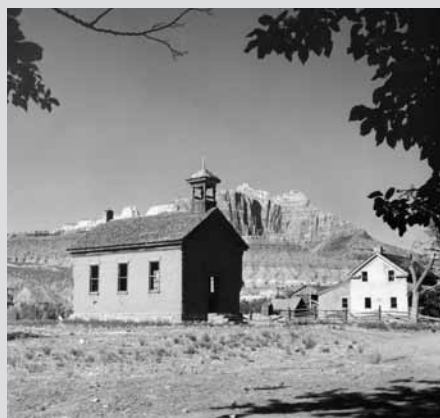


Monument Valley, 1928. Desert water holes are fickle and scarce sustainers of life. Utah State Historical Society.

promising. Water was scarce, and cotton is a thirsty plant. Alkaline soils and blistering summer heat made matters worse. Yet, seven years later, with the outbreak of the Civil War and a spike in cotton prices, Young called three hundred families to go south as part of the "Cotton Mission."

## Water Woes in Grafton

J. Cory Jensen, Utah State Historic Preservation Office



Abandoned schoolhouse, Grafton, c1950. Grafton was mostly abandoned by 1921 due to relentless flooding. Utah State Historical Society.

**N**orthern Utahns' early system of irrigation and water canals worked fairly well, but there were several impediments to irrigation in the south. Sandy soil soaked up water, the water level in streams and rivers was unpredictable, silt built

up in ditches, and flash flooding occurred regularly. Grafton was one of many towns along the Virgin River that struggled with unpredictable water issues – and water eventually forced settlers to abandon it.

A small contingent from the town of Virgin settled a site known as Wheeler in 1859. But Wheeler only lasted until a flood destroyed it in the Great Washout of 1862. Moving a mile upriver, the settlement was reestablished as Grafton. The town constructed an irrigation ditch system and quickly grew. Then, like clockwork, water issues made their presence felt, particularly in the form of silt build-up in the irrigation ditches. The high rate of build-up required farmers to dredge the ditches at least weekly, if not more, to keep water flowing.

In 1866, the Black Hawk War led Grafton's residents to evacuate the town, and a series of severe floods during this time discouraged many from moving back. But others were determined to not let the water situation drive them away. For those who doggedly returned to Grafton, flooding continued to destroy farmland, and the number of residents dwindled to four families by 1890. In 1921 the local branch of the LDS Church disbanded, leaving the town void of any institutional or public presence. Two decades later, in 1944, the last hold-out family left Grafton. The settlement ultimately became one of the most famous ghost towns in the West – featured in films such as *Butch Cassidy and the Sundance Kid* and *In Old Arizona* – all due to its lost war with water.

More families followed, and eventually more than 3,000 Mormon settlers moved into the deserts of southwest Utah and southeastern Nevada in the early 1860s. St. George was established in late 1861 at the confluence of the Virgin and Santa Clara Rivers. By the middle of the decade, Mormon communities had scattered along the course of the Virgin River, from the gates of modern-day Zion National Park in Springdale to St. Thomas in Nevada, which would later be submerged beneath the rising waters of Lake Mead in the 1930s. The Virgin River was both the savior and the curse of the settlements in this area of extreme aridity, where St. George sees less than nine inches of precipitation in an average year.

## Dangers of Flooding

Ironically, more often than a lack of water, destructive floods threatened life and livelihood. In dry times the Virgin River can be little more than a trickle, generally insufficient for the scale of agricultural production that Brigham Young desired. But the Virgin is also prone to disastrous flooding, as it is a steeply dropping river that drains thousands of square miles of high mountains and plateaus. The river washed away dams built on quicksand bases, requiring their rebuilding annually, if not more often. Flooding ultimately forced a number of communities to relocate to higher, safer ground and caused the permanent failure of others.

Fort Clara was one such example. In late 1861, it was a thriving community surrounded by orchards and irrigated fields, laid out in and around a stone fort. Across the river to the southwest was the focus of the mission, the Nuwu (Paiute) village. A recent influx to the Cotton Mission – Swiss-born Mormon converts – had swelled the population, and the mission surveyed homestead lots for the families about a half mile downstream of the fort.



Flooding, St. George, 2005. A house hangs precariously over the flooded Santa Clara River. Trent Nelson, Salt Lake Tribune.



Downtown Flooding, Salt Lake City, 1983. Community residents came out in force to fill and place sandbags, working side-by-side to divert the sudden, massive floodwaters. Tom Smart, Deseret News.

The new arrivals immediately set about damming the Santa Clara and building ditches. After they finished their initial work on Christmas Day, it began to rain. Although they had no way to know it, the rains marked the beginning of a month-long deluge that would devastate communities in California, Oregon, Nevada, and Utah.

Catastrophic flooding hit Fort Clara on the morning of January 17, 1862. Diarist Mary Judd likened the floodwaters to the “sea as it came out of the [canyon] and spread over the bottoms from hill to hill.” The waters drowned livestock, carried huge cottonwood trees, and destroyed the gristmill. By afternoon the waters had receded, but overnight the river rose again. Floodwaters reached the fort and began undercutting its foundation, then burst through the north gate and engulfed the fort in several feet of water, precipitating a mad scramble to save the occupants and salvage what could be carried.

The next morning the extent of the destruction became apparent. Mud and debris covered the land where orchards, vineyards, and fields had stood. Mormon settler and diplomat to the Nuwu Jacob Hamblin wrote that “there was not a single rock of the old fort to be seen but a channel where it once stood, the schoolhouse and 7 other houses above the fort had also disappeared and in their place roar now the wild torrents of the river.” In what afterwards became known as Santa Clara, the residents began to rebuild their community. Historical records do not document the flood’s impact on the Paiutes, but the waters most certainly destroyed their gardens and drove them from their village as well.

If the “Big Washout” of 1862 was an extreme example, it was not a unique event. A century and a half later on January 11, 2005, another winter storm sent floodwaters roaring down the Santa Clara and Virgin

Rivers, doing millions of dollars of damage in the cities of Washington, Santa Clara, and St. George. Between these two great floods came many others, some nearly as large, as well as just as many droughts.

Unlike the more predictable and manageable climate of the Wasatch Oasis, the deserts of southwest Utah and the Colorado Plateau challenged and sometimes

broke the people who tried to live there. Well into the twentieth century the natural cycles of the desert made for an uncertain life. Juanita Brooks, one of Utah's most revered historians, likened her people's struggle with the cycles of flood and drought to an endless war in which neither side could ever claim victory. "The people cannot conquer the river;" she wrote, "it cannot shake them from its bank."

## The Massacre at Bear River



Darren Parry, then Chairman of the Northwestern Band of the Shoshone Nation, Bear River Massacre Site, 2017. The Northwestern Band purchased the massacre site and is now building a memorial and interpretive center there. The plans call for replanting native willows and other waterside vegetation. Sean Dolan, Herald Journal.

In January of 1863, Boa Ogoi, the life-giving river so central to the Newe, became a place of death. A few months earlier, Colonel Patrick E. Connor came to Utah with a battalion of California volunteer troops with orders to stop the raids along the overland trail. Connor employed brutal tactics to achieve this goal, ordering his men to "destroy every male Indian" they encountered in the vicinity of the raids. Growing conflicts between Mormon settlers and the Newe in Cache Valley soon drew Connor's attention.

Twice in late 1862, Connor's troops clashed with Newe bands. In one instance, the troops executed four captured Newe men and threw their bodies into Boa Ogoi,

all in full view of their fleeing kin. In retaliation, two white miners passing through Newe country were killed.

In early January, the territorial court issued an arrest warrant for Newe headmen, including Bear Hunter and Sagwitch. When the marshal approached Connor for assistance in making the arrest, the colonel replied that he had already made his plans and that it was not his intention to take prisoners.

From settler reports, Connor knew where to find the Newe. They were encamped on a small creek flowing into Boa Ogoi that, due to nearby hot springs, was a favored winter camp. Indeed, many more Newe had recently gathered there

to celebrate a "warm dance" to hurry the coming of Spring. On the brutally cold morning of January 29th, Connor's cavalry appeared on the bluffs overlooking Boa Ogoi. Sagwitch was the first to see them and beseeched his people not to fire first. The troops dashed his hopes for a peaceful settlement as they crashed across the icy river and opened fire into the village. The Newe defended themselves the best they could, but Connor soon overwhelmed them. People fled in every direction, some seeking refuge in the willows along the river. By the time the slaughter ended, more than 350 Newe women, children, and men lay dead. One estimate put the death toll at nearly 500. It was the single worst massacre of Native peoples in the American West.

The Newe story did not end with the Bear River Massacre. Sagwitch survived, as did others who continued to look to his leadership. In 1873, on the lower reaches of the Boa Ogoi near the town of Corinne, Sagwitch joined the LDS Church, as did many of his followers. And while today the members of the Northwestern Band of the Shoshone Nation have assimilated into communities along the Wasatch Front, their culture and stories remain.

# DIVIDING THE WATERS

Water law in the West has determined who gets access to a finite resource.

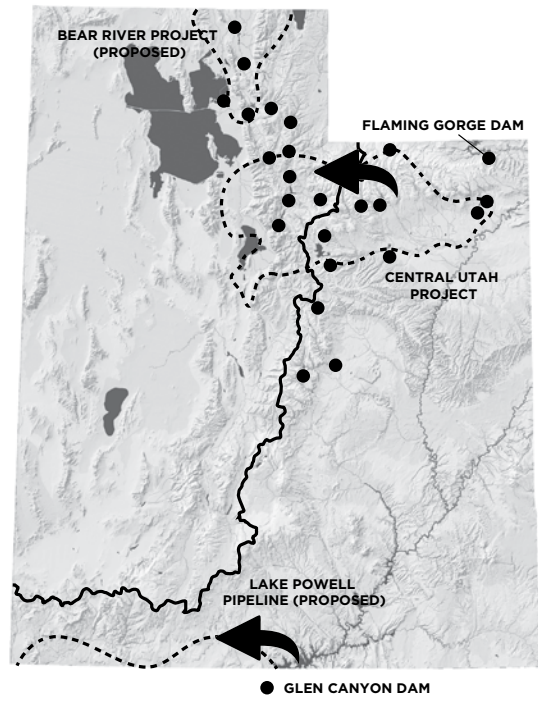
Water is life. This undeniable truth means that, throughout history, people have most often viewed water as a community resource to be managed for the benefit of society. Yet despite this ideal, not all individuals or communities have always had equal rights to or access to water. How a society divides the waters is a critical part of any people's water ways.

