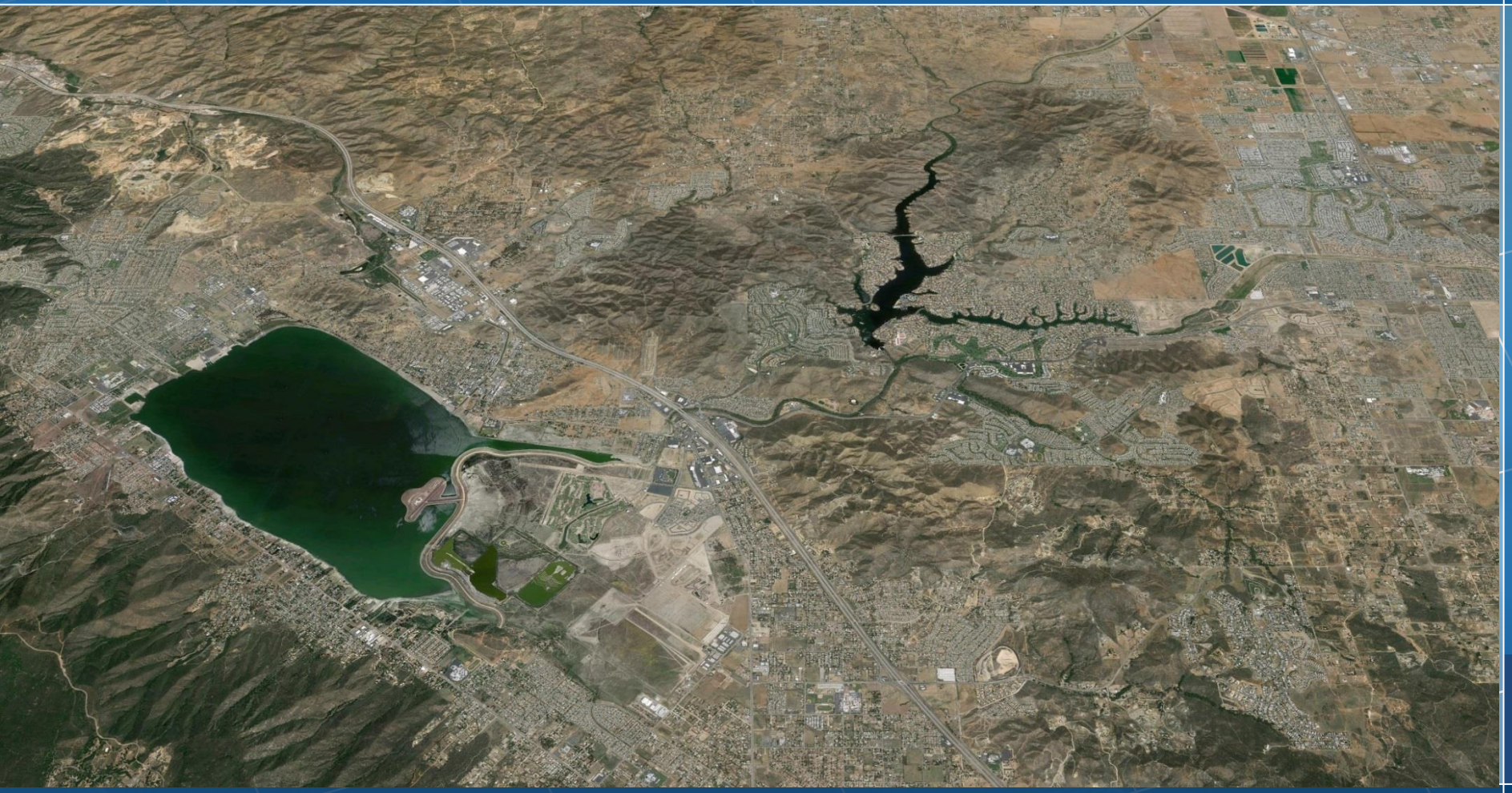
Revision of the Lake Elsinore & Canyon Lake Nutrient TMDL

