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MEMORANDUM

TO: Water Quality Board

THROUGH: Walter L. Baker, P.E.

FROM: Scott Daly

DATE: August 8, 2016

SUBJECT: Request for Water Quality Board to approve a hardship grant for a maximum of \$1,000,000 to conduct research for support of Phase 2 of the Utah Lake Water Quality Study

The Division of Water Quality is conducting a two-phased water quality study on Utah Lake to determine the role of excess nutrients on impairments to the aquatic life and recreational beneficial uses and to determine appropriate nutrient levels in the lake. Hardship Grant funding is requested to assist the Division in obtaining contractual assistance to complete Phase 2 tasks defined below following an overview of ongoing Phase 1 efforts.

Phase 1 Overview

DWQ initiated Phase 1 of the Utah Lake study in 2015 in response to nutrient related impairments identified in DWQ's Integrated Report and in response to harmful algal bloom events on Utah Lake in recent years.

Phase 1 of the study consists of five work elements led by DWQ staff and representative stakeholder subcommittees. DWQ anticipates completing the majority of the Phase 1 work elements in 2016 and launching a Phase 2 study to identify appropriate nutrient management scenarios in winter 2016-2017.

Phase 1 work elements and related progress are discussed below with additional information available in the attached work plan document and the DWQ project webpage (<http://deq.utah.gov/locations/U/utahlake/utahlake.htm>):

1) Stakeholder Outreach and Public Involvement

DWQ is committed to a stakeholder and public involvement process to facilitate transparent decision making with engaged stakeholders to help guide decisions and outcomes for the Utah

Lake Water Quality project. The plan is built on the belief that good stakeholder participation in a water quality project involves: 1) informed Water Quality Subgroup members who understand the elements of the scientific principles and regulatory process that underpin DWQ's decisions; 2) purposeful public meetings at appropriate milestones in the project; and 3) transparent and documented public input into DWQ and partners' work products.

DWQ assembled a large group of stakeholders representing a broad range of interests in the watershed including representatives from local municipalities, POTWs, and state and local governments. In addition to this group, DWQ created a subgroup of stakeholders to inform decisions for each of the following work elements: data and information management, beneficial use assessment, nutrient loading, and model development. These subgroups are responsible for defining the lakes' hydrologic and ecological processes, data gaps and future research needs, and alternatives that are politically, financially, and technically feasible.

2) Data and Information Management

This element will consolidate and synthesize all data sources, make it available to stakeholders, and coordinate ongoing and future monitoring activities on Utah Lake. DWQ has met with the Data and Information Management Subgroup to coordinate ongoing monitoring activities and identify data sources available to this study. This information is currently being compiled into a centralized database that will be the foundation for data analysis for the beneficial use assessment, load analysis and modeling work elements.

3) Beneficial Use Assessment

This work element will evaluate all available data in the context of the lake's designated beneficial uses and its existing uses, including the narrative water quality standard. The initial results of this work are reflected in the 2016 Integrated Report. The report is available for public comment on our website through September 9th, 2016 (<http://www.deq.utah.gov/ProgramsServices/programs/water/wqmanagement/assessment/currentIR2016.htm>). Forthcoming work on this element will include an investigation of appropriate recreational use designations to protect recreational users and an assessment of aquatic life use designation to include evaluation of early life stages. DWQ will also evaluate TDS and cyanotoxins to assess support of the agricultural and secondary water uses, respectively.

4) Load Analysis

DWQ is developing a bulk phosphorus load analysis to update estimates developed during the initial study completed in 2008. As requested by the POTW community, the loading estimate would provide more detailed estimates of tributary loading to the lake and more accurately account for wet-weather events and low flow conditions. We intended to apply a load duration curve approach using tributary and Discharge Monitoring Report data to characterize loading for spring runoff, storm runoff, low flow periods, and seasonal load distributions. This work will be completed in the coming months as data become available.

5) Model Selection and Development

DWQ has been working with the modeling subgroup of stakeholders to determine the most appropriate approach for simulating water quality in Utah Lake. DWQ evaluated a number of potential water quality models to determine their ability to simulate water quality dynamics observed in Utah Lake while utilizing current available datasets. The final documentation for this

selection process, detailing the preferred approach, was completed and circulated to the modeling subgroup.

However, we have momentarily delayed work on this effort to determine if a proposal by the University of Utah will meet the needs of DWQ and the Utah Lake stakeholder group. The University of Utah recently received a grant from the EPA to characterize eutrophication in the Jordan River and Utah Lake watersheds in response to climate change. The proposal utilizes the same suite of modeling tools proposed by DWQ and we are working with the University of Utah to develop a collaborative model package to meet the needs of DWQ and stakeholders and to avoid development of competing products.

DWQ will meet with the water quality model stakeholder subgroup in late August to determine the best path for collaboratively completing this work.

Phase 2 Overview

Phase 2, scheduled to begin in early 2017, will further investigate water quality conditions in Utah Lake and will result in one of three alternatives: 1) Total Maximum Daily Load, 2) Site Specific Nutrient Criteria, or 3) Use Attainability Analysis, should it be determined that nutrient concentrations in the lake are being attenuated naturally thus obviating the need for a more extensive nutrient control strategy.

The water quality model developed in Phase 1 will serve as the primary tool to evaluate the water quality and ecological responses expected from a reduction of nutrient inputs and the carp removal effort. This will require a greater understanding of the unique biological, physical, and chemical interactions in the Utah Lake system.

The research questions presented below generalize the areas of research intended for this funding request. These questions will be fully developed by the Utah Lake Stakeholder group at the completion of Phase 1.

What is the ecological influence on water quality conditions in Utah Lake?

- How do carp populations influence water clarity and nutrient cycling?
- Is it feasible and desirable to shift Utah Lake from a turbid water stable state to clear water stable state?
- Do historical nutrient conditions recorded in the paleo record demonstrate a shift in ecological condition?
- What are realistic ecological endpoints for Utah Lake?

What are the characteristics of nutrient loading to Utah Lake

- What are the origin, timing, and magnitude of nutrient loading from point and nonpoint sources in the watershed?
- How will nutrient loading characteristics change with increasing population and urbanization?
- How does biological uptake and nutrient cycling influence tributary nutrient loading seasonally?

What is the role of internal lake processes on nutrient cycling and biological availability?

- What is the influence of phosphorus mineralization on in-lake nutrient concentrations?
- How do the physical properties of Utah Lake (wave action, temperature, turbidity) influence water quality?
- What is the role of the food web on nutrient cycling in Utah Lake?
- How does legacy loading of nutrients from lake bed sediments influence water column nutrients?

What are the appropriate beneficial uses for Utah Lake?

- What is the desired water quality condition of Utah Lake for recreational users?
- Do recreationists change behavior based on water quality conditions?

Can Harmful Algal Blooms (HAB) be predicted in Utah Lake?

- What is the linkage between in-lake nutrients and presence of harmful cyanobacteria?
- What indicators of water quality physical characteristics can be used to predict HABs?
- How can satellite imagery be used in conjunction with in-lake monitoring sondes to monitor and predict blooms?

What are the economic and social costs of HABs in Utah Lake?

- What was the total economic cost associated with the July 2016 HAB event?
- What indicators of water quality physical characteristics can be used to predict HABs?

What are the potential treatment options for HAB events in Utah Lake?

- Are there viable options for mitigating internal nutrient loads?
- Are there economically and environmentally viable treatment options for HABs?

DWQ intends to complete Phase 2 related research by 2019. Following completion of these studies, the results will be incorporated into either a site-specific standard, TMDL or Use Attainability Analysis.