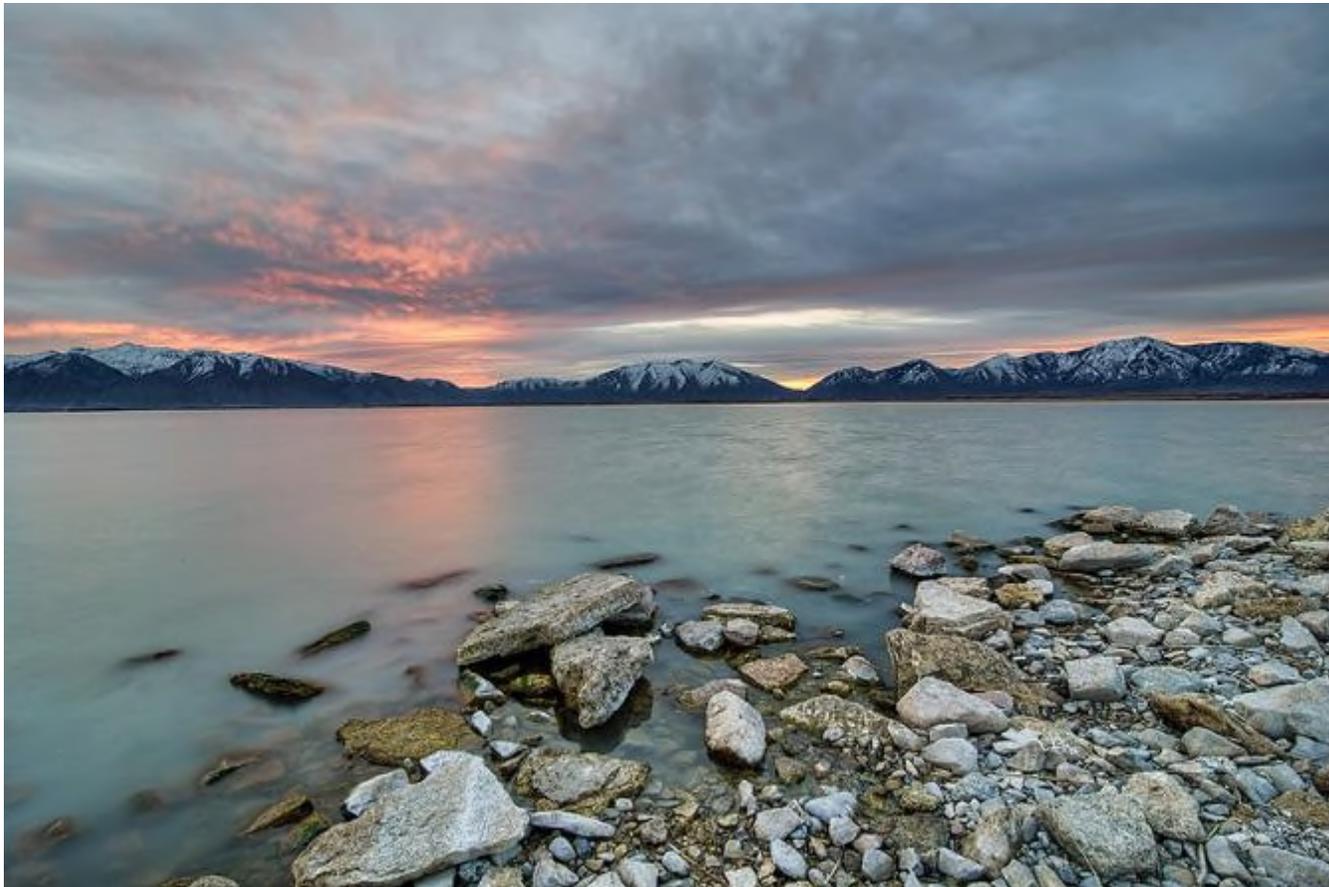


# Utah Lake Water Quality Study

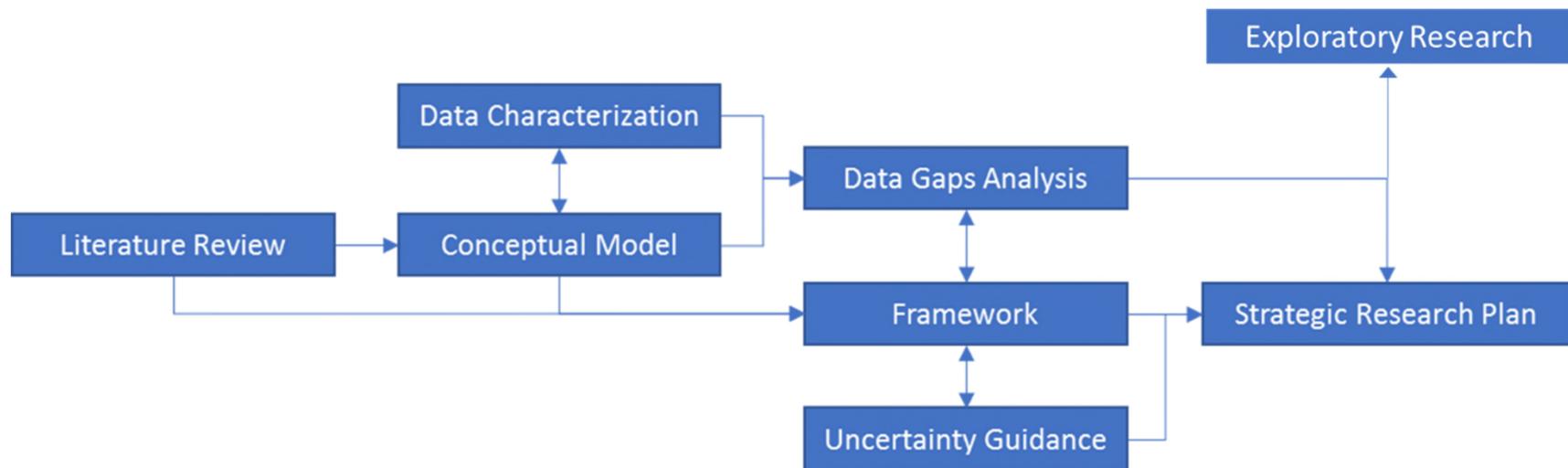
Nutrient Criteria Development Technical Support Project Update

Michael Paul, PhD Tetra Tech Inc

Scott Daly, UDWQ

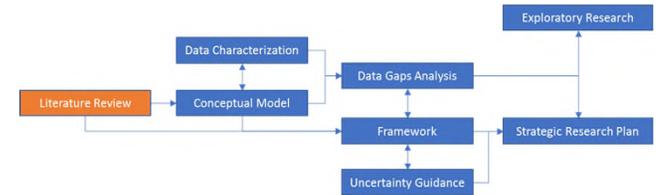


# Project Tasks



# Literature Review

- Completed
- Reviews approaches for deriving numeric nutrient criteria
- Reference, Stressor-Response, Mechanistic Modeling



## Utah Lake Water Quality Study— Approaches for Developing Numeric Nutrient Criteria: A Literature Review

March 29, 2019



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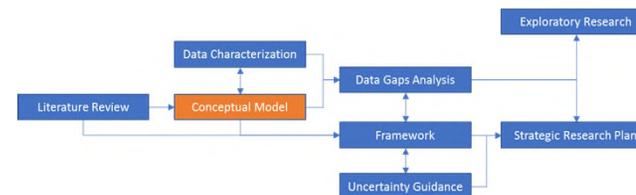
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Salt Lake City, UT 84114

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Tetra Tech  
1468 West Ninth Street, Suite 620  
Cleveland, OH 44113

# Conceptual Models

- Completed
- Reviews different conceptual models
- Compares to mechanistic models



## Utah Lake Water Quality Study— Conceptual Models

November 22, 2019



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Division of Water Quality  
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# Simplified Model

