

# GREAT SALT LAKE SALINITY ADVISORY COMMITTEE

## OCTOBER 26, 2023

This meeting was held in person on October 26, 2023, at the Utah Department of Natural Resources with some members attending remotely via GoogleMeet. The following represents a summary of key points of discussion. It is not intended to represent meeting minutes. The meeting recording may be viewed at <https://www.youtube.com/watch?v=SGn1OHTqo28>.

### ATTENDEES

Bonnie Baxter/Westminster College\*

Phil Brown/GSLBSC

Andy Carlson/USGS

Lynn DeFreitas/FRIENDS of Great Salt Lake

Jeff DenBleyker/Jacobs

Rob Dubuc/FRIENDS of Great Salt Lake

Jim Harris/DWQ\* (co-chair)

Joe Havasi/Compass Minerals \*

Tim Hawkes/GSLBSC\*\*

Elliott Jagniecki/Utah Geological Survey (UGS)\*\*

Bill Johnson/University of Utah (UofU)\*

John Luft/Division of Wildlife Resources (DWiR)\*

Craig Miller/DWRe\*

Mark Reynolds/US Magnesium\*\*

Ryan Rowland/USGS\*

Christine Rumsey/USGS\*\*

Andrew Rupke/UGS\*

Ben Stireman/DFFSL\* (co-chair)

Seth Majors/UDNR

Laura Vernon/DWRe

Marisa Weinberg/DFFSL\*\*

\* Salinity Advisory Committee (SAC) member

\*\* SAC member alternate

### OBJECTIVES

A key objective of the Salinity Advisory Committee (SAC) is to advise the State of Utah regarding how the salinity of Great Salt Lake (GSL) can best be managed and, more specifically, how the new Union Pacific causeway bridge may influence lake salinity. The objective of this meeting was to discuss lake conditions and develop a plan for the evaluations/sampling that will be required to make a decision about modifying the berm.

### SUMMARY

A quorum was present for the meeting. Jeff DenBleyker opened the meeting with a review of the agenda for the meeting and facilitated introductions of people attending in person and online.

### UPDATE ON LAKE CONDITIONS

Christine Rumsey and Andy Carlson provided an overview of lake conditions. South Arm water levels have dropped to 4192.2ft, down 1.8ft since the high level of 4194.0 ft in June 2023. North Arm water levels have been increasing again but still 0.6ft below the spring high of 4189.8ft. There is currently a 3.0ft difference between the water level in the North Arm and South Arm.

Inflow volume water year to date (October 1, 2023 through today) from the Bear River is at the median of historical values. Weber River inflows are at the 75<sup>th</sup> percentile. Farmington Bay outflow is near the median value. Goggin Drain inflows are near the 75<sup>th</sup> percentile value.

South to North flows through the new breach peaked near 1350 cfs in spring 2023 and have dropped to around 800 cfs now. There is no discernable North to South flow. The discharge time series matches the measurements quite well. Data from the old ADVM measuring flow velocity tracks very well with lake level; you can discern when there were significant changes in the berm. The new ADVM is performing well. USGS completed a survey of the berm to develop a cross-section of the berm as it was in August (after the berm eroded this summer). The lowest elevation of the berm is near 4189 (vs 4192ft where it was built). The berm opening currently has more of a v-shape.

Christine noted that the USGS has updated the GSL bathymetry dataset...this is now available to the public. She will send a link out.

The salinity of the South Arm was measured on October 5 as 143-144 g/L. The salinity is not expected to rise above this. There is still some spatial heterogeneity across the lake. Salinity near the surface near the Bear River inflow was measured at 127 g/L. USGS and USGS have made additional measurements in the South Arm since then that are consistent with 140-144 g/L. These are within the target salinities in the berm protocol that the SAC previously developed.

## UPDATE ON BERM PROTOCOL

Ben Stireman said that DFFSL has not officially adopted the protocol. "Natural" changes in the berm this year have worked in our favor. He suggested that we not only consider how much to raise the berm but also to consider a long-term plan. Simply reconstructing the berm to 4192 will not do much considering the South Arm is at 4192 now. Should we raise it further? How should we consider lowering it again next summer? More for the SAC to consider.

## UPDATE ON H.B. 513

DFFSL recently published draft administrative rules pertaining to implementation of HB 513. This is in an informal review right now to try to get as many comments as possible by October 31 and discuss comments with stakeholders. Please provide constructive feedback on how to improve the rules. Those comments will be incorporated as much as possible before formally issuing for public review. There is another chance to review.

Rulemaking took a long time to develop due to the complexity of HB 513. One objective of the rule was to develop a process for review mineral extraction proposals for the lake. "Do no harm" is an important principle. The rules try to define what potential impacts there might be from mineral extraction and demonstrate that there will not be any impacts. A multi-stage approach is proposed for this review. Initial review is based upon submitted data and sets the stage for pilot studies. Those results are then reviewed before moving on to the next stage of approval. A certification will be required before the project is approved; DWQ will be part of the process. Ongoing monitoring during operation will be an important part of agreements. They want to keep an eye out for potential cumulative impacts; there will need to be a cooperative agreement among operators for how to deal with cumulative impacts if they emerge.

The rules provide for emergency triggers for the lake that are based upon salinity (90 g/L at the low end, 150 g/L at the high end). This does not mean that extraction will be stopped if triggers are exceeded; it opens the door to options that HB 513 contemplated. The SAC will be asked for input on conditions and options relative to the triggers.

Other saline lakes around the world are contemplating similar rules but Utah is ahead of them. DFFSL will be looking to its partners such as DWQ, USGS, UGS, etc. to help with monitoring the lake and housing/analyzing the data. DFFSL is trying to be very careful about what is confidential and public data. Jim Harris added that DWQ collects discharge data that will be public. DWQ is currently developing its rules.

Please submit comments via the online form: <https://ffsl.utah.gov/state-lands/great-salt-lake/comments-for-hb-513-rules/> DFFSL will keep the latest version of the rules on its website.