CDM Smith Team
& Risk Sciences



September 21, 2016

Lake Elsinore/Canyon Lake Task Force Meeting

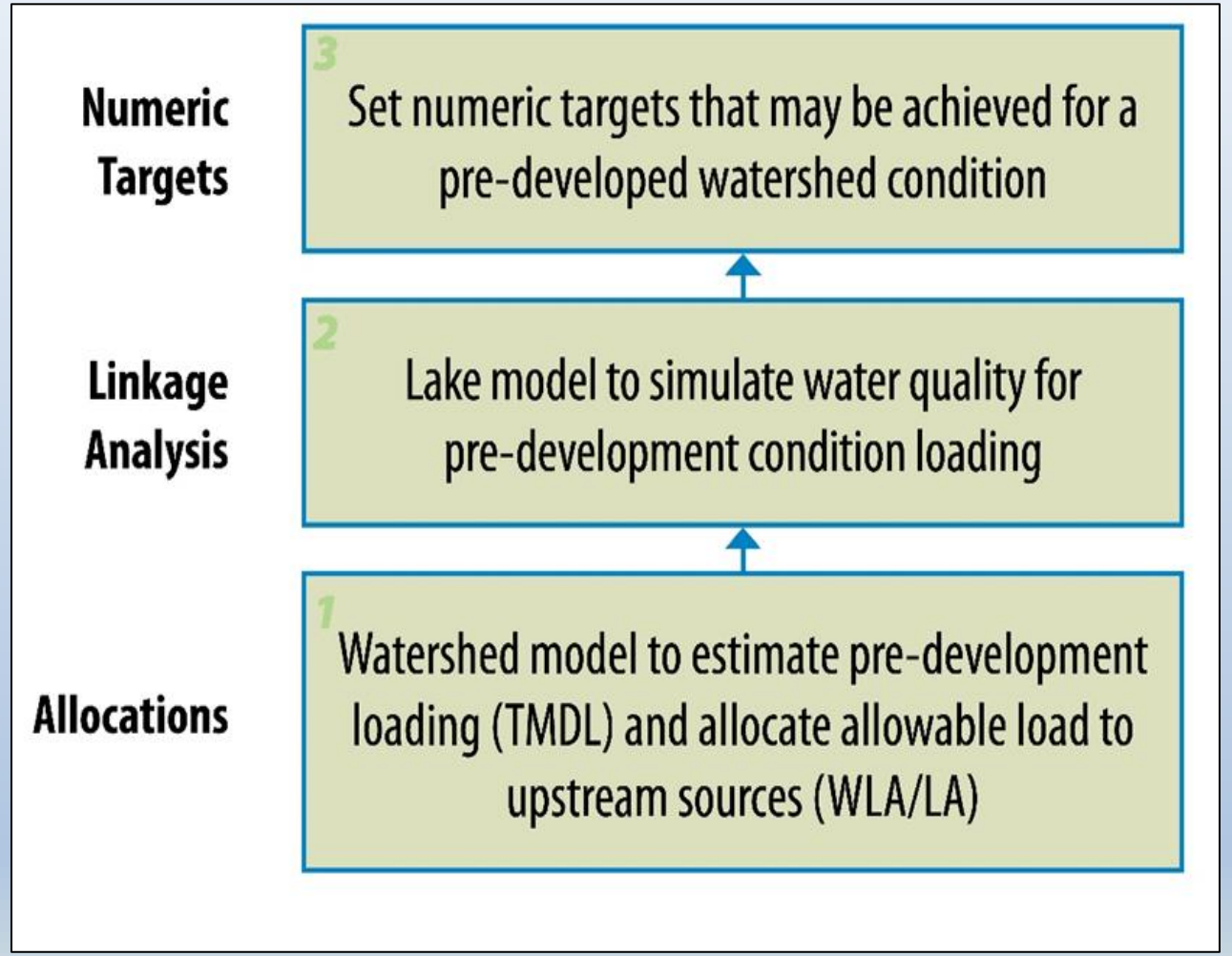
Presentation Outline

- Numeric Targets
- Source Assessment
- Linkage Analysis

NUMERIC TARGETS

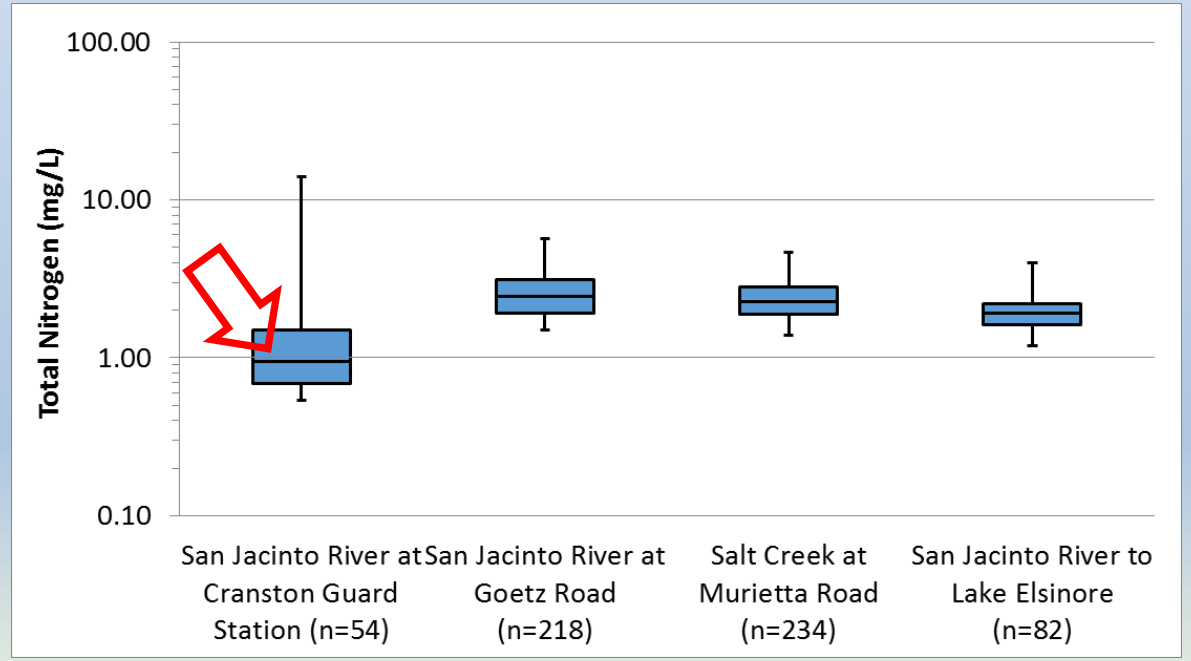
Numeric Target Approach

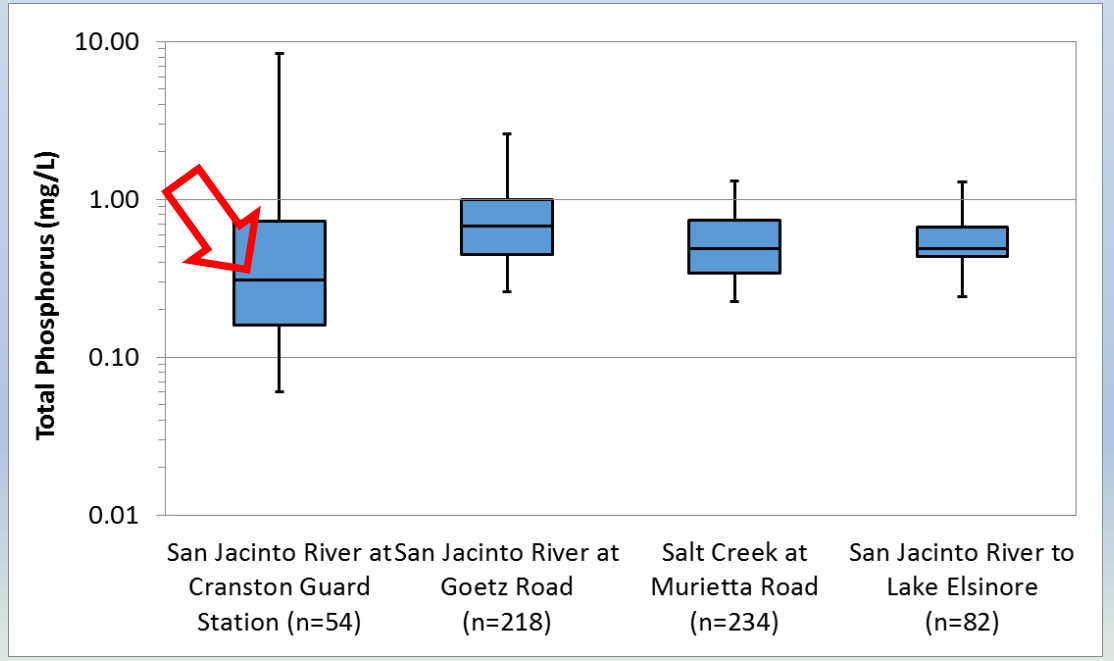
- Reference watershed data assessment
- Develop and run lake water quality models for reference watershed loading:
  - Canyon Lake: ELCOM-CAEDYM
  - Lake Elsinore DYRESM-CAEDYM
- Model results represent numeric targets



Reference Watershed

- External nutrient loading
  - Runoff inflows based on gauged flow data
  - Estimated undeveloped land nutrient washoff from monitoring data



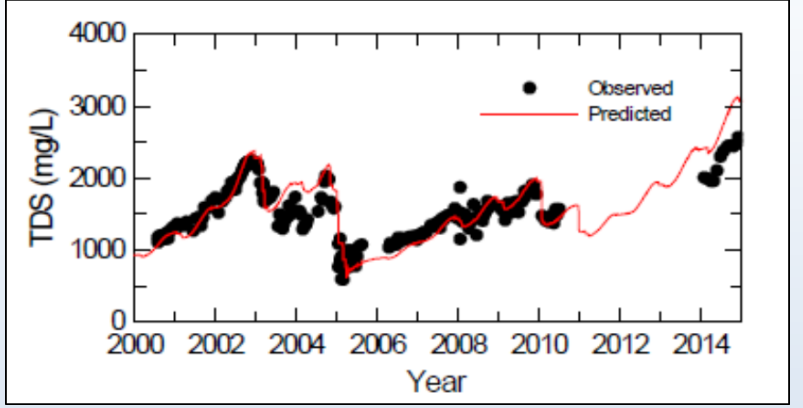


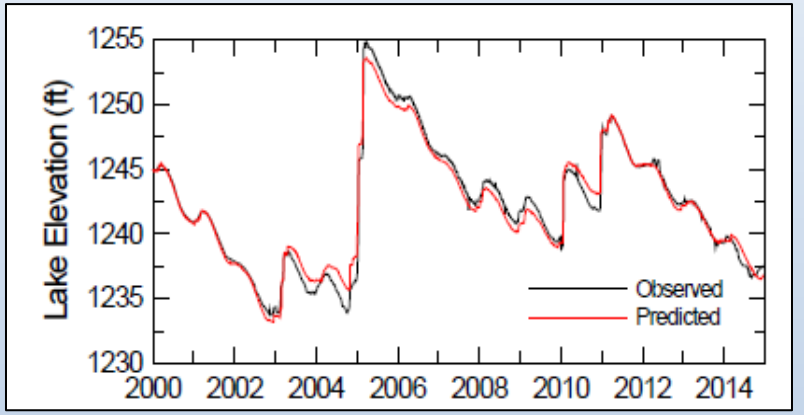
Linkage Analysis for Lake Elsinore

- DYRESM-CAEDYM calibration 2000-2014; long-term simulation 1915-2014

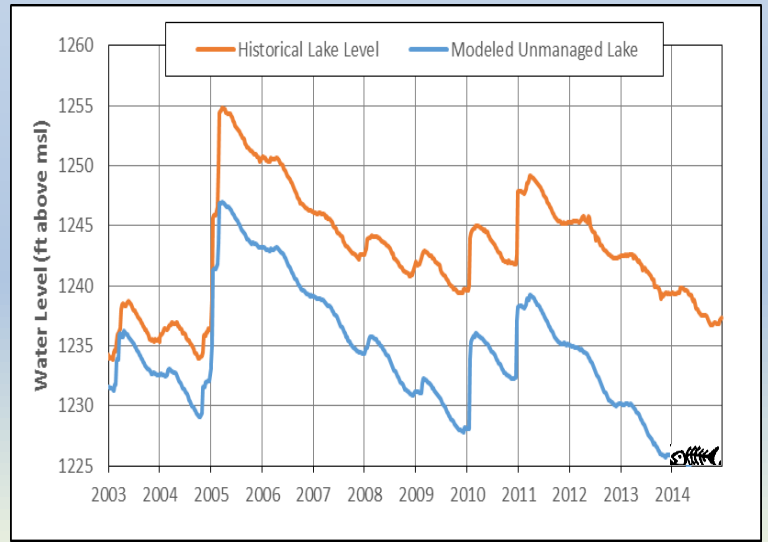
Table 2. Mean observed and predicted values of key water quality parameters for calibration period (2000-2014).

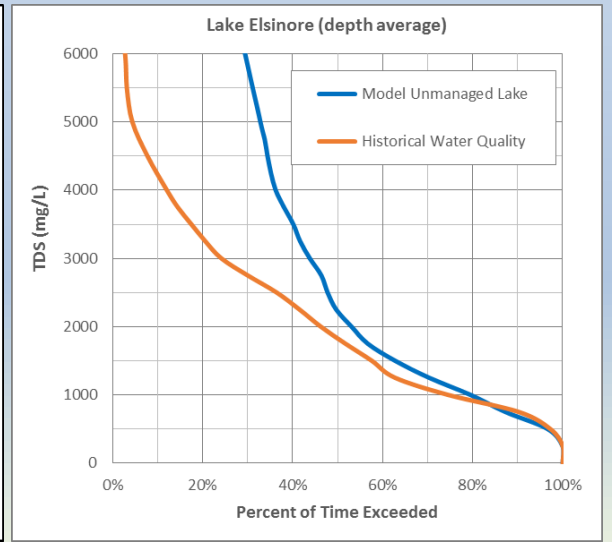
	Observed	Predicted	% Error
Total N	3.98	3.88	-2.5
Total P	0.265	0.235	-11.3
Chlorophyll a	130	137	+5.4