In the United States there have been two dominant legal doctrines that have governed the allocation of water: *riparian rights* and *prior appropriation*.

Riparian doctrine ties water rights to land ownership. Anyone owning riparian lands – land along a river or stream – has the right to reasonably use its waters, provided they do not diminish the resource for others downstream. Riparian doctrine originated in English common law and worked well in the humid East where, like the British Isles, ample rainfall meant farmers did not need to divert water to their fields. Streams provided water for household consumption and served as a power source for mills. Those without riparian property generally relied upon wells for their water.

In the West, however, a different standard would take root – the doctrine known as prior appropriation. Prior appropriation rests on two principles: “first in time, first in right” and “beneficial use.”

In contrast to riparian doctrine, prior appropriation separates water rights from property ownership; simply owning land along a stream does not guarantee its use. Obtaining that right requires establishing a *priority date* by filing a claim with an official such as the state water engineer. Those with earlier priority dates possess *use rights* that are senior and superior to others with claims on the same stream or source. Only the priority date matters, not the location of the right holder's property or the place of diversion. This means that in dry years senior water users could



## Utah's Major Water Infrastructure

- Dam
- ← Flow of (inter-basin) water transfer
- - Area impacted by water project

demand their full allotment even if junior rights holders go dry. First in time, first in right! Emerging first in the California gold fields, the doctrine was a reflection of both the West's aridity and the developing capitalist economy of nineteenth-century America.

The doctrine also rests on a requirement for action; this is where beneficial use comes into play. Under prior appropriation, water is still considered a community resource, not private property. It is the right to use a specified amount of water that is possessed, not the water itself. It cannot be held for speculative purposes or sold to others for a profit.

Consequently, rights holders – whether they be individuals, corporations, or municipalities – must “prove up” their claim by putting the water to a



Measuring Rain, 1932. The type of precipitation that falls in Utah is important, as the state's water supply infrastructure is built to capture snowmelt, not rainfall. With water scarce, precise measurements are critical. Utah State Historical Society.

beneficial use, which might include household, municipal, or industrial consumption; stock watering; working a mining claim; or irrigating crops. Failure to do so means loss of the water right. This is why the tenet of beneficial use is often more bluntly stated as “use it or lose it.” Today, some form of prior appropriation is the law of the land – or, more accurately, the law of the water – in Utah and all other Western states.

## Church Control

The actual application of any legal doctrine, however, has always been embedded within the unique social and political history of a place. In the first decades of Mormon settlement, Brigham Young and other church leaders worked to establish an agrarian society that reflected their communitarian values. Only later would water law in Utah come to more closely resemble prior appropriation.

In addition to preserving water as a community resource, the Mormons aimed to keep outside influences – including the federal government – at bay. They understood that controlling access to water could be a potent tool in pursuit of both of these goals. Into

the 1880s, Mormon settlers divided the waters in Utah in a way that would sustain their autonomy. While land could be privately owned, water could not.

At the first conference of the church held in the Salt Lake Valley in August of 1847, Brigham Young appointed Edson Whipple as water master, a religious position that would oversee the irrigation of plowed fields. As communities and cooperative irrigation works sprang up throughout the Wasatch Oasis, local clergy followed a similar pattern and administered water rights according to established needs and the perceived spiritual worthiness of the individual. The priority date of a diversion or claim did not matter yet.

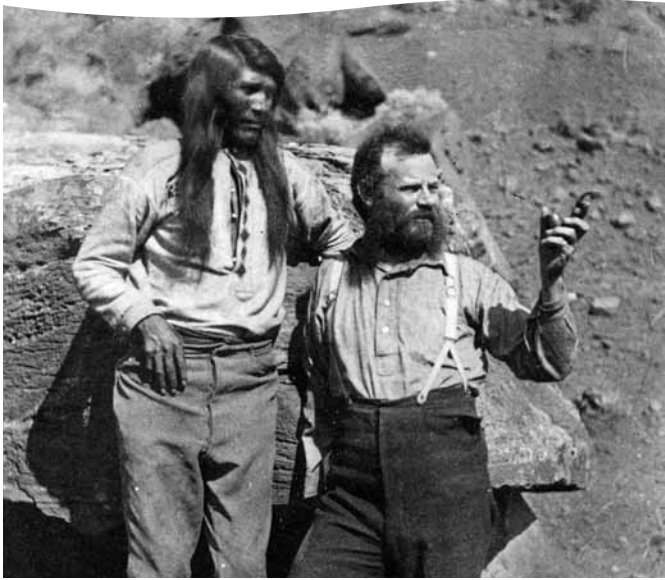
As federal presence in Utah increased, the church moved to decentralize control of water lest federally appointed officials intervene in the process. An 1852 law transferred authority over water and timber resources to county courts (institutions more akin to our modern county commissions), putting these critical resources under local control but maintaining church influence. The courts in turn appointed local water masters whose communitarian values guided them more than a priority-based system of allocating water.

A subsequent 1865 law that allowed residents to organize self-governing irrigation districts also served to sustain local – that is, Mormon – control over water. Under the law, irrigation districts could not issue bonds or assume debts. Only taxes levied on the community that benefited from the irrigation works could finance these districts. The law cut off the possibility of outside investment, but it also prevented outsiders from gaining an interest in precious water resources.

As the Gilded Age got into full swing, however, individual capitalism grew more appealing in formerly communitarian and inward-looking Utah. In 1880, the



Enterprise Dam, Washington County, c1910. Water catchment in flood-prone southern Utah developed as a way to regulate extremes in the flow of water, as well as use rights. Utah State Historical Society.



John Wesley Powell with Paiute Chief Tau-gu, 1871. Between 1871 and 1873, Powell and his crew set up their scientific survey headquarters near Kanab, Utah to maintain access to much-needed supplies, labor, and friendly company. It was here that Powell developed his ideas about watersheds. J.K. Hillers, U.S. Topographical & Geologic Survey, courtesy Utah State Historical Society.

territorial legislature repealed the 1852 statute and charged county water commissioners with recording water rights and determining superior and inferior rights based on seniority. Prior appropriation had effectively become Utah law.

## John Wesley Powell

The failure of the Mormons to create a truly autonomous commonwealth notwithstanding, their success in collectively organizing and sustaining irrigation projects drew the notice of outside observers. Most notable was a Union Army veteran named John Wesley Powell who found valuable lessons in the Mormons' experience for dividing the waters and "reclaiming" other parts of the American West.

A largely self-trained scientist and college professor who lost his right arm in the Civil War, Major Powell became one of the most famous government explorers

## Georgie White: Woman of the River



Georgie White blows a horn, Colorado River, 1980. A commercial river-running pioneer, White was known for leading daredevil river rat adventures. Colorado Plateau Archives (NAU.PH.2006.46.465), Cline Library, Northern Arizona University.

John Wesley Powell's 1869 exploration of the canyons of the Colorado paved the way for a new recreation industry in Utah: river running. Powell and his crew were hardly in search of danger – or even fun. Due to the hardships

of the river, Powell's crew pleaded with him to abandon his research, worrying "We surely will all die if we continue on this journey." But by the following century, white water rafting pioneers such as Georgie White helped establish a culture of commercial river rafting by seeking out the thrills of navigating the rapids.

Georgie White first saw the Grand Canyon on a hike with her friend Harry Aleson in 1944. They couldn't afford a boat, so the following summer, White and Aleson swam through powerful currents and near-hypothermic conditions during their 3-day, 60-mile trip to Lake Mead. White was hooked.

With the end of World War II, surplus boats were plentiful, and the pair obtained a neoprene raft that proved ideal for running rapids. White ran many trips alone in Grand Canyon – sometimes up to three weeks – before she hit upon the idea of "sharing the expense."

In 1951 her new Royal River Rats company began regular no-frills raft trips, and by 1955 was guiding passengers down the San Juan, Cataract, Glen, and Grand Canyons.

White was the first woman to run the Grand Canyon as a commercial enterprise, and developed the "G-Rig," which was three rafts lashed together for stability in large rapids. After a successful passage through Grand Canyon, White would initiate her passengers into the "Royal River Rat Society" by breaking a raw egg over their heads. *Life Magazine* called her "a new kind of iron-nerved mermaid." She was known to navigate the G-Rig with the tiller in one hand and a beer in the other, wearing a full-length leopard-skin leotard.

Georgie White's passion for river-running kept her in business for 45 years, until her death at 81. She once said, "I fell in love with the river, married it, and I don't plan no divorce."



Diversion Tunnel, Glen Canyon Dam, 1959. John Wesley Powell named the Colorado River's Glen Canyon, and the canyon's dam created Lake Powell. A.E. Turner, U.S. Bureau of Reclamation, courtesy Utah State Historical Society.

of the nineteenth century. On May 24, 1869, he and nine other men set out from Green River Station, Wyoming Territory in four small boats to explore the canyons of the Green and Colorado rivers. Just over three months later, the six remaining members of the expedition spilled out of the Grand Canyon and reached the Mormon settlement of St. Thomas at the mouth of the Virgin River.

