DEQ Lake Thunderbird Project
Technical Advisory Committee
Third Meeting

April 24, 2012

Agenda

1. Welcome and notes from last meeting
2. Draft lake model report
3. Discussion of TMDL or Watershed Management Plan in Lieu of TMDL
4. Update of COMCD v. DEQ
5. Next meeting time and place
6. Open discussion

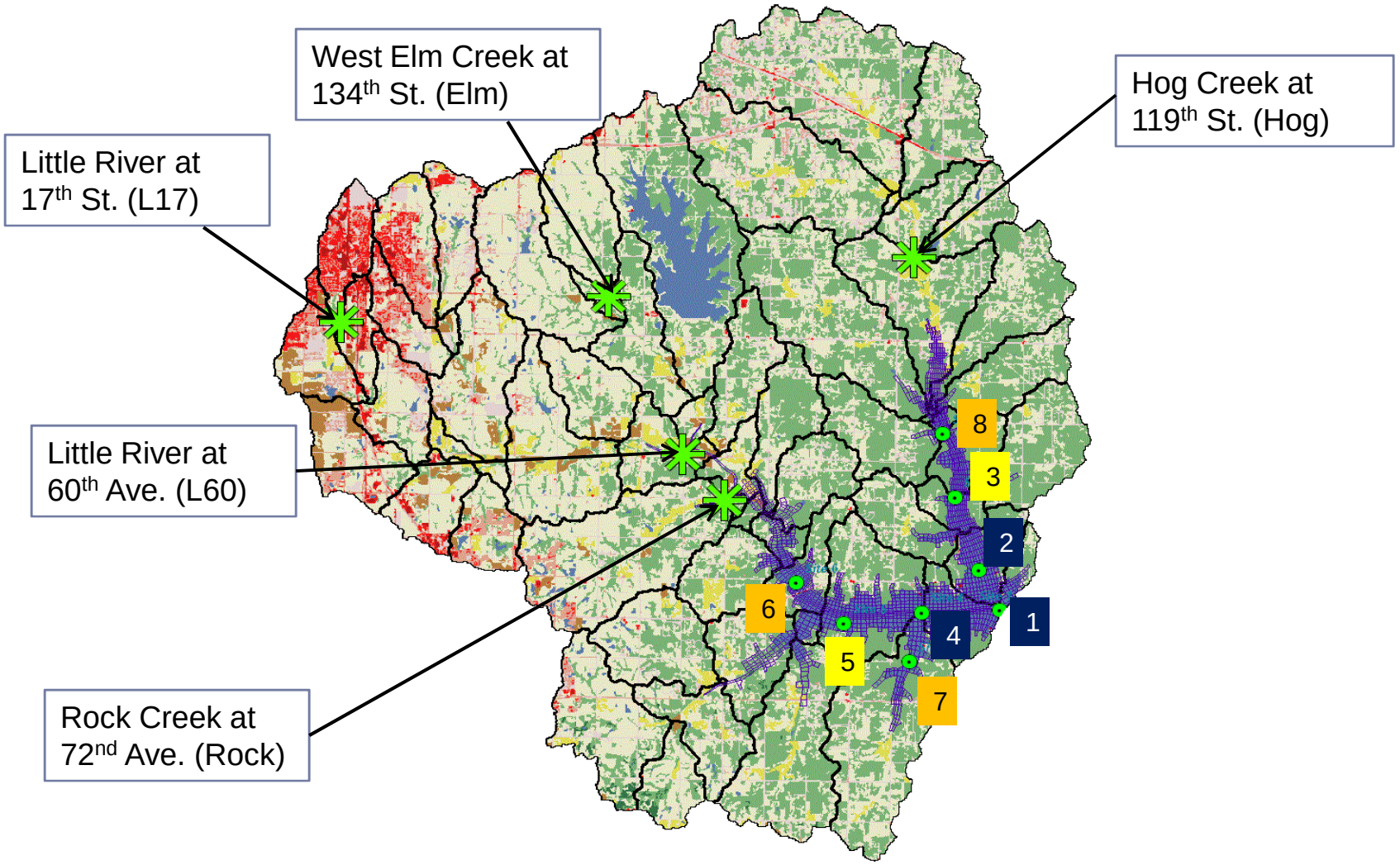
1. Welcome

- Notes from Jan 17 meeting

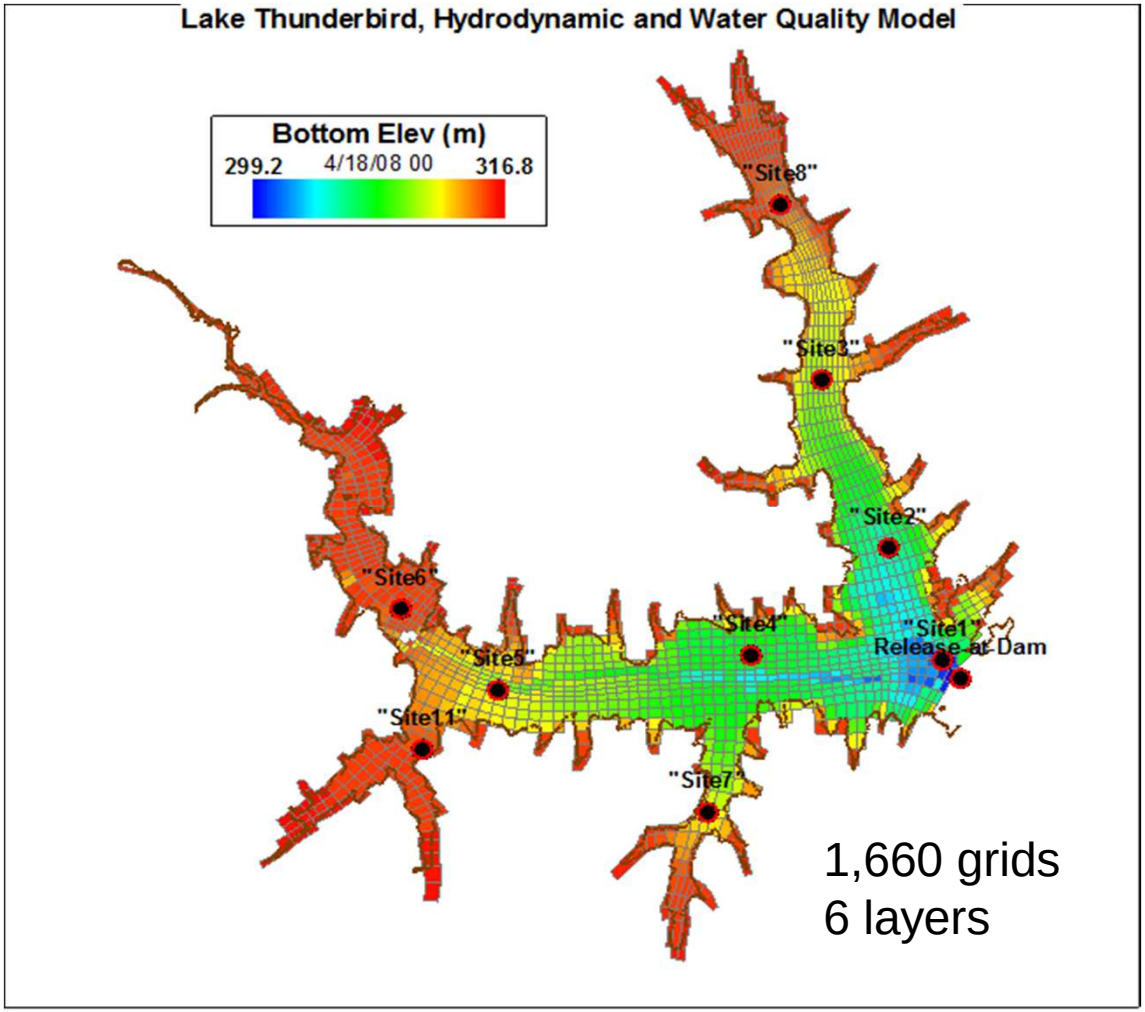
2. Draft EFDC lake model

- Building of the model
  - To best reflect the lake morphology and hydraulic conditions
  - To integrate with the watershed model (HSPF)
- Calibration of the model
  - Visual inspection
  - Statistics (Relative RMSE: ±20% T, DO; ±50% SS & nutrients; and ±100% for algal biomass)
- Projection of the load reduction scenarios: **TMDL goals**
- Sediment diagenesis/spin-up:
  - long-term effect of the load reductions