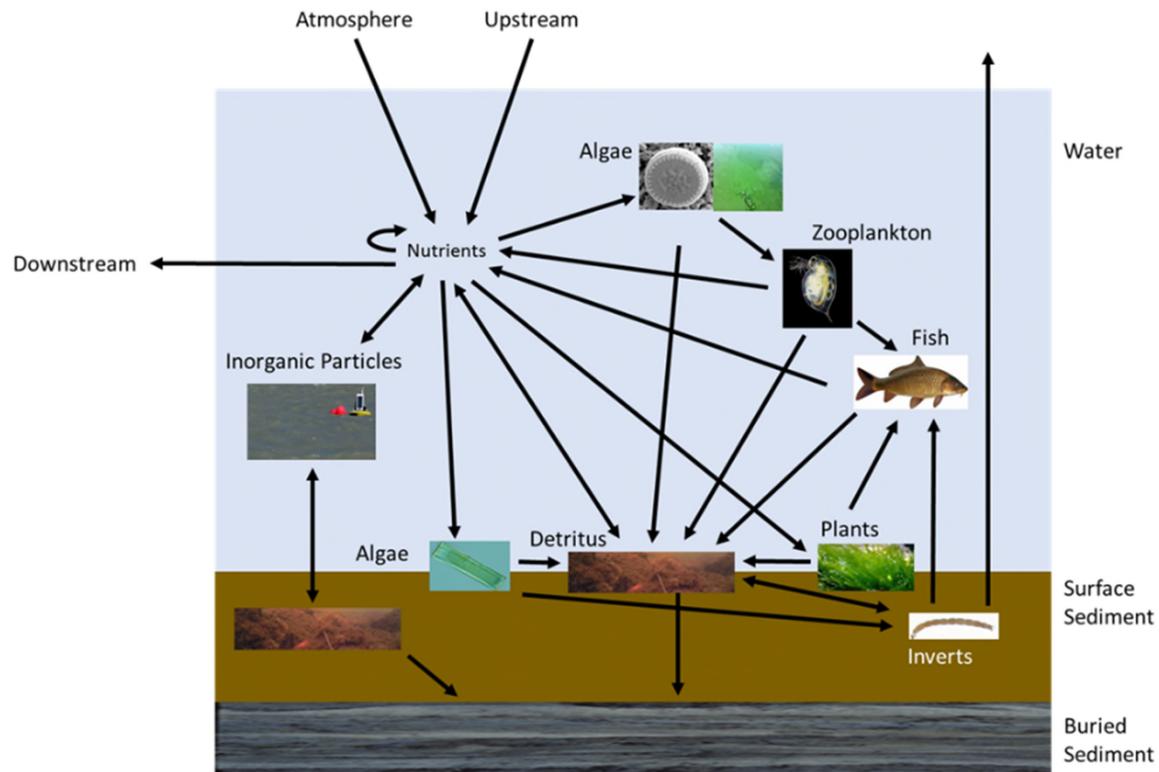
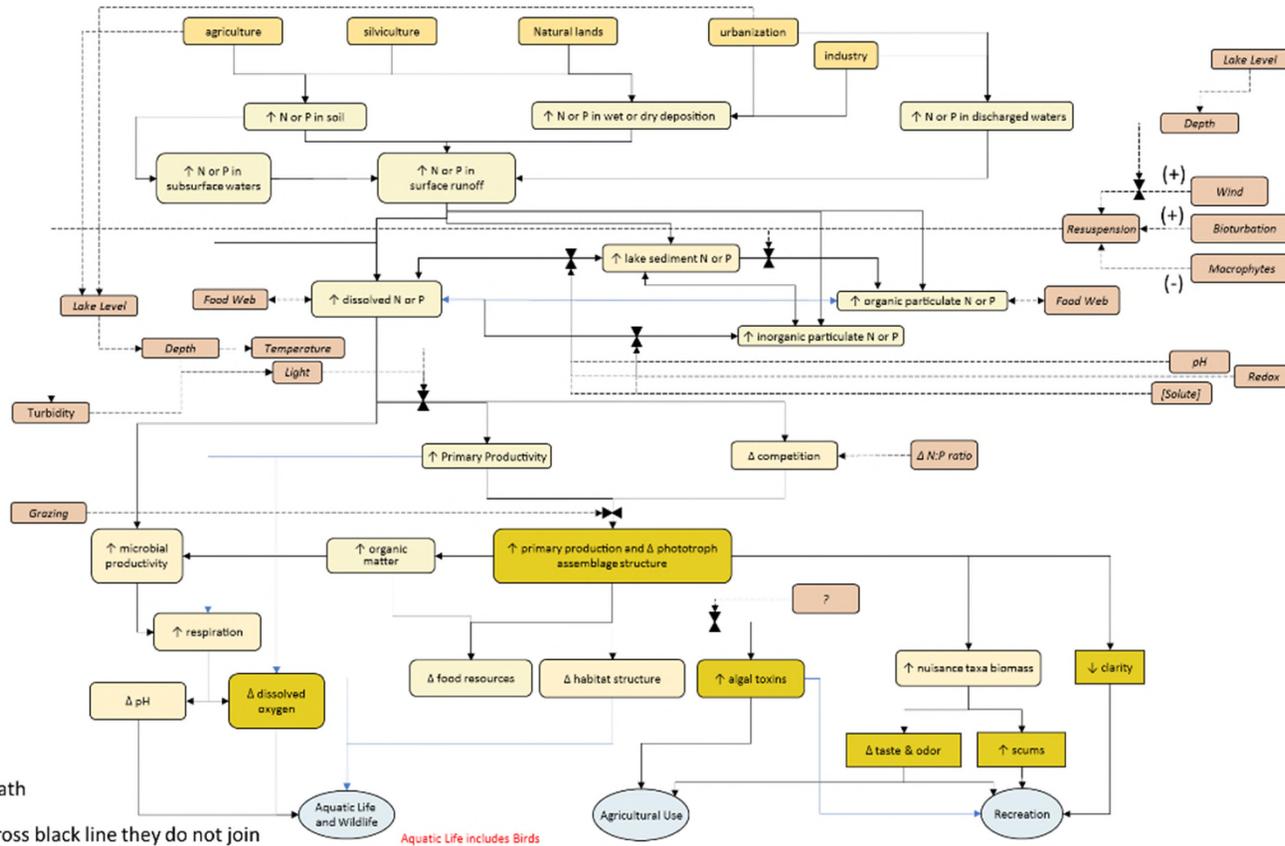