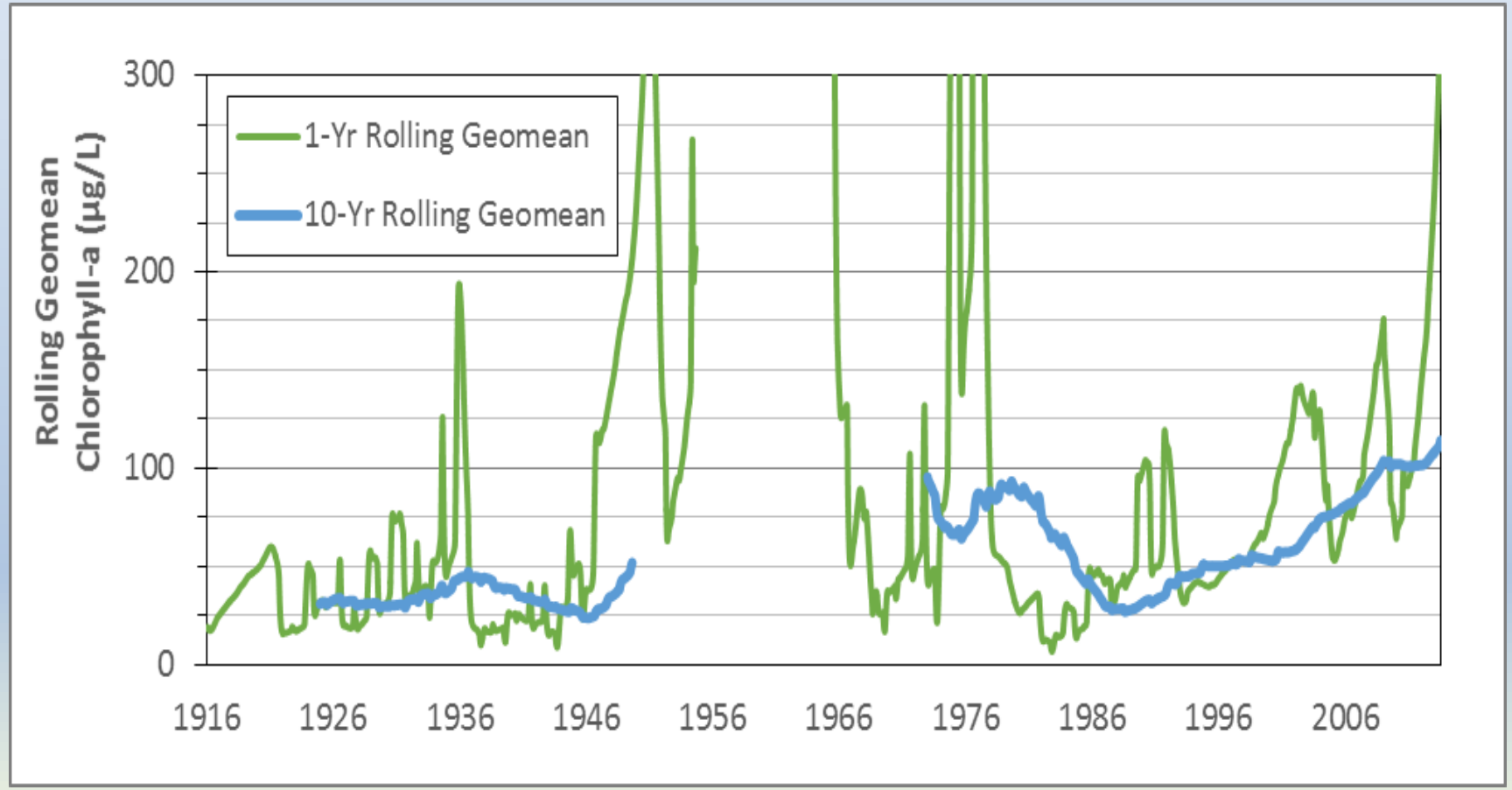
- Model runs for no levee, no reclaimed water, pre-development water quality loading → numeric target
- Model runs also for managed lake condition



