



## GREAT SALT LAKE SALINITY ADVISORY COMMITTEE JANUARY 25, 2024

This meeting was held in person on January 25, 2024, 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=cpTf0sG6zKw&t=1848s>.

### ATTENDEES

Leila Ahmadi/DWRe**	Elliott Jagniecki/Utah Geological Survey (UGS)**
Bonnie Baxter/Westminster College*	Bill Johnson/University of Utah (UofU)*
Carly Bieduhl/Westminster University**	John Luft/Division of Wildlife Resources (DWR)*
Jennifer Biggs/Division of Forestry, Fire & State Lands (FFSL)	Craig Miller/DWRe*
Blake Bingham/DWRI	David O'Leary/USGS
Phil Brown/GSLBSC**	Jack Ray
Tim Davis/Office of the GSL Commissioner	Ryan Rowland/USGS*
Lynn DeFreitas/FRIENDS of Great Salt Lake	Christine Rumsey/USGS**
Jeff DenBleyker/Jacobs	Andrew Rupke/UGS*
Ryan Doherty/Cargill**	Connor Simon/DWR
Rob Dubuc/FRIENDS of Great Salt Lake	Ben Stireman/DFFSL* (co-chair)
Som Dutta/Utah State University	Kyle Stone/DWR**
Jim Harris/DWQ* (co-chair)	Laura Vernon/DWRe
Joe Havasi/Compass Minerals *	Marisa Weinberg/DFFSL**
Ben Holcomb/DWQ**	Sam Schratz/USFWS
Heidi Hoven/National Audubon Society	

\* 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, efforts to model the bridge opening, and next steps.

### 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. Bonnie Baxter made a motion to approve the November 30 meeting summary; Joe Havasi seconded the motion. The motion was passed unanimously.

### UPDATE ON LAKE CONDITIONS

Ryan Rowland provided an overview of lake conditions. South Arm water levels have increased to 4192.7ft, up 0.7 feet since October 1, 2023. North Arm water levels have increased to 4189.9ft, up 1.1 ft since October 1, 2023. There is currently a 2.8ft 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 has been tracking median. Weber River inflows have generally been above median values since October 1, 2023, but dropped off in January. Cumulative inflows from the Weber River are between median and the 75<sup>th</sup> percentile. Farmington Bay outflow has been near the median value; cumulative inflows have been near the 50<sup>th</sup> percentile. Goggin Drain inflows have been just above median.

South to North flows through the new breach were measured at 928 cfs on December 5, 2023, and 962 cfs on January 19, 2024. There is no discernable North to South flow.

The salinity of the South Arm was measured on December 5, 2023, as 138-140 g/L and within the desired range. The salinity is roughly 45-47 g/L less than it was in November 2022. The salinity at the breach was 132 g/L on January 19, 2024, and 129 g/L at Saltair on January 2, 2024.

Christine reviewed her approach and assumptions for forecasting salinity in spring 2024. Variables she evaluated included the timing of raising the berm, various mixing rates of Bear River water with Gilbert Bay, flows through the bridge, and climatic

conditions. Assuming a 40% mixing rate of Bear River water in the South Arm before the berm is raised on April 1, 2024, and 100% mixing after the berm is raised, changing the climate conditions (wet vs dry) results in a change in salinity of about 6 g/L (123 vs 129 g/L, respectively). Average climate conditions resulted in an estimate of 126.1 g/L. Not raising the berm (60% mixing) increased the estimate to 129.1 g/L on May 31. All are below our goal of < 130 g/L in the upper oxic layer in the spring.

## UPDATE ON BERM RECOMMENDATIONS

Ben Stireman referenced a letter from Director Barnes to SAC members regarding the berm protocol and the SAC's berm recommendations from November 2023. FFSL had not finalized the draft berm protocol in summer 2023 because the berm had modified itself in June and FFSL had been waiting for input from the new GSL Commissioner. The protocol are still being considered. The SAC provided recommendations to modify the berm based upon scientific considerations. FFSL did its due diligence to also consider uses of both the North and South Arm. The decision was made, also in consideration of current salinity and snowpack, to not raise the berm but to focus upon designing an engineered flow control structure for the bridge and how we might improve mixing of inflows within the South Arm. Scientific input is critical; the SAC's work is much appreciated. We need to work on developing a long-term salinity management plan.

