1 INTRODUCTION

Water represents life. It is what likely first attracted indigenous peoples to the shores and tributaries of Great Salt Lake (GSL). Harnessing its life was a priority for Euro-American pioneers when they arrived in Utah and first diverted City Creek. Its life is the legacy that subsequent generations worked and sacrificed to leave us and enable the growth and development we have enjoyed throughout the GSL watershed ever since.[12, 18]

What is an Integrated Water Assessment?

An integrated water assessment (IWA) is a means to understanding problems and challenges and evaluating options that enable informed decisions. An IWA is a planning process that holistically looks at planning and managing the entire water cycle and considers it as a single and connected system.[11] It ensures that development and management of a community's resources are coordinated to maximize social and economic benefits while minimizing impacts on the community and the environment. Per House Bill 429, the IWA is intended to provide recommendations for an action plan that will achieve the defined goal.

Recent drought and the observed decline in GSL water levels have elicited significant concern to no surprise. These concerns represent a potential risk to continued economic growth, public health, and vibrant ecosystems and communities in and throughout the GSL watershed.[14, 18, 26] They also represent an urgent challenge to be faced today for generations tomorrow.[12, 14]

Against this backdrop, the Utah Legislature took the significant step in 2019 to recognize "the critical importance of continued water flows to GSL and its wetlands and the need for solutions to address declining water levels, while appropriately balancing economic, social, and environmental needs."[26] The Utah Legislature built upon resulting recommendations to commission and direct the Utah Department of Natural Resources, Division of Water Resources (WRe), to complete a GSL Watershed Integrated Water Assessment (IWA) in 2022.[28] The IWA, within the context of the GSL watershed, must accomplish the following:

- **Assess** the current and future water supply
- **Assess** current and future water demands
- **Investigate** the potential benefits of forest management and watershed restoration
- **Assess** the quality of available water resources
- **Identify** and **evaluate** best management practices that provide adequate flow to sustain GSL, its wetlands, and other ecological functions in its watershed
- **Study** the impact of stormwater management practices on the water budget of GSL

Most importantly, the IWA must integrate ongoing efforts and systems, develop collaborative solutions, and recommend actions that shape a lasting water legacy for future generations.

The GSL Watershed IWA is a roadmap to understanding and action.

ABOUT THIS WORK PLAN

Soon after House Bill (H.B.) 429[28] was passed, WRe and its partners applied to the U.S. Bureau of Reclamation (Reclamation) for a WaterSMART grant for additional funds for preparing the GSL Watershed IWA. WRe was successful and notified in December 2022 that Reclamation would provide up to $3,174,000 in matching funds for a GSL Basin Study. WRe and Reclamation combined H.B. 429's GSL Watershed IWA with Reclamation's GSL Basin Study into one effort: the GSL Basin Integrated Plan (GSLBIP). WRe and Reclamation will jointly manage and deliver this effort using in-house staff, the efforts of partners, and work by contractors. This Work Plan meets the requirements for a Work Plan as outlined in both H.B. 429 and Reclamation's Basin Studies Directives and Standards;[34] these are listed in Table 1-1). This Work Plan represents a roadmap toward developing the GSLBIP—a roadmap to action.