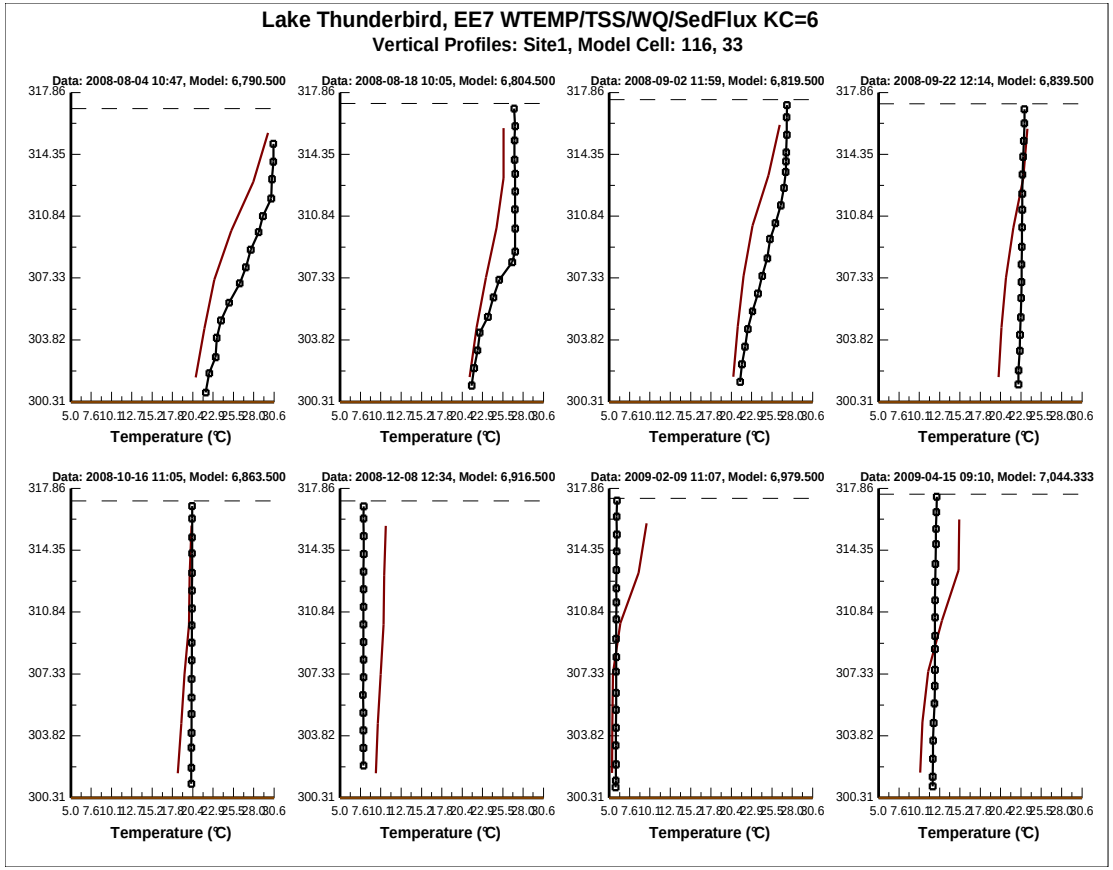
The watershed and monitoring stations



EFDC grids

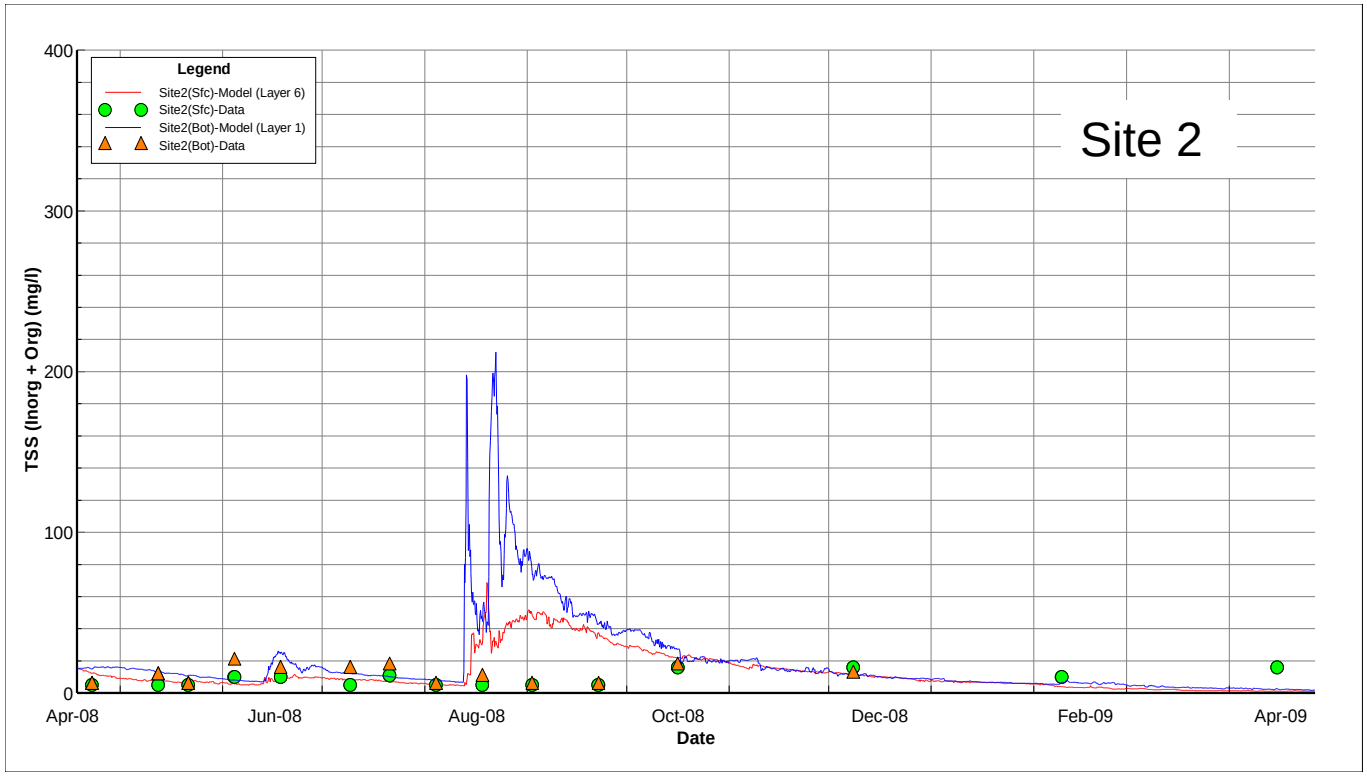

Lake Thunderbird, Hydrodynamic and Water Quality Model
Bottom Elev (m)
299.2
4/18/08 00
316.8
"Site8"
"Site3"
"Site2"
"Site6"
"Site4"
"Site1"
Release-at Dam
"Site5"
"Site11"
"Site7"
1,660 grids
6 layers

EFDC lake model calibration (T °C)



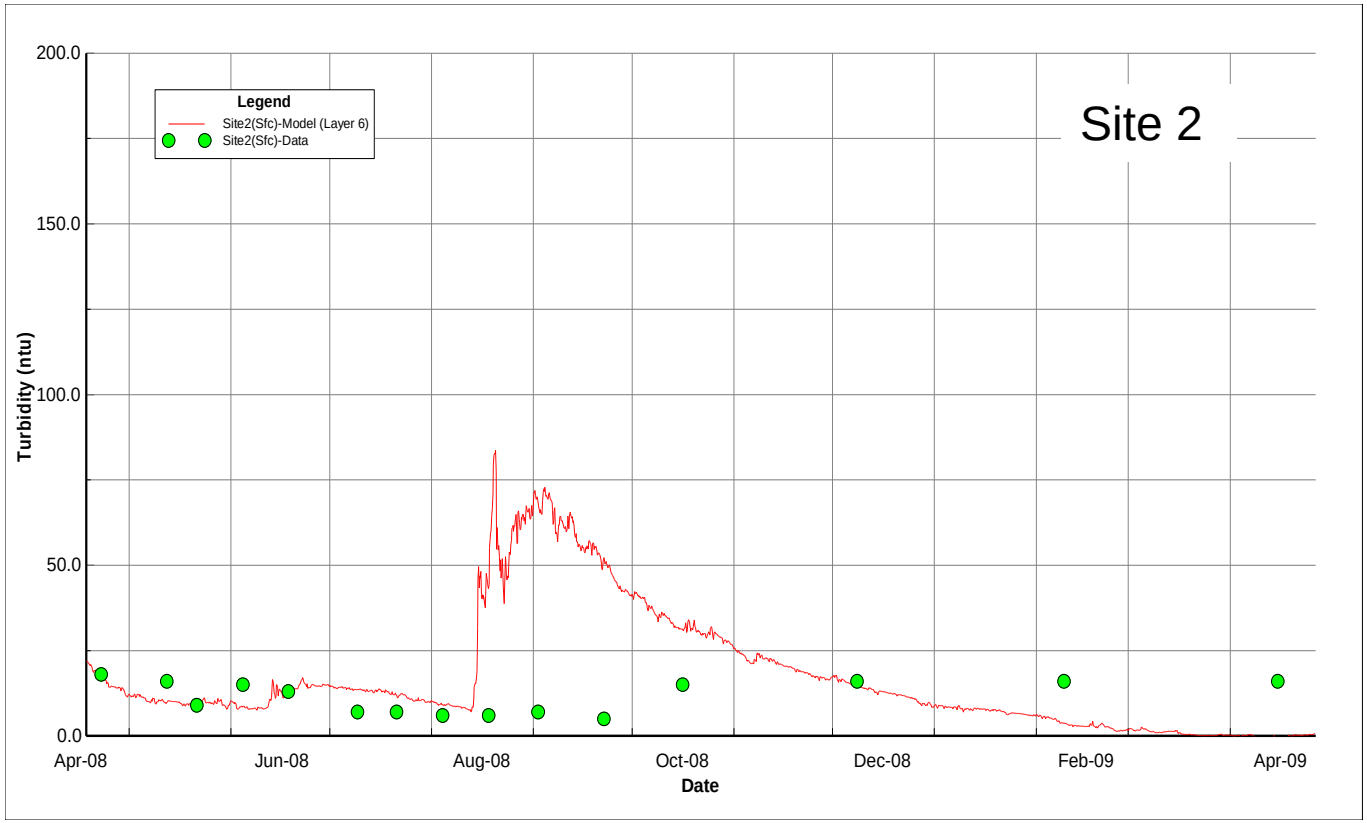
# Pairs	RMS Error (^{0}C)	Relative RMS	Data Avg. (^{0}C)	Model Avg. (^{0}C)
465	1.997	9.291	20.726	20.348