Bonnie Baxter noted that people have already intervened in the lake via the causeway. It will be hard to find a better intervention than the berm. Phil Brown agreed on its simplicity and effectiveness. Ben also agreed; the State wants to improve upon the concept to provide more flexibility. Bonnie added that the SAC has provided significant value for a long time, but wondered if the SAC is still needed and how the letter changes what the SAC does. Ben said that the SAC is needed; the letter doesn't change anything. The SAC is the technical backbone for salinity issues; FFSL can't get this information anywhere else. Ben would like the SAC to continue to advise regarding conditions, standards, alternative solutions, and work in developing a long-term salinity management plan. The SAC brings numerous points of view and disciplines together; something that is much needed.

Bonnie noted that any solutions that may be engineered for the lake will need to consider long term operations, maintenance, and impacts. Bill Johnson added that we will need to carefully consider design criteria, options, and the available expertise to come up with viable solutions. Ben agreed. If the Legislature funds solutions, Ben's intent is to come back to the SAC.

Ben Holcomb agreed with the discussion; the letter opened the question of what the SAC's purpose is. He suggested that we revisit the SAC's charter. Jeff DenBleyker provided an overview of where the SAC fits with the GSLAC, Tech Team, and GSLEP's TAG. He also reviewed the SAC's charter, the SAC's key objectives, and progress on research to date. The SAC has been critical in monitoring changing conditions and providing recommendations to manage salinity. All SAC activities to date have been to work toward a long-term salinity management plan, learning as we go. Bonnie recommended revisiting the organizational relationships and update them to reflect the GSL Commissioner, GSLBIP, etc. She recommended that we make it clear how information and recommendations from various committees are used. Ben Stireman suggested that we include that in the long-term salinity management plan; we can evaluate the role of the SAC as part of developing that plan.

Jeff asked the SAC to consider the different groups and the role of the SAC as we move forward. Where do we have information gaps? Where should the State of Utah invest its monies to manage the salinity of the lake?

## MODELING THE UNION PACIFIC BRIDGE OPENING

Dr. Som Dutta/Utah State University provided an overview of modeling he and his team have completed to better understand and predict flow through the new breach. This work was originally identified as a need by the SAC in 2019 and has been funded through FFSL.

The new computational fluid dynamics (CFD) model for the breach was originally developed to evaluate how raising the berm 0, 4, and 6 feet might influence bi-directional flow, develop an artificial neural network (ANN) model that can be used to represent the breach in other models, and estimate flow rates based upon USGS uplooker velocity measurements. The model is performing very well but USU is improving the calibration based upon actual USGS flow measurements and actual berm geometry. The model requires significant computational resources; this is a reason for developing the ANN model.

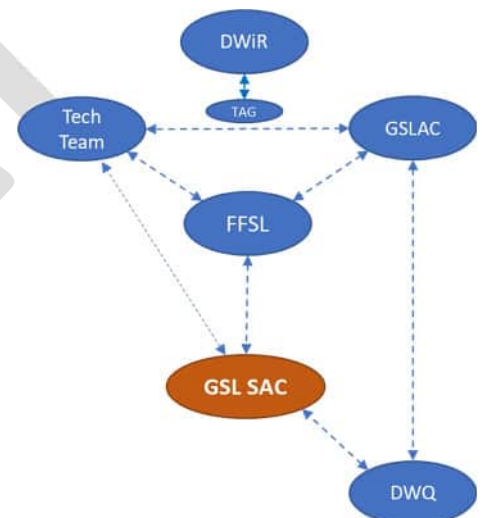


FIGURE 1 GSL ORGANIZATIONAL STRUCTURE - LAST UPDATED IN 2018

NOTE: PARTICIPATION OVERLAPS BUT ARROWS REPRESENT ESTABLISHED REPORTING AND RESPONSIBILITIES

The ANN model is being used to incorporate lake level, wind conditions, and water density to predict flow conditions. USGS has been using this information in its salt balance calculations for the South Arm. USU is continuing to train the ANN model with new data as it becomes available. The Generalized Area Based Index Model (GABI) is being developed to use available velocity data and berm geometry to estimate flow through the breach. USU is currently reformulating the equations in the CFD model to be able to develop rating curves that reflect any berm height. They hope to be finished with that by the end of 2024. This project has been a great example of effective collaboration between USU and USGS.