Mark Reynolds noted that will be important to understand the negative and positive effects of mineral extraction and solar ponding upon GSL. He has some ideas on a study that could be completed by an independent party that he will circulate among committee members. Ben agreed that such a study will be helpful; we need to make sure the study is asking the right questions. Perhaps the SAC could help identify those questions? Tim Hawkes noted that the brine shrimp industry was supportive of such an effort. Ben suggested that DFFSL could direct some of its Hot Topics grant funds toward such a study this next year. Jeff DenBleyker noted that the GSL Basin Integrated Plan has already identified a number of questions that need to be answered, including similar questions pertaining to mineral extraction.

## SALINITY ESTIMATES FOR 2024

Christine Rumsey provided an overview of her calculations. She used the same process she previously described to evaluate two different scenarios:

1. Raise the berm in February 2024 to a height where there is no overflow to the North Arm. She assumed that the outflow to the NA is 800 cfs until then. No south to north flow starting in March 2024.
2. Berm is not raised; flow to the NA is 800 cfs.

She assumed that the salinity of the South Arm is fully mixed, flow to the NA is 800 cfs until/if the berm is raised, used 2012-2022 average climate data, inflow salinity is 4 g/L, and South Arm surface area is constant for direct precipitation and evaporation.

The estimated salinity in spring 2024 is estimated to be 122.9 g/L for scenario 2 to 123.5 g/L for scenario 1. Both are below the 130 g/L goal in the berm protocol. Scenario 2 is slightly less because we continue to export salt to the north arm. Both assume that the salinity is fully mixed in the South Arm.

There is a question whether the assumption of a fully mixed south arm accurately reflects the exported salinity to the North Arm. We have observed, even this month, that the salinity of the south to north flow is influenced (lowered) by the Bear River. Christine did look at this. The salt flux at the breach could be 6-30% less because of impacts from the Bear River; she had assumed a fully mixed South Arm salinity to estimate the salt flux.

- What is the cumulative salt load that would be exported with and without Bear River impact? Can we evaluate what the difference would be this year?
- How might the South Arm salinity be affected if we were exporting the average South Arm salinity rather than the Bear River influenced (lower) salinity? How much does mixing of the South Arm influence the salinity of the South Arm? Can we bracket this with the assumption of a 6-30% reduction in salt flux?
- How much of what we are observing is just a 2023 condition vs something we might expect in the future? What might happen in subsequent years?

Christine noted that USGS and USU are working to develop a rating curve for the breach so that we can more accurately estimate these fluxes. Right now, we only have discrete measurements of flow in time to estimate the flux.

Bill Johnson agreed that this data suggests that if we can mix the lake better than we can better control the salt exported to the North Arm and thus better control the salinity of the South Arm. He also noted that raising the berm does not significantly influence the salinity of the South Arm; it has a much bigger effect on the water level. Ben agreed but added that raising the berm does promote better mixing of the South Arm. Joe Havasi confirmed that Bear River water is short circuiting to the bridge opening.

Ben suggested that there might be structures that could be placed in the South Arm to improve mixing. Should we force water around Fremont Island? Can we use a dike or floating boom to try to direct Bear River water further to the south? What options do we have? We will need to consider impacts to navigability. Ben asked the SAC to consider how we might modify the berm but also whether we should work to improve mixing. Much will depend upon Christine's calculations.

Tim Hawkes noted that last winter is likely different than what we will see this year. We installed the berm in February 2023 before there was much inflow. Soil moisture was low, reservoirs were empty, runoff was delayed and reduced as the system recharged. We are starting this winter with good soil moisture and full reservoirs. We are already seeing inflow rising; timing to raise the berm may be different this year.

- How might seasonal salinity change now due to exporting flow to the North Arm?
- Can we run these calculations further into the future?

## RECOMMENDATIONS FOR BERM MODIFICATIONS

Jeff DenBleyker asked the SAC what they thought about raising the berm above 4192 this winter? Joe said he would like to stay consistent with our protocol where we raise the berm and keep it raised for a few months and then flush water/salt to the North Arm in the late summer. Then we raise the berm again to capture inflows. Ben said we can modify the berm a few times per year if that is what is best for the lake. Tim agreed that modifying the berm demonstrates adaptive management. Joe and Ben commented on the great start to the water year; we very well may have inflow to work with.

Jeff asked whether there were downsides to raising the berm? Ben said that raising the berm to 4192 doesn't really buy us anything. The lake is still at 4192.2 so we will still see some overflow and no new storage. If we do anything, we will want to raise it quite a bit to capture the inflows. But then we have to consider if, how and when to open it back up. Joe suggested lowering the berm now to 4189 and then raising it back up. How much might the outflow increase if we lowered and made it a rectangular opening? Ben noted that given the flows we saw this year, we might not see much of an increase in export by lowering the berm now. The outflow is going to naturally increase as the inflows to and water level of the South Arm increases this fall. Christine said that when the bridge was first opened with a rectangular opening in 2016 we did see a substantial flow of more than 4,000 cfs. We only saw the flow increase by 300 cfs when the exiting berm opened up to its current v-shape. Mark added that the timing of opening the berm will be important to maximize mixing in the South Arm.

Lynn DeFreitas asked how development of the Bear River project might influence this. The Bear River is the biggest contribution of fresh water to the lake; a reduction of inflow will reduce the water level. Benefits of exporting salt could decline if inflows declined. Elliott Jagniecki asked whether there were operational water levels identified for the North Arm that influence flow through the bridge. What should the head difference be? Andrew Rupke added a question, is there a concern about the head difference across the causeway? That is something to consider.

Joe didn't want to raise the berm to 4195 now. A working hypothesis is to leave the berm as is and raise it to 4195 ft in February. That will help further dilute the salt we currently have in the South Arm. Then follow the berm protocol for the summer where we flush water and salt to the North Arm.

John Luft asked whether there was a benefit to store water in the Bear River "trapezoid"? would that help promote mixing? There was more discussion about options to promote mixing. Could we use a floating boom to direct flow from the Bear River to the south? Can we put it near the brine shrimp cooperative marina? A boom would be cheaper and more temporary than a big dike. Navigation and permitting will need to be considered. Jeff noted that a boom is temporary but would require operations and maintenance. Planning will need to consider natural circulation patterns of the lake.