EFDC lake model calibration (TSS)



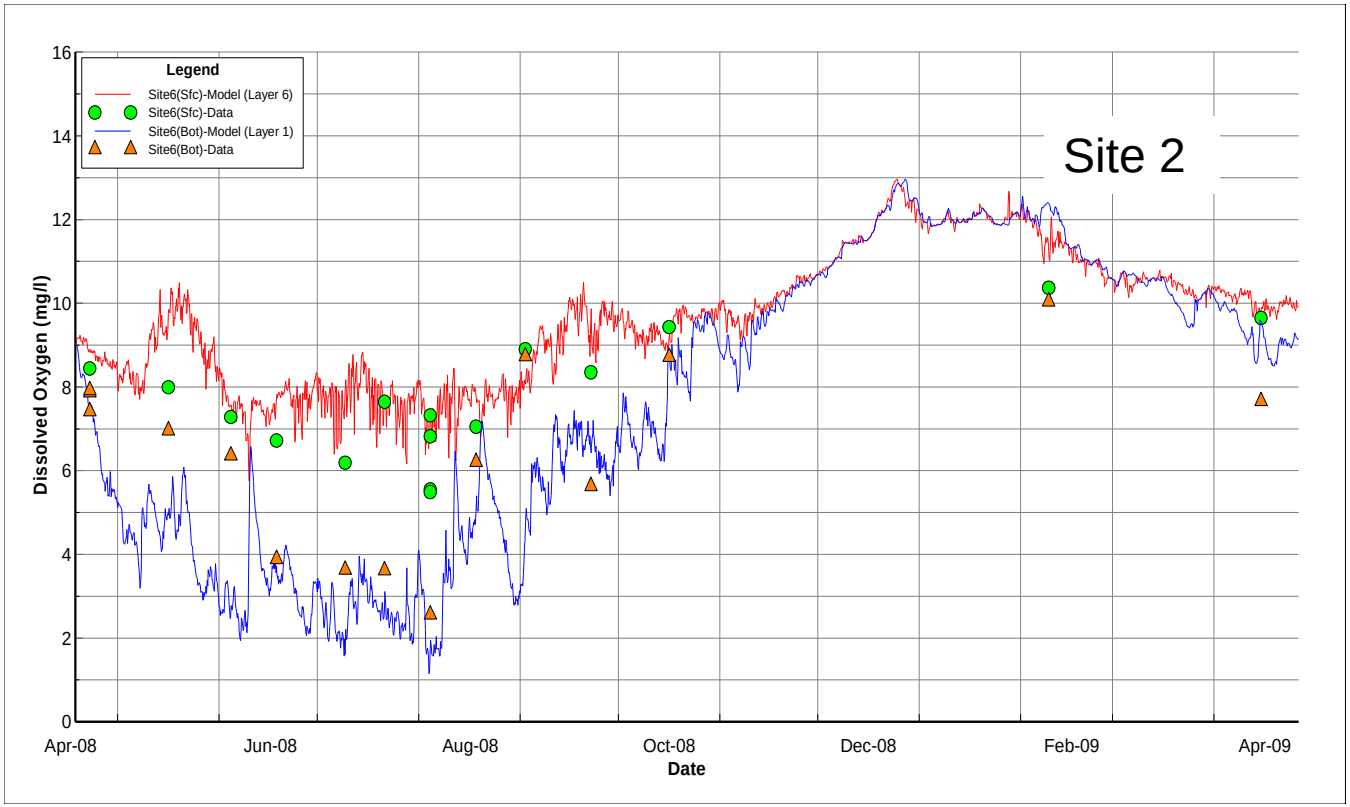
# Pairs	RMS Error (mg/L)	Relative RMS	Data Avg. (mg/L)	Model Avg. (mg/L)
184	22.938	99.560	17.576	18.966

EFDC lake model calibration (Turbidity)



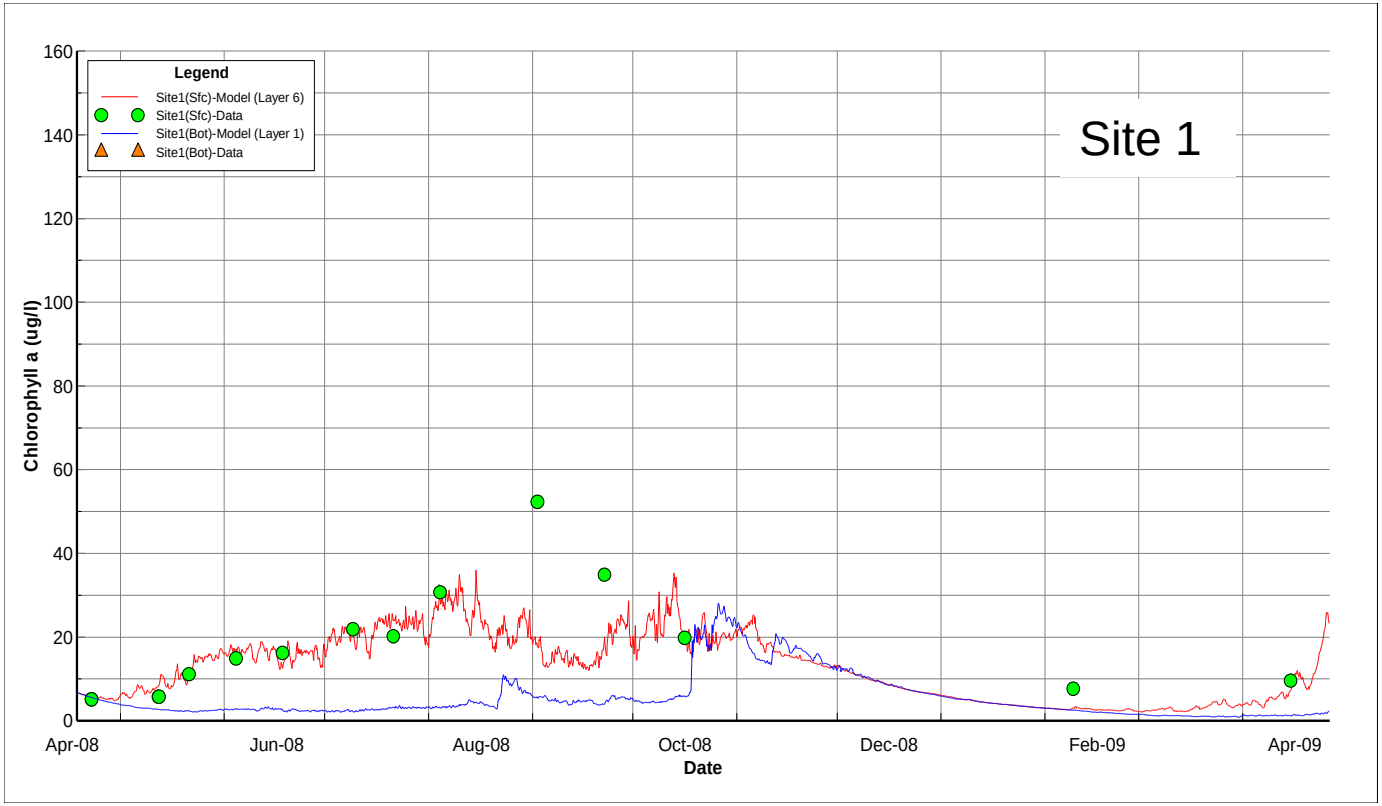
Turbidity =1.4247 TSS – 2.1084, R^2=0.73

EFDC lake model calibration (DO)