Ryan Rowland noted the challenges of gaging flow through the west breach and Bear River Bay causeway bridge. USGS is working to develop the methods required to measure and monitor these flows and talking with USU on how to model these flows. Som added that he is working with USGS to be able to link flow data from the USGS Bear River gage at Corinne to flow through the Bear River Bay causeway. There are many variables to represent this system; the better the data we collect the better we can represent this system.

## LONG-TERM SALINITY MANAGEMENT PLAN

Jeff reviewed some of the action items pertaining to moving this plan forward.

- USGS will continue to update and improve upon their salt balance methodology for the South Arm.
- The SAC should review the research framework (see attached) and identify key gaps that we need to fill. This will help inform future research and development of the long-term salinity management plan.
- The SAC should identify key conditions we need to manage for and key criteria that we need to manage to. This will help guide development of flow control solutions for the new breach as well as development of the long-term salinity management plan.

Ben Stireman suggested that we look at meeting again in February to confirm direction on berm management and then move toward meeting quarterly. Bill Johnson asked that the SAC continue to consider the competing uses of the lake and evaluate partitioning of the lake to enable these continued uses.

The meeting was adjourned.

## ACTION ITEMS

- SAC to consider where we have gaps in information and understanding.
- SAC to consider conditions we need to manage for and key criteria that we need to manage to.

Next meeting: February 22, 10:00am – 12:00pm.

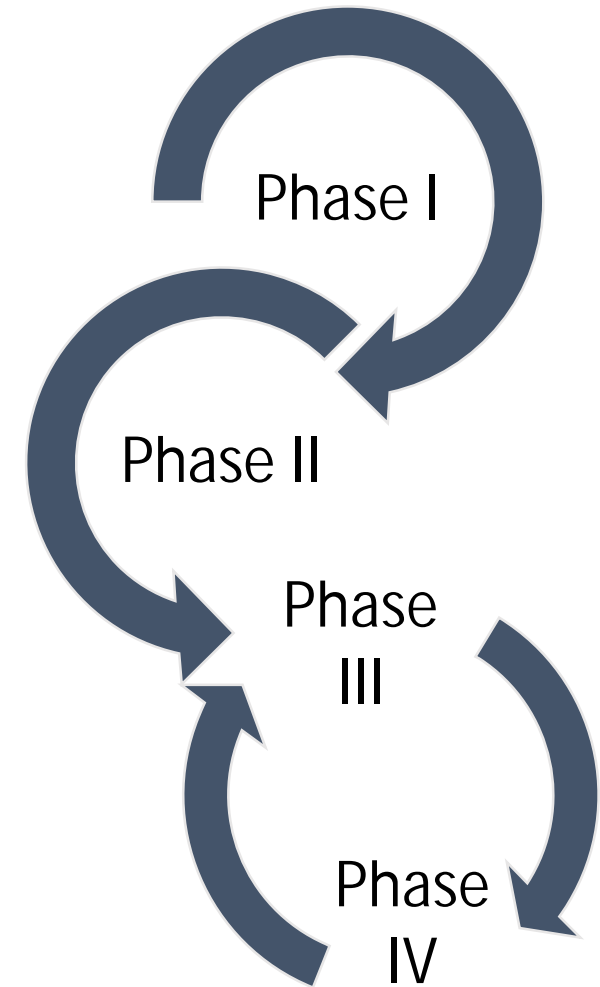
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# Great Salt Lake Salinity Research/Monitoring Framework