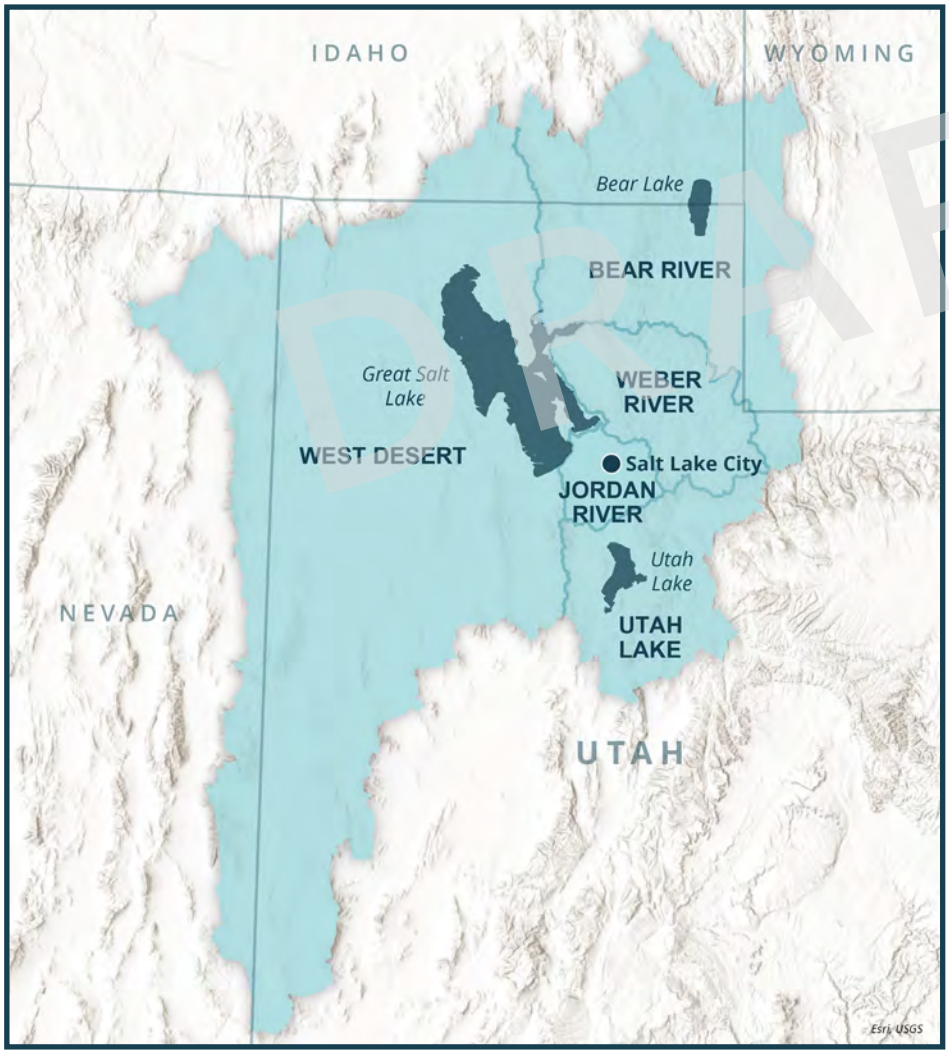
Table 1-1. Requirements for This Work Plan

House Bill 429	Basin Studies Directives and Standards (WTR 13-01)
• Completion by November 30, 2023 • Synthesis of available information, literature, and data • Development of a water budget for the entire watershed, including GSL and its associated wetlands • Assessment of scientific, technical, measurement, and other information needs • Implementation of the Work Plan description before November 30, 2026	• Basin study management structure • Decision-making process • Project team roles and responsibilities • Study team coordination • External communication and outreach processes • Technical analysis methodologies • Task and milestone schedules • Budget and cost control • Deliverables and project documentation requirements • Description of study review process, including reporting requirements

GREAT SALT LAKE WATERSHED STUDY AREA

The GSL watershed is a 36,199-square-mile closed basin within the Great Basin region. GSL is the largest saline lake in the western hemisphere and receives all waters not evaporated or consumed in the watershed. Figure 1-1 illustrates the four states with territory in the watershed: Utah, Wyoming, Idaho, and Nevada. The watershed is home to 2.8 million people (83 percent of Utah's population) living in 141 municipalities. More than 1.4 million acres of farmland are irrigated[45] with water stored in more than 909 reservoirs.[47] While Utah is the fourth fastest-growing state in the nation, GSL's water level has been in long-term decline, with serious implications to wildlife habitat, recreation, public health, industry, agriculture, ecosystem services, and the regional hydrologic cycle. GSL fell below its historical low elevation during 2022, resulting in more public attention on, and engagement with, the lake than perhaps ever before. Similarly, due to the limited water supply, many water supply systems in the GSL watershed were also severely stressed. All five river basins contributing to GSL—Bear River, Weber River, Jordan River, Utah Lake, and West Desert—and GSL itself will be considered in the GSLBIP (Figure 1-1). Each river basin, along with their smaller streams, springs, imported water from the Colorado River Basin, and regional aquifers, supports large agricultural areas, small towns, a growing metropolis, and unique ecosystems. All river basins contribute any water that is not utilized to GSL, the lowest point in the watershed. The GSLBIP will be the first effort to attempt to fully integrate the water cycles and management of each river basin and GSL itself within the context of the GSL watershed.