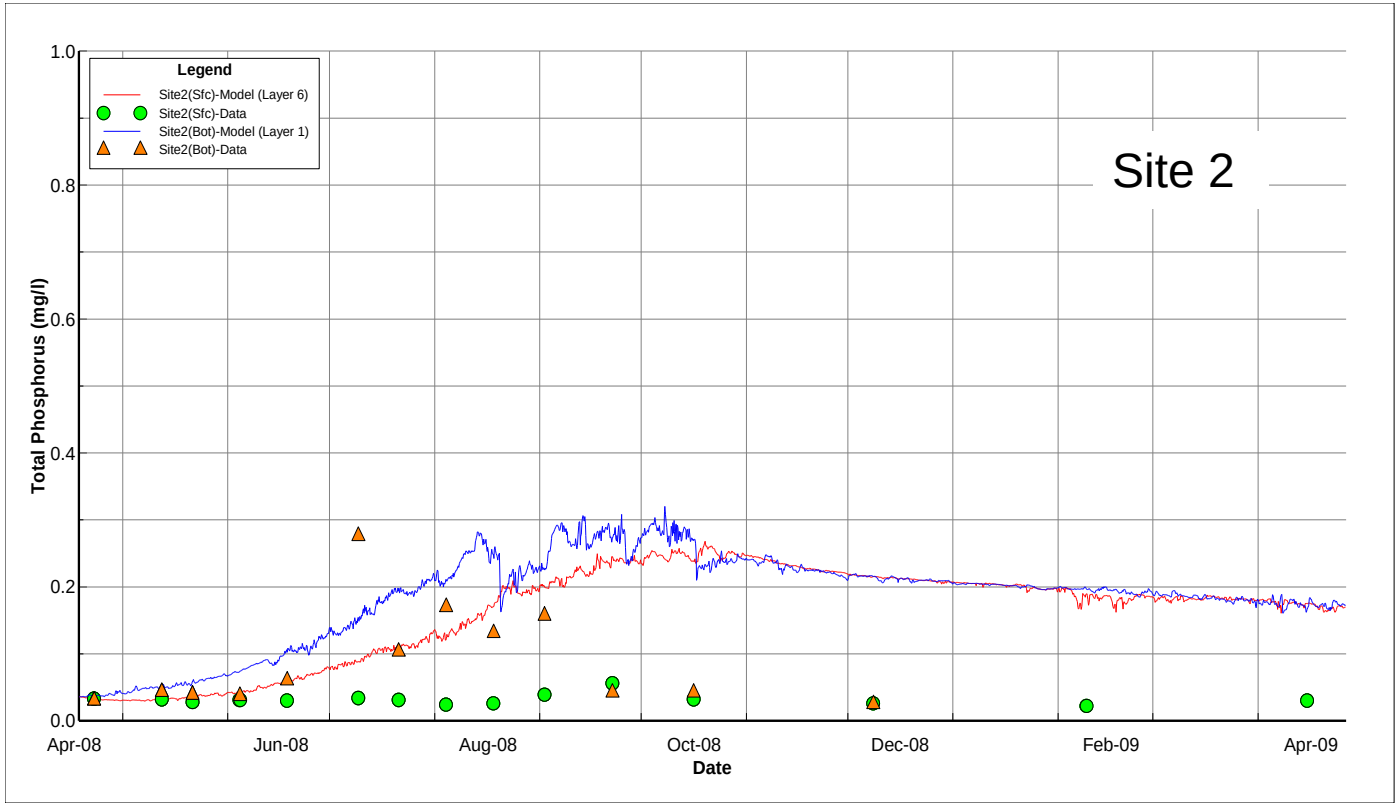
# Pairs	RMS Error (mg/L)	Relative RMS	Data Avg. (mg/L)	Model Avg. (mg/L)
432	1.796	20.906	6.68	6.121

EFDC lake model calibration (Chl-a)



# Pairs	RMS Error (mg/L)	Relative RMS	Data Avg. (mg/L)	Model Avg. (mg/L)
218	12.813	18.964	23.28	18.367

EFDC lake model calibration (TP)



# Pairs	RMS Error (mg/L)	Relative RMS	Data Avg. (mg/L)	Model Avg. (mg/L)
185	0.124	278.910	0.065	0.14

EFDC sediment fluxes/internal loadings

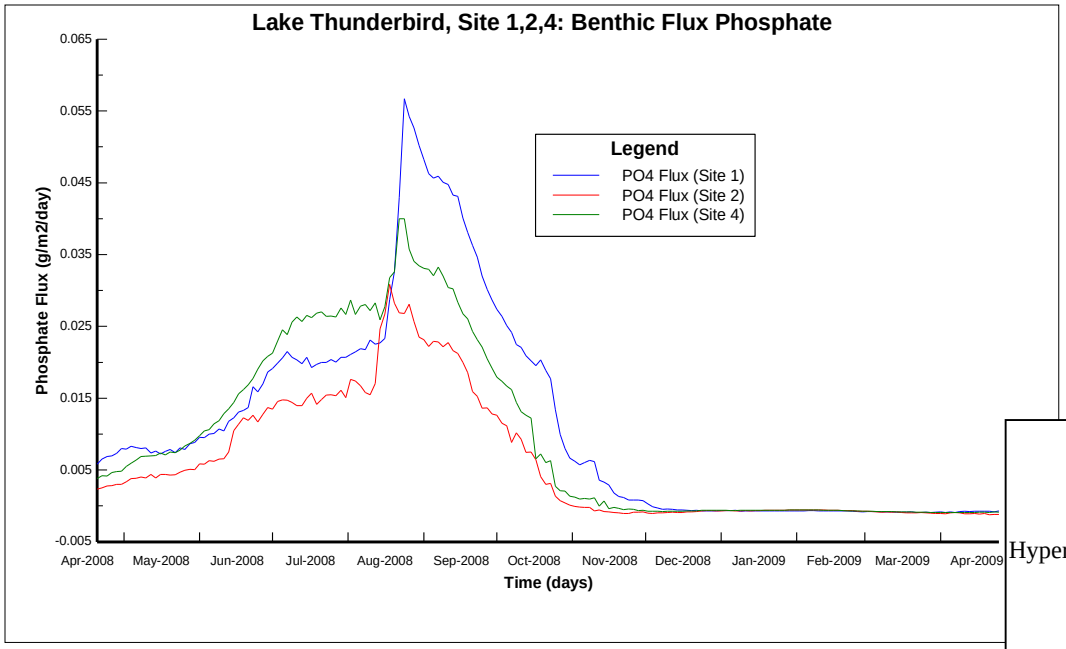
- Release of nutrients accumulated in the sediment to the water column, a function of:
  - What's in the sediment (nutrients, metals, organic matter)
  - Overlaying water column conditions
    - Oxygen level (low oxygen levels promote releases)
    - Temperature (kinetics: higher temperature higher releases)
    - Water movement (diffusion)

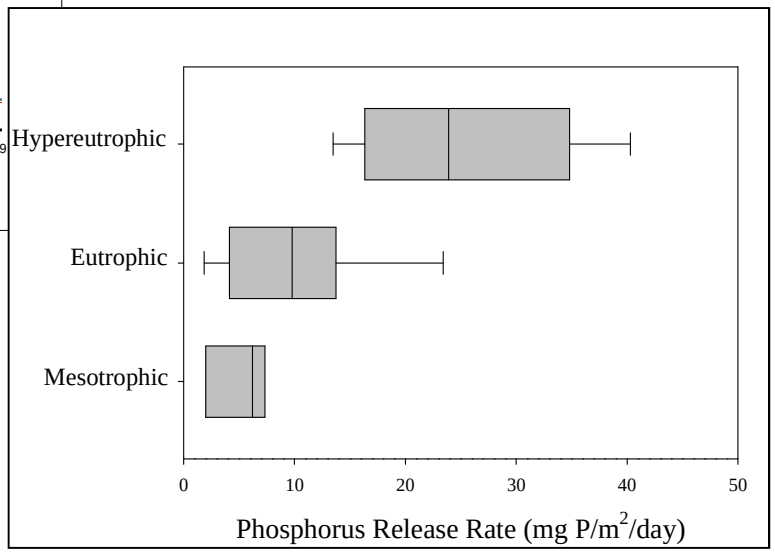
EFDC sediment fluxes/internal loadings

Model	Annual	Annual	Annual	Annual
Calibration	HSPF	AtmDep	SedFlux	Total
	kg/day	kg/day	kg/day	kg/day
NH4	8.0	9.2	290.4	307.6
NO3	41.6	15.8	107.2	164.6
PO4	19.7	1.1	209.8	230.6

	% Total	% Total	% Total	% Total
NH4	2.6%	3.0%	94.4%	100.0%
NO3	25.3%	9.6%	65.2%	100.0%
PO4	8.6%	0.5%	91.0%	100.0%

