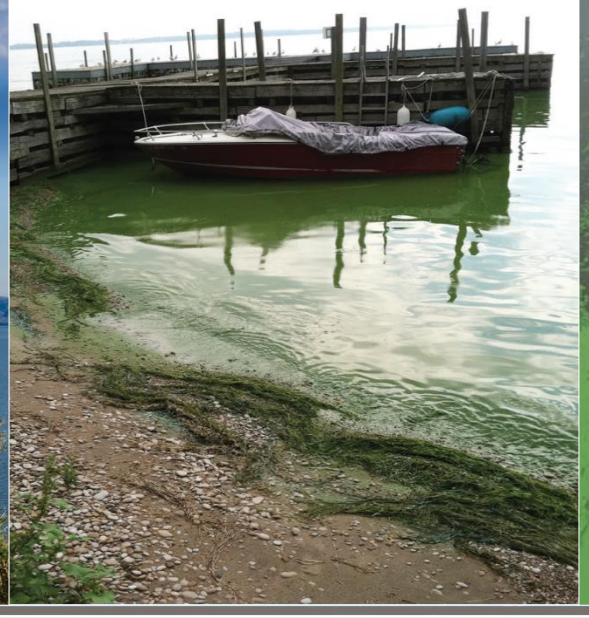
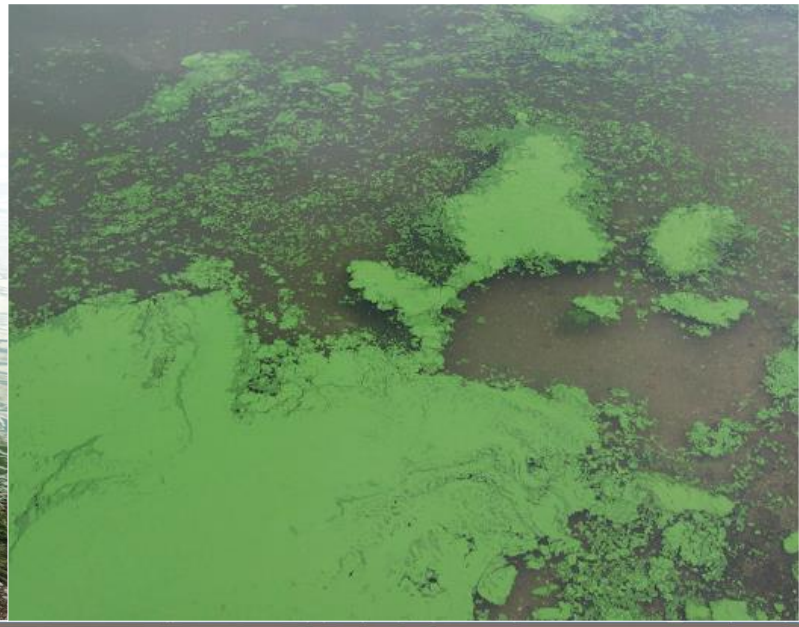
UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

TETRA TECH

ULWQS Charge Questions Reporting

Steering Committee & Science Panel Joint Meeting | January 19, 2022





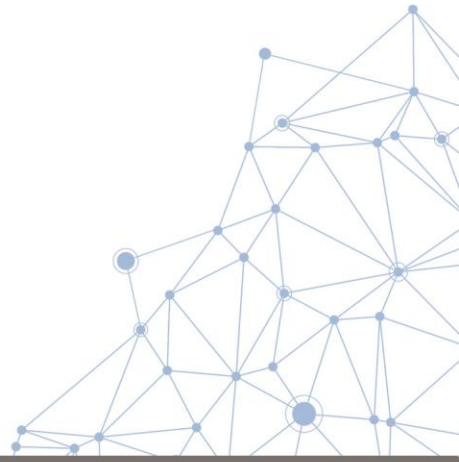
Goals

Present outcomes from interim charge questions reporting document (SP product)

