

Third Party Phased pH TMDL & Adaptive Implementation Plan

2010



Barr Lake & Milton Reservoir Watershed Association

Timeline to 2010



1900's - Barr & Milton Constructed

1950's - Water Quality at its worst

1970's - Barr Lake Improves

WQ Monitoring - 1990's

2002 - 303(d) listed for pH

2003 - BMW Association

Reservoir Assessments - 2005

Reservoir & Watershed Modeling - 2009

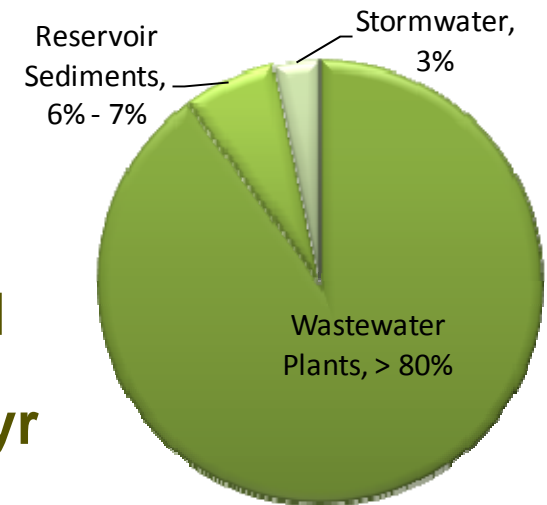
3rd Party Phased pH TMDL & Adaptive Implementation Plan - 07/31/10

Modeling

(Facts)



(AECOM modeled both reservoirs and the watershed for phosphorus, chl-a, and pH)



- **Target load ~ 4,000 kg/yr/reservoir**
- **No linkage between Phosphorus and pH**
- **Phosphorus load to Barr is ~ 70,000 kg/yr**
- **Phosphorus load to Milton is ~ 40,000 kg/yr**
- **Chl-a explains about 54% of the variation in pH**

Modeling

(conclusions)



- **Wastewater Treatment Plants will have to treat for Phosphorus**
- **Internal Phosphorus loading will have to be treated**
- **It will take a >95% reduction in both external and internal loading to see major water quality improvements**
- **Any source to which more than about 0.6% of the total load can be attributed will require some attention, as the load reduction necessary to guarantee compliance is so extreme**
- **A lack of data for conditions in the reservoirs at Phosphorus levels <250 ug/L adds uncertainty, need more data**
- **Best estimate: In-reservoir Phosphorus needs to be around 100 ug/L to keep chl-a below 25 ug/L and pH below 9.0**