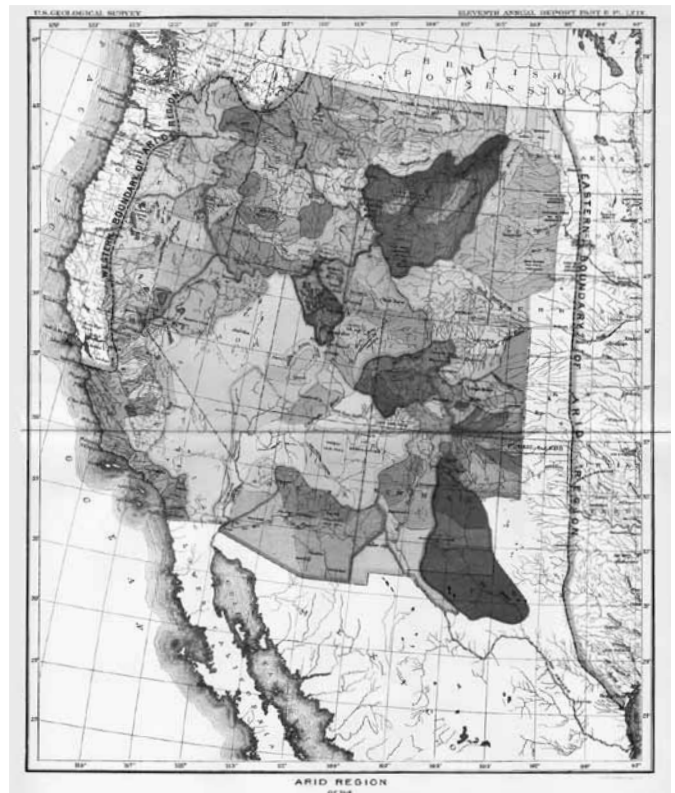
Along the way they lost one boat, passed through or around hundreds of life-threatening rapids, faced near starvation, were racked with internal dissension, and saw four of their comrades abandon the expedition (three of whom left to meet an uncertain fate only two days before the rest reached safety). Yet they had also succeeded in traversing over nine hundred miles of the most forbidding and remote unmapped lands remaining in the United States. Powell became a national figure and returned two years later to lead a second, better financed, and more expansive expedition.

These were epic adventures indeed, and they continue to inspire modern adventurers. River runners still float through Utah's canyonlands with a copy of Powell's *The Exploration of the Colorado River and its Canyons*. Reading aloud from the volume, while passing the many landmarks that the major named or while sitting around the evening campfire, has become a familiar ritual for

recreational river runners. In the popular mind, Powell has become a sort of spiritual godfather of river running as well as a symbol for the conservation of wild rivers. Yet as beloved as these images have become, they are modern perceptions that do not accurately reflect the man or the time in which he lived.

Hardly a reckless thrill seeker, Powell was an ambitious man of science who thought deeply about his nation's future. His expeditions garnered him fame and launched a long career in federal service during which he collected, documented, and studied the natural history and human cultures of the United States. Remarkably, for thirteen years he directed both the US Geological Survey and the Bureau of American Ethnology (the forerunner of the Smithsonian's Anthropology Department).

If Powell was passionate about the sciences, he was also driven by a powerful vision of American economic democracy that both impelled his Civil War service and shaped his later thinking on water and Western settlement. He grew up in a place and time where people revered the freeholding, independent farmer as the cornerstone of the American republic. Sustaining that way of life, he and so many others of his generation believed, would ensure the nation's survival.



Map of the Arid Region of the United States Showing Drainage Districts, John Wesley Powell, 1890-1891. Powell offered a new vision of the American West sectioned off by watersheds rather than arbitrary political boundaries. U.S. Geological Survey.





Emery County Project Dedication, 1966. Bureau of Reclamation Commissioner Floyd Dominy, whose dam-building legacy looms large over the arid West, participated in planting trout in the newly-created Joes Valley Reservoir. These types of water storage facilities are now common in Utah mountains. Utah State Historical Society.

The expansion of slavery posed the greatest threat to free labor and free men in the years before the American Civil War. But with the Confederacy vanquished and white Americans again moving west, another challenge had emerged – the environment itself. West of the hundredth meridian, less than twenty inches of rain fell in an average year, making farming without irrigation precarious or downright impossible. How could American agrarian democracy, raised up in damp Eastern soils, be transplanted to the parched lands of the American West? This great question consumed Powell. To answer it he would propose a radically different way of dividing the waters and settling the land that, had it been adopted, would have transformed the political and physical face of the American West.

### Natural Watershed Districts

Powell began drawing his “blueprint for a dryland democracy” in his 1878 *Report on the Lands of the Arid Region of the United States*. He completed his sketches over the next dozen years in subsequent reports, congressional testimony, and a series of magazine articles. First, he called for Americans to honestly confront and accept the environmental limitations that aridity in the American West imposed. Inhabitants could only irrigate perhaps three percent of the land – today, there are about 1.2 million acres under irrigation

in Utah, roughly two percent of the state’s land area.

Bringing 100 million acres under irrigation to provide homesteads for over a million American families would demand concerted planning, an enormous amount of money, and cooperative labor. It would also require making intensive use of every drop of the region’s scant water. It was not a question that the West’s rivers should – indeed, must – be tamed. “Conquered rivers are better servants than wild clouds,” Powell wrote.

Technological mastery was just part of the answer. The heart of Powell’s proposal entailed redrawing the arid West’s political boundaries to align with its natural watersheds. The straight lines of an imaginary survey grid most often marked existing state, county, and township boundaries, artificially dividing watersheds and making conflicts over water rights inevitable. Instead, under Powell’s plan, nature’s division of the waters would dictate social and political geography and determine water rights. In the American West, that meant that *natural districts* – 200 or more watershed units – would effectively replace a handful of big, squarish states.

How might this have worked in practice? Water rights would accompany land ownership, but, unlike with riparian doctrine, the quality and location of the land would be central considerations. Powell divided major watersheds into three types of districts where a

rational assessment of each district's potential would determine settlement patterns.

First-class, or *headwaters districts*, stretched from the mountains to the fertile valleys immediately below. These, the most desirable and promising districts for irrigation, would keep all of the water that might be used. To preserve a democratic society of freeholders and keep out monopoly interests, the plan would limit ownership of irrigable lands in the watershed districts to single, eighty-acre tracts, and all reservoir and canal sites would be kept as district property. With the exception of mines and townsites in the first-class districts, the plan would also close all non-irrigable lands to development (essentially mountainous timberlands). The federal government would retain ownership in perpetuity and manage them to preserve the health of the watershed, with control vested in the people of the district.

Below the headwaters lay the second-class, or *river-trunk*, districts. Here the residents could build reservoirs below tributary streams and on the main

stem to collect local waters and to capture the waters that might flow down from above, respectively. But, in recognition of the land's more limited potential, their water rights would always be inferior to those of upstream water users. The third-class districts, which Powell gloomily labeled "lost-stream districts," would only possess rights to the meager water that might be trapped within their boundaries. These districts would have a small and widely scattered population.

The first step in reordering Western settlement and water rights along these lines would have been a comprehensive irrigation survey of the region. With the initial support of powerful Western politicians like Nevada senator William Stewart, who hoped the project would facilitate rapid and unfettered development, Congress funded the irrigation survey in 1888. Powell got to work.

How then did Powell's plan actually turn out? We will never know. His concept of autonomous watershed commonwealths did not sit well with the boosters, railroads, cattle barons, and timber companies – or the politicians, most notably Senator Stewart himself – who

## Use It or Lose It: Honerine Tunnel Orchard

### MINING COMPANY'S ORCHARD INSPECTED

TOOELE—Business men and citizens of Tooele were guests of B. G. Sweet Friday afternoon on a visit to the Combined Metals Reduction company's fruit orchard at Bauer, of which Mr. Sweet is superintendent. The purpose of the visit was to display the most abundant fruit crop that has been raised in the orchard in the past five years.

The orchard, which consists of 152 acres, contains 9000 fruit trees, of which 8000 are apples, the remainder being peaches, apricots and plums.

The water which comes from the mine is used to irrigate the orchard.

Article clipping, *Salt Lake Telegram*, July 28, 1934. Using runoff water from the Bauer Honerine Tunnel to grow fruit allowed the mining company to retain water rights. Utah Digital Newspapers.

Water from the Honerine Tunnel that drained mines in the Oquirrh Mountains supported one of the largest apple, apricot, and peach orchards in the state. The

story of how a mine company came to operate a fruit orchard shows the clever use of a limited water supply, as well as the potential drawbacks of seeking to "use or lose" every drop.

After decades of mining in the Oquirrh Mountains, Tooele mines started to shut down in the early 1900s because vast reservoirs of groundwater blocked access to new ore deposits. The Honerine Tunnel was constructed in 1903 in an attempt to revive mining operations. It was seven feet wide, nine feet high, and 4,000 feet deep. A flume that ran below the car track allowed up to 2,000 gallons of water per minute to flow downhill from an underground reservoir.

With the groundwater drained, mining operations continued, and the Bullion Coalition Company purchased the Honerine and all

surrounding mines. Motivated by a need to retain rights to the runoff water, the company's founders Charles L. Crockwell and B. F. Bauer helped establish an orchard of fruit trees at the base of the mine. This water made the Tooele Bauer apple orchard the largest in Utah and the only one owned by a mine. It contained 19,000 apple trees and for years shipped out carloads of fruit around the state.

The heavy metals naturally found in the mine's reservoirs almost certainly had a poisonous effect on the fruit – an effect possibly unknown at the time. In the end, the orchard was abandoned as water was increasingly diverted for ore smelting operations. Ore production and fruit growing may never again be paired in such a way – which is probably for the best.



Flaming Gorge Dam, 1964. The construction of Flaming Gorge Dam on the Green River was met with resistance, and opinions over the finished product were mixed. By the time construction wrapped up in 1964, it wore a price tag of 65 million dollars. Uintah County Library Regional History Center.

looked after their interests. They had a very different vision of capitalist development in the West that would not be driven by Jeffersonian, yeoman farmers.