Jeff will summarize the questions for Christine to evaluate. The SAC members should consider pros and cons to implement the scenario listed above.

Mark Reynolds suggested we will also need to consider how we build the berm, a similar rock structure?

## GREAT SALT LAKE BASIN INTEGRATED PLAN

Laura Vernon provided an overview of the effort, and the Work Plan the Division of Water Resources has been developing. This project was initiated by H.B. 429 to help understand all water needs in the GSL watershed, including GSL itself. A key challenge has been trying to understand the full picture of what we know and don't know. The project will need to integrate many different efforts as well as the water supplies of the various river basins. The GSLBIP will be developed over the next three years (completed in 2026) but will include actions that can start now. The result will be an action plan.

Laura reviewed the results of a situational assessment completed to inform the Work Plan. A primary item identified was that it will be important for stakeholders to become involved and actively participate in developing and evaluating the decision tools. DWRe has set up a Steering Committee (watershed stakeholders) and Advisory Group (state and federal agencies) to support the effort. River basin watershed councils and the GSL Advisory Council will also be an important part of the effort. Laura described the gap analysis process and model scoping plan, and Jeff DenBleyker reviewed the list of GSL salinity opportunities. Connecting the watershed and developing a shared understanding across the watershed will be critical for success.

The Work Plan will be available for public review the week of November 13, 2023. Work will start in 2024.

<https://water.utah.gov/gsl-basin-integrated-plan/>

The meeting was adjourned.

## ACTION ITEMS

- Jeff DenBleyker will summarize questions discussed and forward to Christine Rumsey.
- Christine will begin work to evaluate the questions and send out a link to the new GSL bathymetry data.
- SAC members will consider options for modifying the berm and improving mixing in the South Arm.

Next meeting: November 30, 2023, 10:00am – 12:00pm.

DRAFT

October 26, 2023

Great Salt Lake Salinity Advisory Committee

# Great Salt Lake Basin Integrated Plan

Laura Vernon  
**Division of Water Resources**



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# GREAT SALT LAKE ELEVATION

**1986**



**2000**



**2022**



**2023**



RECORD HIGH  
**4211.65 FEET**



AVERAGE  
**4202.2 FEET**



RECORD LOW\*  
**4188.5 FEET**  
\*PROVISIONAL



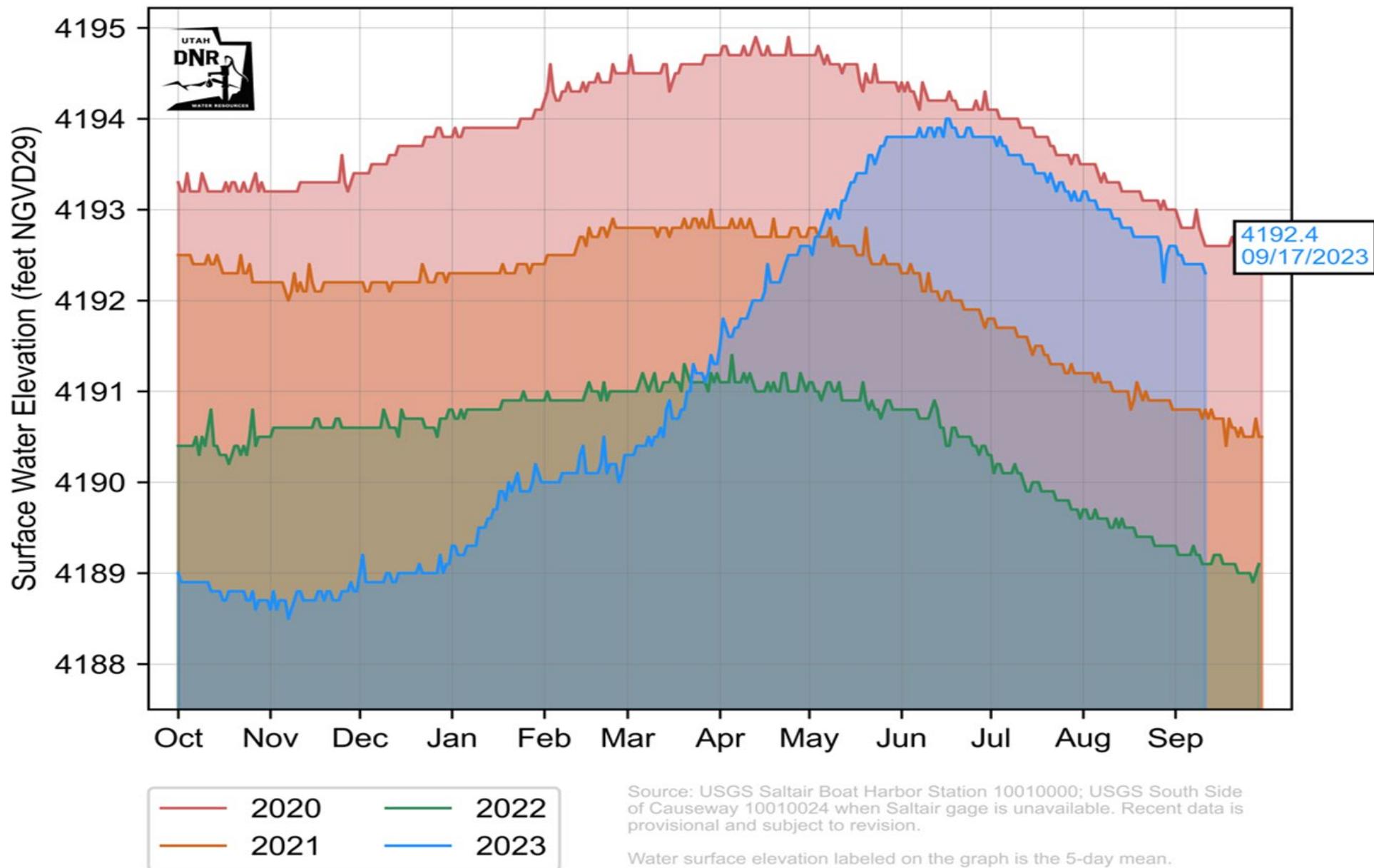
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# Great Salt Lake South Arm Elevation





