Utah Lake Water Quality Study: Stakeholder Process
Science Panel Meeting #2 (August 8) and #3 (August 9)
Meeting Summary
August 8-9, 2018

This document includes a list of future meetings, action items, and a brief summary of the discussions. Please review the action item list for tasks assigned to you and/or the Science Panel in general. A list of attendees can be found at the end of the document.

Upcoming Meeting/Call	When & Where	Suggested Agenda Items
ULWQS Science Panel Call #3	*Tuesday, August 28, 2018 10:00 a.m. to 12:00 p.m.*	• Review and approve tasks in OP; review and approve Charge document
ULWQS Science Panel Call #4	*Thursday, August 30, 2018 1:00 p.m. to 3:00 p.m.*	• Discuss modeling efforts; discuss data quality and approach to uncertainty

I. Action Items – August 8 and 9

Meeting Summaries	Who	Due Date	Date Completed
1. Share draft Meeting Summary	Facilitation Team	August 23	August 23
2. Review and share comments on summary	Science Panel	August 30	August 30
3. Finalize summary and post to Dropbox	Facilitation Team	September 4	August 31
Science Panel Operating Principles	**Who**	**Due Date**	**Date Completed**
4. Update SP tasks (from Operating Principles) for SP review and comment	UDWQ	August 21	August 21
5. Define a method/protocol for sharing information (data and analysis)	Facilitation Team/SP	August 28	August 28
6. Describe next steps for further SP discussion on uncertainty (Task)	UDWQ	August 30	August 30
7. Describe next steps for further SP discussion of how to assess proposed work plans and to evaluate the studies (Task)	UDWQ	August 30	August 30
Charge (SC to SP) Document	**Who**	**Due Date**	**Date Completed**
8. Update the Charge document based on the SC/SP discussion for SP review	Facilitation Team/UDWQ	August 21	August 21

9. Share revised Charge document with SC for review and final approval	Facilitation Team	August 31	August 31
Utah Lake Modeling Efforts	**Who**	**Due Date**	**Date Completed**
10. Share background information on overall approach and set stage for further SP discussion of how ULWQS can utilize	UDWQ/Modelers	August 30	August 30
Data and Information Sharing	**Who**	**Due Date**	**Date Completed**
11. Share Gaeta Lab's Utah Lake biological data	Facilitation Team	August 15	August 15
12. Share Carling et al., paper on P and HABs	Facilitation Team	August 15	August 15
13. Share links from James for fetch and lake models	Facilitation Team	August 15	August 15
14. Share DWQ WWTP upgrade feasibility study and economic benefits study	UDWQ	August 15	August 15
15. Provide assessment of phosphorus analysis method, specifically regarding turbidity interference, used by DWQ	UDWQ	August 23	August 23
16. Develop list of ideas for modeling studies, in-situ experiments, and literature reviews based on SP conversations	Facilitation Team/UDWQ	August 28	August 28
17. Provide WFWQC monitoring data to the SP	Theron Miller	August 28	
18. Add figures and data, per SP requests, to the Phase 1 Report (and finalize)	UDWQ	September 6	
19. Provide headwaters nutrient criteria	UDWQ	September 30	
20. Expand depth of information/summarization of ~12 papers from the Literature Review	UDWQ/Limnotech	TBD	
21. Develop a summary of biological data	UDWQ/Technical Consultant	TBD	
22. Reach out to Sam Rushforth about accessing diatom data (analysis of core samples) and share results with SP	UDWQ	Ongoing	

Technical Contractor	Who	Due Date	Date Completed
23. Present preliminary thoughts on Technical Contractor scope (roles and responsibilities)	UDWQ	August 30	August 30

Wednesday, August 8, 2018 1:00 p.m. to 6:00 p.m.

II.   Key Points of Discussion – August 8

A recording of the meeting (also available on the DWQ website in the near future) can be found at the following link: **http://resolv.adobeconnect.com/pc6u3zwb4s3r/**. Please use the video scroll bar along the bottom of the recording window to find the appropriate time in the webinar recording for the session you would like to watch. There are bookmarks in the 'Events Index' on the left side of the screen identifying each session. In addition, a 'recording agenda' is attached at the end of the summary which also provides the timestamps for when each session begins in the webinar recording.