EFDC sediment fluxes/internal loadings





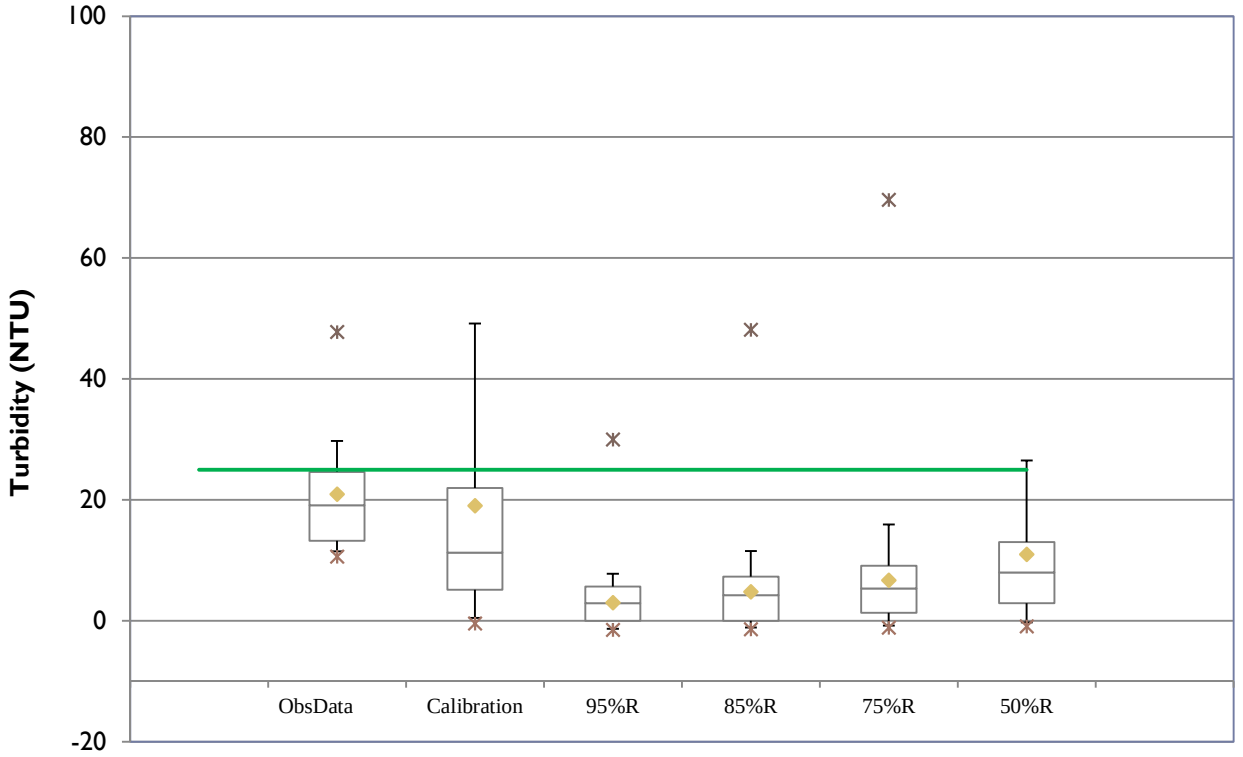
KS, MO, & IA (Dzialowski & Carter, 2011)

EFDC model load reduction scenarios

- Across-board uniform reductions for all pollutants
- 50, 75, 85, and 95% reductions considered
- Using the 2008-09 weather conditions
- Compare results with water quality standards

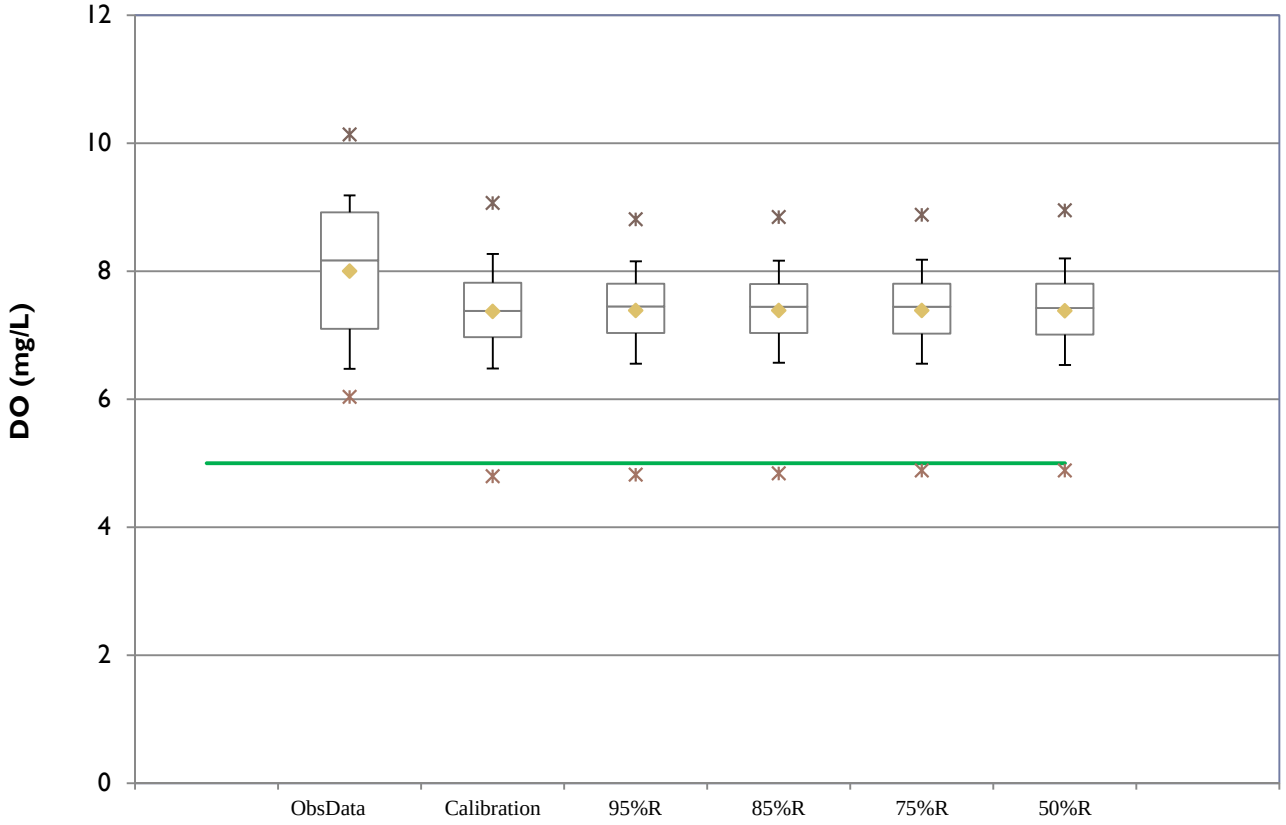
EFDC model load reduction scenarios

- Turbidity



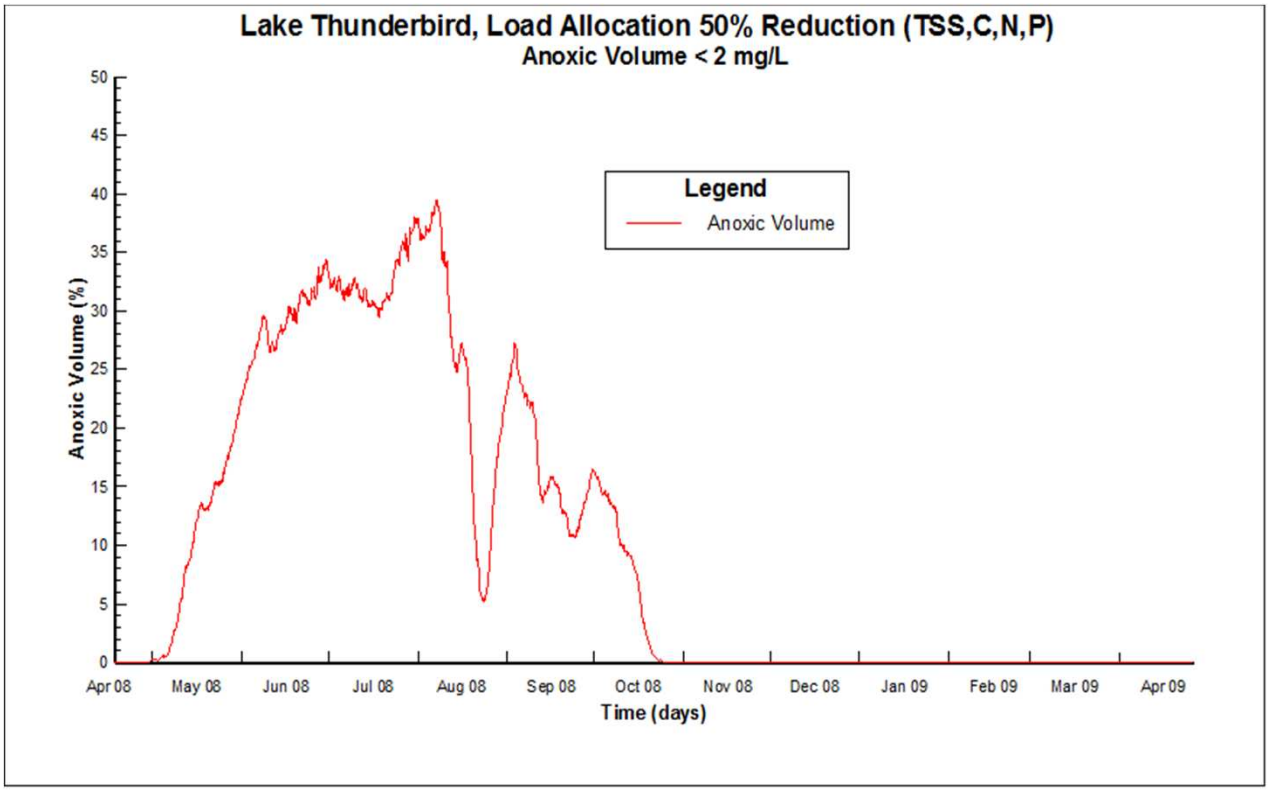
EFDC model load reduction scenarios

- Dissolved oxygen (DO): surface layer (epiliminion)