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# The need for a plan

- Stressed water resources in the basin
- Multiple previous and current studies/plans
- No consensus on data, methods, problem
- Planning has never been done at this scale
- Need a vision and steps to make vision reality
- Need informed decision-making
- Provide direction and list actions

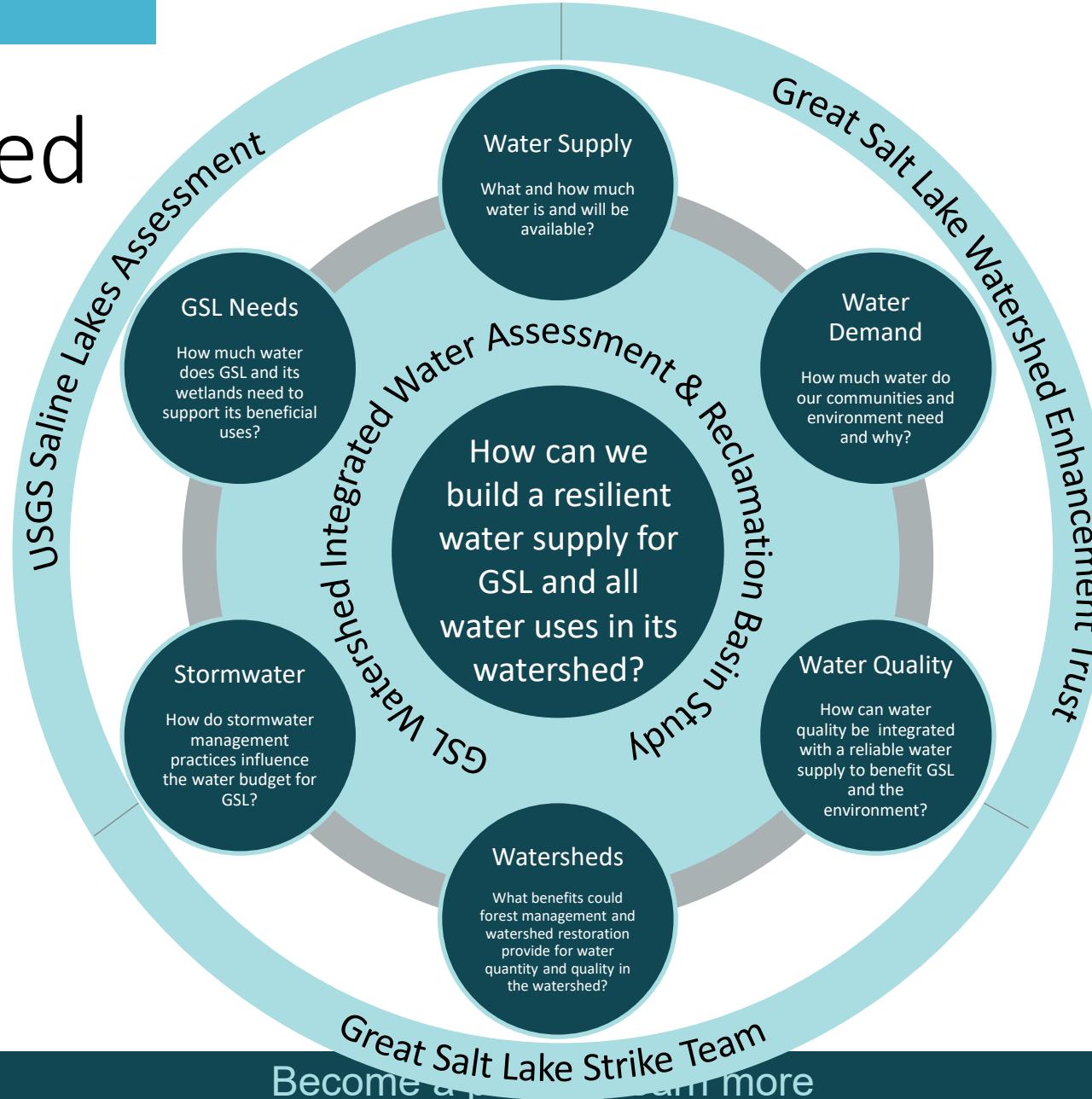
Goal: Ensure a resilient water supply for  
GSL and all water uses in the watershed



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# An Integrated Approach



“Identify and evaluate BMPs that may be used to provide a reliable water supply that

- Meet water quality objectives
- Meet agricultural water objectives
- Accommodate anticipated growth and economic development
- Provide adequate flow to sustain GSL, GSL's wetlands, and other ecological functions in GSL's watershed”

-HB429

“Provide a thorough trade-off analysis to help decision-makers balance water supply and demand, and avoid deterioration of agriculture, industry, and ecosystems”