## Conflict & Litigation

After only two years, with the work barely underway, Congress cut appropriations for the irrigation survey and shuttered the operation. Nor could Powell find support from most average Westerners. Loathe to accept that they could successfully “reclaim” only a tiny fraction of the region, they preferred to embrace promises of unbounded expansion and prosperity.

Such boosterism and unrealistic expectations were on full display when the second International Irrigation Congress met in Los Angeles in 1893. An increasingly demoralized Powell was in attendance. As the delegates approved a platform calling for government intervention to provide irrigated farms for millions of landless Americans, Powell took to the stage to throw a bucket of cold water on their fervor. No matter if they used every river, creek, brook, spring, and well, he asserted, there simply was not enough water to fulfill their grand vision. “Gentlemen,” he concluded, “you are piling up a heritage of conflict and litigation over water rights, for there is not sufficient water to supply these lands.”

The response was immediate. Angry shouts nearly drove Powell from the podium. It would be the last time he spoke publicly on water and irrigation in the West, and the following year he resigned as director of the US Geological Survey. His warning for the future would prove prescient even if Powell’s plan had been firmly rejected. As the American West entered the twentieth century, the contests over water rights only grew sharper as Western states fought for their share of the region’s most precious resource.



Colorado River Commission, 1922. The Colorado River Compact began negotiations, rancorous at times, that would stretch through the 20th century. State engineer R. E. Caldwell, (standing, third from left) who represented Utah, allied with Colorado’s Delph Carpenter (standing, far left) to forcefully advocate for the Upper Basin states. The Denver Post via CSU Morgan Library Archives & Special Collections.

## Colorado River Compact

Nowhere is the “heritage of conflict and litigation” more evident or complicated than in the Colorado River Basin. Like the Nile, the Colorado is an *exotic river*, a river with headwaters in humid highlands that flows through a desert region. Seven thirsty states – including the nation’s five driest – and the nation of Mexico all have claim to the basin’s waters. By the turn of the twentieth century, California already looked to the Colorado River to sustain its booming population growth and its rapid expansion of industrial agriculture.

The other basin states watched with both admiration and apprehension. In 1902, the federal Reclamation Service (now the Bureau of Reclamation) was established, and looming developments on the lower Colorado River would potentially benefit California. The other basin states feared their own economic development could falter if they did not assert their rights to the river.

In 1920, Colorado attorney Delph Carpenter proposed a solution: an interstate compact between all seven states. The plan would supposedly prevent years of costly litigation (Carpenter had recently argued the losing side in a water rights case between his home

state and Wyoming before the Supreme Court) and remove the allocation of water from the hands of unpredictable judges. The following year, Congress authorized the compact, and in early 1922 the Colorado River Commission began its work.

After nearly a year of hearings, stalemates, and negotiations, the commissioners came together in Santa Fe in November to sign the Colorado River Compact of 1922. This, along with subsequent agreements, court decisions, and decrees, has become known as the “Law of the River.” The compact divides the Colorado River watershed into two basins, or “divisions,” at Lee’s Ferry, Arizona, just a few miles south of the Utah border. The Upper Basin includes Wyoming, Colorado, New Mexico, and Utah; the Lower Basin is made up of Arizona, Nevada, and California.

The years leading up to the compact had been unusually wet, and the commission operated under the mistaken belief that, in any given year, at least 15 million acre-feet of water flowed through the system. In fact, natural drought cycles mean that, in many years, the Colorado River carries far less water. The compact promised each basin state 7.5 million acre-feet per year based on this false premise, with later agreements determining each state’s share of that total. For example, under the Upper



President John F. Kennedy, Salt Lake City, 1963. On his conservation tour through Western states with reclamation projects, JFK spoke in support of these massive hydraulic projects and pressed a key to start the first value generator at Utah’s Flaming Gorge Dam. Mel Davis, U.S. Bureau of Reclamation, courtesy Utah State Historical Society.

# Water is Alive

*Hank Stevens, Navajo Chapter President interview with Jedediah Rogers, Utah State Historical Society*



Glen Canyon Dam, 1966. The dam impounds the flow of the Colorado River, transforming a landscape that holds meaning in traditional Diné spirituality and creating an artificial oasis on the arid Colorado Plateau. F. Finch, U.S. Bureau of Reclamation, courtesy Utah State Historical Society.

The impacts of contemporary water management in the West extend beyond simple hydrology. Hank Stevens, a Diné community leader, offers a glimpse of the holistic way that Diné traditions understand the landscape: “Land and water and the atmosphere and the universe – the whole thing is actually interconnected.

“They used to tell us that water is alive. Every living thing has to have oxygen. Even water has to have oxygen. If it doesn’t have oxygen, it won’t flow. And if you look at the water, if you ever look at running water, you’ll see little bubbles in it. ...A Navajo name [for water] is The One That You Can See Through.

“Every living thing on earth, there’s always a female and a male. Even the thunderstorms and the clouds and the rain. The rain that we sometimes

get out here, the male rain, the ones that actually come with a lot of lightning and a lot of thunder, it’s kind of like a male I guess. The soft rain that doesn’t accompany thunder and lightning, that’s the female rain.”

In Stevens’s telling, damming the Colorado River significantly impacted the spirituality and health of the Navajo Nation.

“They say that the San Juan River is the female and the Colorado River is the male. Down here where they used to converge – you don’t see that no more because of [Lake Powell] – [It’s] just north of Navajo Mountain. So a lot of your ceremonies, some of your blessing ways, and when they do an offering, were done right there at that convergence point. But now with the impoundment of the Colorado River we weren’t

able to do that anymore.

“We never really had any type of health problems or anything like that until, in recent years, some of our [people] have become diabetic and some ... are actually dying of heart attacks and all that. If you look at the rivers, that impoundment is pretty much like a blockage in your artery. Both rivers were actually the main arteries of the land. But once you stopped it and held it back... Those are some of the things that some of our traditional people are looking at as to why some of our people are being exposed to some of these health problems.

“When nature was natural, the Creator established these rivers to flow, not to be impounded. During the impoundment a lot of this water, when it started rising, has actually engulfed some of our traditional homes.”

Colorado River Basin Compact of 1948, Utah's share was set at twenty-three percent of the Upper Basin's water, or 1.71 million acre-feet.

The compact, while it has been an enduring cornerstone of Western water law, failed to head off more conflict and litigation. Arizona, for example, refused to sign the agreement until 1944; even then, it remained locked in a legal battle with California for two more decades. For the Upper Basin states, the allocation of water by quantity rather than by a percentage of actual flow posed persistent concerns, especially before they could build major water storage and transfer infrastructure. And finally, the compact proceedings ignored and, in fact, completely excluded one important stakeholder group – Native peoples.

## Paper Water to Wet Water

In water law parlance, *paper water* refers to a legal right and *wet water* means the real thing! Development constitutes the meaningful distinction between the two. Without the infrastructure to collect and deliver water, a right remains only a written promise. Developing the resource makes it real.

As a consequence, there is little incentive to delay development. On the contrary, Western states have tended to push forward as rapidly as possible with water infrastructure projects as a means of turning promise to reality, paper water to wet water.

The initial developments on the Colorado (including Hoover Dam, completed in 1935) benefited the Lower Basin states, especially California. It was not until the Colorado River Storage Project Act of 1956 that the Upper Basin got a comprehensive development plan.



Mechanical Mole, 1971. The 80 ton machine, with its cutting face of 13 feet in diameter, drilled the Central Utah Project's Water Hollow Tunnel. When the aqueduct system was complete, it delivered water to triple the capacity of Strawberry Reservoir. Uintah County Library Regional History Center.

The act authorized both the Glen Canyon and Flaming Gorge Dams as well as a series of participating projects that would develop water resources on a local and regional scale. Among these was the Central Utah Project (CUP).

## Central Utah Project

The largest water project ever undertaken in Utah, the CUP is the cornerstone of the state's plan to fully develop its share of Colorado Basin waters. With multiple units and phases, the still incomplete CUP provides water for Uinta Basin farmers and communities and also supplies the urban Wasatch Front with water for municipal and industrial development.

The CUP's architects designed its Bonneville Unit, an inter-basin transfer that would move water from one watershed to another, to address the conundrum that Utah had long faced. While the sparsely populated Colorado River watershed held far more water, the vast majority of the state's population lived in the Great Basin watershed in the densely populated Wasatch Front. The most direct way to resolve this conundrum would be to tap the tributaries of the Green River in the Uinta Basin.

This idea was not new. In fact, it was first proposed in 1879 and achieved on a smaller scale with the Strawberry Valley Project in the early 1920s. After decades of funding delays and conflicts over environmental impacts, the diversion of water to the Wasatch Front began in 1989. And while the scope of the Bonneville Unit's trans-basin diversion has been scaled back substantially, it will still provide around 100,000 acre-feet of water annually to the rapidly growing communities of Salt Lake and Utah Counties.

## Native Impact

The Ute people, however, view Utah's twentieth-century water development, including the CUP, in a very different light. Rather than a tale of technological triumph and reclamation, it is for many another part of a long history of betrayal and exploitation. In 1865, most of the Uinta Basin, deemed worthless for white settlement, had been set aside as the Ute reservation. By the end of the century, however, white settlers began to covet the basin and its waters.

As early as 1879, a group of farmers in the Heber Valley began a series of projects to divert water from the Strawberry River and direct it west via Daniels Canyon to the Great Basin watershed. By 1895, their works included several canals as well as an eight-hundred-foot tunnel bored through the mountain at the head of



Construction of Strawberry Highline Canal, Salem, 1915. The Strawberry Valley Project was the first major inter-basin transfer of water in the state. Utah State Historical Society.

Daniels Canyon. Even though government officials acknowledged that this was an illegal diversion of water from the Ute Indian Reservation, the principle of “beneficial use,” combined with a disregard for Ute resource management, kept the diversion in place.