Figure 1-1. Great Salt Lake Watershed Study Area



THE CHALLENGE TO OVERCOME

The challenge to overcome by the GSLBIP initially appeared to be straightforward and clear. GSL's gradual decline, culminating in a record low water level in 2022, poses a significant risk to Utah's economy, public health, and ecosystems.[14, 26] Exposed lakebed, resulting dust emissions, reduced habitat, and ecosystem impacts from elevated salinity[13; 15] became most acute in 2022 and attracted widespread publicity and concern.[9; 20] The GSL Strike Team, which comprises state agency professionals and researchers from Utah State University and the University of Utah, recently concluded that "the situation requires urgent action."[14] Upon further evaluation, however, GSL's decline appears to be a symptom of more consequential water resource challenges in the watershed.

As a terminal lake that receives inflow from its watershed but has no outlet, GSL reflects the change its watershed has experienced over time. Thus, the long-term decline of GSL, even as punctuated by the floods of the 1980s, reflects similar symptoms observed in its watershed and surrounding region. Population growth,[17] recent declining trends in instream flows,[14, 22] declining groundwater levels,[49] increasing impacts from drought to agriculture,[36] increasing risks from wildfire[38] and from reduced flows to habitat, wildlife, and water quality,[24] aging infrastructure,[3, 29] growing water challenges,[29, 34] and increasing efforts and investments in water management to sustain the status quo in the GSL watershed[8, 27, 29] are consistent with GSL's symptoms. The decline of reservoirs in the Colorado River system, groundwater levels in Utah's other Great Basin aquifers,[25] and in terminal lakes[1, 26] throughout the western United States[3]5 are also consistent with GSL's symptoms. All are symptoms that point toward a long-term impact from climate change, increasing water use in the watershed[14] and an increasingly complex social, political, and regulatory system of systems.[29] Together, they point toward what is considered a wicked problem[16, 23]—a problem or a challenge that cannot be definitively defined due its social and technical complexity (refer to Appendix A, *Challenge Statement Development Technical Memorandum*).

Challenge Statement

Ensuring a resilient water supply requires extraordinary vision and collaborative effort. Solutions remain socially and technically complex as demands on this limited resource continue to increase. Today's water management decisions shape tomorrow's possibilities.

The challenge was organized to describe the social and technical complexities as follows (Appendix A provides more details):

Social complexity

- Social challenges
- Awareness challenges
- Fragmentation
- Organizational and institutional challenges
- Legal challenges

Technical complexity

- Water supply
- Water management
- Land management
- Quantification
- Environmental challenges

Ensuring a resilient water supply requires extraordinary vision and collaborative effort. Solutions remain socially and technically complex as demands on this limited resource continue to increase. How can we build a resilient water supply that sustains the health and growth and enables the future we envision for GSL and all water uses in its watershed? The challenge is to make water management decisions today that determine whether adequate water is available to support the needs of all uses within the watershed for generations to come. Today's water management decisions shape tomorrow's possibilities.

THE GOAL TO ACHIEVE

An outcome-oriented goal statement provides clarity about the desired outcome to be accomplished over time; it also provides an opportunity for stakeholders to forge early consensus around a vision for the result of their efforts. The goal statement helps facilitate connection and create an incentive to participate in the process.

The following goal statement for the GSLBIP was developed and refined over time to reflect the intent of H.B. 429 and input received throughout Work Plan development:

> **Ensure a resilient water supply for GSL and all water uses, including people and the environment, throughout the watershed.**

A proven means of maintaining focus during an investigation is to also cast the goal as a question, as follows; all studies and projects to be completed as part of the GSLBIP should work to answer the question and achieve the goal:

> **How do we ensure a resilient water supply for GSL and all water uses, including people and the environment, throughout the watershed?**

What is a resilient water supply?