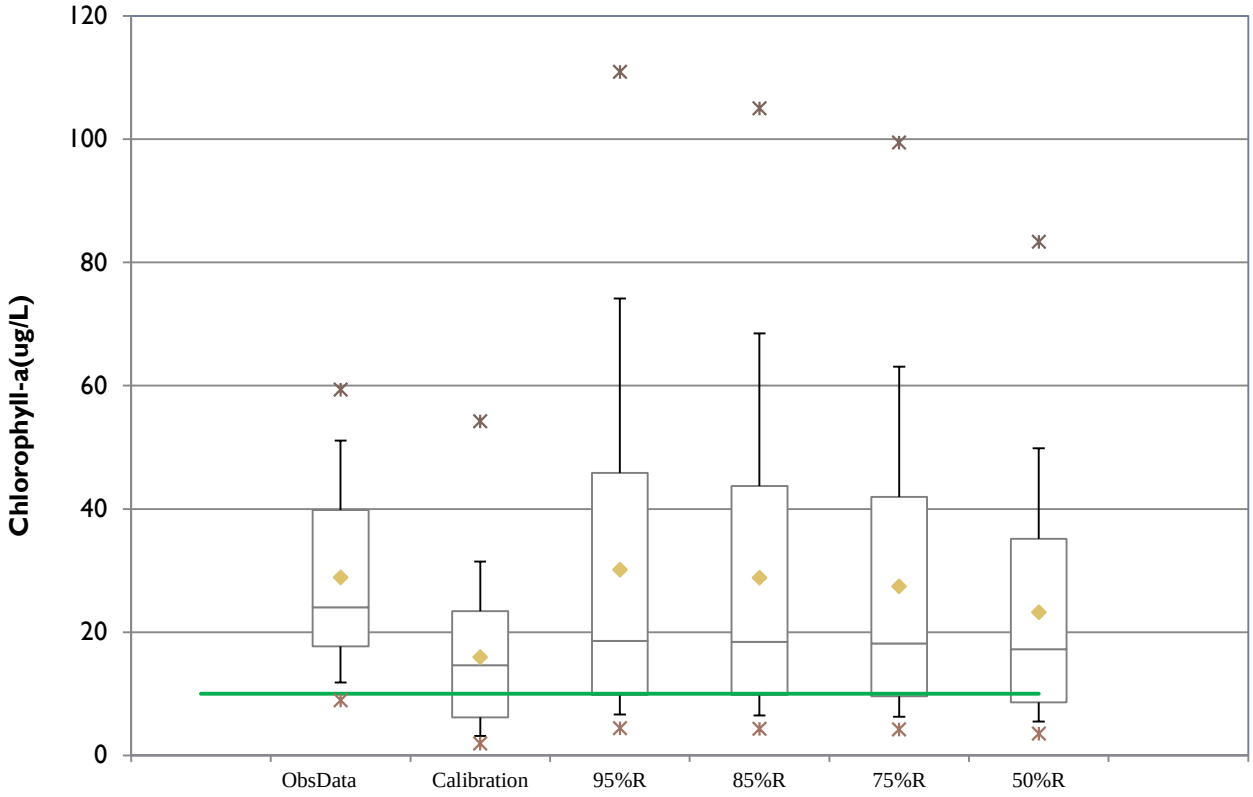
EFDC model load reduction scenarios

- Dissolved oxygen (DO): anoxic volume



EFDC model load reduction scenarios

- Chlorophyll-a



EFDC model sediment diagenesis spinup

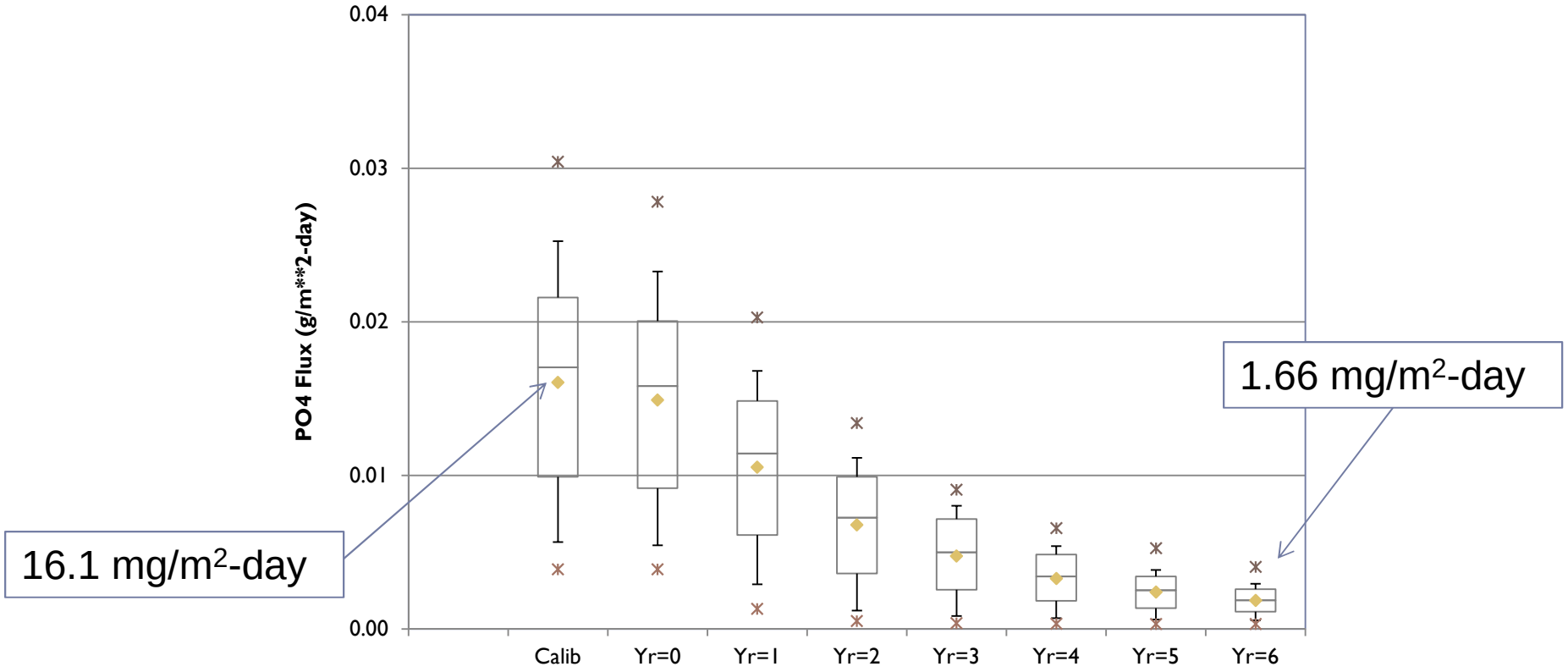
- To simulate sediment responses to watershed pollutant load reduction
- To estimate long-term effect of watershed load reduction on lake water quality indicators
- Methodology
  - Watershed loading reduction maintained at 75%
  - Using the same 2008-09 weather conditions repeatedly
  - Extend model simulation for 6 years
  - Observe changes in sediment nutrient fluxes over time
  - Estimate the impact on lake water quality indicators over time

EFDC model sediment diagenesis spinup

- Information provided
  - Evidence of sediment "self-cleanup"
  - Estimate of long-term effect of watershed reduction on lake water quality
  - Realistic expectations on lake recovery
- Caveats
  - Future weather conditions unknown (affecting watershed loading and water column conditions)
  - Errors in calibration get propagated and amplified

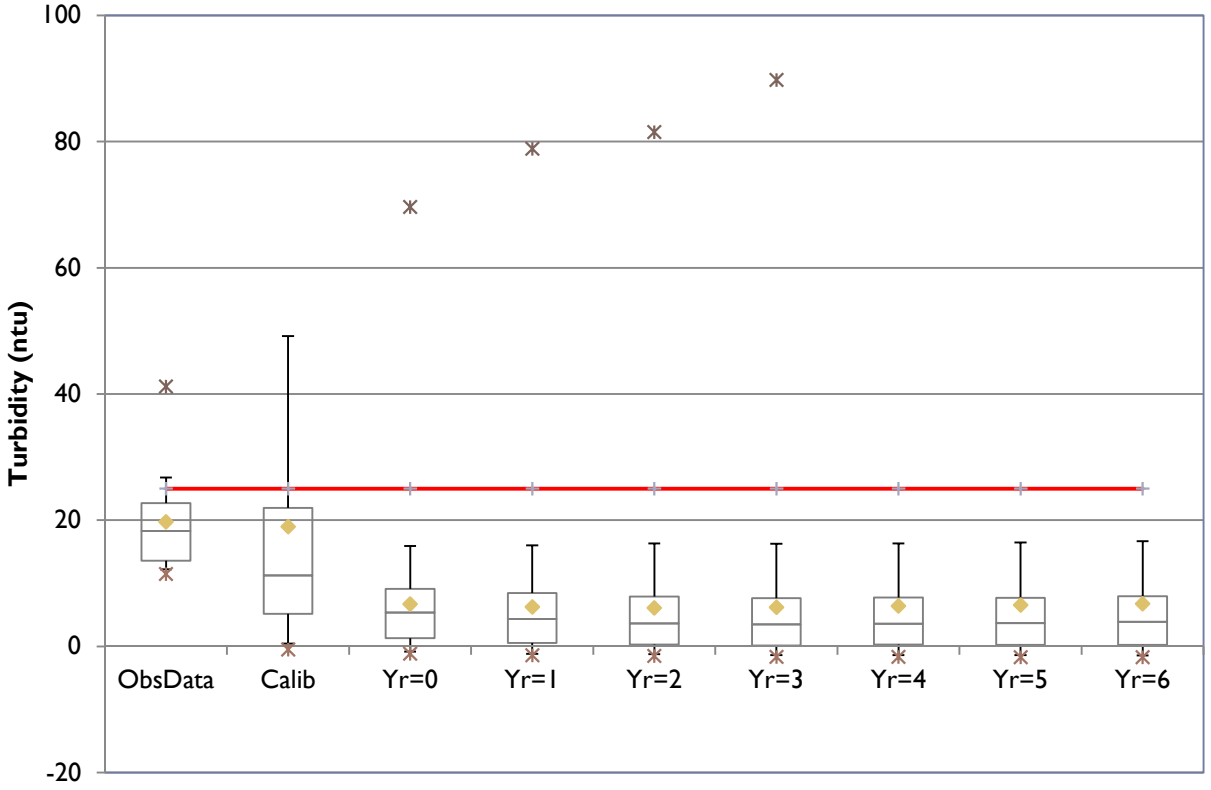
EFDC model sediment spinup

- PO4 flux (stratified)