Great Salt Lake Salinity Advisory Committee  
(Updated October 12, 2022)

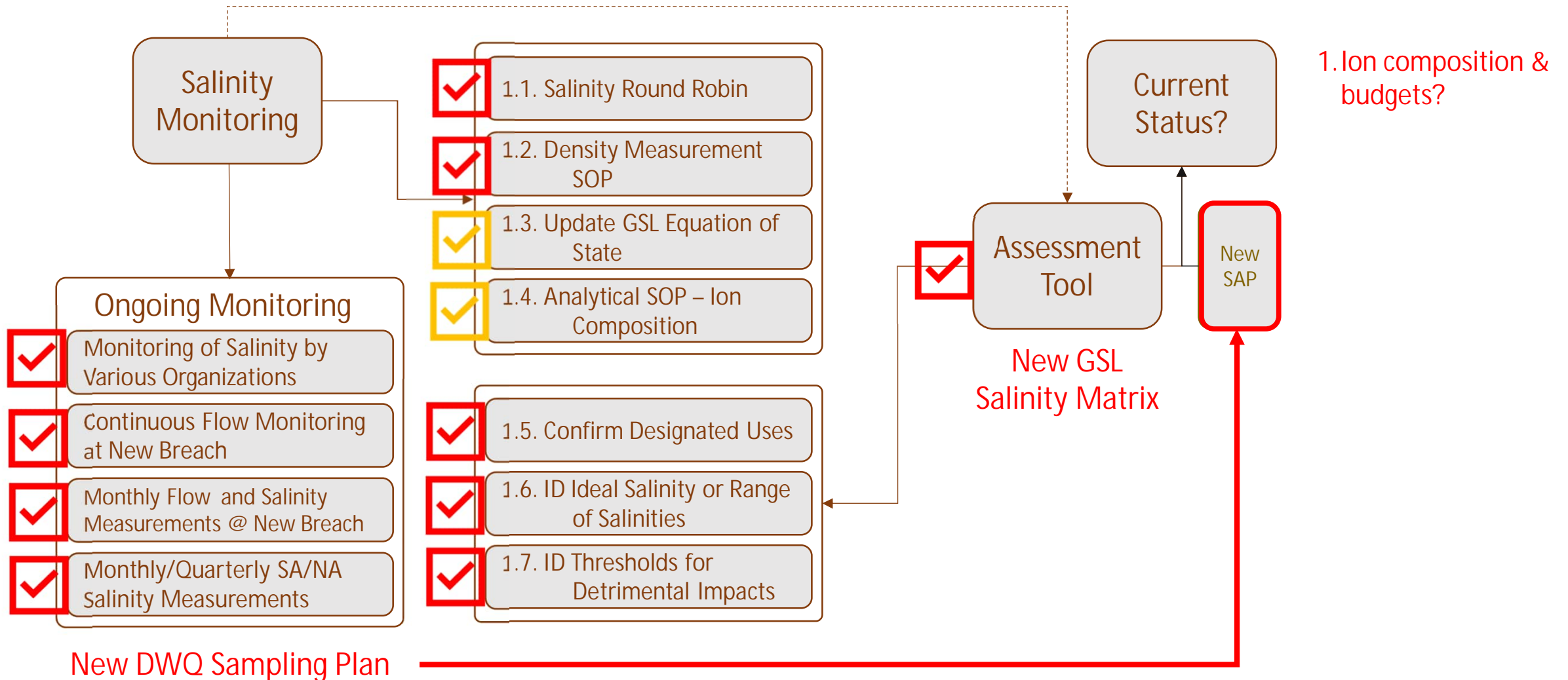
# Phased Approach

- Phase I – Are we using the correct methods and thresholds? Is our current condition ok?
- Phase II – What key salinity characteristics and dynamics drive the system and how?
- Phase III – Can and how should salinity be managed into the future?
- Phase IV – How could and do watershed and lake level changes affect the salinity?