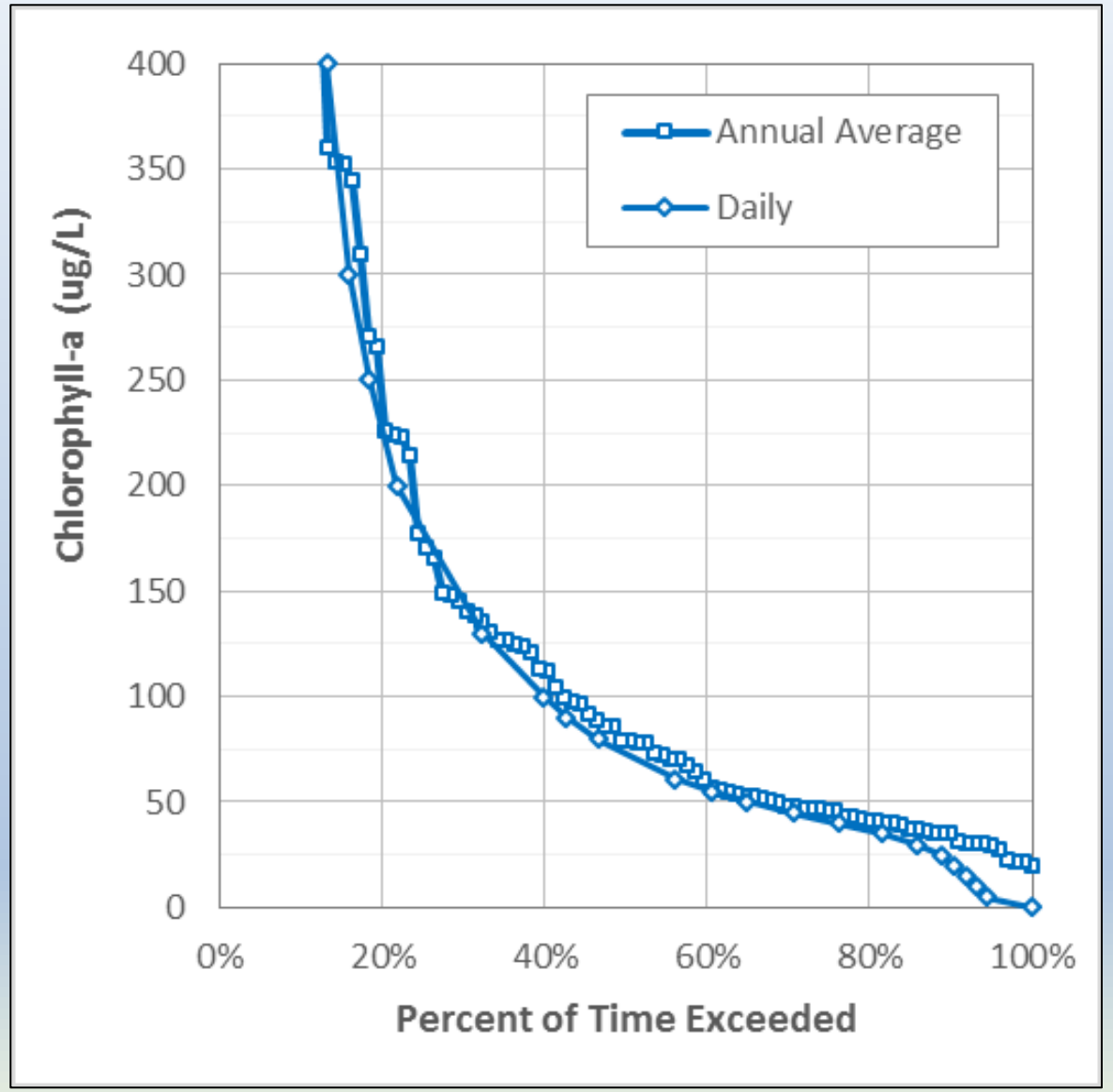


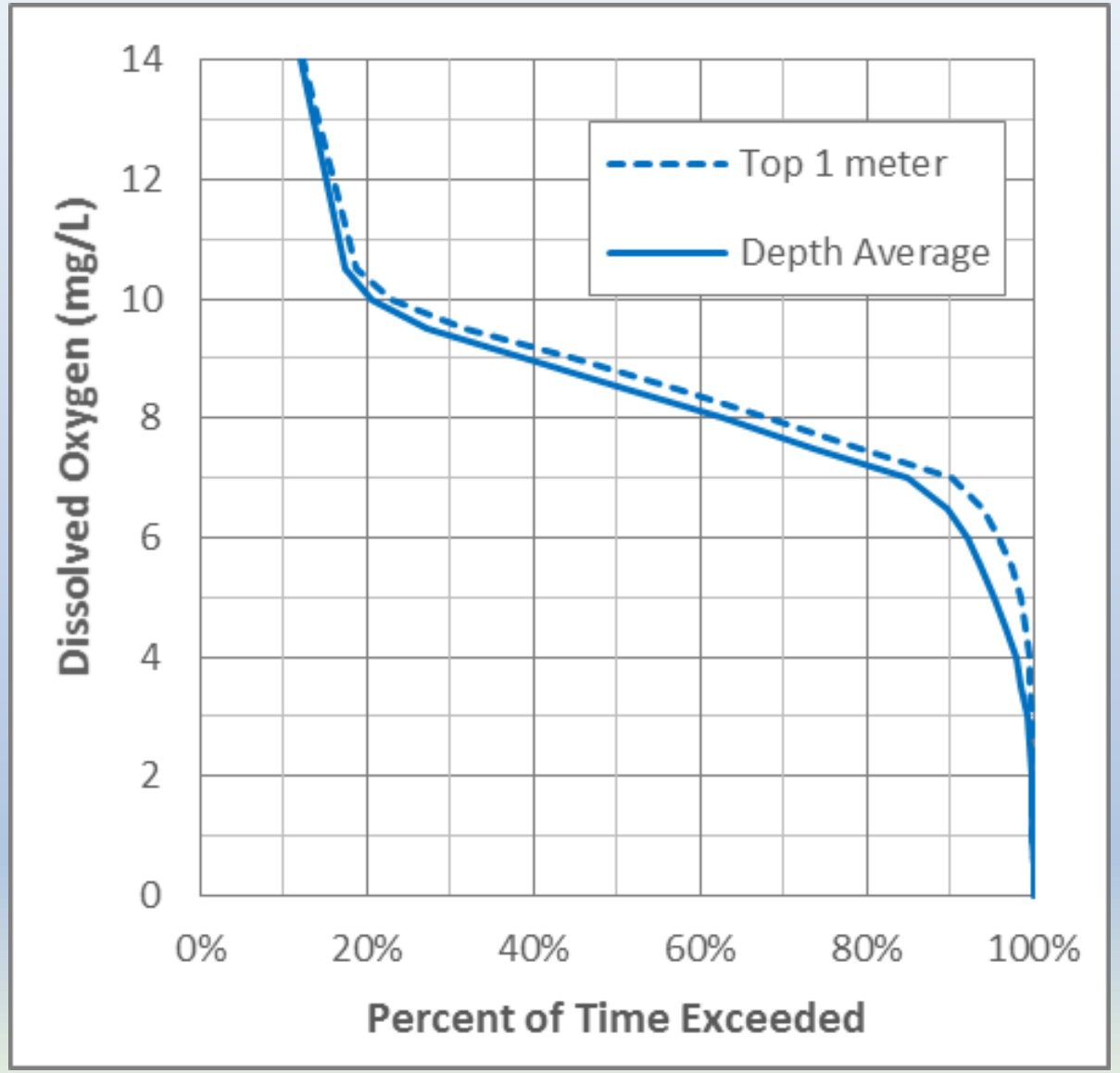
Lake model for Lake Elsinore

- Water quality response for reference watershed loading controlled by long term (multi-decadal) hydrologic variability
- Singular numeric targets for shorter averaging periods not appropriate



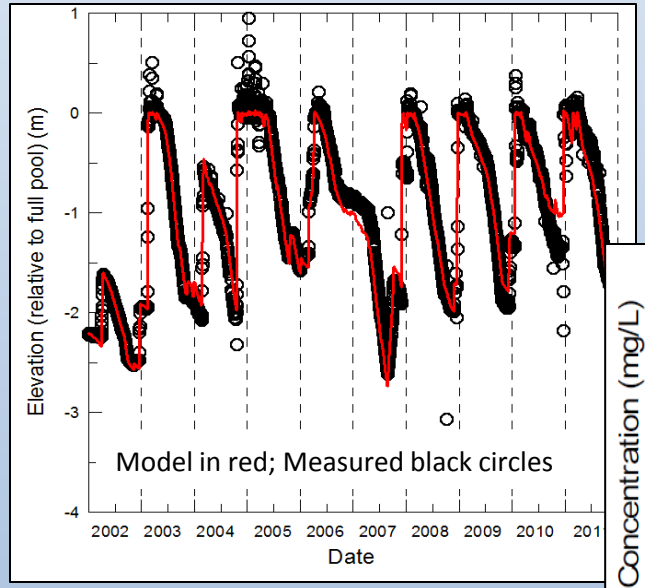
Numeric Targets Lake Elsinore

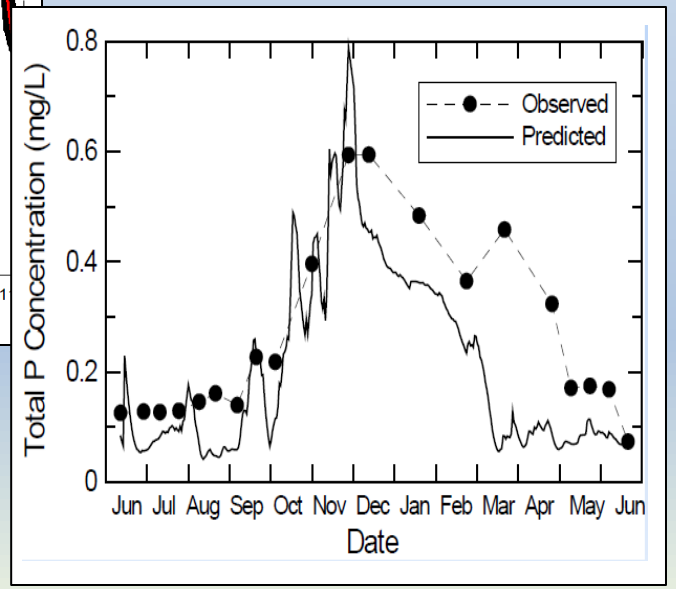


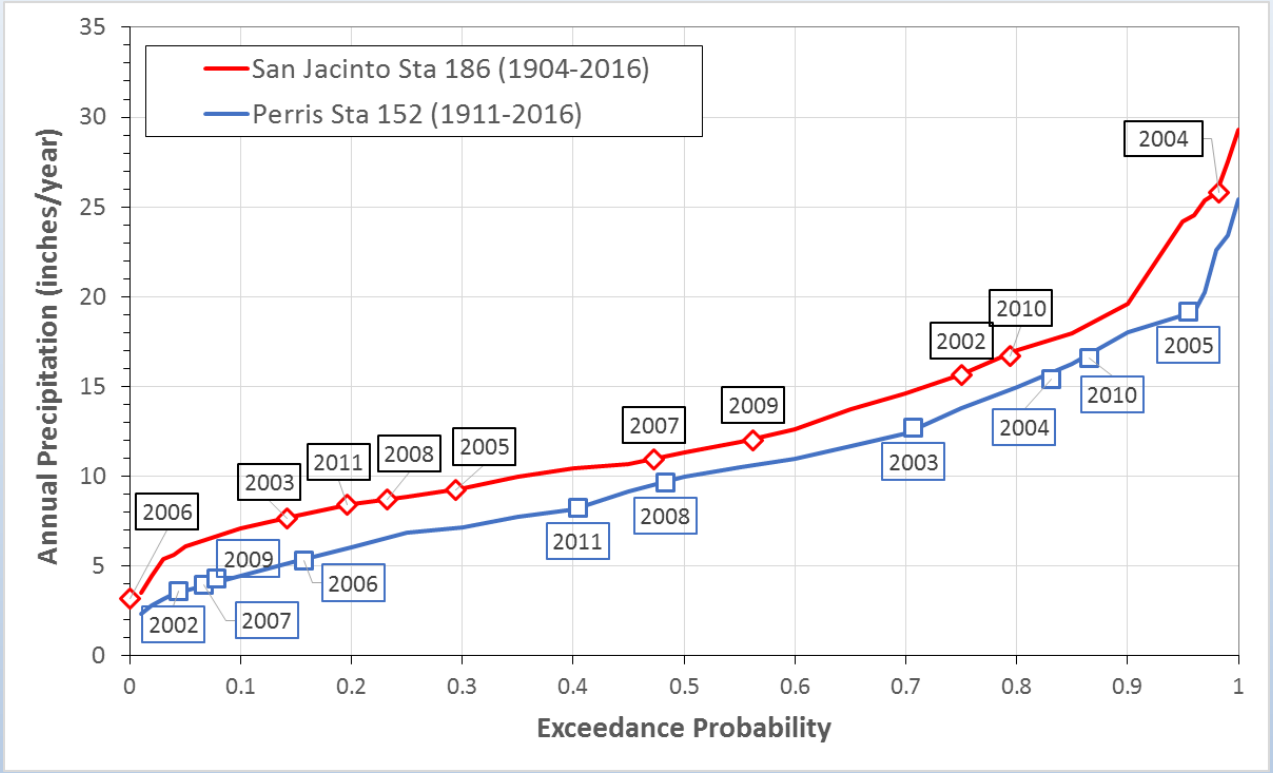


Lake model for Canyon Lake

- ELCOM-CAEDYM simulation period 2002-11 representative of long-term rainfall distribution