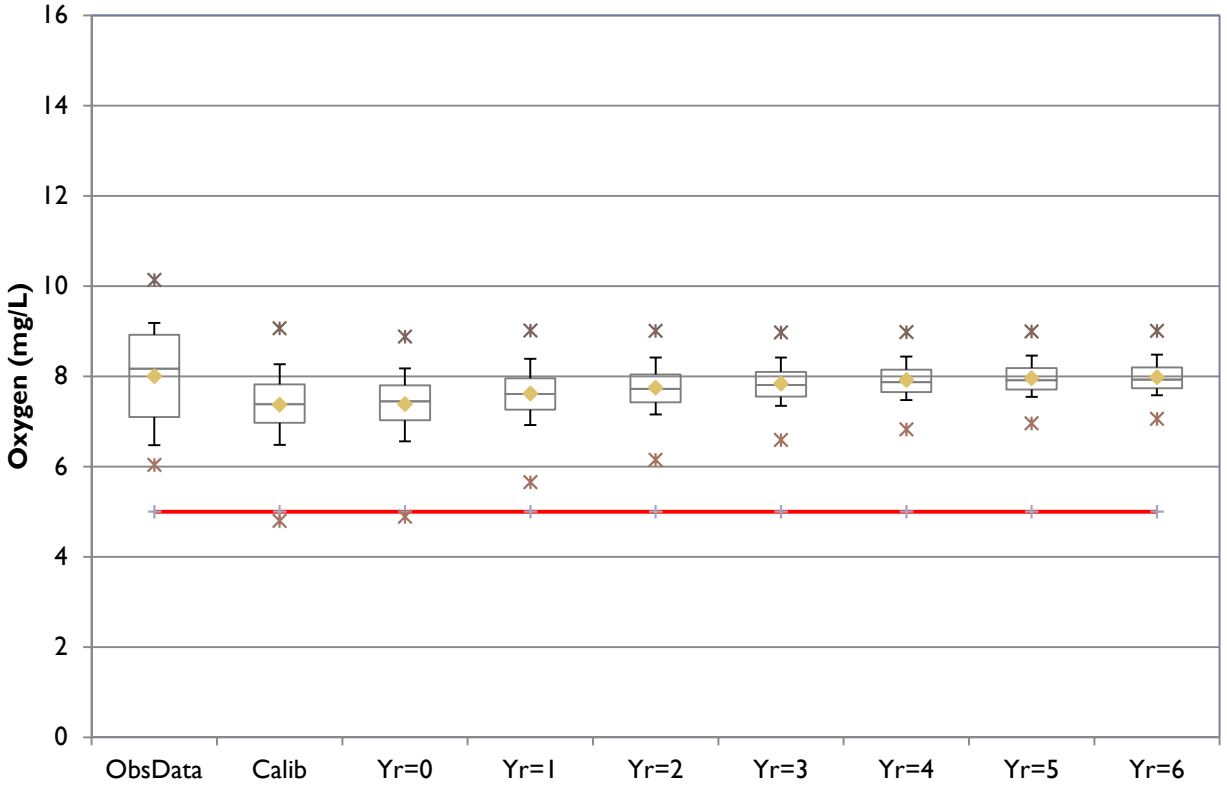
EFDC model sediment spinup

- Turbidity



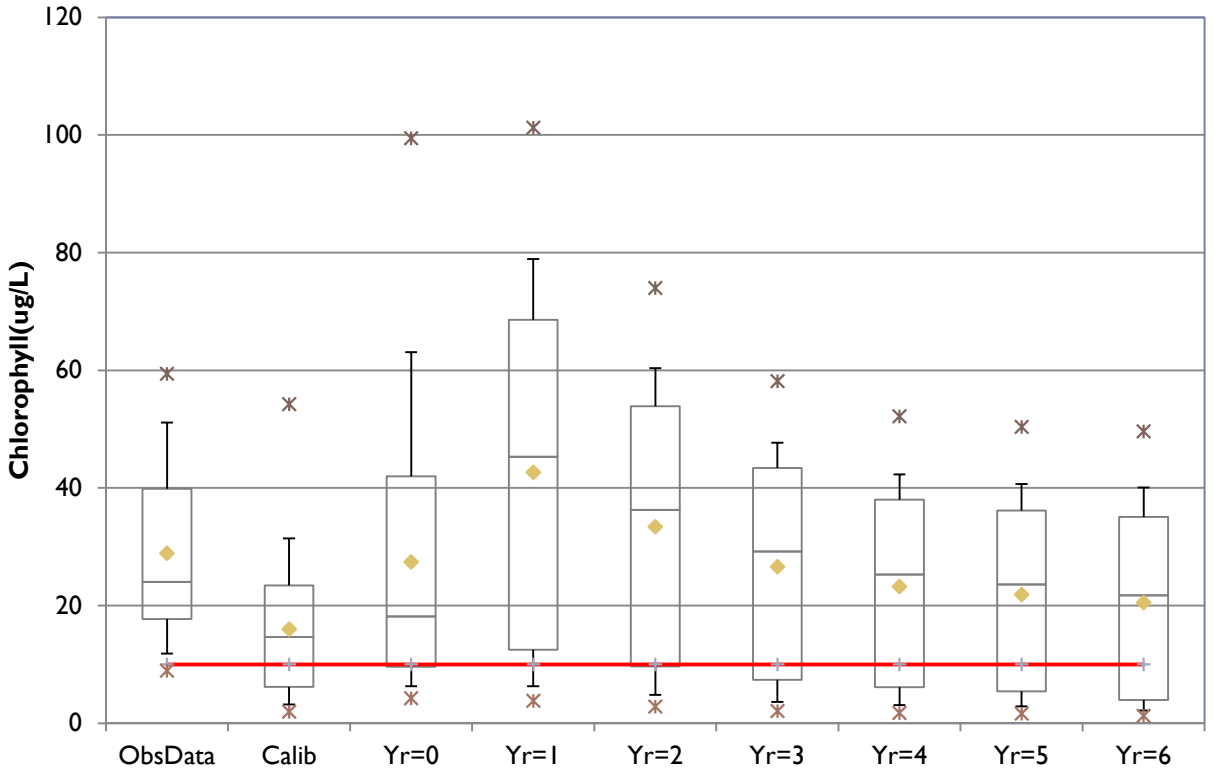
EFDC model sediment spinup

- Dissolved oxygen (surface layer)