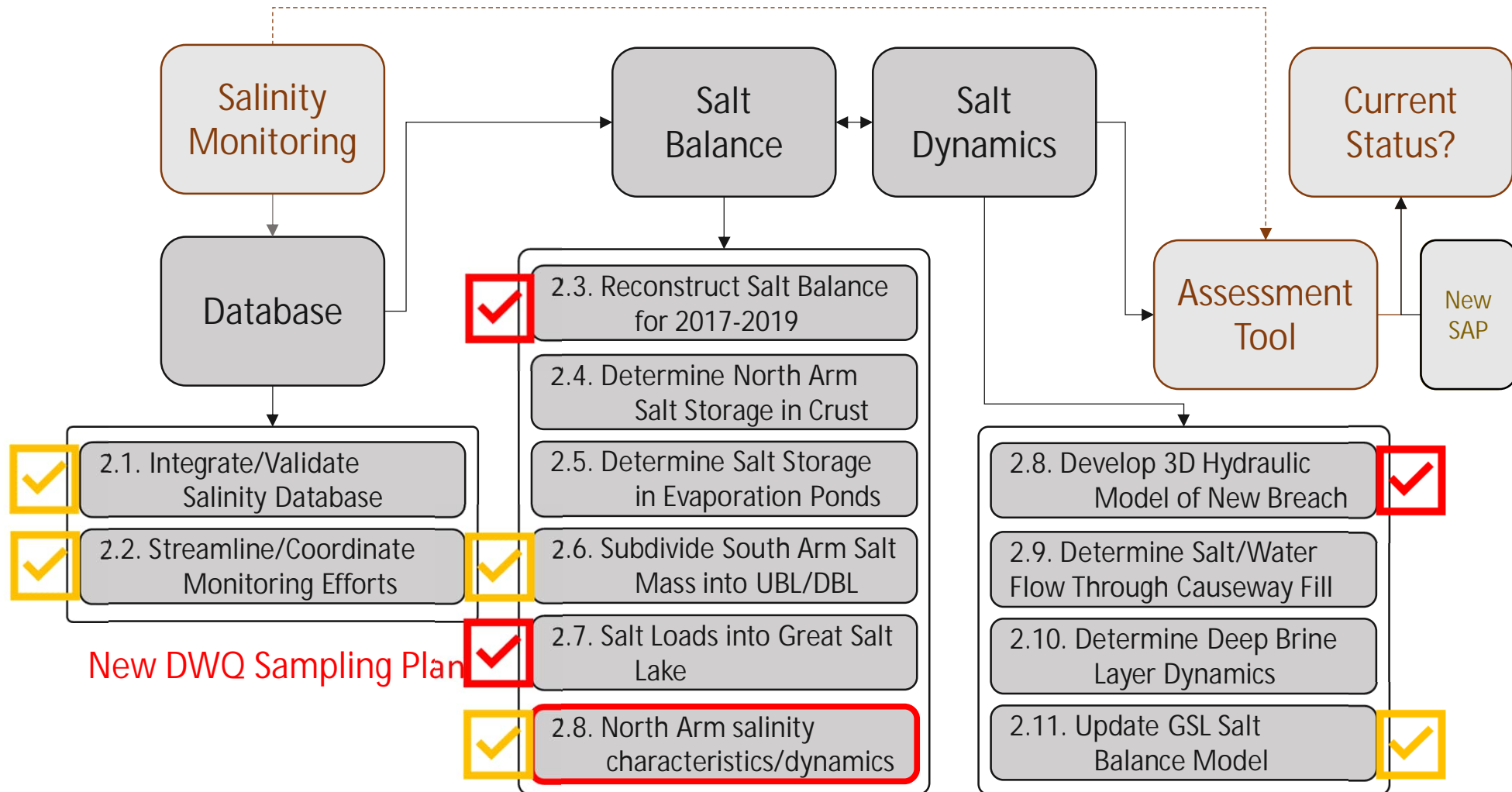
# Salinity Research Framework – Phase I

Are we using the correct methods and thresholds? Is our current condition ok?



# Salinity Research Framework – Phase II

What key salinity characteristics and dynamics drive the system and how?