Operating Principles and Role of Science Panel in ULWQS

Scott Daly, Utah Division of Water Quality (DWQ), presented a section of the ULWQS Science Panel Operating Principles (describing SP tasks) that reflected the edits made to the original version based on comments and reactions from the Science Panel during the May 30 SP meeting. Several members of the Science Panel suggested edits to the document. One member of the Science Panel suggested that a protocol is needed for sharing data, information, and analyses with the Science Panel and an action item was created to address this. Mr. De Morgan suggested that an updated version of the document reflecting the suggested changes would be developed in advance of the August 28 and 30 Science Panel calls.

Utah Lake Water Quality Model Development

Dr. Michael Barber, University of Utah, introduced himself to the Science Panel and provided a brief introduction to the modeling project that he is leading with a group of other researchers. Dr. Barber explained that the modeling effort is taking climate change, population growth and planning into account as they evaluate the subsequent effects on Utah Lake and the surrounding watershed. Mr. Daly added that the University of Utah received a grant from the Environmental Protection Agency to develop the model and DWQ decided to use the same model in their efforts to define numeric nutrient criteria for Utah Lake (ULWQS).

Nick Von Stackelberg, DWQ and University of Utah, explained that the University of Utah research group was looking for complex (3-dimensional) and public (freeware) models and identified EFDC (hydrodynamics model) and WASP (water quality model). Members of the Science Panel raised several questions regarding the capabilities of the models and their ability to model certain ecosystem compartments and processes. Mr. Von Stackelberg confirmed that there are several processes that occur in Utah Lake that are not included in the EFDC/WASP models.

Juhn Yuan Su, University of Utah, presented the details of the various compartments and processes modeled by the WASP model. Members of the Science Panel asked numerous questions regarding the capabilities of the model and several "data gaps" were identified and compiled into a list. The Science

Panel stressed the importance of calibration and sensitivity analyses and the general need for a rigorous statistical evaluation. Mr. Su explained that the University of Utah is operating under a challenging schedule that may not allow for exhaustive statistical evaluation. Mr. Daly explained that there will be a point in the process where the DWQ Utah Lake modeling effort diverges from that of the University of Utah and that DWQ may need to pursue additional calibration efforts beyond what the University of Utah would have undertaken.

Literature Review

Mr. Daly explained that the DWQ hired a consultant to perform a review and summary (literature review) of the Utah Lake bibliography. Mr. Daly explained that the literature review categorized the studies included in the bibliography by date, topic and their relationship to the high-level charge questions. The Science Panel expressed that while the literature review is helpful, it would be beneficial for the review to go into greater detail on a subset (~12) of the studies. A discussion ensued among members of the Science Panel and identified specific data analyses and summaries that would be beneficial to the group. A list was generated, and several action items were identified and added to the list.

III.   Public Comments – August 8

Two members of the public signed up to speak during the public comment period.

- David Richards: There are more than >150 phytoplankton taxa and >400 benthic algae taxa in Utah Lake, not 35.
- Dan Potts: for beneficial uses: DWR has not developed a resource management plan for Utah Lake. Maybe this process will help encourage that.

Day 2: Thursday, August 9, 1:00 p.m. to 4:30 p.m.

IV.   Key Points of Discussion – August 9

A recording of the audio portion of the meeting (also available on the DWQ website in the near future) can be found at the following link: https://documents.deq.utah.gov/water-quality/locations/utah-lake/DWQ-2018-009524.mp3.

Open SP Dialogue

Mr. De Morgan welcomed everyone to the meeting and explained that the meeting agenda would be adjusted to allow for open dialogue and discussion among the members of the Science Panel. To initiate the discussion, each member of the Science Panel shared some thoughts related to the study and how they might contribute to the effort moving forward. The group began developing a list of ideas for modeling studies, in-situ experiments, and literature reviews and requested those be captured in a single document for future reference (see Attachment A). The Science Panel will review the list in future meetings and it will serve as a starting point for developing scopes of work for future research studies. Additionally, numerous sources of relevant data were identified, and action items were created to locate and share this data. The Science Panel also identified potential future analyses and/or studies that would provide important information to the ULWQS effort.