- Reclamation Basin Study



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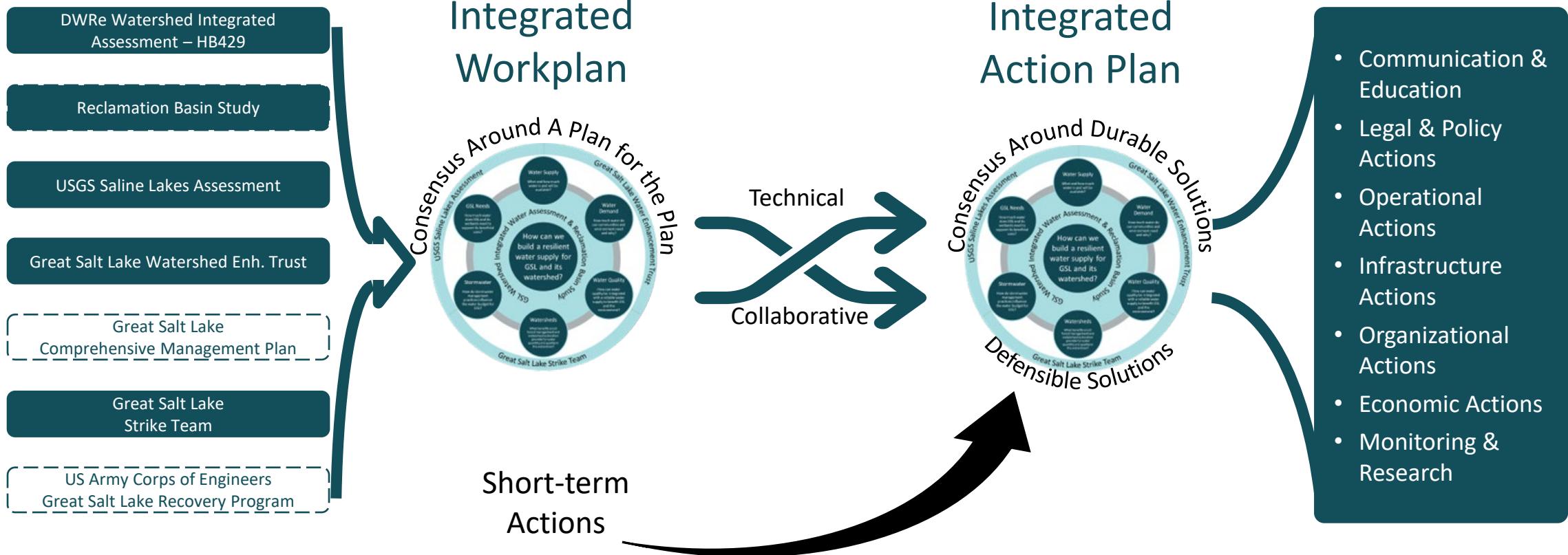


# An Integrated Approach

2023

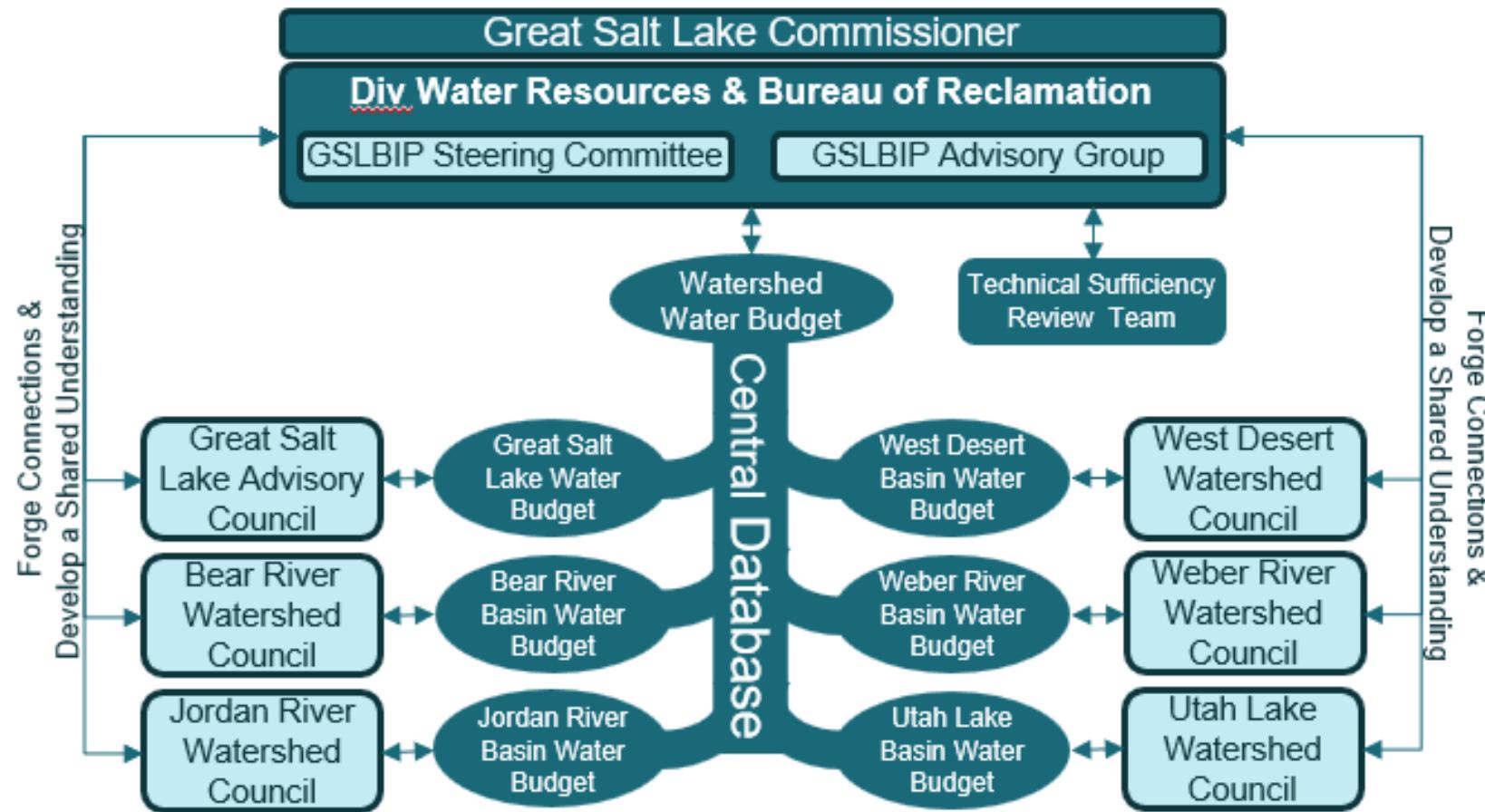
2024-2026

2027



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# An Integrated Collaborative Approach



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# An Integrated Approach to Workplan Development



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# Great Salt Lake Basin Integrated Plan