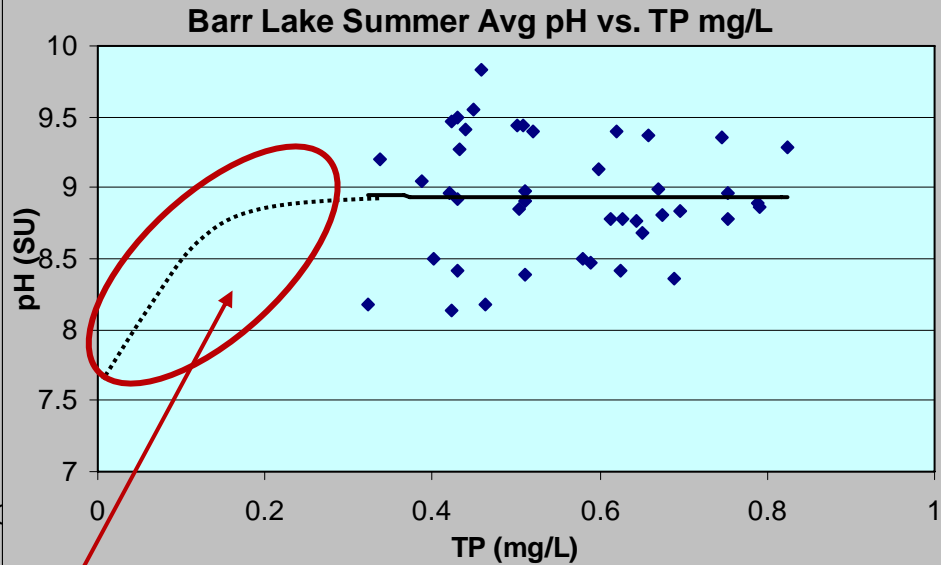
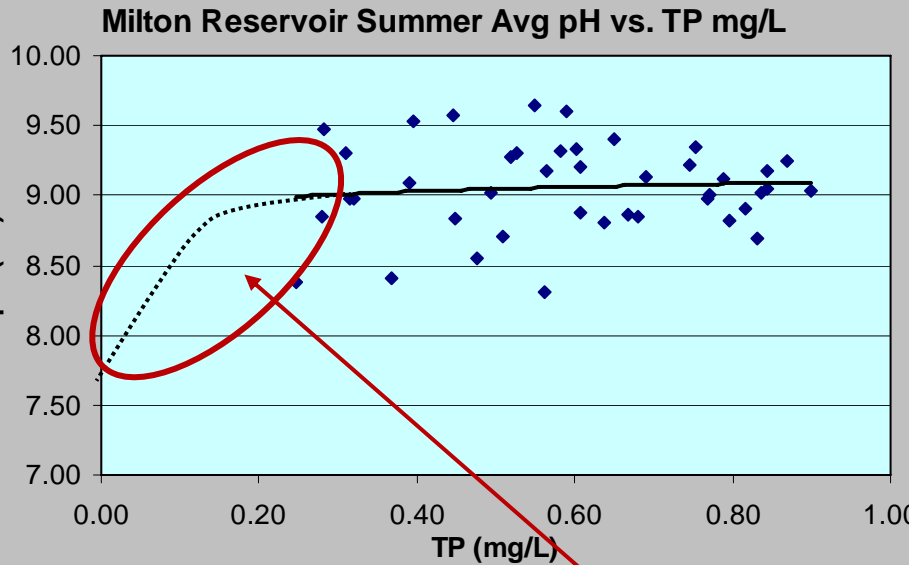
Modeling

(Uncertainty)



- **Linkage between pH and Phosphorus does not exist, lack of data for conditions at Phosphorus levels <250 ug/L adds uncertainty**
- **Linkage between pH and chl-a is weak, 54% explanation**
- **Phosphorus loads are extremely high and outside the range for models to accurately predict results**
- **Models were used to predict responses outside range of site data**
- **Internal Phosphorus load is highly variable and hard to predict**
- **Actual data is “spotty”**
- **Biological factors are less amenable to modeling and induce variability/uncertainty in predictions**

Modeling (Uncertainty)



?

Uncertainty

What is background pH?

Will chl-a drop if TP is reduced?

What TP level will drop pH below 9.0?

Standard TMDL vs Phased TMDL



Standard TMDL

The maximum amount of a pollutant (i.e., allowable load) that a water body can receive and still meet applicable water quality standards.

- Defines allowable load allocations to the pollutant's sources.

Phased TMDL

A phased TMDL must include all elements of a standard TMDL. However, the allowable load takes into consideration the high level of **uncertainty** caused by predictive tools that may not adequately characterize the problem.

- Due to uncertainty, the TMDL allowable load and allocation plan will be revised in the near future as additional information is collected.
- The phased TMDL will include a schedule for installation and evaluation of source control measures, data collection, and assessment of water quality standards attainment.
- An adaptive implementation plan will also be developed.

3rd Party Phased pH TMDL



3rd Party =

Someone besides the State writes the TMDL. The BMW Association is the third party.

Phased =

Because of uncertainty with how pH will change with phosphorus reductions, the TMDL will be updated in the future with new information.

pH TMDL =

A Total Maximum Daily Load (i.e., allowable load) to achieve the pH standard of 9.0 85% of the time. Phosphorus will be the surrogate parameter to achieve the pH standard since pH cannot be allocated to the sources.