Facilitate SC and SP interaction to ensure any SC questions are answered

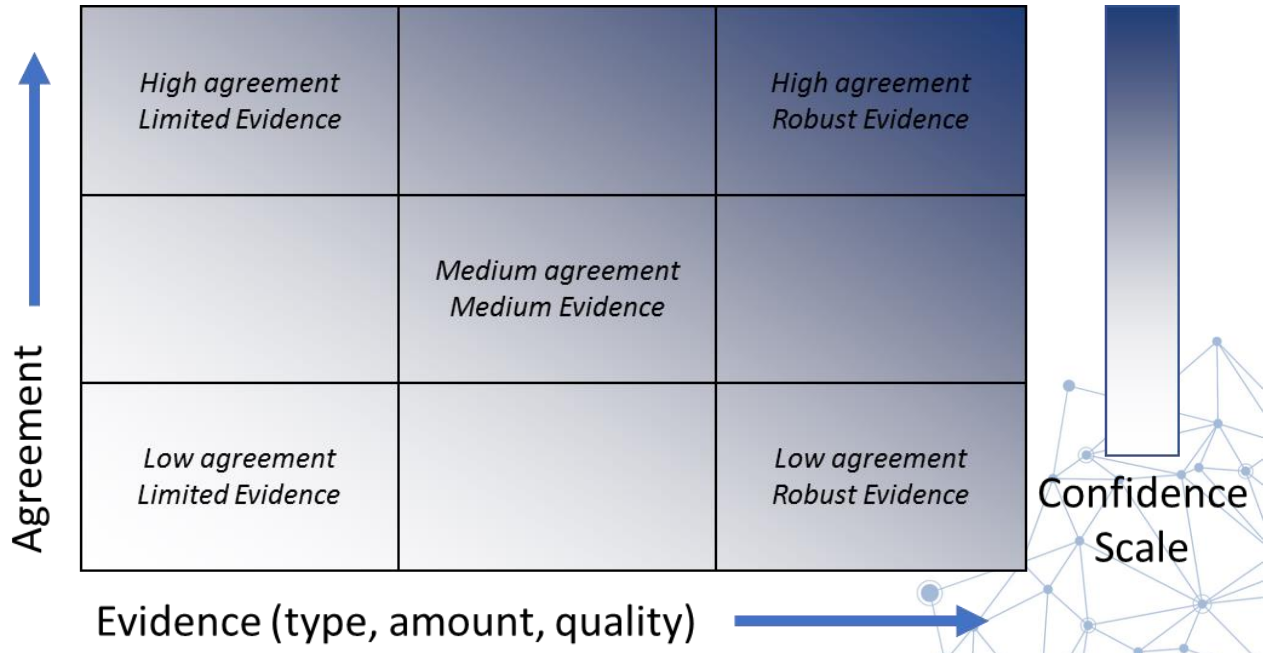
ULWQS Charge Questions

- **4 Overarching questions posed by SC**
  1. What was the historical condition of Utah Lake with respect to nutrients and ecology pre-settlement and along the historical timeline with consideration of trophic state shifts and significant transitions since settlement?
  2. What is the current state of the lake with respect to nutrients and ecology?
  3. What additional information is needed to define nutrient criteria that support existing beneficial uses?
  4. Is there an improved stable state that can be reached under the constraints of current water and fishery management?
- **32 more detailed sub-questions developed by SP**



SP Process

- **Questions divided into 6 themes**
- **Expertise-based SP sub-groups evaluated questions according to Uncertainty Guidance**
  - Evidence description
  - Evidence type
  - Evidence amount
  - Evidence quality
  - Evidence agreement
  - Confidence: matrix of evidence & agreement
  - Likelihood: quantification of uncertainty