Gap Analysis – Revisiting Sub-questions in the Draft Charge

The Science Panel reviewed the high-level charge questions and the related sub-questions and made a series of comments and suggested modifications to the order and location of the sub-questions. The facilitation team and DWQ agreed to integrate those into a revised version for SP review after the meeting. The group also worked to identify where data/information is lacking. Numerous questions and ideas for how to answer the questions were developed in this discussion, which helped to identify where additional data would be needed. Ideas for how to obtain this data (e.g., from the literature, new studies) were shared in the discussion. Members of the Science Panel suggested specific sources of data and information in the scientific literature and also referenced the body of research that has been conducted to date on Utah Lake. Specific to Charge question #4 related to beneficial uses, members of the Science Panel brought up the potential value of ecosystem services that Utah Lake provides. Erica Gaddis (Steering Committee co-chair) mentioned that DWQ commissioned a cost study in the past, which would be uploaded to the Science Panel Dropbox folder. Additionally, the Science Panel suggested that they need to have a discussion regarding uncertainty in data analysis and modeling. Several action items related to information-sharing and next steps came out of this discussion and are included in the table above.

V.   Public Comments – August 9

One member of the public signed up to make a public comment.

- David Richards:
    - Provo Bay actually provides habitat for tons of shorebirds even though water quality is impacted there.
    - Contribution of native mollusks to the ecosystem. The mollusks may filter the whole lake in a day.

VI.   Participation – August 8 and 9

Meeting Participants (Name, Organization) – August 8

Members of the Science Panel:
- Janice Brahney, Utah State University
- Mike Brett, University of Washington
- Greg Carling, Brigham Young University
- Jereme Gaeta, Utah State University
- Mitch Hogsett, Forsgren Associates
- Ryan King, Baylor University
- James Martin, Mississippi State University
- Theron Miller, Wasatch Front Water Quality Council

Members of the Public:
- Jeff Denblyker
- Chris Keleher
- Mike Mills
- Jay Olsen
- Dan Potts

- David Richards
- Daniel Riddle

University of Utah Modeling Team
- Michael Barber
- Yuhn Yuan Su

State of Utah Staff Present:
- Erica Gaddis
- Jim Harris
- Carl Adams
- Scott Daly
- Nick Von Stackelberg

Facilitation Team:
- Paul De Morgan, RESOLVE
- Dave Epstein, SWCA

Meeting Participants (Name, Organization) – August 9

Members of the Science Panel:
- Janice Brahney, Utah State University
- Mike Brett, University of Washington
- Soren Brothers, Utah State University
- Greg Carling, Brigham Young University
- Jereme Gaeta, Utah State University
- Mitch Hogsett, Forsgren Associates
- Ryan King, Baylor University
- James Martin, Mississippi State University
- Theron Miller, Wasatch Front Water Quality Council

Members of the Public:
- Chris Keleher
- Mike Mills
- David Richards

Division of Water Quality Staff Present:
- Erica Gaddis
- Jim Harris
- Carl Adams
- Scott Daly
- Jim Harris

Facilitation Team:
- Paul De Morgan, RESOLVE
- Dave Epstein, SWCA

Attachment A

**ULWQS Science Panel Ideas for Studies, Experiments, and Literature Reviews
From August 2018 Science Panel and Joint Meetings**

Study Objectives
- Understand the Utah Lake-specific relationship between nutrient availability and the frequency of HABs?
  - How much do nutrient concentrations need to be reduced to reduce the frequency of HABs?
- Understand what the effect of carp removal is on:
  - Macrophytes
  - Turbidity
  - Sediment and nutrient resuspension
- Understand the equilibrium concentration of phosphorus at the sediment-water interface (in the sediments, pore water, and water column)
- Identify the equilibrium concentration of phosphorus at the sediment-water interface once nutrient reductions occur (new/future condition)
- Identify the nutrient concentration thresholds/tipping points for HABs
- Understand the biology of Utah Lake
  - Patterns of phytoplankton and zooplankton
- Understand the dynamics of diatoms in Utah Lake