Federal Indian policies aimed at assimilating Native peoples also facilitated the cause of white farmers. The 1887 Dawes General Allotment Act empowered the government to break up tribally held reservations into individual allotments. The “surplus lands” that remained would be opened to white settlement.

According to the same Jeffersonian vision that inspired John Wesley Powell, private property and agricultural instruction would transform Native peoples into individualistic American citizens. In practice, allotment did little to assimilate Native peoples, but it did dispossess them. In 1905 the federal government allotted the Ute Reservation, opening much of it to white settlement. However, the government withheld and reserved portions of the Strawberry Valley as a “reservoir site necessary to conserve the water supply for the Indians, or for general agricultural development.” White farmers, rather than the Utes, benefited.

The move gave rise to the Bureau of Reclamation’s Strawberry Valley Project (SVP), the first project the Bureau undertook in Utah. Built between 1906 and

1922, the SVP was also the first substantial inter-basin transfer in the state, moving water from Strawberry Reservoir in the Green River (Colorado) watershed through a tunnel to the Spanish Fork River and the farms of Utah County.

Congress not only denied the Utes the grazing fees owed for the withdrawn lands, it also extinguished the Ute’s title to the land itself, without tribal consent, in 1910. In exchange the Utes received \$1.25 per acre. With the authorization of the CUP, Ute water was once again up for grabs. In 1965, the state and the tribe negotiated an agreement allowing the CUP to divert 60,000 acre-feet of Ute water to the Wasatch Front in exchange for additional CUP projects that would serve tribal lands. Over two decades later, those projects remained unfinished, and in 1989 the government proposed simply paying off the Utes for the nation’s water.

The ensuing, bitter politics within the tribe complicated years of legal wrangling. Eventually, the Ute Nation reluctantly accepted a settlement of \$295 million to be paid over a fifty-year period. Still, work continued on two CUP water storage projects on Ute land until 1999, when a frustrated Ute Business Committee voted to withdraw tribal support and participation. The move effectively killed both projects. Dividing the waters in this way had become “untenable from the tribe’s perspective.”

# UTAH'S WATER FUTURE

We have no crystal ball to peer into, but Great Salt Lake can be a possible window into the future as Utahns learn to adapt to the challenges of climate change and regional population growth.

Water is life. Just as Utahns of the past have adapted to this land of extremes, the state's present inhabitants must meet a new set of challenges. It is imperative to understand how we are using water in order to chart a sustainable course for the future. No single environmental feature has captivated Utah more than Great Salt Lake, and nothing, perhaps, offers a better glimpse of Utah's water future.

What some people might think of as a "dead sea" is a weird and wonderful place that is a vital part of Utah's water ways. It has sustained life, drawn tourists, provided livelihoods, and inspired art and literature. Great Salt Lake is a unique and globally recognized resource. It is fitting then to consider what Great Salt Lake has meant to Utah and the valuable lessons we might draw from it for the future.

## Recreation

For generations, Great Salt Lake was a source of fascination for Utahns and visitors from around the world! Brigham Young led a trip to Great Salt Lake just a few days after the first pioneer company arrived in the Salt Lake Valley. Church leader Erastus Snow reported that the group had a "fine bathing frolic," and, "those that could not swim at all floated upon the surface like a cork." Before heading home, they also gathered some of the fine white salt off of the rocks, anticipating the mineral industry that would soon develop.

On July 4, 1851, nearly the entire population of Great Salt Lake City celebrated the holiday at Black Rock on the lake's south shore. Like most early visits, it was a two-day excursion due to the slow, thirty-five mile round trip from the city. When Great Salt Lake's first resort Lake Side opened on Farmington Bay in 1870,



Population Density by County



the location had the virtue of railroad access even if the beaches were subpar.

Within a few years, a rail line ran to Black Rock, and attendance at south shore resorts like Garfield Beach quickly eclipsed Lake Side's. Saltair, which first opened in 1893, was the grandest of all. The building's original Moorish style pavilion, which sat atop 2,500 pilings some 4,000 feet out from shore, was designed by famed architect Richard Kletting. Saltair's two biggest draws were swimming and dancing. No beach was necessary, as bathers simply stepped from a platform into the water. Dances drew such huge crowds that the Charleston was banned for fear that all the dancers stomping down in unison might collapse the structure.

Over the years, Saltair added more attractions: a roller coaster, Ferris wheel, power boats, and a game midway.





Swimming at Saltair, c1910. Bathing in the buoyant waters of Great Salt Lake was just one of the attractions at what some called "The Coney Island of the West." Utah State Historical Society.

But fluctuating lake levels and fires plagued the resort. The original pavilion burned in 1925, and although a replacement was quickly built, falling lake levels left it high and dry by 1934. The Great Depression and World War II also hurt business.

Changing tastes drove the final nail in Saltair's coffin. In post-war America, tourists turned toward the mountains and to Utah's national parks. The lake no longer held an exotic allure, and the grand Saltair finally closed in 1958. Intermittent attempts to reopen ended when arsonists burned the whole thing to the ground in 1970. A decade later, developers built a new pavilion at its current site on the shore but only kept it in operation for a couple of years before the rising lake swallowed it. When the water receded, it sat vacant until concert promoters bought it in 1991 and reopened it two years later as a live music venue.

Recreation around Great Salt Lake was not limited to the beach resorts. In fact, into the twentieth century, the wetlands northwest of Salt Lake City beckoned Utahns to swim, fish, hunt ducks, and soak in celebrated hot springs. Hot Springs Lake was the centerpiece of this watery landscape. It was a year-round draw with easy access from the city. Industrial and urban development doomed these resources in the

twentieth century. The springs were diverted and the lake dried up and then was paved over. Today, the oil refineries along Beck Street are built upon the former lakebed where Utahns once boated, swam, hunted, and picnicked.

## Economic Resource

Since the first permanent salt works were established on the lake's south shore in 1850, mineral extraction has remained Great Salt Lake's most important and visible industry. Today several major corporations use massive solar evaporation ponds to isolate and extract salt and a range of other chemicals, bringing an estimated one billion dollars to the Utah economy each year.

Although producing only a fraction of the income of mineral extraction, brine shrimping is undoubtedly the lake's most unique and intriguing industry. Cleon Sanders, a tropical fish enthusiast from Ogden, started the industry in 1949. Rather than buying frozen brine shrimp from San Francisco Bay to feed his pets, Sanders decided he could simply collect them from the lake. Soon he launched Sanders Brine Shrimp Company to harvest, freeze, and ship adult brine shrimp for aquarium fish. In 1952, he pivoted to harvesting brine



Southern Pacific Train, Lucin Cutoff, c1959. A causeway across the lake replaced the aging wooden trestle, separating the lake's waters into north and south arms and causing vastly different saline levels. Utah State Historical Society.

shrimp cysts (eggs), as they did not require freezing and were easier to ship. It was an eastern businessman who came up with the idea of selling small packets of brine shrimp cysts as "Sea Monkeys" through ads in the back of comic books.

The rapid expansion of global aquaculture in the 1980s created a massive new market. Newly hatched Utah brine shrimp now feed prawn larvae and fish hatchlings from South America to Southeast Asia. At first the brine shrimpers improvised ways to gather the cysts, but the on-lake harvest has evolved into a highly technical operation. Companies now use spotting planes and fast boats to stake out the richest "slicks" of brine shrimp cysts, all under the watchful eye of the state's Division of Wildlife Resources.

## Transportation

The railroad has transformed the lake's ecology more than any other industry, yet it does not extract anything from its waters. For a railroad engineer, the perfect line is straight and flat. Steep grades and sharp curves not only complicate construction, they also make the line's operation more difficult and expensive. However, given near-historic high-water levels and the limited engineering capabilities of the day, the engineers building the first transcontinental line in 1869 rejected the idea of bridging Great Salt Lake. Instead the Central

Pacific and the Union Pacific railroad lines raced to Promontory Point on the lake's north shore.

The relatively steep and winding Promontory section slowed traffic along the transcontinental line. By 1902, water levels had dropped, allowing construction of a bridge across the lake, the Lucin Cutoff, to begin. The route, completed two years later, included twenty-eight miles of earthen fill embankments and, most famously, a twelve mile trestle that bridged the deepest portion of the lake. At the time it was the longest bridge across open water in the world. Yet, within half a century, the historic wooden trestle was deteriorating, and maintenance costs soared.

The railroad determined that the most cost-effective solution was to replace the trestle with an earthen fill causeway. Finished in 1959 at the cost of \$53 million, it radically changed the ecology of the lake. The causeway effectively cut the lake into a South Arm and North Arm, with only the South Arm seeing any significant inflow of fresh water, via the Bear, Ogden, Weber, and Jordan Rivers. Before the causeway, the lake brine density was probably uniform. Afterwards, largely cut off from fresh water inflow, the North Arm has become hypersaline. Seawater averages about 3.5 percent salt while Great Salt Lake's larger South Arm averages twelve percent; the waters of the North Arm can reach twenty-eight percent salt!



Morton Salt Grantsville Facility, Great Salt Lake, 2016. Mineral extraction continues to be an important industry on the Great Salt Lake. Courtesy John Higgins.

Yet life still survives. *Halophiles*, salt-loving microbes, can survive in these extreme conditions. The carotenoid compounds in their cell membranes give the water in the North Arm its striking red or pink-orange hue. Although breaches cut in the causeway in 1984 and 2016 have helped to mitigate water and salinity levels to some degree, Great Salt Lake is, in a sense, two lakes with two different ecologies.

### High Water Consumption

Great Salt Lake has been central to Utah's water ways, so what can it teach us about our water future? First and foremost, we must understand that decisions we make about our water have consequences far beyond our immediate intentions. Over the past century and a half Utahns have prioritized water development over the health of the lake and its ecosystem. Today, agricultural diversions and rapidly expanding urban water demands premise ever lower lake levels and, perhaps, dire consequences for the Wasatch oasis. We simply can no longer afford to ignore Great Salt Lake.

