UNCERTAINTY GUIDANCE

Utah Lake Water Quality Study
Science Panel Call
March 3, 2020

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

GOALS

Review Document Updates

Finalize Document

Utah Lake Water Quality Study—Uncertainty Guidance

DRAFT

February 11, 2020
Version 6.0

PRESENTED TO

Utah Department of Environmental Quality
Division of Water Quality
PO Box 144870
Salt Lake City, UT 84114

PREPARED BY

Tetra Tech
1 Park Drive, Suite 200
Research Triangle Park, NC 2709

PROCESS

Feedback from December Meeting

Additional internal DWQ Review

Revised version sent

EDIT SUMMARY

- General formatting
- Added a great deal more information tying assessment endpoints to management goals
- Amended language to clarify contingent vs committed actions
- Updated the mechanistic model language – incorporating James' presentation
- Added language that commits funded studies to this structure
- Added language that commits model team to this structure
- Added language to facilitate SP uncertainty discussions

NUMERIC NUTRIENT CRITERIA TECHNICAL FRAMEWORK

Utah Lake Water Quality Study
Science Panel Call
March 3, 2020

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

GOALS

Review Document Updates

Finalize Document

Utah Lake Water Quality Study—Numeric Nutrient Criteria Technical Framework

DRAFT

February 24, 2020
Version 6.0

PRESENTED TO

Utah Department of Environmental Quality
Division of Water Quality
PO Box 144870
Salt Lake City, UT 84114

PREPARED BY

Tetra Tech Inc., Ecological Sciences
1 Park Drive, Suite 200, PO Box14409
Research Triangle Park, NC 27709

PROCESS

Feedback from December Meeting

Additional internal DWQ Review

Revised version sent

EDIT SUMMARY

- General formatting
- Reconcile with the criteria setting regulatory process
- Management goal/assessment endpoint/measure of effect language
- Adding pH as an assessment endpoint
- New language on constraints of S-R modeling for single system
- New language on frequency and duration
- Clarify state change challenge – and roles of SC and SP
- Added a few new citations
- Clarify stringency rule with criteria
- Assure criteria protectiveness requirement with MLE

STRATEGIC RESEARCH PLAN

Utah Lake Water Quality Study
Science Panel Call
March 3, 2020

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

GOALS

Review Prioritization Exercise and Approve Priorities

Summarize one-to-one highlights

Begin list of discrete RFP projects

PRIORITIZATION

- Started with 13 ideas from 2019 that were not funded
- December – Two groups, modified Delphi ranking, introduced 6 new ideas
- January – Ranked all research ideas
- Straight average
- Are we okay with this ordering?
- Do we need to combine any?

	Research ideas	Mean Ranking - Feb 2020	Mean Ranking - Dec 2019
1	**How large is internal vs external loading (how long would recovery take?)**	**2.3**	**1.9**
2	**Sediment budgets (C, N, and P; nutrient flux chambers)**	**3.6**	**3.9**
3	**Calcite scavenging (how bioavailable is SRP – does bioassay address?)**	**4.3**	**3.4**
4	**Adding modules to the WQ models (sediment diagenesis, calcite scavenging)**	**4.3**	**5.2**
5	Carp effects on nutrient cycling	7.3	
6	Lake level (effect on macrophytes)	9.2	9.0
7	Bioassays that incorporate sediment (next phase mesocosms)	9.4	
8	Macrophyte recovery potential (Provo Bay demo)	10.0	10.7
9	Lake-level effects on biogeochemistry and nutrient cycling	10.2	
10	Environmental controls on toxin production	11.1	
11	Turbidity effect on primary producers	11.2	10.6
12	Resuspension rates from bioturbation	11.7	
13	Carp effects on zooplankton (and does this influence algal response)	11.8	9.6
14	Carp effects on macrophytes	12.1	9.9
15	Toxin Production and N Species	13.7	12.3
16	Recreational surveys	13.8	9.6
17	Macrophyte role (to biogeochemistry)	14.0	11.1
18	Additional atmospheric deposition data	14.6	
19	Alternative models (PCLake – cyano/macrophyte state change)	14.9	12.0

ONE-ONE CALL SUMMARY

- Last 2 weeks – met with everyone
- Identified some common (and unique) elements among calls
- We review those here

ONE-ONE CALL SUMMARY

	Research ideas	Mean Ranking - Feb 2020	Mean Ranking - Dec 2019
1	How large is internal vs external loading (how long would recovery take?)	2.3	1.9
2	Sediment budgets (C, N, and P; nutrient flux chambers)	3.6	3.9
3	Calcite scavenging (how bioavailable is SRP – does bioassay address?)	4.3	3.4
4	Adding modules to the WQ models (sediment diagenesis, calcite scavenging)	4.3	5.2

- Items 1-4 are not independent
  - Does that mean 1 project?
- Internal vs External Loading/Sediment Budgets
  - Need to consolidate knowledge - may have all we need
  - Use intermediate model (PHREEQ, SEDFLUX) to consolidate and predict water column concentrations
  - What are internal load stocks and fluxes? Just sediments?
  - What critical stocks and fluxes can we put numbers on?
  - Can you use that to predict recovery?
  - More in-situ chamber measurements – run longer and more locations?
  - What is the mechanism of getting from sediment to water column?
  - Where are the major gaps/uncertainties?
  - How could that be answered?
  - Are sediments anoxic? Where? What is Redox condition? What is pH gradient?