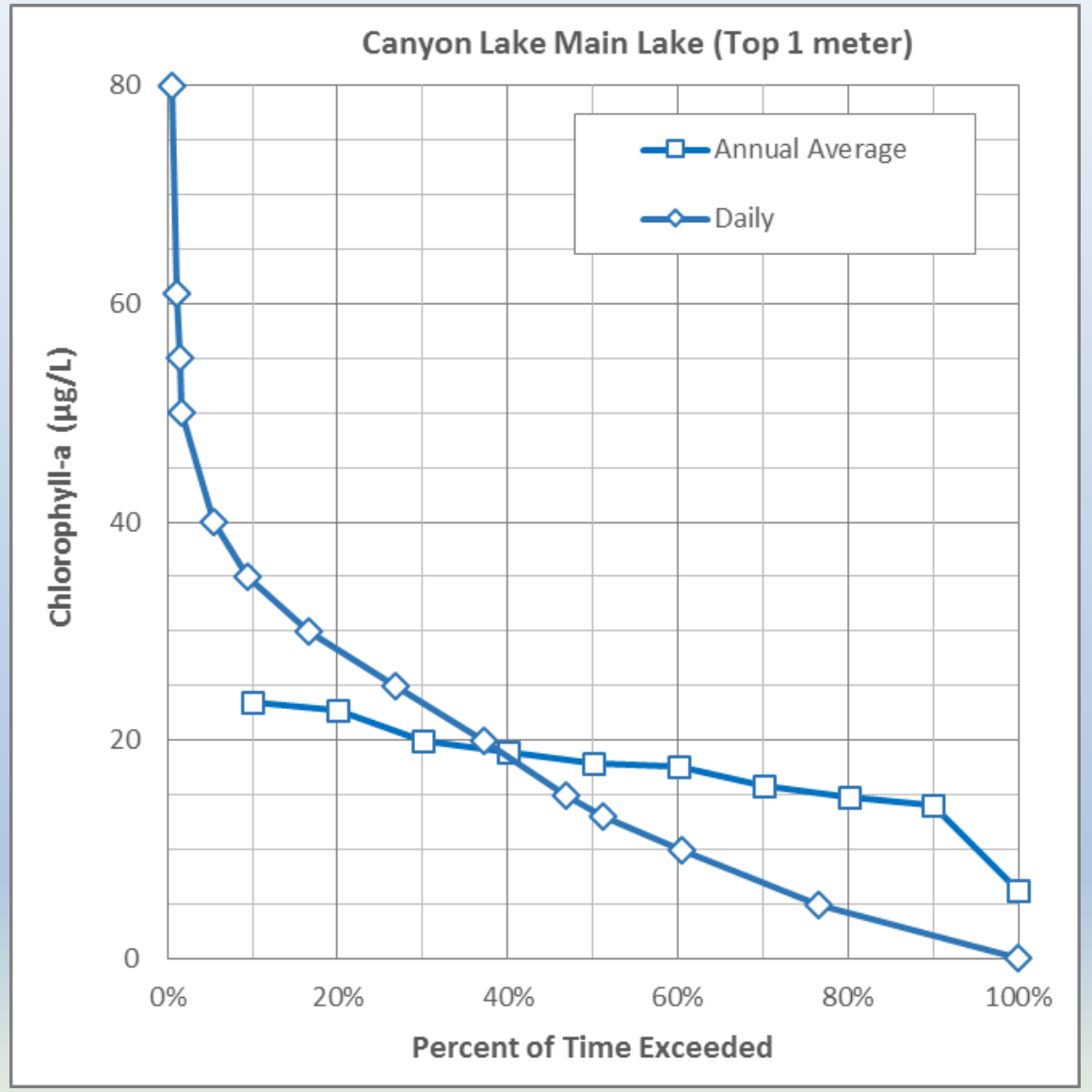


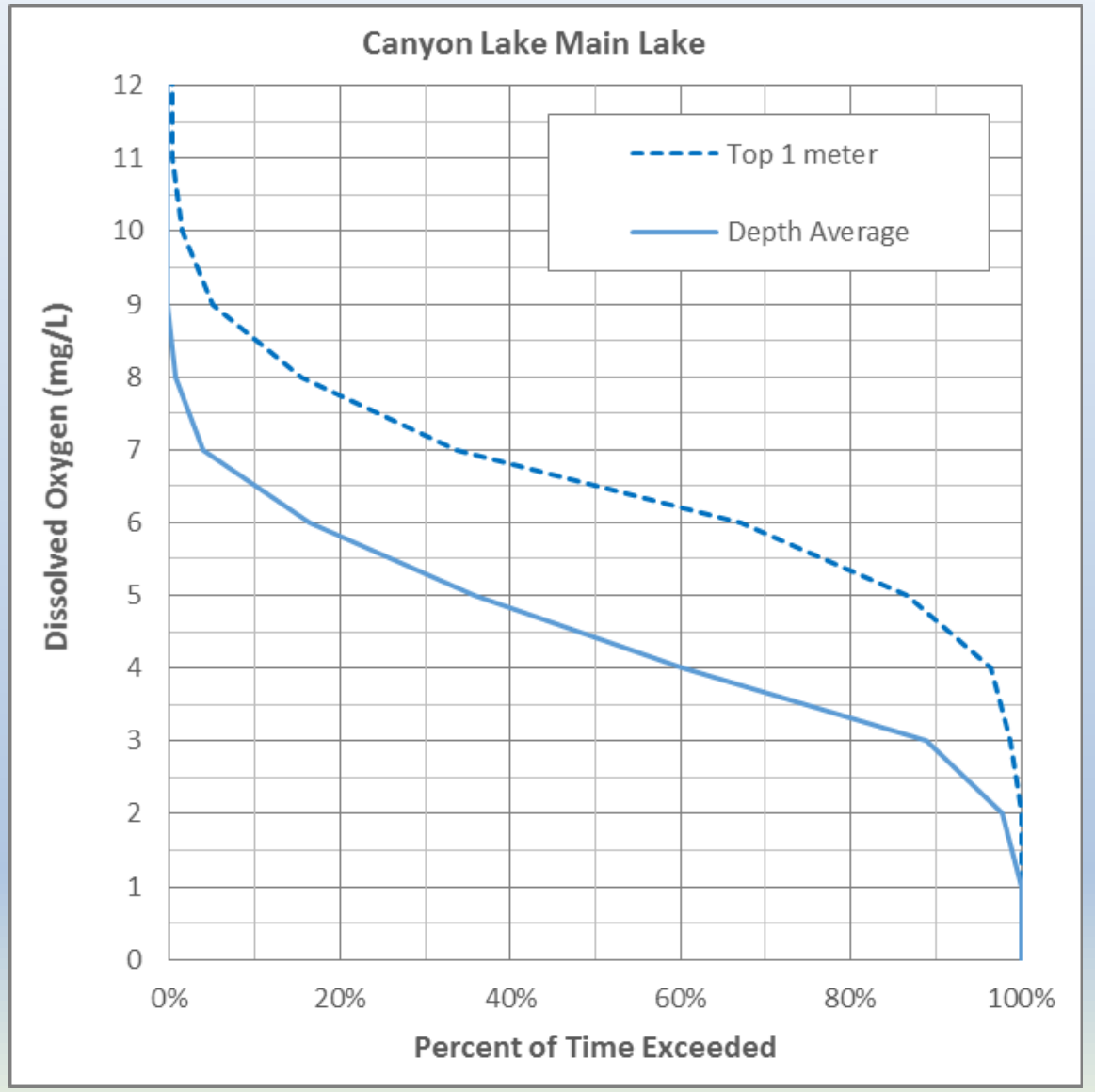




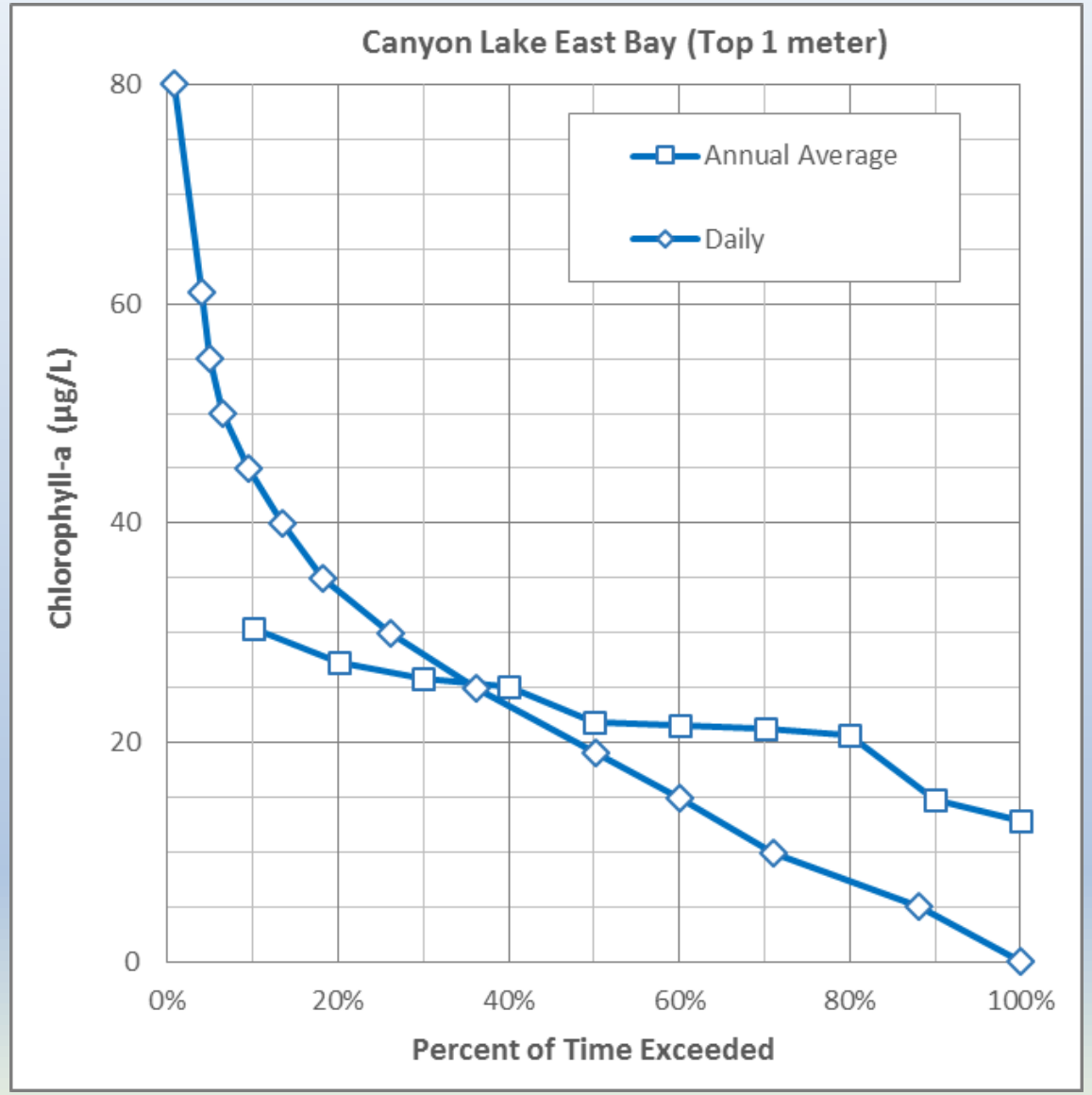
- Model predicts lake response to predevelopment water quality loading → numeric target