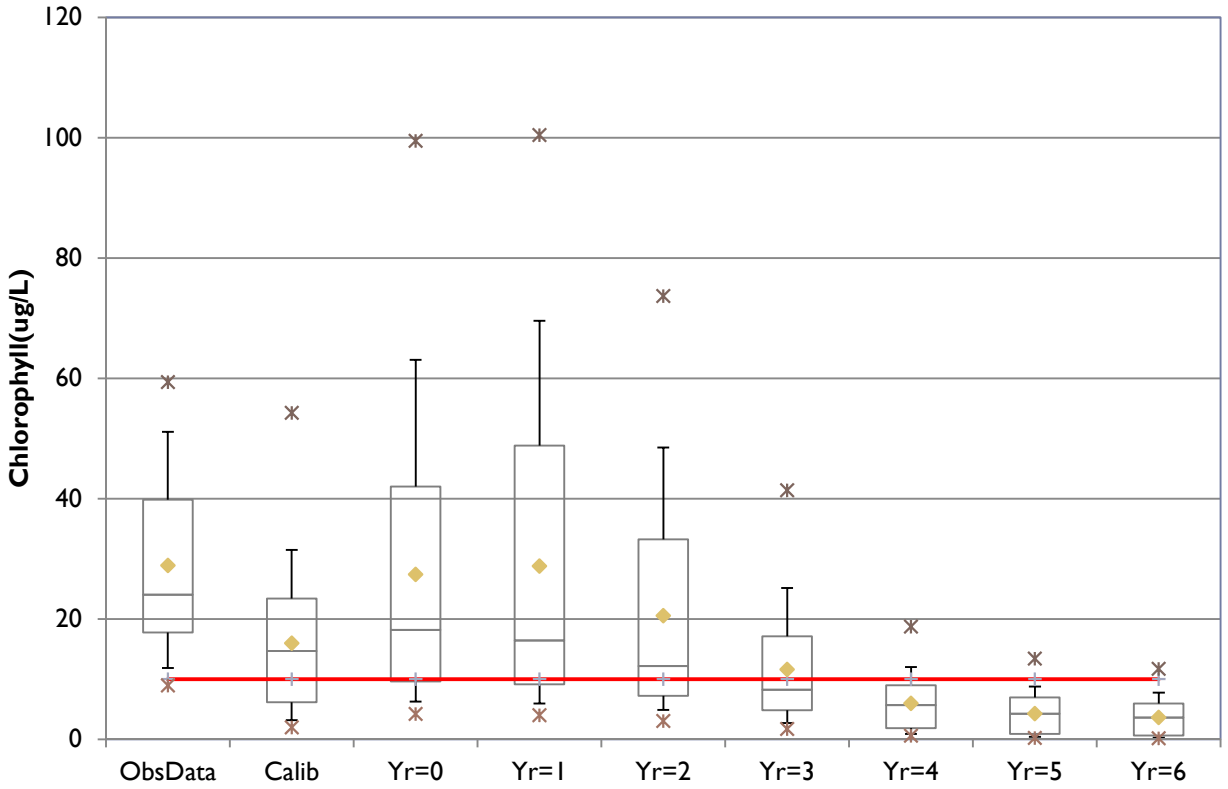
EFDC model sediment spinup

- Chlorophyll-a



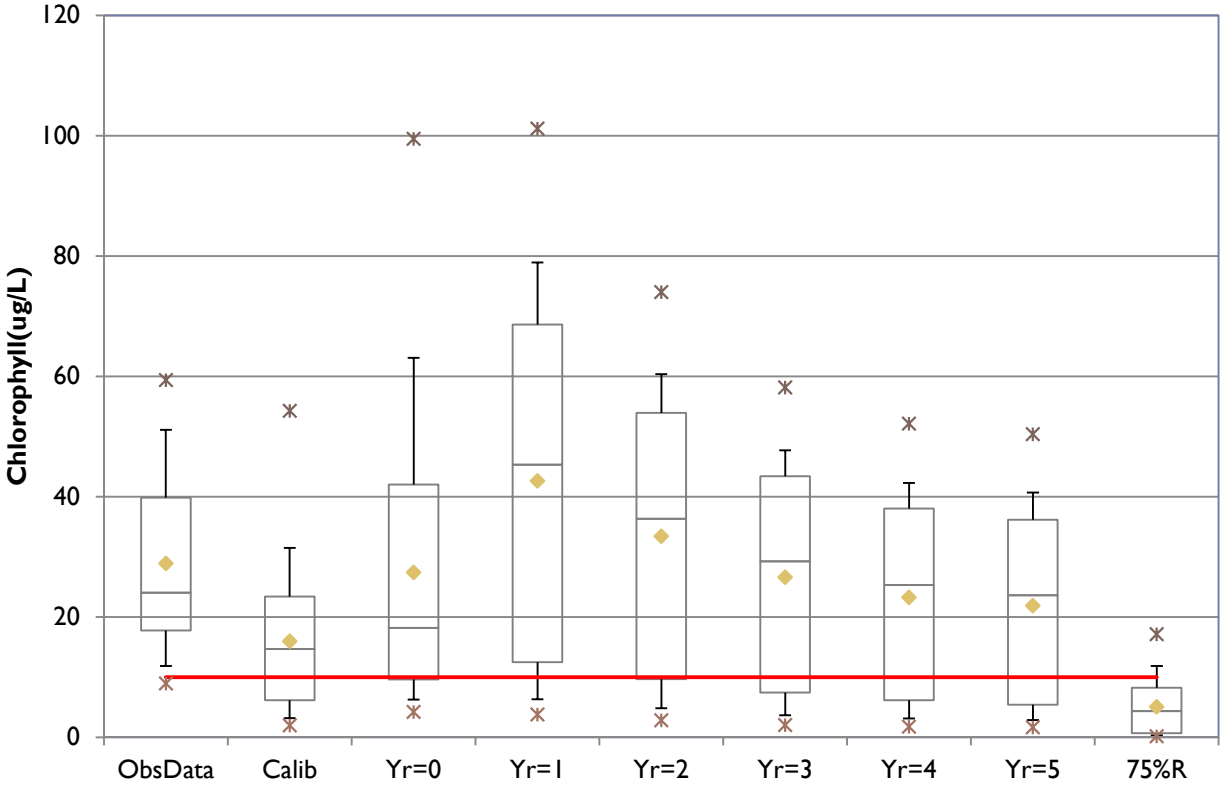
EFDC model sediment spinup

- Chlorophyll-a (repeat initial water column conditions to prevent error propagation)



EFDC model sediment spinup

- Chlorophyll-a (repeat initial water column conditions to prevent error propagation for the last year only)



EFDC lake modeling result synopsis

- Model setup reflecting lake conditions and integrated with the watershed model
- Model calibrated met criteria mostly
- Watershed load reduction scenarios showed
  - Turbidity and DO standards can be met at 50% reduction
  - Chl-a may be met at 75% under 10 years (caveats!!!)

EFDC lake modeling result synopsis

- More load reduction scenarios could be done, e.g.,
  - < 50% reductions
  - Different load reductions for different pollutants depending on BMPs implemented
- Different scenarios of spinup with
  - < 75% load reductions
  - Longer periods of weather data: e.g., 10-years of simulation of watershed loadings and lake responses using 2001-2010 data
- Simulation for lake BMPs on water quality
  - The oxygenation project
  - Lake water volume augmentation options

3. A TMDL vs. WMP in Lieu of TMDL

- TMDL = WLA + LA + MOS
  - TMDL: target load to the lake for each pollutant (after reduction goal is set)
  - WLA: waste load allocation (all NPDES permittees)
  - LA: load allocation (all non-permittee areas)
  - MOS: margin of safety: further reduce loadings can be discharged to the lake)
- Watershed Management Plan
- Watershed Management Plan in Lieu of TMDL

4. Update on COMCD v. DEQ

- 2007 Agreement between COMCD and DEQ
  - Dispute on stormwater permit for Oklahoma City
  - Agreement on a TMDL/WMP by April 2010
- Judge's ruling on April 20
  - "Agreement is valid; must be complied with"
  - DEQ options
  - Ramifications on DEQ, COMCD, and the cities

Update on COMCD v. DEQ

- Currently
  - COMCD wants a final TMDL by November 2012
  - DEQ proposed a final TMDL by July 2013
- DEQ Option 1 (no further community involvement):
  - Eliminate community involvement/dissolve the TAC
  - Finalize the modeling report by May 2012 (no more model runs on reduction options and potential BMPs)
  - Use the 75% reduction for the TMDL
  - Assign the WLA to each city in the watershed based on watershed area % (incorporated 75% load reduction to all city stormwater permits)

Update on COMCD v. DEQ

- DEQ Option 1 (Cont'd)*: TMDL = WLA + LA + MOS

	Acres	% total Area	TSS (kg/day)		TN (kg/day)		TP (kg/day)	
			Current	TMDL	Current	TMDL	Current	TMDL
Midwest City	130	0.1%	58.3	13.1	0.3	0.1	0.06	0.01
Moore	13,245	8.5%	5,958.0	1,340.6	31.5	7.1	5.79	1.30
Noble	1,161	0.7%	522.1	117.5	2.8	0.6	0.51	0.11
Norman	83,756	53.7%	37,675.1	8,476.9	199.1	44.8	36.58	8.23
Oklahoma City	53,898	34.6%	24,244.6	5,455.0	128.2	28.8	23.54	5.30
Slaughterville	957	0.6%	430.6	96.9	2.3	0.5	0.42	0.09
Unincorporated (Cleveland Cnty)	2,758	1.8%	1,240.7	279.2	6.6	1.5	1.20	0.27
Total	155,906	100%	70,129	**15,779**	371	**83**	68	**15.32**

(* 1. With a 10% MOS; 2. TOC will be added)

WLA LA

Disclaimer: This is only an example of potential TMDL outcome

Update on COMCD v. DEQ

- DEQ Option 1 (Cont'd):
  - Draft TMDL report for EPA technical review – July 2012
  - Public comment – Sep and Oct 2012 ???
  - Submit final draft TMDL for EPA review – Nov 2012 ???
  - **Assuming no substantial EPA and public comments along the way**

Update on COMCD v. DEQ

- DEQ Option 2 (Including community involvement):
  - Finalize the modeling report by May 2012 (with TAC input)
    - More simulations for lower load reductions
    - Various pollutant load reduction combinations
  - Write draft TMDL: October 2012 (with TAC input)
    - Look at pollutant contribution from each subwatershed and city
    - Separate urban areas from rural/agricultural land
    - Consider cost-effective BMPs based on various load reduction
    - Design phased goals on load reductions for each city

Update on COMCD v. DEQ

- DEQ Option 2 (Cont'd):
  - Submit the draft to EPA for technical review: January 2013
  - Take public review/comment: March - April 2013
  - Submit final draft TMDL for EPA approval review in June 2013
  - Get approved TMDL: July 2013
  - **Assuming EPA and public comments are not difficult to address due to the TAC involvement and careful TMDL design along the way**

5. Next meeting

- Lake modelers coming over
  - Special TAC meeting?
  - Public meeting afterwards?
- Time
  - Late May?
- Place
  - DEQ?
  - Moore-Norman Technology Center?

Open Discussion