## Situational Assessment Report

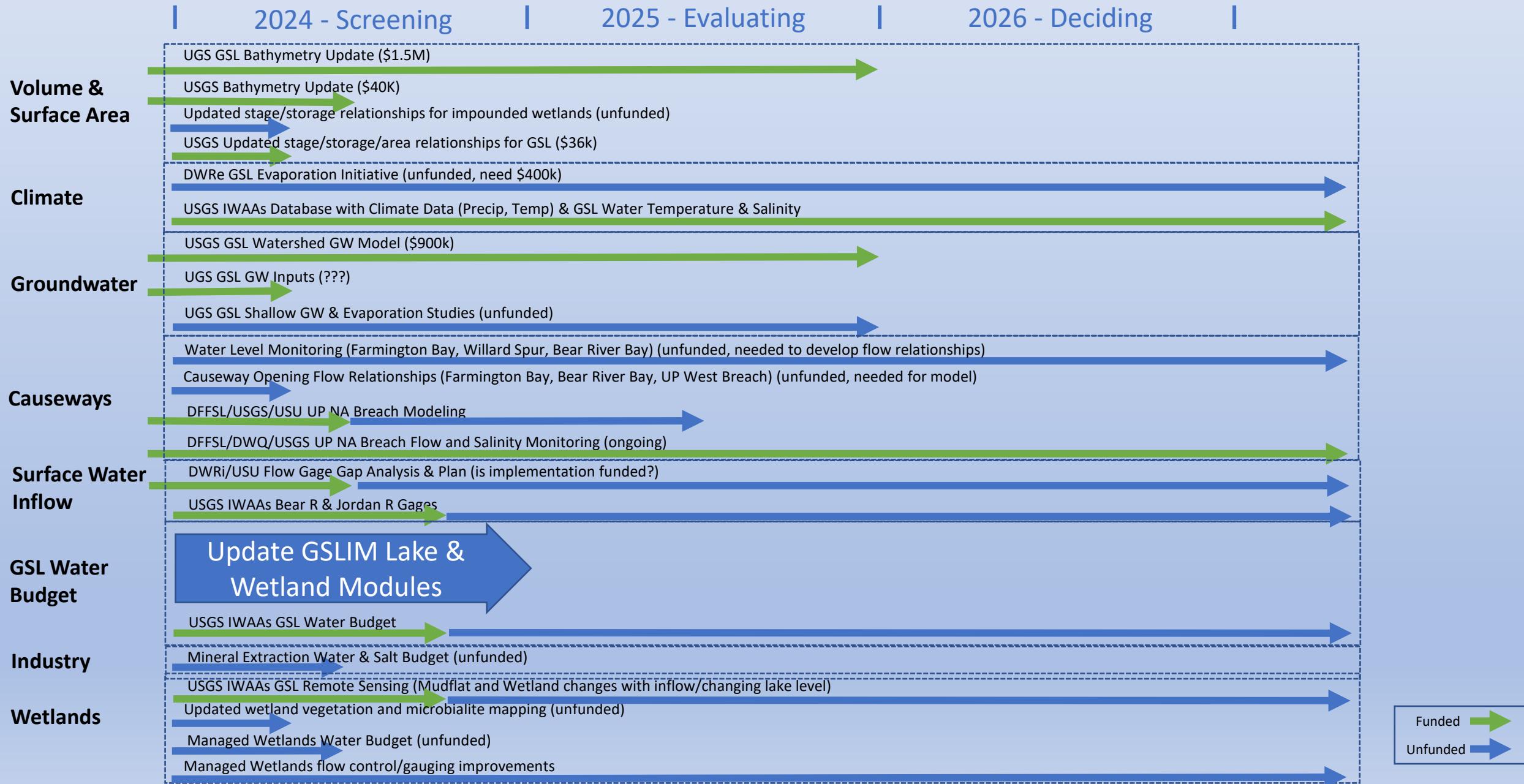
June 2023



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# Projects - GSL Hydrology



Funded   
Unfunded



Table 1. What is the Quality of Existing Water Bodies and Water Resources?