1. Where should future data reside?
2. North Arm salinity dynamics/characteristics?
3. South Arm salinity mass balance?
4. Flow through causeway fill
5. South Arm deep brine layer dynamics?
6. Areal South Arm salinity dynamics?
7. Salt precipitation processes
8. What can we learn from historical shifts?



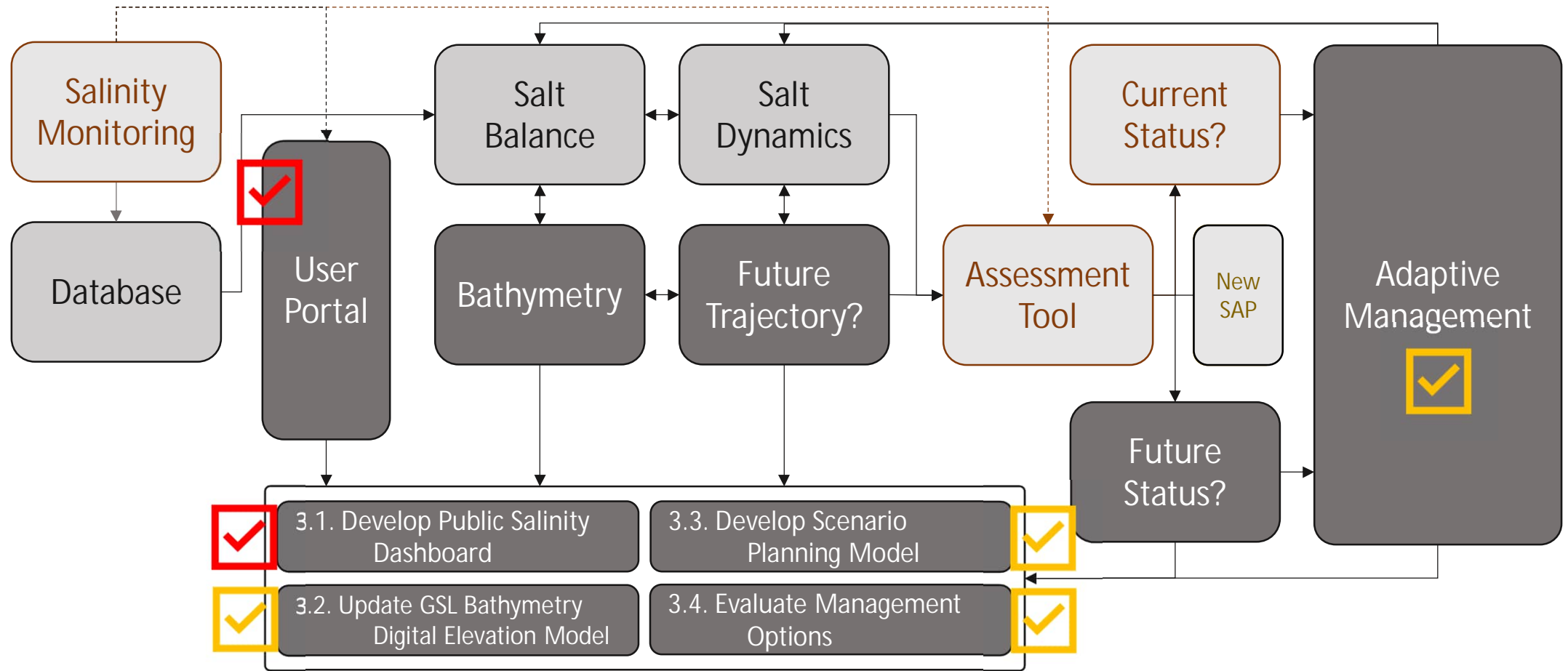
# Salinity Research Framework – Phase III

Can and how should salinity be managed into the future?

- How can we integrate these processes?
- Which factors have the most influence? At what time-scale?
- How might salinity change into the future?
- How can we manage in-lake salinity?
- How does saltwater removal influence salinity (removing salt & water)?
- Should something be done about the deep brine layer?