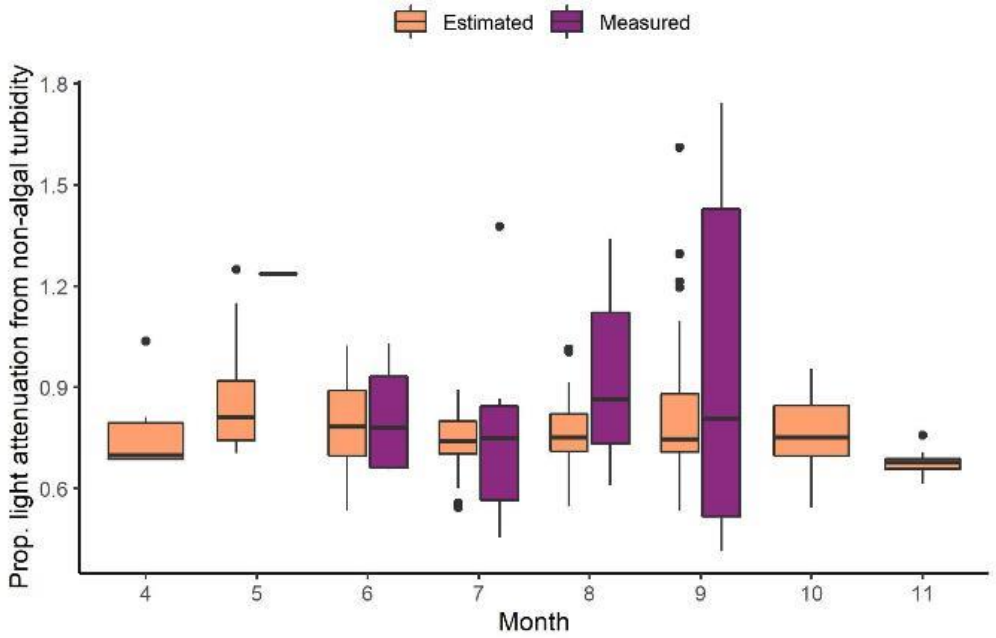


Historical Condition

- **Presence and species of diatoms and macrophytes in sediment cores:** *high amount, high quality = high confidence*
- **Historical change from oligo-mesotrophic conditions to eutrophic conditions:** *high amount, high quality = high confidence*
- **Historic nutrient conditions in sediment cores:** *high amount, quality, agreement = high confidence*
- **Phytopigment and DNA evidence of historical water quality and trophic state:** *high quality, medium amount, high agreement = high confidence*
- **Nutrient regime assuming no inputs from human sources:** *low confidence**