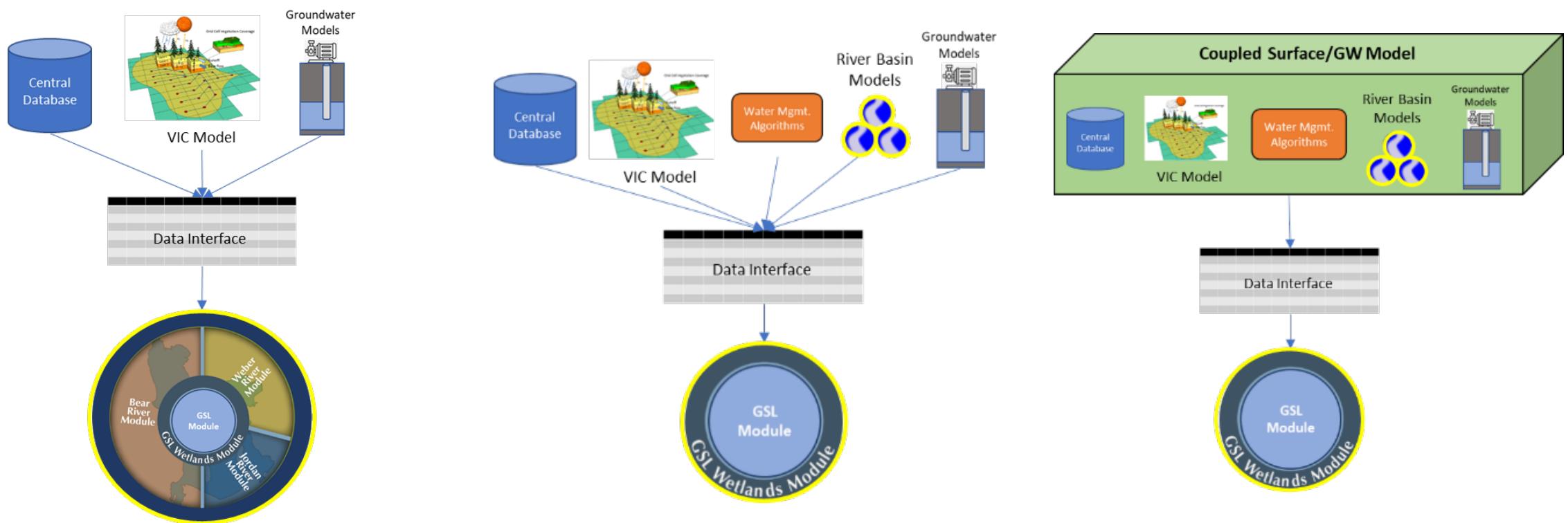
	Strengths of Current Programs and Resources	Gaps/Weaknesses in Available Resources	Proposed Area of Capacity Development
Data Collection	<ul style="list-style-type: none"> <li>DWQ's GSL Water Quality Strategy (<a href="#">DWQ 2014b</a>) provides a roadmap for management of GSL and balanced decision making on issues affecting the Lake.</li> <li>The United States Geological Survey (USGS) has an extensive water chemistry and discharge monitoring program.</li> <li>DWQ has an extensive monitoring program that revolves between basins. DWQ's <i>Elements to Utah's Monitoring and Assessment Program, 2020-2020</i> (<a href="#">DWQ 2020</a>) outlines DWQ's monitoring strategy. Additionally, DWQ manages a <a href="#">Cooperative Monitoring Program</a> that expands DWQ's monitoring capabilities by leveraging agency partner resources. There are many satellite monitoring programs that operate in the Basin and many in conjunction with DWQ.</li> <li><a href="#">DWQ's GSL Monitoring Program</a> establishes standardized sampling and analytical methods to be used on GSL.</li> <li>The <i>DWQ/USGS Quality Assurance Project Plan for the Great Salt Lake Baseline Sampling Plan</i> (<a href="#">DWQ 2014a</a>) for GSL provides an excellent example of a collaborative and organized approach to data collection.</li> <li>The <i>DWQ/USGS Workplan for Ongoing Monitoring of Great Salt Lake Water Quality to Inform Management of the New Breach</i> was developed in 2022 (DWQ 2022) to support ongoing discussions with the GSL Salinity Advisory Committee.</li> <li>The GSL Salinity Advisory Committee developed standard operating procedures for measuring water density and calculating the salinity of GSL waters (<a href="#">GSL SAC 2020</a>)</li> </ul>	<ul style="list-style-type: none"> <li>DWQ's <i>Great Salt Lake Water Quality Strategy</i> (<a href="#">DWQ 2014b</a>) is nearing the 10-year mark and likely needs to be updated to reflect existing conditions and the progress that has been made over the last 10 years on projects and initiatives identified in the 2014 strategy.</li> <li>Shared, GSL Basin-specific water quality sampling objectives have not been defined outside of the <i>DWQ/USGS Quality Assurance Project Plan for the Great Salt Lake Baseline Sampling Plan</i> (<a href="#">DWQ 2014a</a>). Most water quality samples in the Basin are collected in support of a variety of different monitoring objectives, depending on the scope and goal of the project and/or program initiating the sampling.</li> <li>Further investigation is needed to form a complete understanding of the data gaps (temporal and spatial) that pertain to water chemistry data in the GSL Basin.</li> <li>DWQ monitoring programs are typically not oriented towards forecasting potential risks or evaluating future scenarios of water quality conditions. That is, DWQ monitoring programs are focused more on identifying and resolving water quality problems as opposed to protecting high quality water.</li> <li>DWQ collects water quality grab samples based on a 6-year rotating basin schedule, which makes long-term trend analysis unfeasible.</li> </ul>	<ul style="list-style-type: none"> <li>Develop a GSL Basin Water Quality Program <a href="#">[PROGRAM DEVELOPMENT]</a>. The following sub-bullets would all be accomplished under the umbrella GSL Basin Water Quality Program: <ul style="list-style-type: none"> <li>Define GSL (and GSL Basin) water quality goals. Shared goals provide a baseline against which to measure current conditions, future trends, and data gaps. For example, water quality goals may consist of beneficial use attainment in the GSL Basin, or other important thresholds defined for GSL and throughout the watershed. Not all waterbodies have numeric criteria, so establishing other thresholds will be important. <a href="#">[TASK]</a></li> <li>Conduct a water quality data gap analysis. An outcome of the study would be the identification of temporal and spatial gaps that need to be filled to evaluate current conditions as they compare to water quality goals. Reference multiple water quality databases in the study. <a href="#">[STUDY]</a></li> <li>Establish water quality monitoring objectives. Water quality monitoring objectives help ensure that data collected can be used to measure progress against goals. Potential monitoring objectives include: filling data gaps and monitoring trends over time. <a href="#">[TASK]</a></li> <li>Define representative monitoring locations and water quality parameters to measure progress on GSL Basin water quality goals. Establish a networks of sentinel sites that are monitored on a more frequent basis. <a href="#">[STUDY]</a>. The study could be piloted in one river basin within the GSL Basin.</li> <li>Develop sampling and analysis plan to standardize data collection</li> </ul> </li> </ul>



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# Model Development



# The Big Picture

2023 | 2024 | 2025 | 2026 | 2027 | 2028

Today

Beyond

Policy  
Projects

Tomorrow

Strategic Research Studies

Decision Support System

Solution Development

Capacity Development



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# Workplan Rollout

- Mid-November release
- November 15 presentation to legislature
- Early December open house
- 45 + day review period
- BIP project contracting begins January 2024