# Salinity Research Framework – Phase III

Can and how should salinity be managed into the future?



# Salinity Research Framework – Phase III

Can and how should salinity be managed into the future? What are the implications?

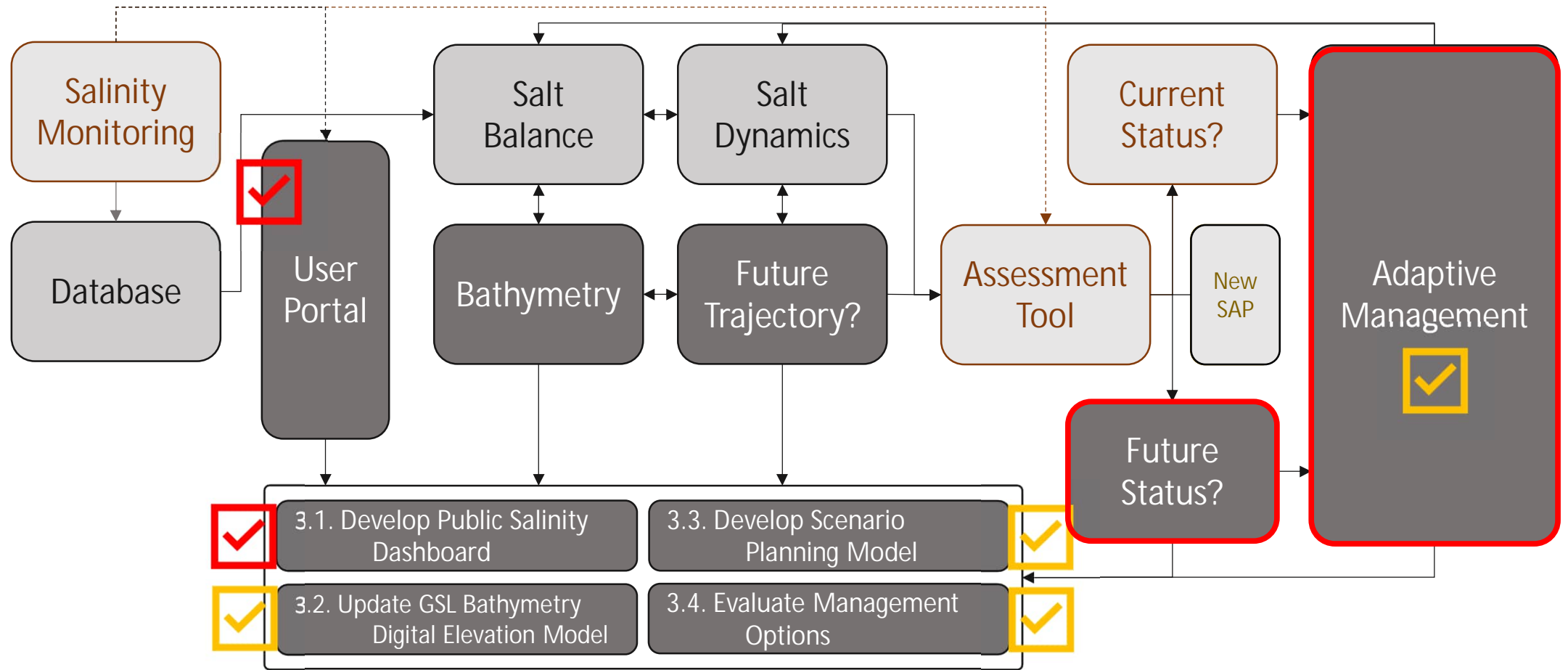
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Pacific Ocean proposal?

- What are the implications to designated uses if we change paradigms (ecology, mineral extraction)?

# Salinity Research Framework – Phase III

Can and how should salinity be managed into the future?