Figure 1. Simplified nutrient model

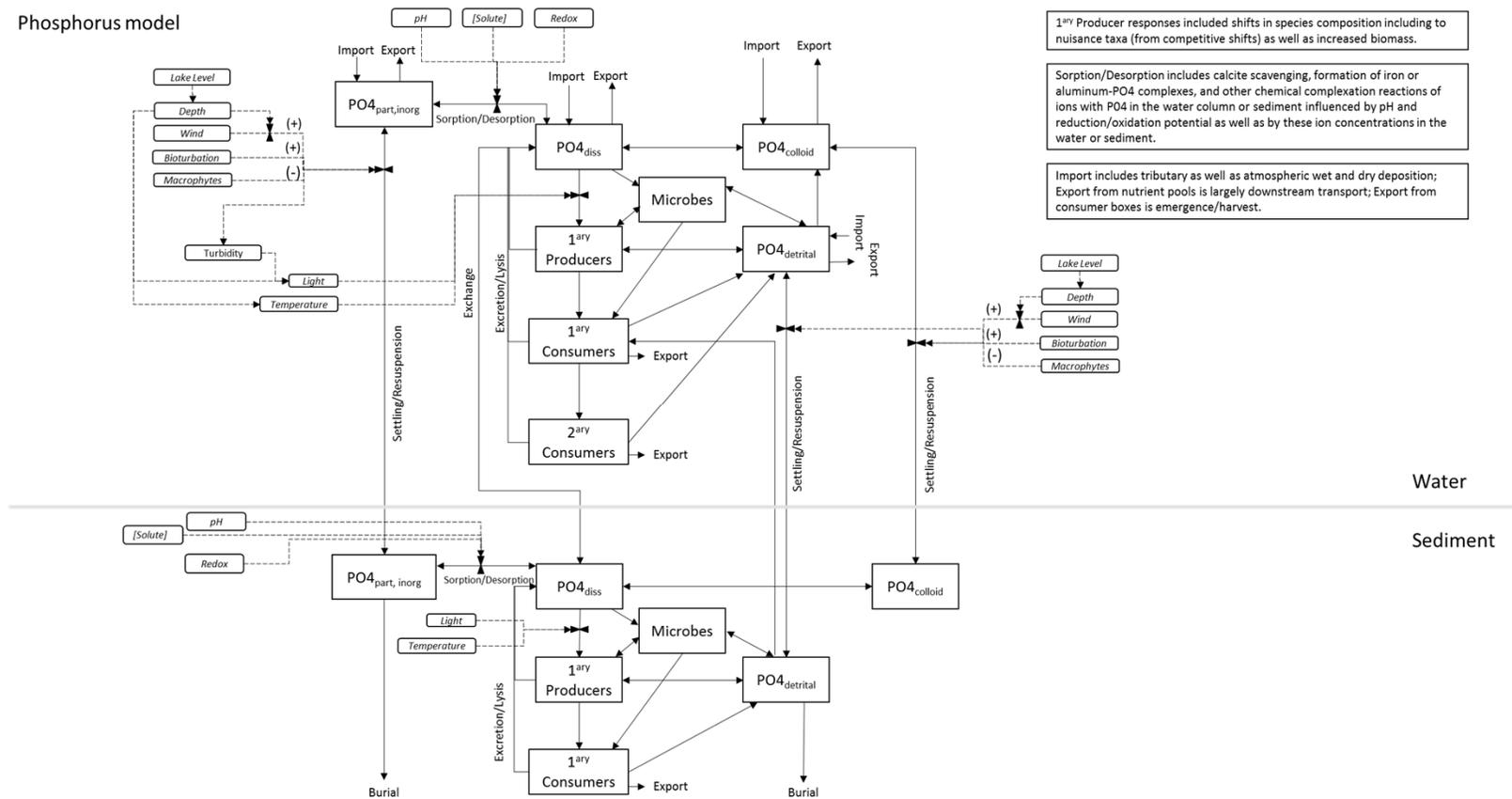
# Causal Model

Causal model



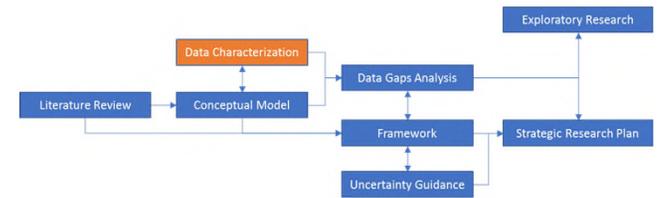
# Nutrient Models

Phosphorus model

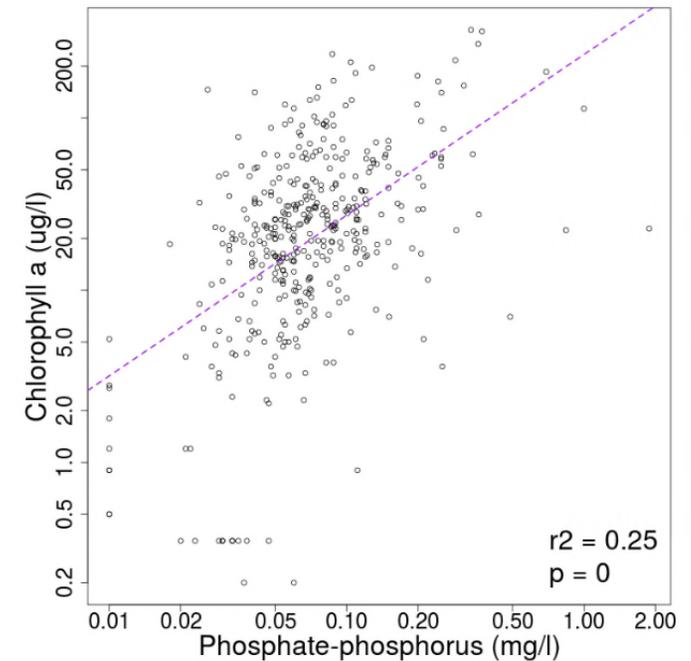


# Data Characterization and Analysis

- Ongoing analysis and SP review
- Empirical statistical modeling
- Using UDWQ's extensive water quality datasets
- Focused on SC charge questions and numeric criteria support
- Ultimate goal: a final analysis report characterizing the analyses, March 2020.



Lake elevation Water chemistry Trophic state NLA comparison Water quality map Phytoplankton



# Uncertainty Guidance

- Draft - SP deliberation and discussion
- Process to characterize uncertainty in every line of evidence
- Evaluate the amount, quality and agreement among evidence
- Characterize likelihood and confidence
- Ultimate goal: a final uncertainty guidance document, February 2020.

Agreement	High	Medium	High	Very High
	Medium	Low	Medium	High
	Low	Very Low	Low	Medium
		Limited	Medium	High
		Evidence		