Like most Western states, Utah uses more water for agriculture than any other purpose. Irrigation accounts for over eighty percent of Utah's water use, with alfalfa – livestock feed – being the most important crop in terms of acreage and dollar value. This leaves less than twenty percent for all other purposes, which are lumped together as *municipal and industrial* (M&I) use. Household water use amounts to about ten percent of the state total, or about half of M&I consumption. If we look even closer at Utah homes, we find that the lion's share of household water is used outside to water lawns. Only two to four percent of the water consumed in Utah each year is used inside the home for drinking, cooking, bathing, and cleaning.

Even so, Utahns are water hogs! In 2015, Utah ranked second in the nation in per capita domestic water use at 178 gallons per day (Idaho came in first at 184 gallons). For comparison, the national average was only eighty-two gallons. While domestic water consumption has been dropping nationally, Utahns have been using more.

In the early twenty-first century, Utah's water ways face two intertwined challenges: population growth and climate change. Utah has been among the fastest growing states in the nation through much of the last decade. This is not a new phenomenon; population growth has remained steady, increasing on average around twenty-five percent every decade since World War II. Utah's population first exceeded one million in the 1970 census, and, in the past half century, it has more than tripled!

### The Urban West

As with precipitation statistics, statewide averages tell only part of the story. Where Utahns live also matters. Utah and the American West, despite the iconic images of big skies and wide-open spaces seen in westerns, are intensively urban places. They always have been, partly as an effect of aridity.

For the past 12,000 years, people in Utah have lived in close proximity to its precious water. Just as the Wasatch Oasis beckoned Utahns of the past, it calls to the state's modern migrants. Today, over eighty percent of Utahns live in the oasis counties. If you throw in the fast-growing counties of the Wasatch Back, the percentage of the Utah population jumps to



Display of Water Pressure, Farmington, c1900. Municipal & industrial water usage in Utah is a mere fraction of agricultural usage. Half of municipal usage goes toward watering lawns. Utah State Historical Society.

eighty-six percent. All indicators suggest that future population growth will largely remain concentrated in the Wasatch Oasis.

The exception, Washington County, has seen even more explosive growth. Fifty years ago, the county was home to fewer than 14,000 people; today that number is nearly 180,000, a thirteen-fold increase. By 2065, the population of St. George and the other desert communities will exceed 500,000. That is a half a million people living in some of Utah's hottest and driest desert landscapes.

The state's changing climate will further compound the water demands of Utah's rapidly growing population. Since the beginning of the Industrial Revolution, greenhouse gases that trap the sun's radiant energy in our atmosphere (such as carbon dioxide) have led to a warming planet. Melting polar ice packs, rising sea levels, and volatile weather patterns are already evident on a global scale. On the local and regional levels, the effects of climate change can vary radically. Some areas, like the Southeastern United States, may see greater rainfall, while others will experience extreme drought. What will climate change bring to Utah? Observed changes and

computer models indicate that we will face warmer and drier conditions with reduced water supplies. Many areas of Utah have already warmed by more than two degrees Fahrenheit in the last century.

### Local Effects

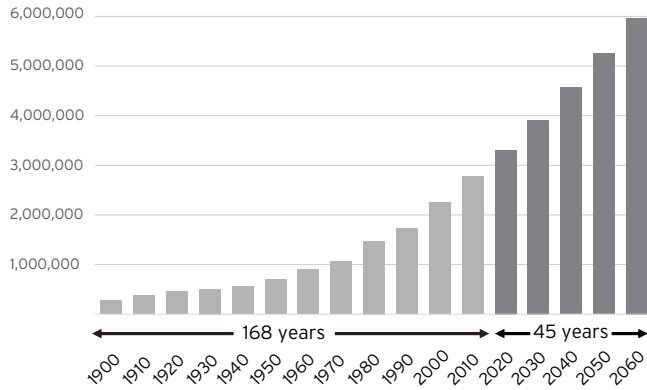
Snowpacks have been in decline statewide since the 1950s. As temperatures increase, snow melt occurs earlier in the year, with a greater share of precipitation falling as rain. This poses real problems for Utah's water infrastructure, which was designed to catch and store spring runoff from the melting snowpack. Warmer summer temperatures will also mean greater evaporative loss from reservoirs, further reducing water supplies.

Does this mean that Utah is running out of water? It depends on whom you ask. Many state officials and water district managers, particularly those in the fastest growing areas like the arid Washington County, say that Utah's water supply is running low. From their perspective, the answer is to tap new supplies and build systems to bring more water to expanding urban centers. They argue that outdated and over-stretched water systems stymie growth and leave communities ill-prepared to face emerging crises.



Alfalfa Hay Field, Sevier County, 1974. Irrigated alfalfa, grown as feed for livestock, is the top agricultural crop grown in Utah. The Sevier River is one of the most over-allocated rivers in the West. Utah State Historical Society.

## Utah Projected Population Growth



This is, of course, not a new idea. As we have seen, the CUP's Bonneville Unit brings outside water to the Wasatch Front. Today, the Lake Powell Pipeline is one of the most costly – and one of the most controversial – projects under consideration. It would pump water 140 miles from Lake Powell through southern Utah and northern Arizona to serve ten cities and towns in Washington County.

For many others, however, such arguments and projects make little sense. Utah, they assert, has plenty of water for today and the future, as long as state and local governments do more to conserve water and stop relying on the building of elaborate systems to increase supply. According to one expert, "We do not have a water crisis; we have a water management crisis."

To be sure, many counties and municipalities have instituted programs to "slow the flow," yet there is much more that Utah can do to conserve water. Critics point not only to conservation measures that domestic and agricultural consumers might take, but also to cutting tax subsidies for water suppliers and letting the market determine the true cost of water.

## Canary in the Coal Mine

According to the old adage, someone else – somewhere – is always downstream. For the Wasatch Front, Great Salt Lake is downstream of everyone and everything! Salts and other minerals continue to wash into the lake as they always have, but now so do fertilizer and pesticide residues from agricultural run-off, industrial wastes from storm drains, and the treated effluent from municipal wastewater facilities.

Today, Utah's underappreciated wonder is threatened. The balance between inflow and evaporation determines the volume of water in Great Salt Lake at any given time. Because the lakebed resembles a plate

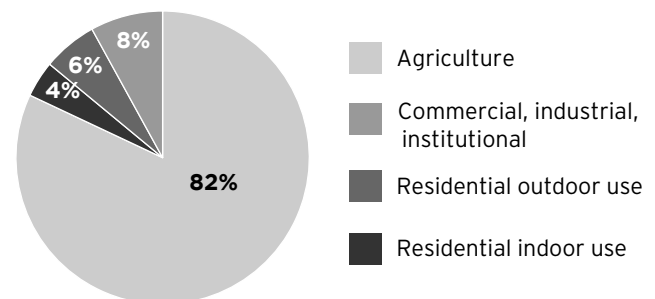
or a shallow pan with a very gradual slope, modest fluctuations in Great Salt Lake's volume translate into substantial changes in its surface area. The lake has always expanded and contracted, rising quickly when inflow exceeds evaporation and falling just as rapidly during droughts.

Great Salt Lake hit its historic low, at least since record-keeping began, in 1963. The surface elevation of the South Arm dropped to 4,191 feet above sea level, and the lake's waters covered about 950 square miles. The lake's historic high-water mark of 4,211 feet came in 1986 and 1987 during a period of record winter snowfalls. In those years, the lake covered over 3,000 square miles, engulfed the new Saltair, overlapped the I-80 freeway, and threatened Salt Lake International Airport. Since that time, however, the lake's surface elevation has trended steadily downward. The evidence does not point to natural cycles but to us.

Great Salt Lake possesses no guaranteed water right, a major reason why it is vulnerable. By 2016, the lake's level was precariously close to the historic low, actually dipping below it in the North Arm. Utah State University released a study that same year which concluded that diversions of the lake's principal water sources – the Bear, Weber, and Jordan Rivers – were largely responsible for reducing its volume by half, dropping its surface elevation an estimated eleven feet, and exposing 550 square miles of mud flats. Future projects to supply the urban Wasatch Front, including the proposed Bear River Development Project, will potentially lower lake levels even more.

As of June 2020, the lake surface is just over 4,194 feet, only three feet above the historic low water mark and six feet below the management benchmark average that the state legislature set in the 1980s. With vast areas of lakebed such as the northwest playa exposed, Gunnison Island is high and dry, and the White Pelican rookery is vulnerable to predators. This is not to say that unusually wet periods will not come again;

## Utah Water Usage



## Waterscape as Inspiration: Alfred Lambourne



*Cliffs at Promontory*, Alfred Lambourne, 1887, oil on canvas. Lambourne homesteaded on Gunnison Island on Great Salt Lake, rendering his experience and inspiration into large paintings well-known for their grandeur. Purchased with funds from Friends of the Art Museum, Utah Museum of Fine Arts, University of Utah (UMFA1987.006)."

The stark and surreal beauty of Great Salt Lake has long inspired artists. One such artist, the painter and poet Alfred Lambourne, came to Utah in 1866 with his parents as recent converts to the LDS Church. Lambourne went on to garner fame for his large panorama-style paintings of Utah scenery and his widely published journals about living alone on Gunnison Island on the Great Salt Lake. Lambourne's works were unique for how they captured Utah's epic, desolate inland sea with a haunting visual beauty.

Shortly after Lambourne arrived in the Salt Lake Valley with his family at the age of 16, he began working as a set painter for the Salt Lake Theater. His self-taught painting skills impressed Brigham Young, and Lambourne accompanied Young a few years later on a trip to document Zion National Park. Mountain vistas appealed to him at first, but he increasingly turned his attention to Great Salt Lake. In the summer of 1895, as he spent many days

sailing on the lake with his yachtsmen friends, he discovered Gunnison Island and hatched his plan for adventure.