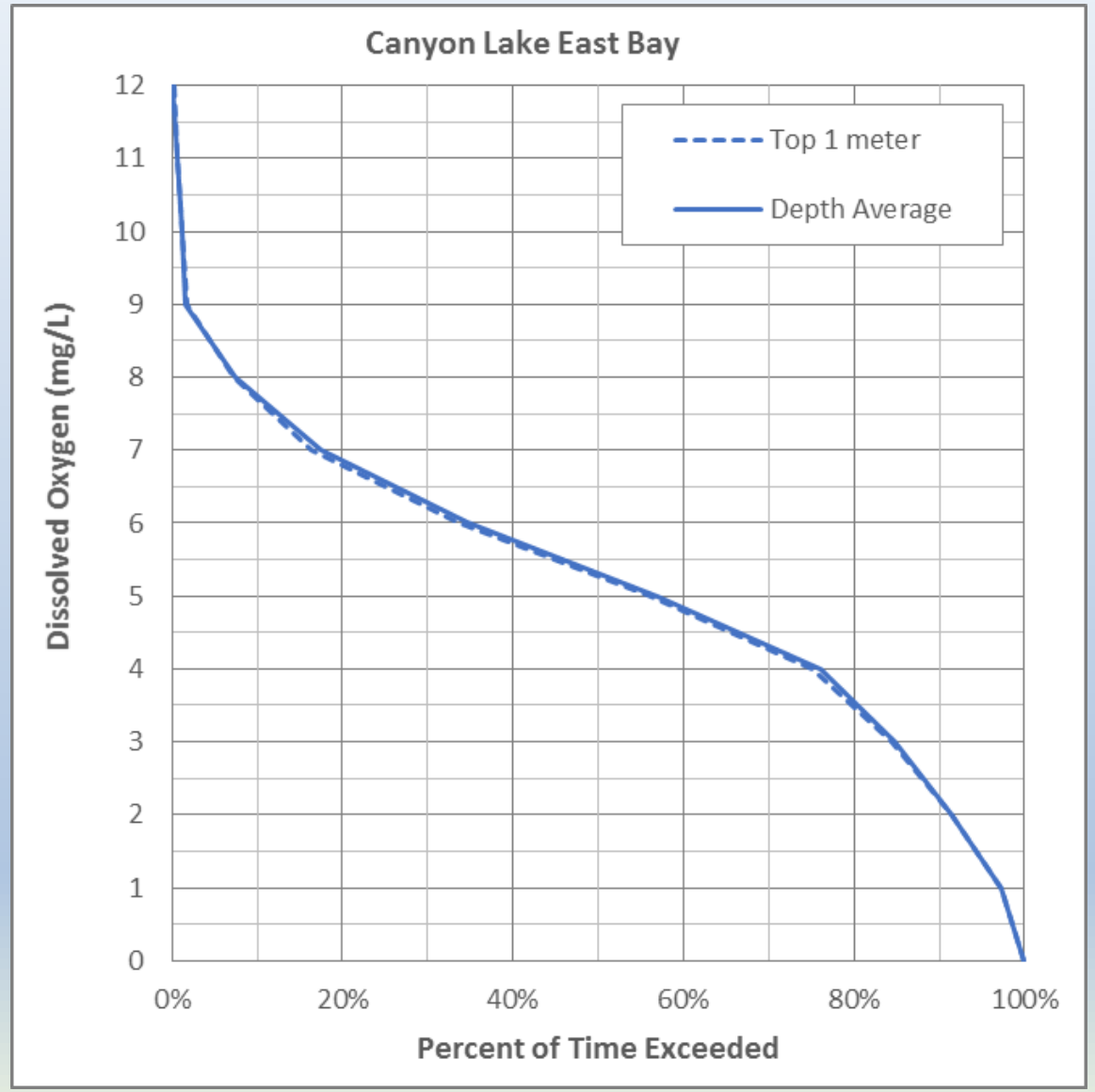
Numeric Targets (Canyon Lake Main Lake)





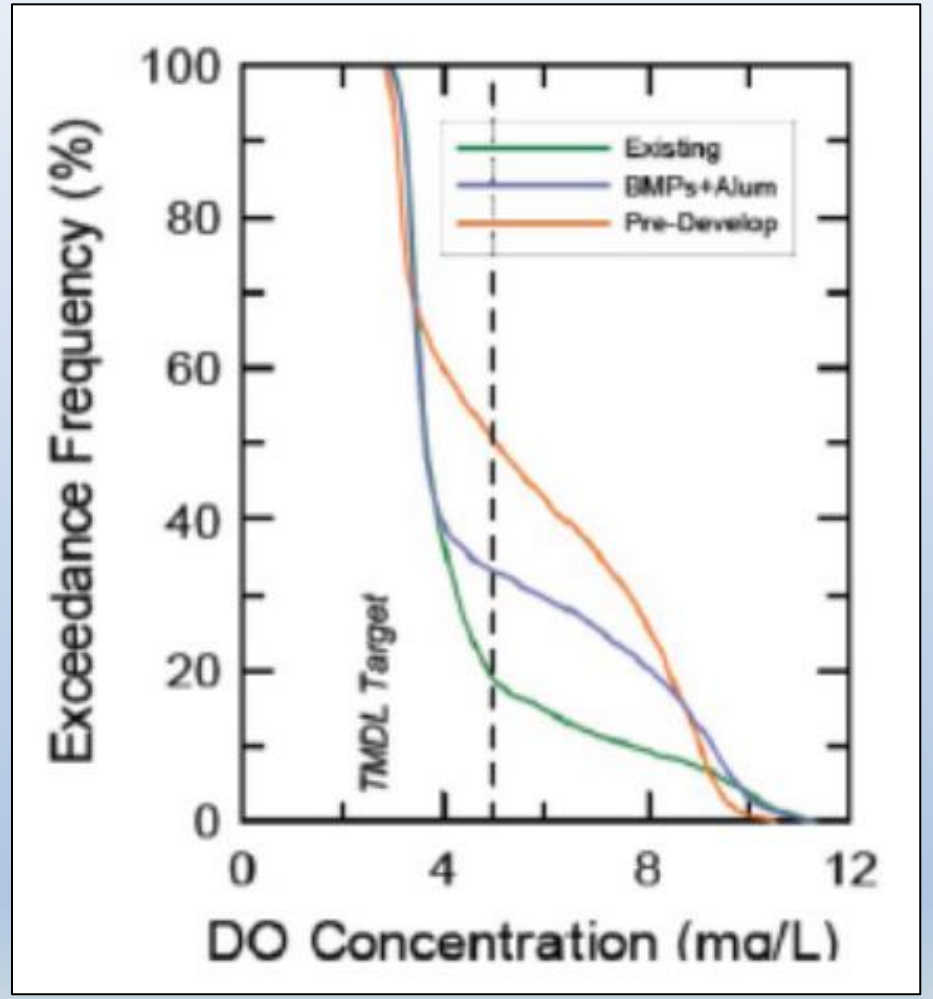
Numeric Targets (Canyon Lake East Bay)





Assessment of TMDL Compliance

- Comparison of watershed monitoring data with reference watershed levels – verify any additional loading is offset with in-lake BMPs
- Continue to collect in-lake data to develop post implementation CDFs for comparison with numeric target CDFs
  - Multi-decadal monitoring record needed to generate comparable CDFs



Example from prior modeling for illustrative purposes only

SOURCE ASSESSMENT UPDATES

Update

- Watershed model presented in July 2016
- Revision of land use based EMCs
- Development of Mystic Lake overflow volume estimates

Variables - Event Mean Concentration (EMC)