Very High

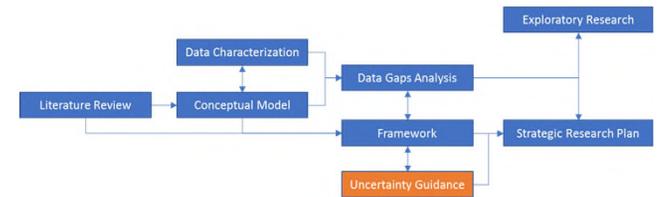
High

Medium

Low

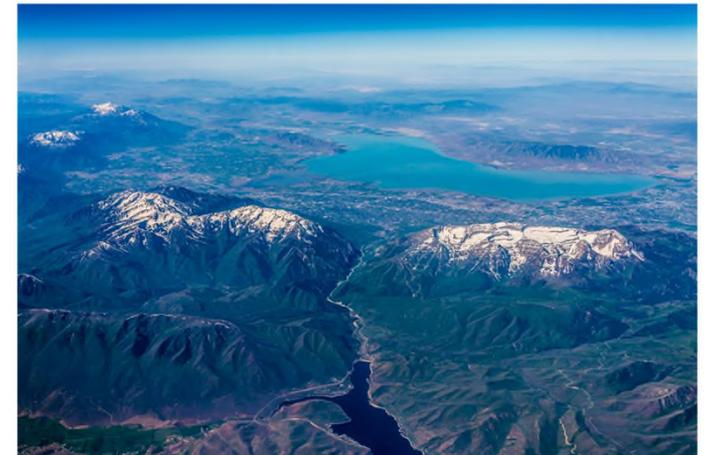
Very Low

Confidence Scale



## Utah Lake Water Quality Study— Uncertainty Guidance

September 23, 2019  
Version 3.0



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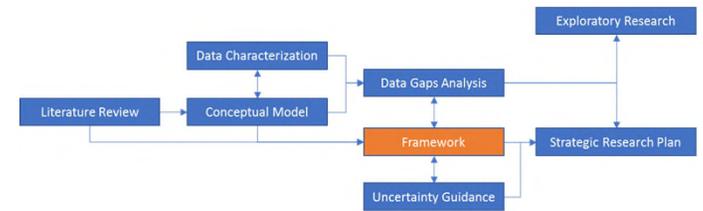
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# Framework

- Draft - SP deliberation and discussion;
- How SP will use multiple lines of evidence to derive and recommend numeric nutrient criteria
- Combines all the tasks
- Includes recommendations for evaluating and incorporating uncertainty from each line.
- Includes recommendations for communicating results
- Ultimate goal: a final framework document, March 2020.



**DRAFT**

## Utah Lake Water Quality Study— Numeric Nutrient Criteria Technical Framework

September 23, 2019  
Version 2.0



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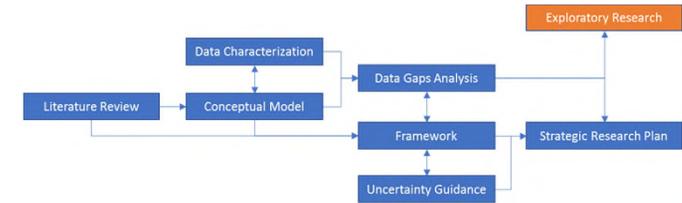
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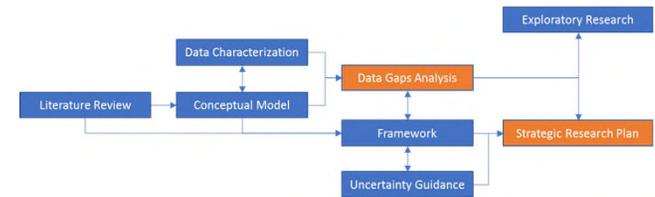
# Exploratory Research

- Completed. Three Request for Proposal documents in May 2019.
- Initial set of 3 research projects to meet existing and known data gaps
- Bioassays
- Paleolimnology
- Sediment Study



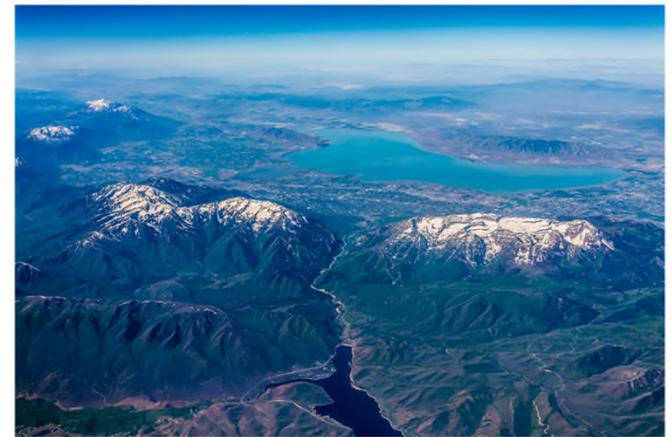
# Strategic Research Plan

- Ongoing Draft Document Development – SP Refining
- List of additional data gaps to respond to Steering Committee charge questions
- List of strategic research projects
- Ultimate goal: a final strategic research plan, June 2020



## Utah Lake Water Quality Study— Strategic Research Plan

November 4, 2019  
Version 2.0



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# Project Tasks - Summary