**additional evidence forthcoming*

Macrophytes and Diatoms

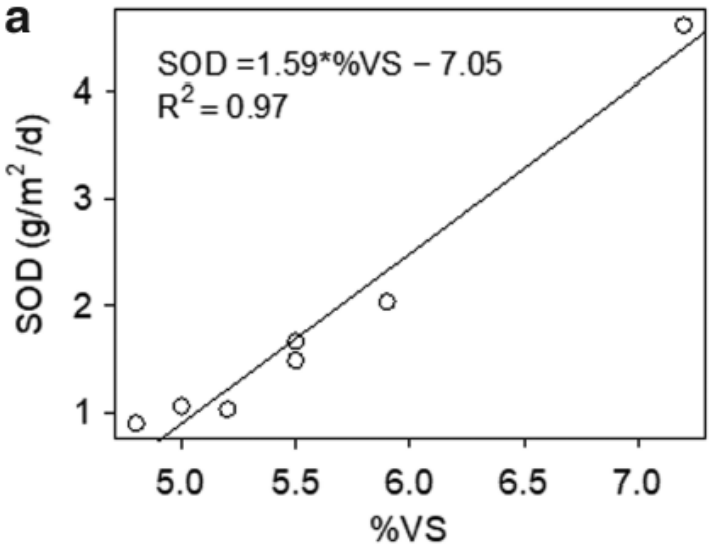


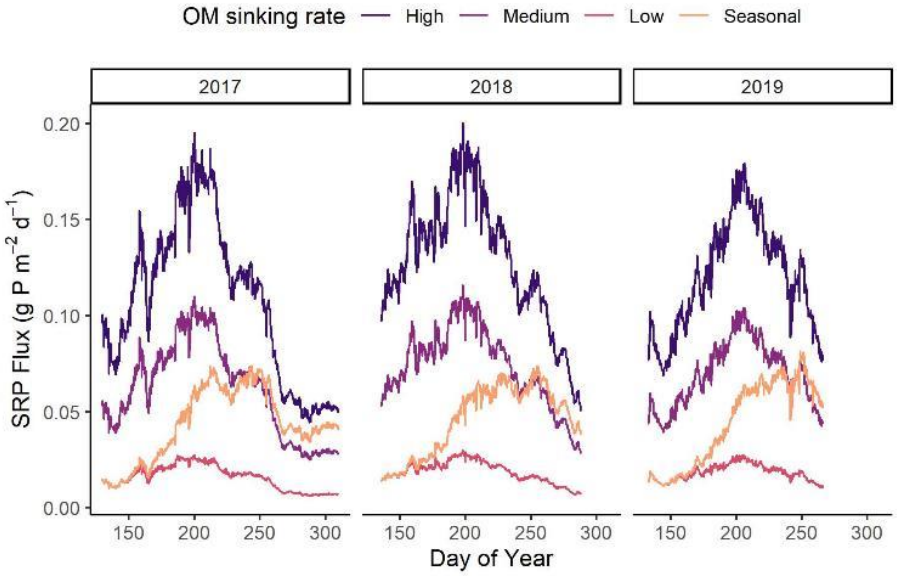
- **Environmental requirements for present and historical macrophyte species:** *medium amount, low-high quality, high agreement = medium confidence*
- **Role of lake drawdown on macrophyte recovery:** *low direct evidence + literature, high quality, high agreement = medium confidence*
- **Relationship between carp, wind, macrophytes on non-algal turbidity and nutrient cycling:** *high amount, med-high quality, high agreement = high confidence*
- **Shift to macrophyte-dominated state following nutrient reductions:** *low confidence**

**additional evidence forthcoming*

Sediments

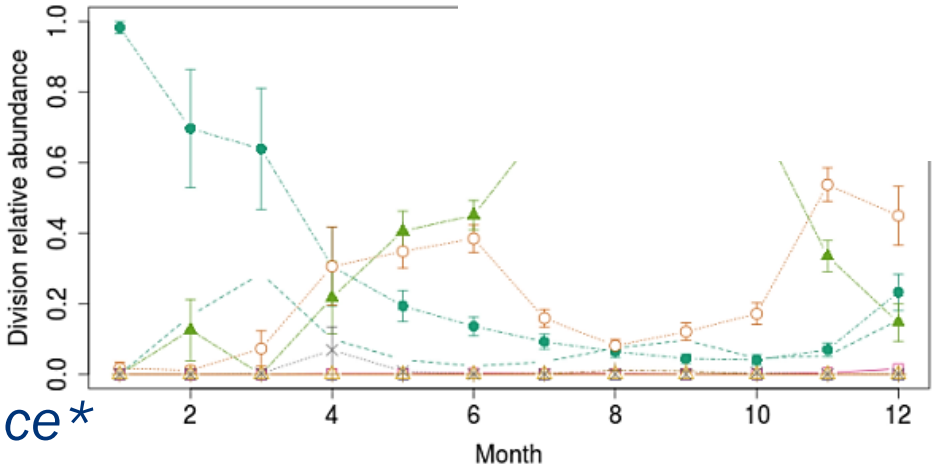
- **Calculating equilibrium P concentration between sediment and water column:** *low amount + high quality = low confidence**
- **Sediment oxygen demand and nutrient release:** *high amount, quality, agreement = high confidence*
- **Impact of stratification on anoxia and P release:** *limited evidence, high quality = medium confidence*