Adaptive Implementation Plan



Adaptive Implementation Plan

- Submitted and phased with the pH TMDL
- Provides roadmap for implementation of Phosphorus controls to reach targets defined in the TMDL.
- Implementation must be iterative, methodical, and have a continued focus on reducing the uncertainty within the TMDL.
 - A carefully targeted monitoring effort and experiments will provide new information to improve the TMDL.

Phased TMDL

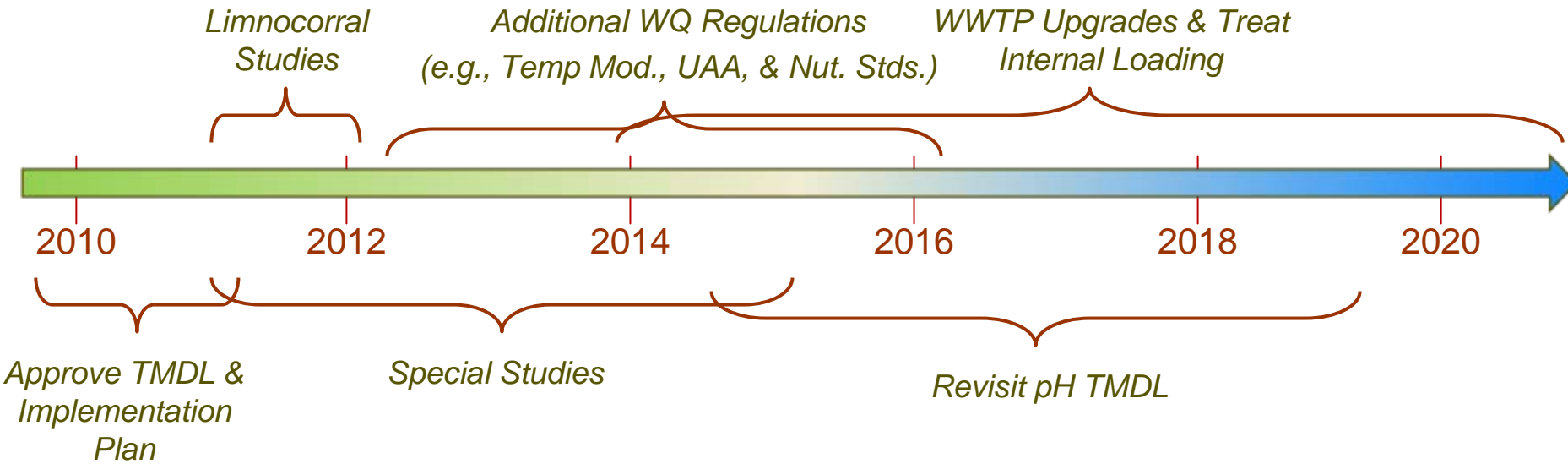


EPA clarification regarding phased TMDLs (2006 EPA memo)

“. . . the use of additional data would likely increase the accuracy of the TMDL load calculation and merit development of a second phase TMDL. Such significant uncertainty may arise, for example, because the State is using a surrogate to interpret a narrative standard. . . and it is difficult to predict how the a water body will react to the planned load reductions.”

“An example of a phased TMDL could be a TMDL for phosphorus in a lake watershed where there are uncertain loadings from the major land uses and/or limited knowledge of in-lake processes. In such a case, the loading capacity of the water body may be difficult to establish and the State may decide to include a schedule for establishing a revised TMDL based on follow-up monitoring.”