ONE-ONE CALL SUMMARY

- Calcite/Bioavailability Issue
  - What is P binding to in Utah Lake? May be more than Ca.
  - This chemistry is complex.
  - May be need for a pilot analysis/study to identify these.
  - What is the nature of binding? Mineral matrix or adsorption?
  - Sequential extractions may be needed?
  - Experiments to measure rate of P sequestration
  - May need lab experiments/analyses to get at the specific Ca formations
  - Focus on mixing zones at tributaries (low to high pH)

  - Bioassay studies may have data on Ca effect (+N, pH)
  - Algal growth potential assays could be run (easy to do)

  - Need a WQ module to capture this.

ONE-ONE CALL SUMMARY

- Model Modules
  - Sediment diagenesis and Ca-scavenging need to be in model
  - Model like PHREEQ should predict how/when Ca-P is formed
  - WASP has sediment diagenesis module (2 layer – aerobic/anaerobic; does not do calcite or P binding chemistry – just equilibria)
  - WASP can model a Ca-bound fraction
  - What needs to be included to model calcite formation and P binding? All chemistry or just equilibria with pH?

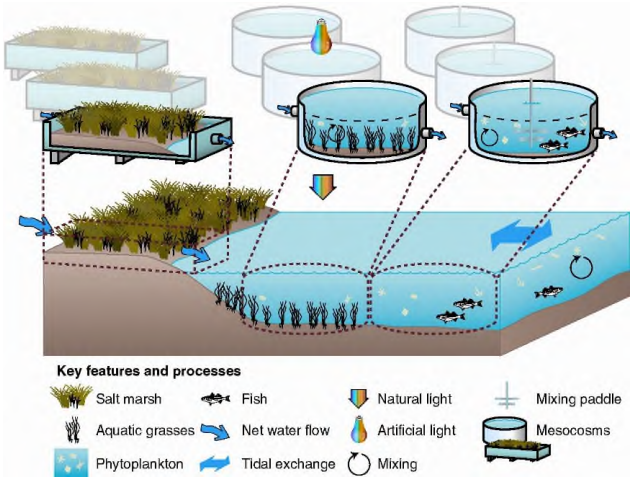
ONE-ONE CALL SUMMARY

- Nitrogen
  - Is our understanding of nitrogen really lacking?
  - Estimates of N fixation? Nitrification? Denitrification?
  - Given aerobic conditions and low C in sediments, where is Denitrification occurring? Water column aggregates?
  - Is N building up in the system?

- Lake Level as a Driver
  - What is flux from littoral sediments as they dry and wet? Sinks or Sources?
  - What is the pattern of wetting and drying?

- Carbon
  - Where is the carbon going? Is Denitrification carbon limited?
  - Lots of productivity, but low carbon in sediments (are they light limited?); NEP~0
  - Reaeration estimates?
  - Do we know enough about C cycle? May need more metabolism measurements.
  - So where is respiration happening?

ONE-ONE CALL SUMMARY



- Mesocosms are an opportunity
  - Manipulate: nutrients (by species), pH, sediment, carp, macrophytes, lake level
  - Can use mesocosms to test hypotheses about P chemistry, N chemistry, fluxes, drivers
  - Can measure all aspects of biogeochemical flux as well (lots of birds with one stone)
  - What is the best design (y1) and then implement (y2)
  - How does/does not this interact with the Timpanogas plan?
  - May want to try in Provo Bay – less wind/wave

- Any others?

PROJECT IDEAS

So, what project(s) do we want to prioritize to answer these questions?

We have time here to brainstorm some ideas

Idea 1: Compile everything we have on stocks and rates; try and fit a model like SEDFLUX and see where the gaps are? Report status, major gaps and propose experiments to fill them.

Idea 2: N budget study – what are standing stocks, rates, and fluxes of N? Start with compiling what we know and then measure the gaps.

Idea 3: Calcite binding - what are rates and forms? Again, start with assembling what we know and small pilot to study calcite formation, characterization, etc.

Idea 4: Mesocosm experiments – things you would conduct if you had mesocosms to use? A miniature N and P budget study? pH manipulations?