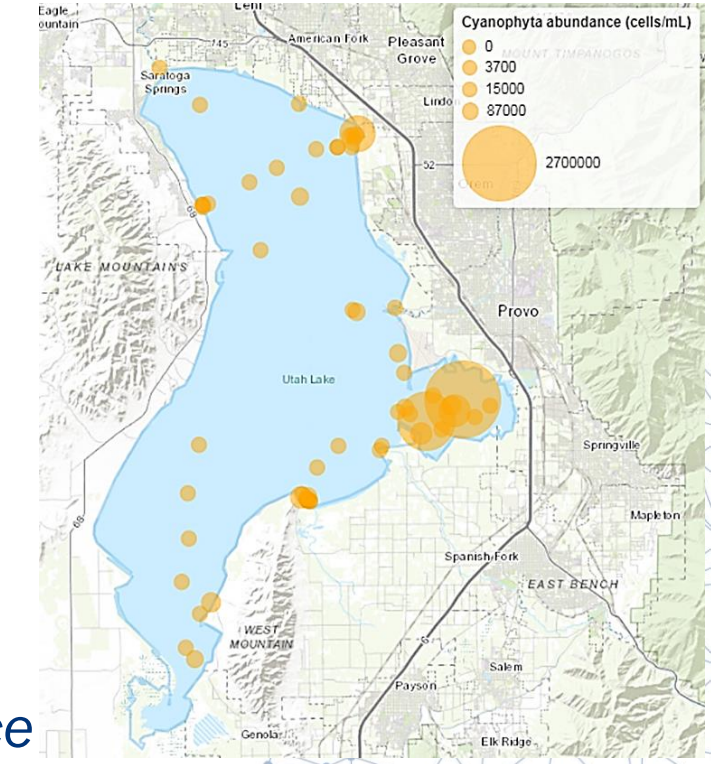


*additional evidence forthcoming

Harmful Algal Blooms



- **Spatial distribution of HABs and proximity to nutrient sources:** *limited evidence, high quality = medium confidence**
- **N and P limitation of primary production and HABs:** *robust evidence, high agreement = high confidence*
- **Role of lake elevation on HABs:** *limited evidence, medium quality = medium confidence*
- **Role of other factors on HAB formation:** *evidence varies by constituent, medium confidence*
- **Role of calcite scavenging on P:** *limited evidence**
- **Relationship between light extinction and algae, TSS, turbidity:** *robust evidence, high agreement & quality = high confidence*
- **Extent HABs can be reduced by nutrient reductions:** *high confidence*



*additional evidence forthcoming

Aquatic Life

- **Paleo record of carp over time:** *limited evidence, high quality = medium confidence*
- **Contribution of carp to nutrient cycling:** *medium confidence in range, low in mean*
- **Impact of carp removal on macrophytes, nutrients, clarity:** *high amount, medium-high quality, high agreement = high confidence*
- **Non-algal turbidity from wind vs. carp: medium confidence** *(both contribute) & low confidence (relative impacts) (limited amount of Utah Lake-specific analyses)*
- **Early life stages:** *limited evidence, high quality = medium confidence (some areas meet needs), distribution info needed*
- **Which species are sensitive and need protection from nutrient impacts:** *lack of info*

Criteria Development

- Question 3: What additional information is needed to define nutrient criteria that support existing beneficial uses?
- Response based on management goals table evaluation & technical framework