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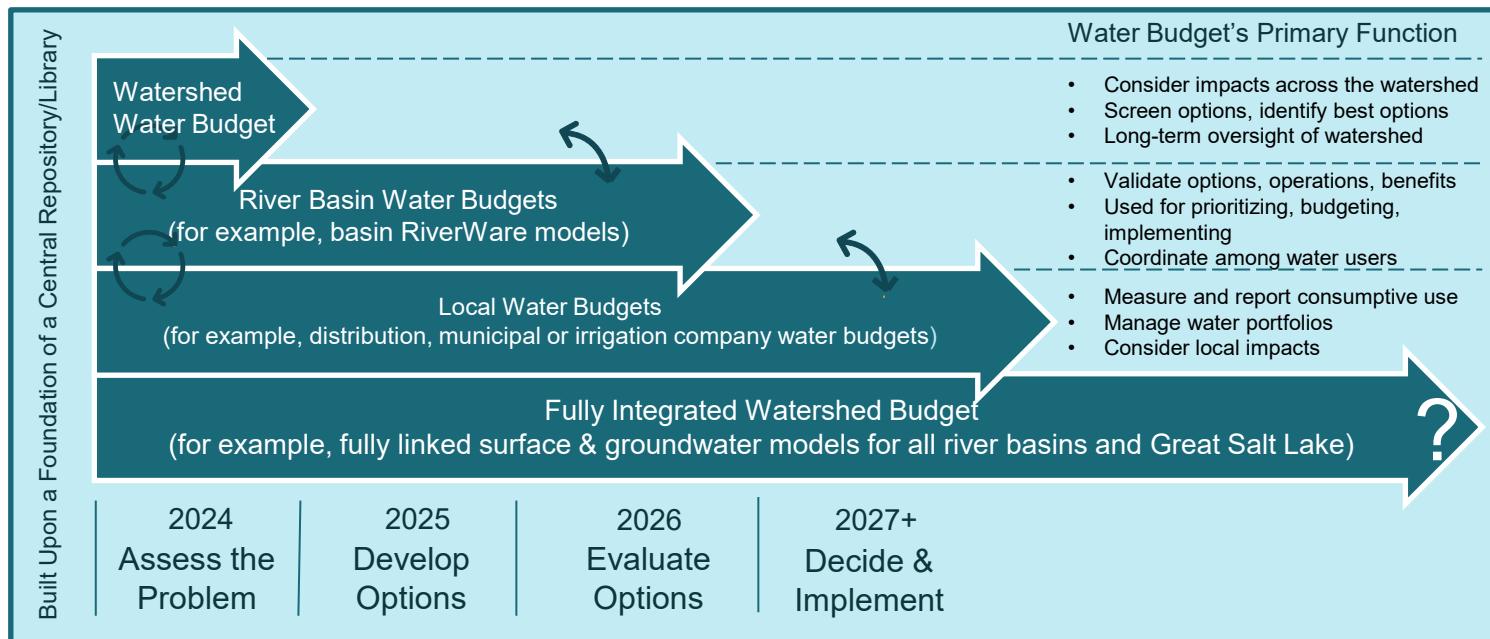
# THANK YOU



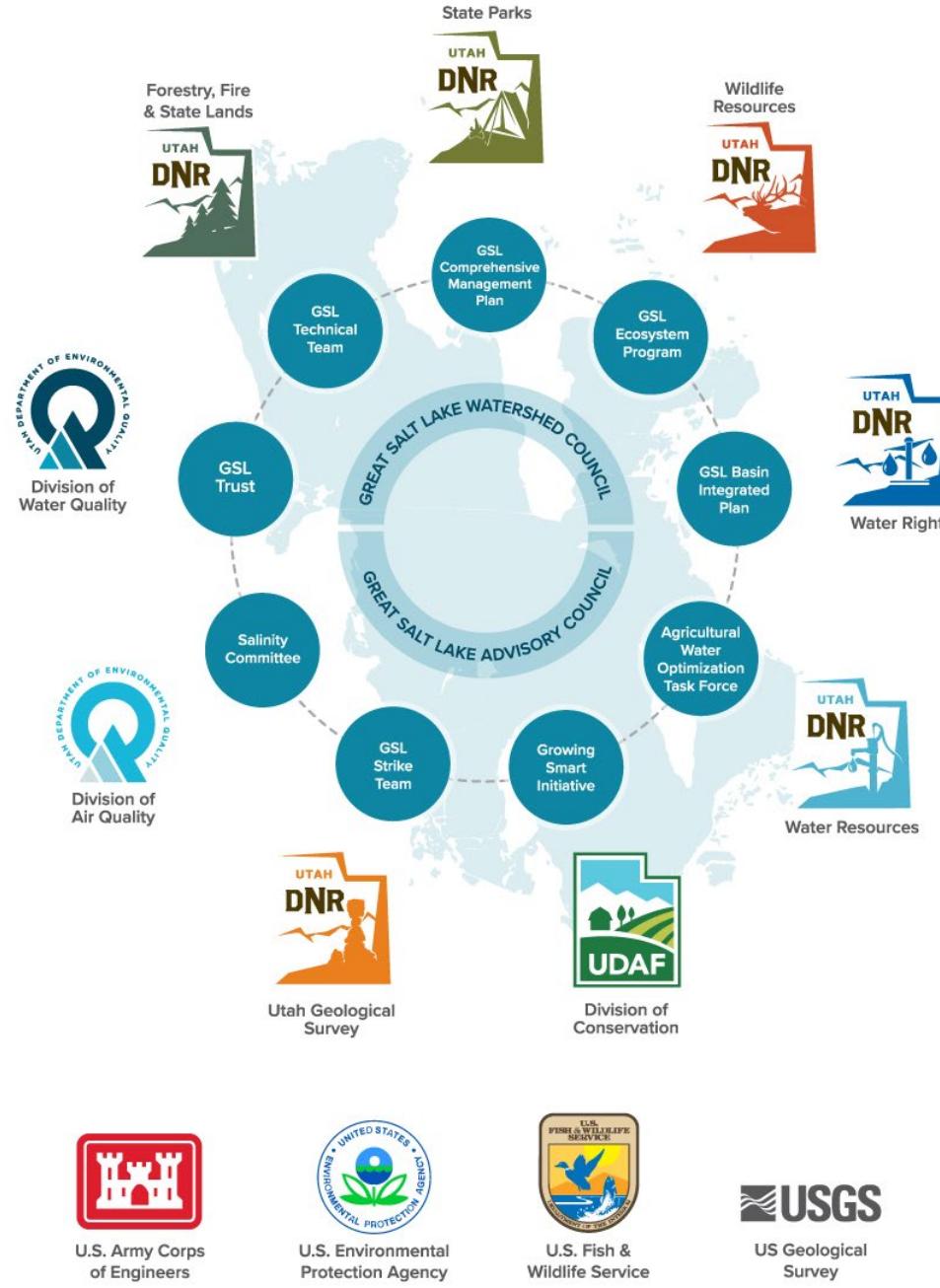
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# Proposed Model Framework



# Great Salt Lake is complex



# Basin plan framework