The means are in place to provide a water supply that can meet the following criteria:

- Anticipates the effects of short- and long-term water-related shocks and both acute and chronic stresses:
  - –Acute— drought, spills, infrastructure failure, wildfire, earthquake
  - –Chronic— climate change (increasing temperature and evapotranspiration), growing water demands, water storage and management to meet growing water demands, declining aquifer and lake levels, water quality and habitat degradation
- Is prepared and can resist disruptions
- Can survive through and recover from adverse impacts of those events
- Can adapt and transform in a way that allows us to learn and thrive
- Can balance both human and environmental needs/demands

OBJECTIVES FOR THE GREAT SALT LAKE BASIN INTEGRATED PLAN

Objectives are the measurable steps taken toward achieving the stated goal. The following strategic objectives will help enable successful GSLBIP completion and implementation:

1. **Forge connections—**Just as the water cycle connects GSL with its watershed, the GSLBIP must connect the water supply and water uses of GSL with those in its watershed. Our social, political, regulatory, organizational, and research structures must connect; that is, relationships must be established to build resilience in the watershed. Connections are typically forced upon us when crises occur to enable us to respond. Building resilience demands that we anticipate and create these connections. The GSLBIP will forge lasting connections throughout the watershed that build and sustain a resilient water supply for GSL and all water uses in its watershed. These connections will be the basis for integrated collaborative solutions.
2. **Develop shared understanding—**Building resilience requires a common understanding of the GSL watershed's complex hydrology, its built and natural environments, and the political, regulatory, and legal regimes that govern them. We must agree what the challenges are and why they must be addressed. We must have a transparent technical dataset and analyses that form the basis for decisions. We must understand our options and own our actions. Through GSLBIP development and implementation, stakeholders throughout the watershed will develop a shared understanding of the issues.
3. **Quantify water resources—**H.B. 429 rightly emphasizes the importance of developing a water budget for GSL and its watershed. We must understand the available water supply, its quality, and the demands placed upon it in the past, present, and future to build a resilient, sustaining water supply.[28] This requires active and accurate measurement, assessment, and forecasting tools, processes, and infrastructure. The GSLBIP must develop the means to quantify the existing water supply and water demands and forecast the future water supply and water demands for GSL, its associated wetlands, and its watershed.
4. **Evaluate options—**The GSLBIP must consider the following: (1) GSL watershed potential points of failure and determine how these weak points can be protected or backed up, (2) the means to build flexibility into water systems to facilitate quick response and deep recovery, (3) the means of minimizing impacts and stopping cascading losses, (4) options that will enable a return to healthy systems as quickly as possible, and (5) options that promote active learning, rapid adaptation, and improved response. The GSLBIP must identify and evaluate options that will mitigate risks, adapt to and mitigate potential water shortages, embrace future uncertainties, address the challenges and achieve its goal.
5. **Recommend actions—**GSLBIP development must carefully consider the values and requirements of the human and natural systems, minimize short- and long-term risks, evaluate potential conflicts and tradeoffs, and develop consensus around a suite of recommended actions. The GSLBIP also must include a robust trade-off analysis to help decision-makers balance water supply and demand and avoid deterioration of agriculture, industry, communities, and ecosystems. The final GSLBIP will include recommendations for actions for achieving its goal.

THE EXPECTED OUTCOME

This Work Plan outlines a roadmap for the GSLBIP of engagement, monitoring, study, modeling, and analyses intended to uncover and develop durable and defensible solutions that overcome the challenge and achieve the GSLBIP's goal. Developing the GSLBIP will require innovation, flexibility, transparency, collaboration, and compromise to achieve consensus. There will be a temptation to expand the scope, a need to delve into more detail, and a desire to extend the schedule. The challenge the GSLBIP must overcome, however, cannot wait. The GSLBIP must result in a timely action plan that the public will support and decision-makers can feasibly implement. The water legacy we will leave to future generations is on the line.