Needed Analyses of Existing Data
- Depiction of the seasonal succession of phytoplankton and zooplankton.
  - What is the typical pattern of phytoplankton and zooplankton, how do they wax and wane?
    - The biology of the system is relatively unknown to the SP
- Phase 1 Report
  - Need to beef up the biology component of the Phase I Report
  - Modify loading data to show concentration of nutrients and water flow
  - Present % of biovolume of cyanobacteria in addition to the cell counts because cell volume varies between species.
- A comprehensive analysis (or report) that could help to identify data gaps (e.g., Phase 1 Report; biological data summary)
- A (4-5 page) summary of what is available in the literature on diatoms

Needed Studies
- A new/updated study on diatoms in Utah Lake
  - The taxonomy of diatoms has changed considerably in the last 10 years. There would be a lot more to be learned from new diatom studies.
- A spatial and possibly temporal study of HABs and attempt to make connections to local environmental conditions in the lake
  - Do HABs generally begin near POTW outfalls?
- Macrophyte enclosure study/carp exclusion study
  - Evaluate the response of macrophyte growth and sediment suspension in the absence of carp
- Back of the envelope calculations (simplified modeling studies; WASP, LAKE2K, fetch model, etc.) to identify which parameters or processes that are most important

- o Lake2K: pH-primary production coupling; calcite formation is a slow reaction (night)
- Paleo study to look at historic conditions (did macrophytes exist) and changes in composition and abundance of numerous taxa and nutrients
  - o Estimate production of algae and macrophytes
- Explore relationship between rain and HABs
- Summary of literature on nutrient (water quality) criteria development
  - o To be done by a contractor who could also give a presentation to the SP on how the process goes and how it would need to be done
  - o Also may include a stressor-response study or a mechanistic model (Erica)
- Stand-alone sediment diagenesis model
  - o More detailed version of what is in WASP
    - ▪ Developed by Greg Pelletier
- Paired studies
  - o Nutrients and HABs
- Investigation of environmental requirements for macrophyte growth (separate from the enclosure study). It would involve, for example, first identifying environmental requirements (light, substrate, etc.) and then mapping the areas of the lake where under existing or future conditions, macrophyte growth would be possible. For example, macrophyte growth would probably not be expected in areas with unconsolidated sediments or areas where wind shear is appreciable. One component of the study could be the application of the USGS fetch model.

Data Needs
- Lake stratification data
- Measurements of sediment oxygen demand and phosphorus flux into/from the sediments
- Information on the role of macrophytes in water clarity (turbidity) and sediment resuspension
- Population size, size structure and excretion rates for carp.
  - o Excretion rates of carp (Mike Vanni study may provide this)
- Geolocations of historic sightings of macrophytes
- Sediment shear stress, Utah Lake fetch (fetch model above)
- Environmental requirements of macrophytes found in Utah Lake
- Equilibrium sediment phosphorus concentrations
- Sediment phosphorus release rates, sediment oxygen demand (SOD)
- Data from sondes from 2016 HABs events
- Sequestration of calcium and others – pH fluctuation
- How is DWQ (and others) accounting for turbidity in phosphorus analyses?

U of U Modeling Effort
Shortcomings of EFDC:
- Bioturbation
- Calibration Goals

Shortcomings of WASP:
- Groundwater inputs
- Stormwater
- More complex sediment diagenesis
- Atmospheric Deposition
- POTW Inputs

- Particle inorganic P, binding with calcite
- Biological export of P (chironomids, carp) and internal recycling of nutrients by carp
- Food chain mechanisms (only phytoplankton loss rates
    - Need for a stand-alone food web model?
- Calibration Goals, maybe something is wrong with the model if the run time is too longSP would like to understand more about the calibration effort
    - DWQ may have to lead the final calibration/statistical evaluation after the model is "handed off" by the U of U
- regardless of time constraints, statistical evaluation of fit needs to be evaluated and the prioritization of which processes are the most important for goodness of fit ahead of time. Prioritize which components of the model must have the best fit.