Lambourne moved to the island that November while his wife and children remained in Salt Lake City. His intention was to homestead on the island for fourteen months and then use a provision of the Homestead Act to buy his claim outright. His solitude on the island was short-lived; a crew of guano sifters set up operations a short distance from his cabin in the summer of 1896. In truth, it was a lonely life, and he welcomed the company.

Later, when he attempted to file his claim, he was turned away. The mining interests had already succeeded in having Gunnison Island declared a mineral reserve and withdrawn from homesteading. Lambourne returned to the island only once after his plans were dashed, but the lake continued to inspire his painting and writing, including his memoir of his time on the island: *Our Inland Sea*.

While homesteading on the shores, he wrote about standing on "the blackness of unfreezing waters." He described the lake with terror and awe, having felt a "strange sinking of the heart" when realizing his isolation. He wrote about the desolate wilderness around him being "deeper than all imagining" and called it "the savage poem around me."

"There is another phenomenon, to be seen... on the Inland Sea," he wrote, "one that is unpaintable... during the calm summer twilight, when the pale, fairy-like tints on the water are breathed upon by opposite currents of languid wind. As they interplay in bands, in points, in shifting isles of amber, azure and rose, the whole surface shimmers and glistens like a silken robe studded with countless pearls." Perhaps his greatest artistic feat was capturing the loneliness, mystery, and grand beauty of the Great Salt Lake – one that keeps us visiting its briny shores time and time again.

they undoubtedly will, and the lake will rise temporarily. But the long term forecast for Great Salt Lake can only be downward as long as water diversions for urban development mean it has no guaranteed inflow and as long as our warming climate reduces water supplies statewide. Catastrophic changes to Great Salt Lake could transform the oasis zone that most Utahns call home. [Since this essay was first published, Great Salt Lake fell to a new historic low level during the summer of 2021.]

What might the future look like for Great Salt Lake if we do nothing? The Aral Sea, which borders Kazakhstan and Uzbekistan in central Asia, offers a telling example. It used to be the fourth largest lake on earth, roughly ten times the size of Great Salt Lake. Beginning in 1960, however, a massive Soviet irrigation project diverted the rivers feeding the Aral Sea to water some five million acres of cotton and other crops. With no guaranteed inflow, the lake's water levels began to drop. By the late 1990s nearly ninety percent of the Aral Sea was a dry, desolate playa. The productive fishery vanished, and winds stirred up a toxic mix of dust and pollutants, fouling the region's air.

Could Great Salt Lake become another Aral Sea? Perhaps. Recent studies suggest that Utah is already moving in that direction, but also that it is not too late. Researchers at Brigham Young University have found that ninety percent of the dust in the air along the Wasatch Front originates in the dry lakebeds of

Utah's West Desert, impacting not only air quality but also soils and mountain snowpacks. Another study, conducted by atmospheric scientists at the University of Utah, identified four *dust plume hotspots* around Great Salt Lake, including now-dry Farmington Bay, which lies between Antelope Island and the suburban communities of Davis County. The study concluded that if lake level was maintained at 4,200 feet, it would submerge seventy-five percent of the problem areas in Farmington Bay. Conversely, if we do nothing and let lake levels continue to drop, more dust-generating hot spots will emerge. A healthy Great Salt Lake ecosystem is a benefit for us all.

Great Salt Lake is truly the distillation of our decisions and actions. Due to the lake's physical geography, it can act as a sort of hydrologic canary in the coal mine, revealing consequences of those decisions and actions very quickly.

Water is life. It has shaped the stunning, inspiring, and often difficult landscapes of our state. It sustains our very existence and has largely defined where Utahns have lived for the past 12,000 years. And there can be no future without water. While the challenges facing Utahns appear daunting, the story of Utah's water ways can offer us a guide. By trying to understand the natural world, its limitations and reasonable opportunities, and considering the many ways in which Utahns have engaged our precious waters, we might use history to map a sustainable way forward.



NASA Earth Observatory image created using Landsat data from the US Geological Survey, 2011 versus 2016. With no guaranteed water right, portions of Great Salt Lake such as Farmington Bay have seen dramatic decreases in water level. Joshua Stevens, NASA.

Gregory E. Smoak is the consulting state scholar for the Think Water Utah project. As Director of the American West Center and Associate Professor of History at the University of Utah, Smoak specializes in American Indian, American Western, Environmental, and Public History.

## RECOMMENDED READING

Edward Abbey, *Down the River* (Dutton, 1982).

Thomas G. Alexander, *Utah: The Right Place* (Gibbs Smith, 1996).

Ayja Bounous, *Shaped by Snow: Defending the Future of Winter* (Torrey House Press, 2019).

Craig L. Childs, *House of Rain: Tracking a Vanished Civilization Across the American Southwest* (Back Bay Books, 2006).

Craig L. Childs, *The Secret Knowledge of Water: Discovering the Essence of the American Desert* (Paw Prints, 2010).

Jared Farmer, *On Zion's Mount: Mormons, Indians, and the American Landscape* (Harvard, 2010).

Quinn Grover, *Wilderness of Hope: Fly Fishing and Public Lands in the American West* (University of Nebraska Press, 2019).

Heather Hansman, *Downriver: Into the Future of Water in the West* (University of Chicago Press, 2019).

Sondra G. Jones, *Being and Becoming Ute: The Story of an American Indian People* (Utah, 2019).

Eric Kuhn and John Fleck, *Science Be Dammed: How Ignoring Inconvenient Science Drained the Colorado River* (University of Arizona Press, 2019).

Alfred Lambourne, *Our Inland Sea: The Story of a Homestead* (Deseret News, 1909).

Ellen Meloy, *Raven's Exile: A Season on the Green River* (University of Arizona Press, 1994).

Darren Parry, *The Bear River Massacre: A Shoshone History* (2019).

PBS Utah, *Utah's Uncertain Water Future* | <https://www.pbsutah.org/whatson/kued-productions/utahs-uncertain-water-future>

Zac Podmore, *Confluence: Navigating the Personal & Political on Rivers of the New West* (Torrey House Press, 2019).

John Wesley Powell, *The Exploration of the Colorado River and its Canyons* (Government Printing Office, 1875, 1895).

Marc Reisner, *Cadillac Desert: The American West and Its Disappearing Water* (Viking, 1986).

Jedediah S. Rogers and Matthew C. Godfrey, eds., *The Earth Will Appear as the Garden of Eden: Essays on Mormon Environmental History* (Utah, 2019).

Wallace Stegner, *The Sound of Mountain Water: the Changing American West* (Doubleday, 1969).

Terry Tempest Williams, *Refuge: An Unnatural History of Family and Place* (Vintage, 1991).

Donald Worster, *A River Running West: The Life of John Wesley Powell* (Oxford, 2000).

Utah Division of State History, *Glen Canyon Dam Online Exhibit* | <https://utahstatehistory.omeka.net/exhibits/show/glencanyondam/introduction>

"Great Salt Lake," *Utah Historical Quarterly* 56 no. 2 (Spring 1988).

"Edges of the Great Salt Lake," *Utah Historical Quarterly* 87 no. 1 (Winter 2019).

*Western Waters Digital Library* | <http://westernwaters.org/>

## SOURCES CONSULTED

Thomas G. Alexander, "John Wesley Powell, the Irrigation Survey, and the Inauguration of the Second Phase of Irrigation Development in Utah," *Utah Historical Quarterly* 37 (April 1969): 190-206.

Thomas G. Alexander, "Irrigating the Mormon Heartland: The Operation of Irrigation Companies in Wasatch Oasis Communities, 1847-1880," *Agricultural History* 76 (Spring 2002): 172-87.

Leonard J. Arrington and Dean May, "A Different Mode of Life: Irrigation and Society in 19th Century Utah," *Agricultural History* 49 (January 1975): 3-20.

Will Bagley, ed., *The Pioneer Camp of the Saints: The 1846 and 1847 Mormon Trail Journals of Thomas Bullock* (Arthur C. Clark, 1997).

Larry V. Benson & Michael S. Berry, "Climate Change and Cultural Response in the Prehistoric American Southwest," *KIVA Journal of Southwestern Anthropology and History* 75 (2009): 87-117.

Riley Black, "New Study Explores How Utah's Fremont Farmers Watered Their Crops," *Natural History Museum of Utah Blog*, April 29, 2019.