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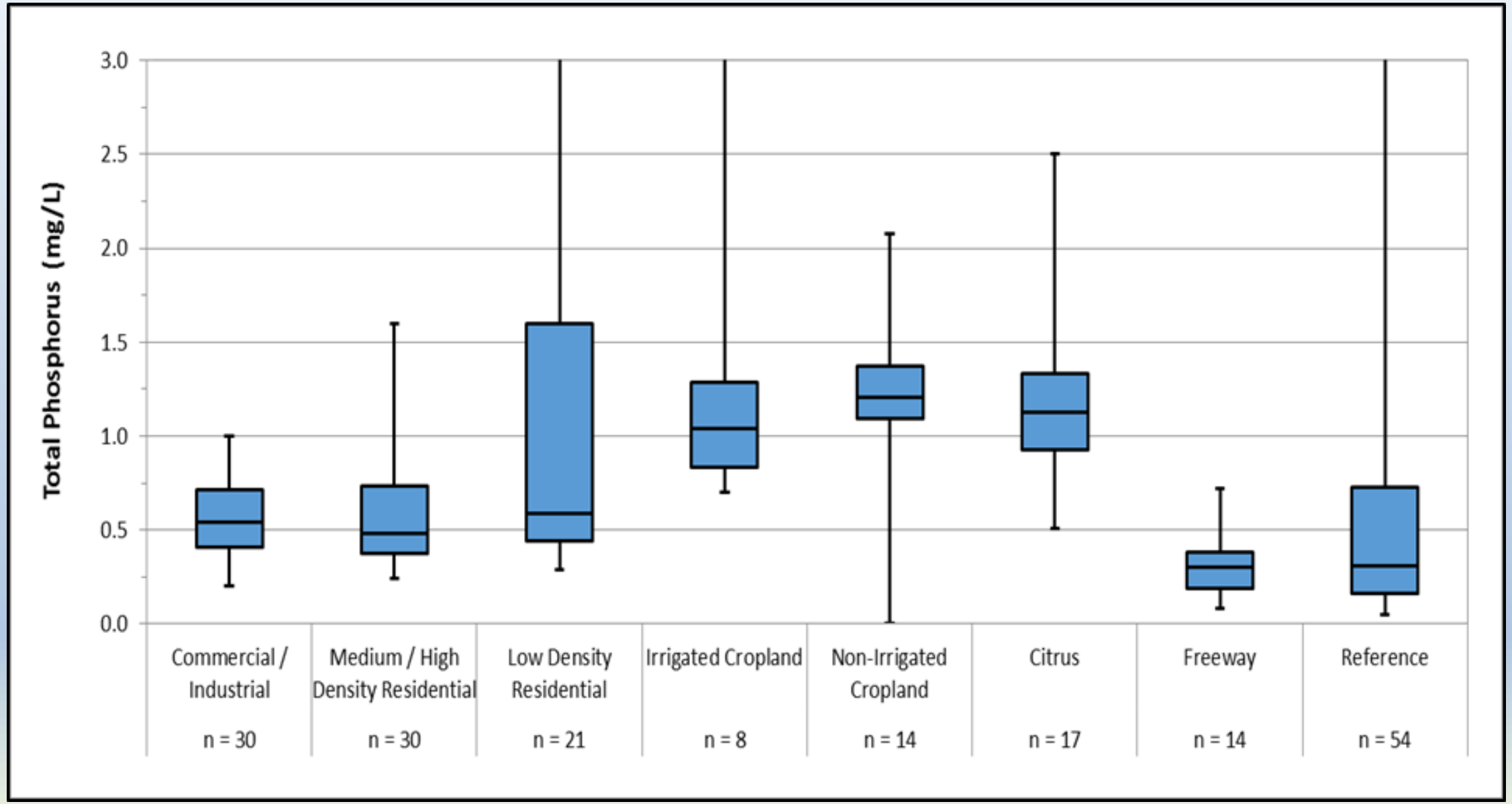
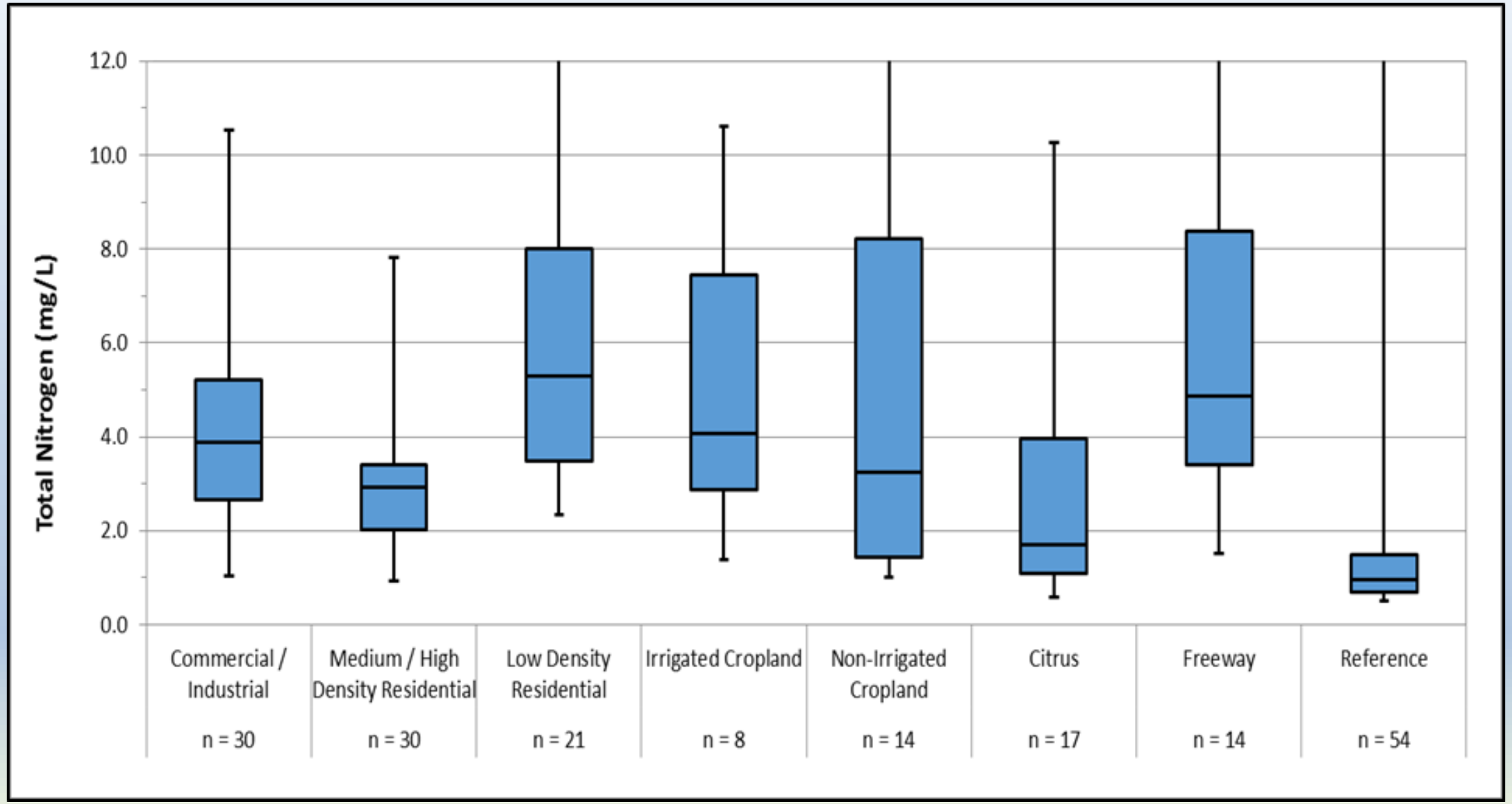


Variables - Event Mean Concentration (EMC)



Variables - Event Mean Concentration (EMC)