Timeline to 2020



Get Involved



Join BMW Association - \$30 Suggested Annual Fee

Join a Committee

Technical: 4th Thursday

Budget: 4 times a Year

Information/Education: 3rd Thursday

www.barr-milton.org

Barr Lake

Source	Current Load (kg/yr)	% of Total Load	Load Reduction Rationale	Reduction (%)	Target Load (kg/yr)
Wasteloads within datashed					
Pump Works (from Metro)	26075	36.9%	Major treatment upgrade possible, target effluent TP=100 ug/L	96.5%	913
Metro WWTP	-	-			
Littleton-Englewood WWTP	33893	47.9%	Major treatment upgrade possible, target effluent TP=100 ug/L	96.5%	1186
Centennial WWTP	1194	1.7%	Upgrade facility from effluent TP=700 ug/L to 100 ug/L	85.7%	171
South Adams WWTP	-	-			
Fort Lupton WWTP	-	-			
Brighton WWTP	-	-			
Aurora WWTP	-	-			
Hudson WWTP	-	-			
Lochbuie WWTP	-	-			
MS4 Regulated Areas	2189	3.1%	Some activity over last decade, target 25% further reduction	25.0%	1641
Wasteload total	63350	89.6%			
Loads from inside or outside datashed*					
Clear Creek	-	-			
Big Dry Creek	-	-			
Cherry Creek Reservoir	596	0.8%	Most of drainage area detained in res., other parts in MS4; no action		
Bear Creek Reservoir	1091	1.5%	“		
Chatfield Reservoir	1338	1.9%	“		
All other subwatersheds	-	-			
Benthic P Load from Barr	4341	6.1%	Treatment to inactivate all P in upper 4 cm of sediment	95.0%	217
Benthic P Load from Milton	-	-			
Load total	7366	10.4%			
Total Load (all sources)	70716	100%	Calc. loading limit to achieve desired conditions = 3950-5900 kg/yr	94.2%	4128

Milton Reservoir

Source	Current Load (kg/yr)	% of Total Load	Load Reduction Rationale	Reduction (%)	Target Load (kg/yr)
Wasteloads within datashed					
Pump Works (from Metro)	54	0.14%	New effluent TP = 100 ug/L follows from upgrade to improve Barr	96.5%	2
Metro WWTP	28529	72.6%	New effluent TP = 100 ug/L follows from upgrade to improve Barr	96.5%	999
Littleton-Englewood WWTP	1840	4.7%	New effluent TP = 100 ug/L follows from upgrade to improve Barr	96.5%	64
Centennial WWTP	65	0.17%	New effluent TP = 100 ug/L follows from upgrade to improve Barr	85.7%	9
South Adams WWTP	1102	2.8%	Upgrade facility to yield effluent TP = 1000 ug/L	78.0%	243
Fort Lupton WWTP	494	1.3%	Upgrade facility to yield effluent TP = 1000 ug/L	67.0%	163
Brighton WWTP	491	1.3%	Upgrade facility to yield effluent TP = 1000 ug/L	67.0%	162
Aurora WWTP	28	0.07%	Effluent TP currently at 200 ug/L; no action	0.0%	28
Hudson WWTP	29	0.07%	Upgrade facility to yield effluent TP = 1000 ug/L	67.0%	9
Lochbuie WWTP	22	0.05%	Upgrade facility to yield effluent TP = 1000 ug/L	67.0%	7
MS4 Regulated Areas	452	1.2%	Some activity over last decade, target 25% further reduction	25.0%	339
Wasteload total	33106	84.3%			
Loads from inside or outside datashed*					
Clear Creek	919	2.3%	Application of BMPs to greatest feasible extent; target 50% reduction	50.0%	459
Big Dry Creek	2301	5.9%	Application of BMPs to greatest feasible extent; target 50% reduction	50.0%	1150
Cherry Creek Reservoir	56	0.1%	Most of drainage area detained in reservoir, other parts in MS4; no action	0.0%	56
Bear Creek Reservoir	76	0.2%	Most of drainage area detained in reservoir, other parts in MS4; no action	0.0%	76
Chatfield Reservoir	122	0.3%	Most of drainage area detained in reservoir, other parts in MS4; no action	0.0%	122
All other subwatersheds	70	0.2%	Application of BMPs to greatest feasible extent; target 50% reduction	50.0%	35
Benthic P Load from Barr	2171	5.5%	Reduced by 95% by internal load controls associated with Barr treatment	95.0%	109
Benthic P Load from Milton	455	1.2%	Treatment to inactivate all P in upper 4 cm of sediment	95.0%	23
Load total	6169	15.7%			
Total Load (all sources)	39275	100.0%	Calculated loading limit to achieve desired conditions = 3550-5300 kg/yr	89.7%	4055