- Bruce Bradley, "Pitchers to Mugs: Chacoan Revival at Sand Canyon Pueblo" *KIVA Journal of Southwestern Anthropology and History* 74 (2008): 247-262.
- Charles Hillman Brough, *Irrigation in Utah* (Johns Hopkins, 1898).
- Todd M. Compton, "The Big Washout: The 1862 Flood in Santa Clara," *Utah Historical Quarterly* 77 (Spring 2009): 108-25.
- Hal Crimmel, ed., *Desert Water: The Future of Utah's Water Resources* (Utah, 2014).
- Jared Farmer, *Glen Canyon Dammed: Inventing Lake Powell and the Canyon Country* (University of Arizona, 2004).
- Dan L. Flores, "Zion in Eden: Phases of the Environmental History of Utah," *Environmental Review* 7 (Winter 1983): 325-44.
- Craig W. Fuller, Robert E. Parson, and F. Ross Peterson, *Water, Agriculture and Urban Growth: A History of the Central Utah Project* (Utah State Historical Society, 2016).
- J. Wallace Gwynn, ed., *Great Salt Lake: An Overview of Change* (Utah Division of Natural Resources, 2002).
- Norris Hundley, Jr., *Water and the West: The Colorado River Compact and the Politics of Water in the American West* (California, 2009).
- Wells A. Hutchins, *Mutual Irrigation Companies in California and Utah* (Farm Credit Administration, 1936).
- LaVell Johnson, "The Watermaster's Stick," *Utah Historical Quarterly* 42 (Spring 1974): 189-96.
- Gregory D. Kendrick, ed., *Beyond the Wasatch: The History of Irrigation in the Uinta Basin and Upper Provo River Area of Utah* (Government Printing Office, 1989).
- Martha Knack, *Boundaries Between: The Southern Paiutes, 1775-1995* (University of Nebraska, 2001).
- Chimalis R. Kuehn, *The Agricultural Economics of Fremont Irrigation: A Case Study From South-Central Utah* (Thesis, 2014).
- Alexander J. Lindsay, Jr., "The Beaver Creek Agricultural Community on the San Juan River, Utah" *American Antiquity* 27 (1961): 174-187.
- Hikmet Sidney Loe, "Alfred Lambourne's Great Salt Lake at the UMFA," *15 Bytes*, January 6, 2014.
- Kathryn L. MacKay, "The Strawberry Valley Reclamation Project and the Opening of the Uintah Indian Reservation," *Utah Historical Quarterly* 50 (Winter 1982): 68-89.
- Daniel McCool, *River Republic: The Rise and Fall of America's Rivers* (Columbia, 2014).
- Duncan Metcalfe and Lisa Larrabee, "Fremont Irrigation: Evidence from Gooseberry Valley, Central Utah" *Journal of California and Great Basin Anthropology* 7 (1985): 244-254.
- Miriam Murphy and Craig Fuller, "Glimpses of Ice Skating and Coasting in Utah," *Utah Historical Quarterly* 70 (Fall 2002): 326-340.
- Jeffrey D. Nichols, "Daredevil Georgie White Ran Utah's Great Rivers," *History Blazer*, *Utah State Historical Society*, August 1995
- Kevin D. Perry, et. al., "Results of the Great Salt Lake Dust Plume Study (2016-2018)," *University of Utah Department of Atmospheric Sciences* (April 2019).
- James Lawrence Powell, *Dead Pool: Lake Powell, Global Warming, and the Future of Water in the American West* (University of California, 2008).
- John Wesley Powell, et. al., *Report on the Lands of the Arid Region of the United States* (Government Printing Office, 1878).
- Alexa Roberts, Richard M. Begay, and Klara B. Kelley. *Bits'íís Ninéézi (The River of Neverending Life): Navajo History and Cultural Resources of the Grand Canyon and Colorado River*. Navajo Nation Historic Preservation Department, 1995.
- Steven R. Simms, *Ancient Peoples of the Great Basin & Colorado Plateau* (Left Coast Press, 2008).
- Steven R. Simms, Chimalis Kuehn, Nancy Kay Harrison, *The Archaeology of Ancient Fremont Irrigation* (2012 33rd Great Basin Anthropological Conference Poster).
- George D. Smith, ed., *An Intimate Chronicle: The Journals of William Clayton* (Signature, 1995).
- William E. Smythe, *The Conquest of Arid America* (Harper & Brothers, 1900).
- Howard Stansbury, *An Expedition to the Valley of the Great Salt Lake of Utah* (1852).
- Wallace Stegner, *Beyond the Hundredth Meridian: John Wesley Powell and the Second Opening of the West* (Penguin, 1992).
- Richard K. Talbot and Lane D. Richens, *Steinaker Gap OP #2: An Early Fremont Farmstead* (BYU Press, 1996).
- George Thomas, *The Development of Institutions Under Irrigation: With Special Reference to Early Utah Conditions* (Macmillan, 1920).
- Richard H. Wilshusen, Melissa J. Churchill and James M. Potter, "Prehistoric Reservoirs and Water Basins in the Mesa Verde Region: Intensification of Water Collection Strategies during the Great Pueblo Period," *American Antiquity*, 62 (October 1997): 664-681.
- Donald Worster, *Rivers of Empire: Water, Aridity & the Growth of the American West* (Pantheon, 1986).
- Kenneth R. Wright, "Ancestral Puebloan Water Handling," *Lakeline* (2008): 23-28.



**Many thanks to our program partner, the Utah Division of Arts & Museums' Office of Museum Services, for its generous support of this publication and the Utah tours of *Water/Ways* and *H2O Today*.**

The Office of Museum Services' mission is to advance the value of museums within Utah and to enable the broadest physical, intellectual and emotional access to collections and programs. The Office assists Utah museums in improving their ability to:

- care for and manage collections
- develop quality educational resources
- provide access to collections for research
- identify and successfully compete for financial resources

**Learn more at [artsandmuseums.utah.gov/museums/](http://artsandmuseums.utah.gov/museums/)**

## #ThinkWaterUtah



Listen to Utah water stories on *The Beehive Archive* | [www.utahhumanities.org/stories](http://www.utahhumanities.org/stories)  
Follow the *Beehive Archive* on Instagram at [@UtahBeehiveArchive](https://www.instagram.com/UtahBeehiveArchive)



Share your water story with the Smithsonian | [museumonmainstreet.org/stories/](http://museumonmainstreet.org/stories/)



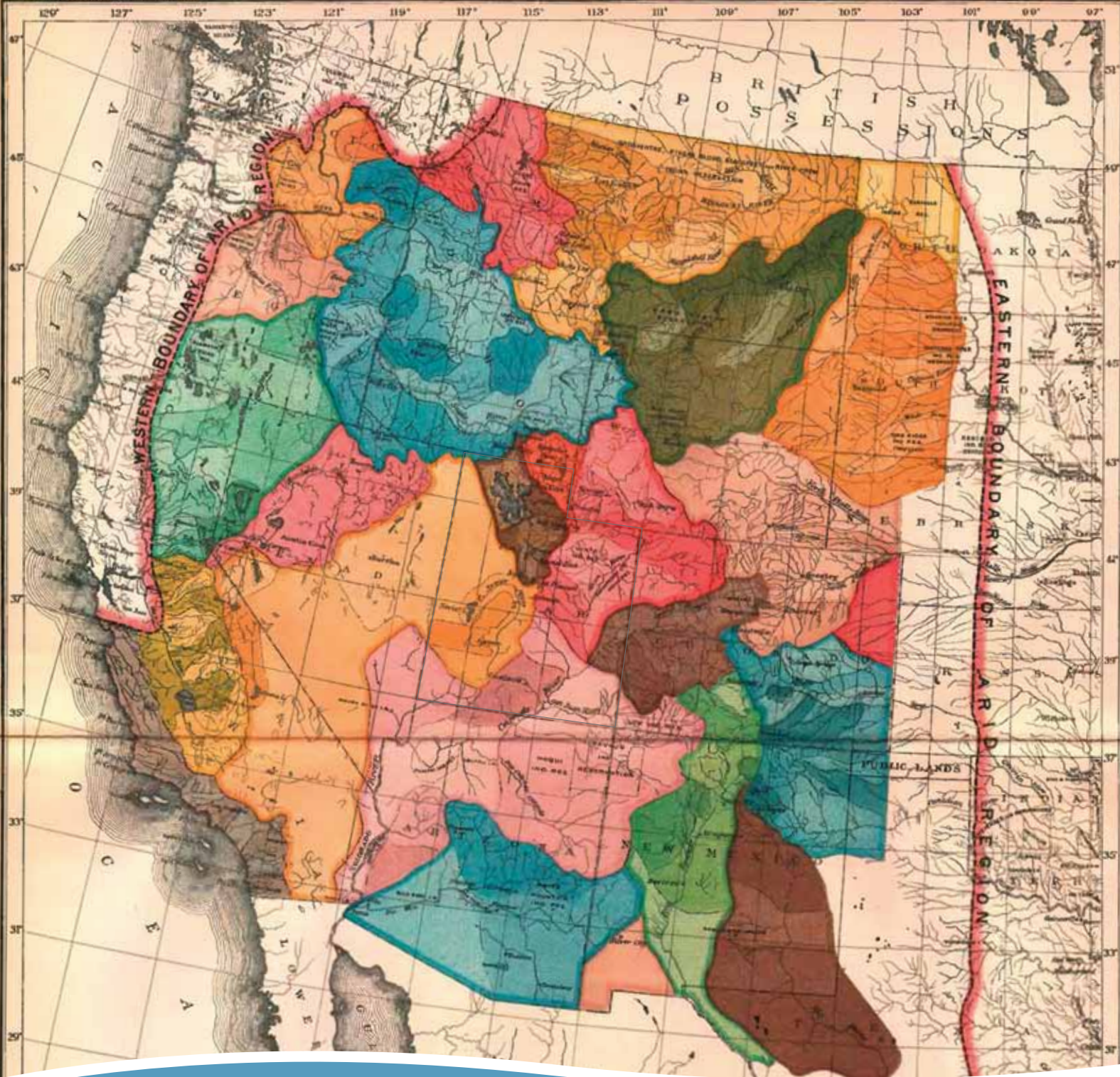
Learn more about the history of water in Utah | [www.history.utah.gov](http://www.history.utah.gov)



*Think Water Utah* is a statewide collaboration and conversation on the critical topic of water presented by Utah Humanities and its partners.

Learn more about the *Think Water Utah* project, exhibitions, and activities

[www.utahhumanities.org](http://www.utahhumanities.org)



## Map of the Arid Region of the United States

In 1890, explorer and scientist John Wesley Powell proposed a drastically new idea for settlement of the West. Political districts would be drawn according to watershed boundaries. Rather than draw arbitrary lines across the landscape, settlers would organize themselves in deference to the most fundamental element of life in the West: water.

- ⤿ How might our lives be different if Powell's vision had been approved?
- ⤿ What drives this impulse to challenge the natural limits of the physical landscape?
- ⤿ What are the consequences of stretching our natural resources to the breaking point?



**Water is an essential component of life on our planet —  
environmentally, culturally, and historically.  
What role does water play in your life?**

**#ThinkWaterUtah | #MyWaterStory | #IdeasInAction**



**UTAHHUMANITIES**

Ideas in Action

**202 West 300 North, Salt Lake City, UT 84103**

**801.359.9670 | [www.utahhumanities.org](http://www.utahhumanities.org)**

Utah Humanities empowers Utahns to improve their communities  
through active engagement in the humanities.