

**Barr Lake/Milton Reservoir Watershed Association  
 Technical Committee Meeting  
 Wednesday, November 4<sup>th</sup>, 2015 (9:00am – 10:30pm)  
 Conference Call**

## Draft MINUTES

**In attendance:**

Steve Lundt – Metro Wastewater  
 Laurie Rink –FRICO  
 Linda Chynoweth – Aurora  
 James Boswell – Thornton  
 Hope Dalton – Metro  
 Al Polonsky – DEH

Al Baker – Centennial W&S

**Guests:**

Ken Wagner – Limnologist extraordinaire  
 Amy Conklin – BMW

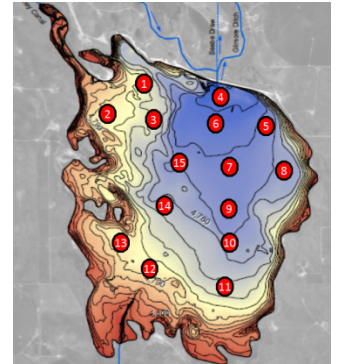
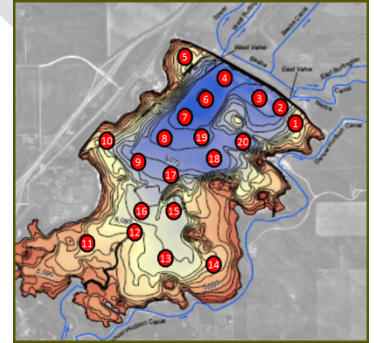
Steve introduced everyone.

**1. In-reservoir Treatment Study**

Steve began by reminding everyone that he had collected sediment samples from Barr and Milton and sent them for analysis to a lab at Colorado State University, from locations shown in the figures to the right. Ken has analyzed the data as part of his work to help BMW evaluate in-lake treatment options.

Ken began by talking about the sediment sampling results and what they meant in terms of refining the assessment of the internal loading component of the lake dynamics and in terms of relevance to treatment options. His conclusion is that Barr and Milton have significant amounts of phosphorus (P) being released from the sediments, but it is not as much as was estimated in developing the TMDL. In sediments, P absorption is influenced by the amounts of Iron (Fe) and Calcium (Ca) in the sediment as well as by the amount of organic material (OM). When P is Fe-bound in sediments under anoxic conditions, the P is more quickly released into the water column than when the P is Ca-bound. In addition the Ca has a buffering effect on pH. The greater the amount of OM in the sediments, the greater the amount of Fe-bound P. Based on the OM concentrations and the lab results, Ken concluded that the internal P loading from the sediments was smaller than previously calculated. The TMDL estimated about 4,000 kg/yr of loading for Barr Lake, when the refined number may be closer to 900 kg/yr. Ken said the TMDL estimate was close enough in estimating internal loading in a natural system.

Ken estimated that the amount of area that would need to be treated to control internal P loading from sediments was 300 acres, as only the deeper parts of the reservoirs would require treatment. In considering alum application, typically the amount applied is about twice the amount that is estimated of P that needs to be bound. Based on those assumptions, Ken estimated an in-lake alum application for Barr Lake at about \$1.5 million and about \$800,000 for Milton. In-canal alum applications, if allowed to migrate out into Barr Lake could reduce the costs. Because internal loading is not currently a significant source of loading to the reservoir, Ken suggested that alum



application not be considered until it is. He will be further refining his cost estimation in the report he hopes to provide to the committee for review in January 2016.

He further explained that the option of alum application depends on the severity of the problem. If internal loading is a significant problem, then alum application may not be the better choice. He made the analogy of a leaking boat; if the leak is small, alum may be the best choice. Typically all the alum would be applied in one effort, although more than one application may be required, it would be done in a relatively short time frame, typically within one year or one growing season. The beneficial effects of the alum application can last up to 10 years in a shallow lake, 20 years in a deep lake.

Steve asked about the effects of bioturbation in accelerating internal loading. Ken said those effects are very hard to measure. He would take a look at the data from when Barr Lake was drained to the Dead Pool to see if he could make an estimate of the effects of bioturbation.

Ken also evaluated oxygenation and circulation options for controlling internal loading. For oxygenation, there are several different technologies that have been used and more that are being developed. Ken discussed some of the options concluding that first we need to know how much oxygen (O<sub>2</sub>) we would need to apply for effective reductions in internal loading. When anoxic conditions are present at the bottom of a water body, next to the sediments, sediment P release is enhanced. The concept of oxygenation is to maintain dissolved oxygen levels in the water next to the sediments to reduce or prevent sediment P release.

Of the technologies available, Ken prefers technologies that maximize O<sub>2</sub> going into solution. Based on an estimate of the amount of O<sub>2</sub> needed, he estimated that capital costs for each of the lakes would be between \$200,000 and \$300,000 with operating and maintenance costs at about \$100,000 per year. He assumed about 150 days per year of operation that should decrease over time. He will refine and prepare the options and costs for oxygenation in the report he will prepare for review in January.

Circulation options were also evaluated. One key tenant of circulation strategies is to be sure that water body does not stratify. Recovering from a stratification event is difficult and expensive. One advantage of using circulation treatments is that they might help to attain the pH standard. One local example of implementation of a circulation strategy is the system used in Cherry Creek Reservoir. He estimated capital costs for each lake to implement a circulation system at about \$500,000 with about \$100,000 in annual operation and maintenance costs. Any circulation system will need to be oversized, as the entire water body will need to be mixed, not just the deepest 300 acres. The system will also need to be designed so that it can easily be adjusted to account for the vagaries of natural systems.

As he refines the options, Ken will consider the option of using a circulation system to which alum could be added. He will try to keep the system and the assumptions simple. There has been a lot of progress, conceptually, on the options but there are still a lot of details to consider.

Laurie commented that she would like Ken to revise the internal loading calculation incorporated into the TMDL as part of this effort. She also was very pleased that he was thinking broadly about treatment options rather than just P inactivation. She also appreciates his intent to incorporate as much flexibility in the treatment system as possible.

Steve requested that Ken prepare a cost per pound of P removed as part of the evaluation. It was noted that a mixing system, whether oxygenation or circulation would help resolve Dissolved Oxygen and ammonia standard exceedances. **The group asked Ken to prepare a report for review prior to the January 28<sup>th</sup>, 2016 Technical Committee meeting.** We will plan to have Ken come out for a presentation in March of 2016. It will be best if all the options can be as fully explored as possible before the March presentation.

**2. Ammonia Listing of Milton**

- a. Update – Steve and Laurie reported that a re-evaluation of ammonia data from Milton Reservoir, rather than from the outlet, still resulted in Milton exceeding the ammonia standard just enough to be placed on the 303 d list. BMW submitted a responsive pre-hearing statement but does not plan to make any comments at the December meeting of the Water Quality Control Commission.

**3. Limnocorral Study Summary** – The report was not yet ready for review.**4. Next Meeting**

- a. Tech. Committee: **January 28th, 9:00am to 11:00am at Metro**

DRAFT