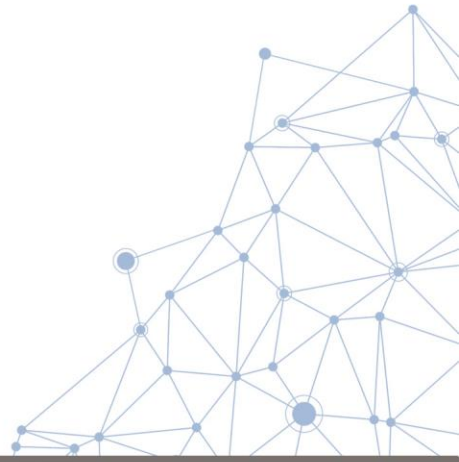
Management Goal	Assessment Endpoint	Relevant to developing in-lake N and P criteria?	Is the measure currently quantifiable?
Primary contact recreation (2a)			
Harmful algal blooms (HAB) will not create toxins that threaten public health.	Algal toxin concentrations	Yes	Yes
HAB occurrence is limited in spatial extent and infrequent to support robust recreational industry and community.	Magnitude, frequency, and duration of algal blooms.	Yes	Yes
Improve submersible recreation (swimming, paddle boarding, water skiing, etc.) experience.	Magnitude, frequency, and duration of algal blooms.	Yes	Yes
Swimming beaches and shoreline access locations are open all summer without nuisance algae or public health advisories.	Magnitude, frequency, and duration of algal blooms.	Yes	Yes

Stressor	Response	Empirical S-R Data Available	Mechanistic Model Output
Chlorophyll *a*	Microcystin concentration	Yes	No
Cyanobacterial abundance	Microcystin concentration	Yes	No
Chlorophyll *a*	Cyanobacterial abundance	Yes	Yes
Chlorophyll *a*	pH	Yes	Yes

Forthcoming Studies that will improve confidence

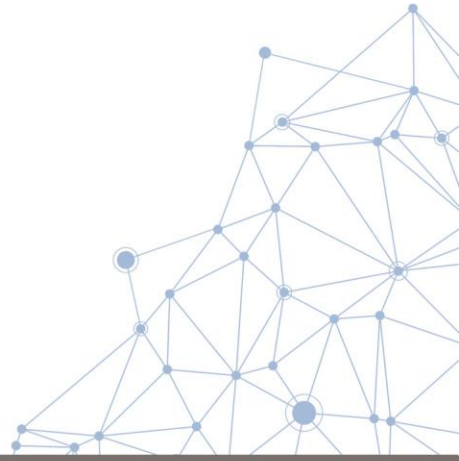
Note: these are Utah Lake-specific studies. Remaining gaps in knowledge can be filled with literature-derived information.

- **Lake model (EFDC-WASP)**
- **Watershed model (HSPF)**
- **Empirical stressor-response analysis**
- **Paleolimnological study**
- **Phosphorus binding study**
- **Littoral sediment study**
- **Limnocorral study**
- **Atmospheric deposition study**
- **Nutrient mass balance analysis**
- **FWS & USGS toxin study on aquatic life**
- **DWQ monitoring program additions**
- **Food web model (Richards)**
- **MIBI (Richards)**
- **Recreation survey**