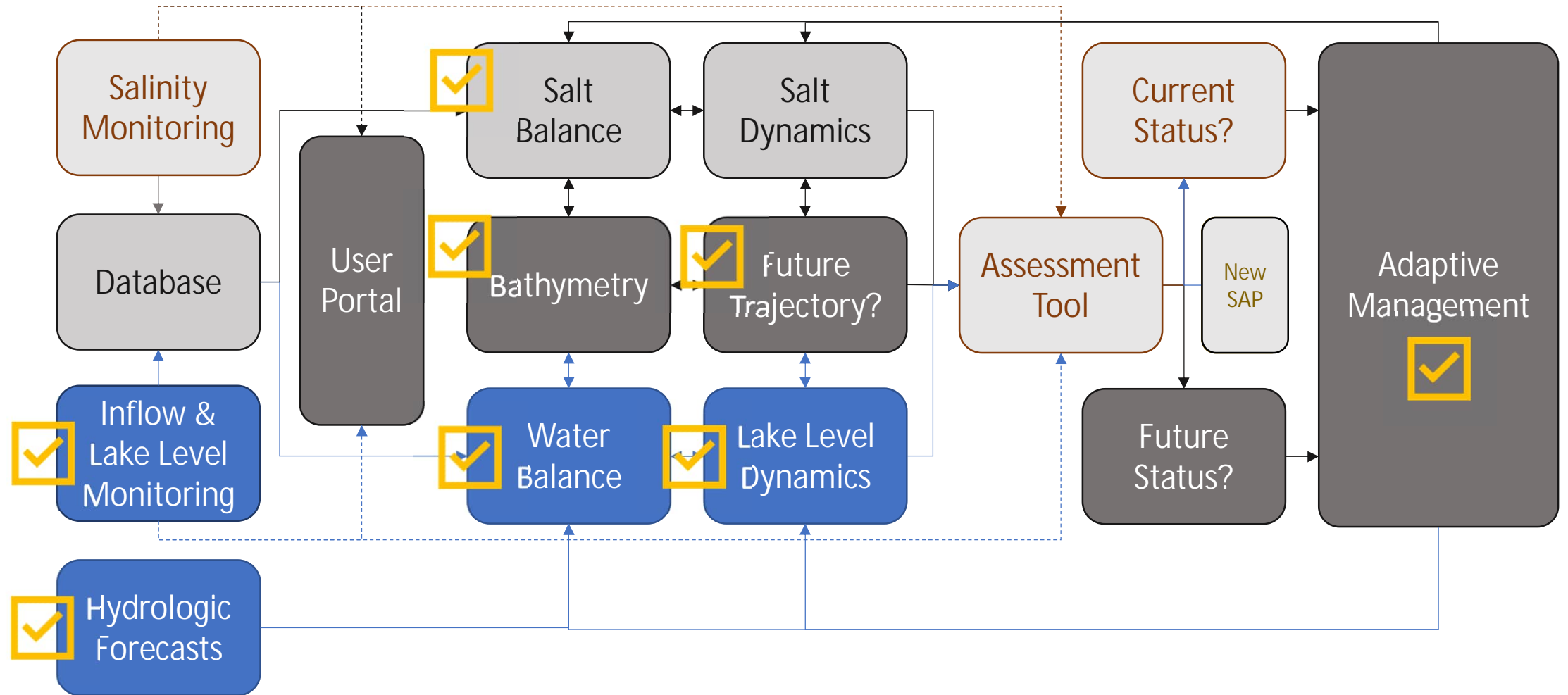
# Salinity Research Framework – Phase IV

How could and do watershed and lake level changes affect the salinity?

- How can we integrate these processes?
- Which factors have the most influence? At what time-scale?
- How might salinity change into the future?
- How can we manage in-lake salinity?
- How does saltwater removal influence salinity (removing salt & water)?
- Should something be done about the deep brine layer?
- How do reductions of inflow influence salinity?
- What happens if lake levels come back up?
- What are the implications to designated uses if we change paradigms (ecology, mineral extraction)?

# Salinity Research Framework – Phase IV

How could and do watershed and lake level changes affect the salinity?



# Misc topics that didn't fit into the above

- Where does Farmington Bay and Bear River Bay fit into this?