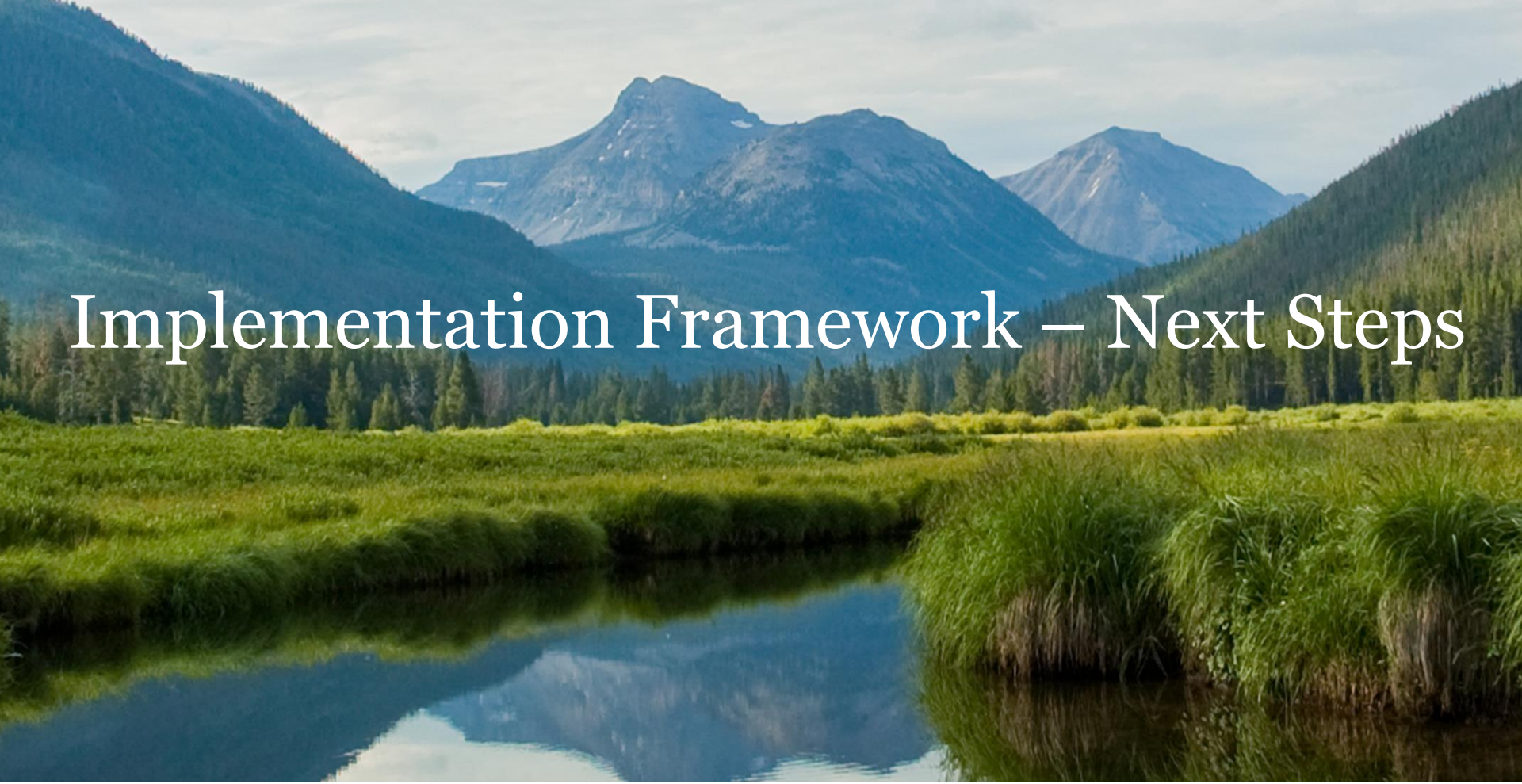
Anticipated Changes from Interim to Final

- **Today's joint SC/SP meeting: record SC comments and considerations to guide SP research, analysis, and final response development**
- **Incorporation of forthcoming studies → increase in confidence**
- **Schedule:**
  - SP studies: completion targeted for first half of 2022
  - Lake and watershed models: completion targeted for end of 2022
  - Update charge questions responses: 2023



Discussion

Questions/clarifications/considerations from the SC to the SP?



Implementation Framework – Next Steps

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

ULWQS Steering Committee
January 19, 2022
Scott Daly

Executive Summary

- Would the SC like to include an executive summary?
- If so, are there specific elements to address?
- Process for development, review, and approval?

Initiate Framework Projects/Components

- Confirm Framework with POTWs
- Chronological workflow and priority
- Initiate discussions with SC
  - Key stakeholders and public outreach (Table 2) – February to March
  - Watershed characterization (Table 3) – February to March
  - ID and evaluate strategies (Table 4) – March to December
- Resource Identification

Resource Identification

- SC and/or SC task groups to evaluate strategies?
- Identify and procure technical support
  - Science Panel engagement?
- Identify financial needs and resources

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