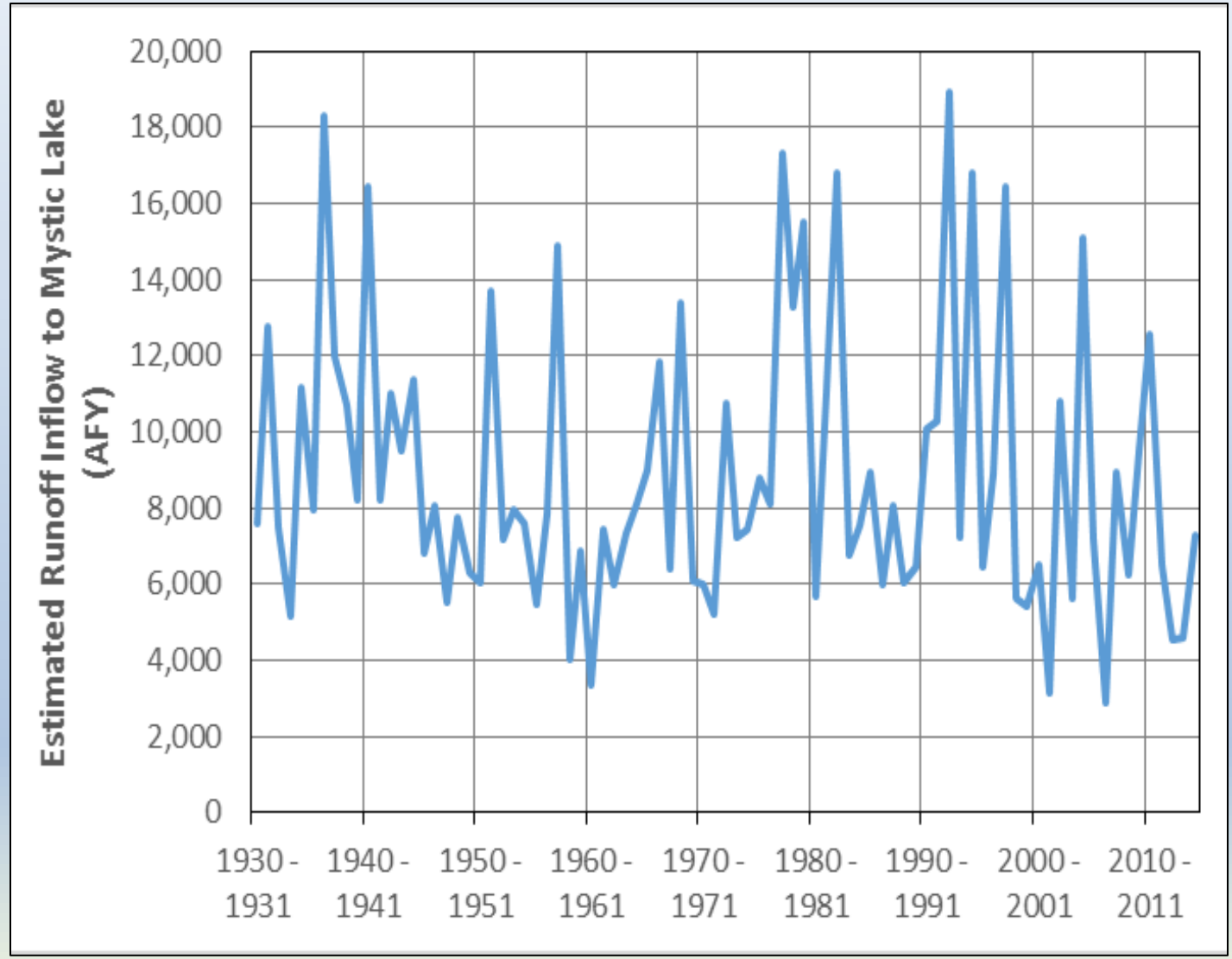
- Median values

Land Use	Event Mean Concentration		Source
	TP (mg/L)	TN (mg/L)	
Dairy	0.00	0.00	Presume compliance with CAFO Permit
Forested	0.31	0.95	Cranston Guard Station
High-Density Residential	0.48	2.93	Station 316 Sunnymead Channel (n=30) 2004 - 2015
Irrigated Cropland	1.04	4.08	UCR Ag Study
Low-Density Residential	0.59	5.30	Station 834 Quail Valley site (n=21) 2000-2004
Non-Irrigated Cropland	1.21	3.25	UCR Ag Study
Open Space	0.31	0.95	Cranston Guard Station
Orchards / Vineyards	1.13	1.71	UCR Ag Study
Other Livestock	2.00	5.00	Default values, refinement pending
Pasture / Hay	0.76	2.10	Assume midpoint between open space and non-irrigated cropland
Roadway	0.31	4.88	NSQD local sites FW landuse (n=14)
Commercial / Industrial	0.54	3.89	Station 40 Corona Storm Drain (n=30) 2004 - 2014

MYSTIC LAKE OVERFLOW VOLUME

Mystic Lake Overflow

- Overflow frequency estimated to be 10 percent
- Watershed model for subwatershed zones 7-9 used to approximate runoff inflows to Mystic Lake
- Average annual runoff inflow is 8900 AFY



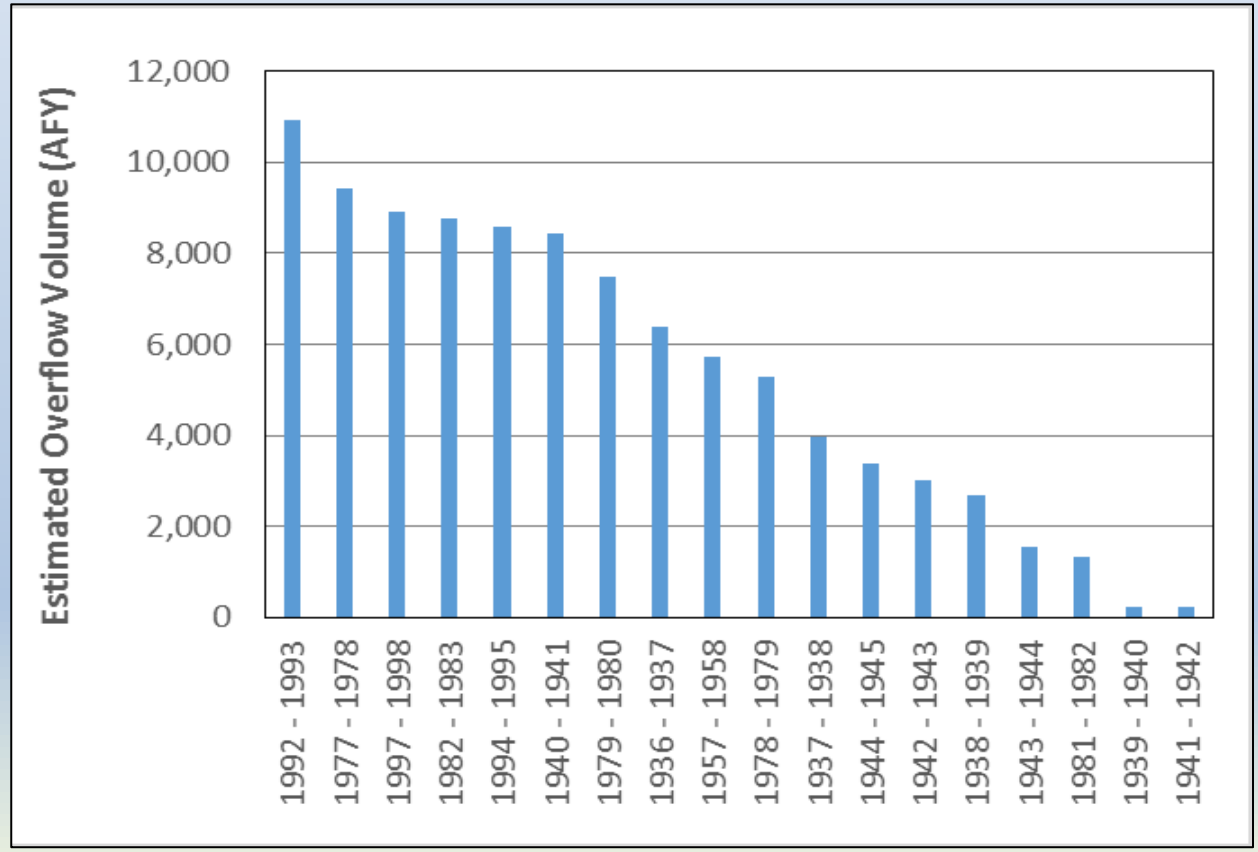
Mystic Lake Overflow

- Reservoir routing analysis developed to assess potential overflow volume to Canyon Lake Main Lake

$$O_i = R_i - (S_{MAX} - S_i)$$

$$S_i = R_{i-1} + S_{i-1} - E_{i-1} - O_{i-1}$$

- R_i from watershed model
- S_i not to exceed max capacity 22,000 AF by 2040
- E_i from CIMIS (49.6 in/yr)



Mystic Lake Overflow

- Total overflow volume between 1929 - 2016
  - 83,000 AF in 18 wet seasons
- Divided into 87 year simulations period yields long term overflow volume of ~950 AFY (~10 percent of inflows to Mystic Lake)

From slides presented to Task Force 9/9/15 by Mike Venable, RCFC&WCD

LINKAGE ANALYSIS UPDATES

Linkage Analysis Canyon Lake / Lake Elsinore TMDL Revision

- Objective is to determine response in receiving water for a reference watershed nutrient loading
- Consists of lake water quality models with external nutrient load inputs
- Estimates dynamics of response variables as well as spatial patterns

Progress Update

- Summary of lake models and scenarios required for Linkage Analysis

Lake Segment	Baseline, Reference Watershed Loads	Managed Lake, Existing Watershed Loads	Implementation
Lake Elsinore	Completed Draft (Numeric Target CDF)	Completed Draft (Demonstrate multi-benefit for implementation chapter)	Preliminary runs (Tech Memo 1.2 Feb 2016)
Canyon Lake Main Lake	Completed Draft (Numeric Target CDF)	n/a	Preliminary runs w/DYRESM; ELCOM simulation to be scoped
Canyon Lake East Bay	Completed Draft (Numeric Target CDF)	n/a	Preliminary runs w/DYRESM; ELCOM simulation to be scoped

How Should **Blue-Green Algae** and Cyanotoxins be Addressed in the Updated Nutrient TMDL for Lake Elsinore & Canyon Lake?

SCCWRP's 2015-16 Monitoring Data

(water samples only)

Cyanotoxin	Canyon Lake	Lake Elsinore
Total Microsystins	ND – 1.58 ug/L	ND – 5,665 ug/L
Cylindrospermopsin	ND – 18.2 ug/L	ND – 21.2 ug/L

Table 1. CyanoHAB Trigger Levels for Human Health

	Caution Action Trigger	Warning TIER I	Danger TIER II
Primary Triggers [a]			
Total Microcystins [b]	**0.8** µg/L	**6** µg/L	**20** µg/L
Anatoxin-a	**Detection** [c]	**20** µg/L	**90** µg/L
Cylindrospermopsin	**1** µg/L	**4** µg/L	**17** µg/L

Blue Green Algae Work Group of
the State Water Resources Control Board (SWRCB),
the California Department of Public Health (CDPH), and
Office of Environmental Health and Hazard Assessment (OEHHA)

Cyanobacteria in California Recreational Water Bodies:

Providing Voluntary Guidance about Harmful Algal Blooms, Their Monitoring, and Public Notification

July 2010 Draft

Changes from the prior draft (September 2008), other than some minor editorial changes, are shown as ~~strikeouts~~ for deletions and <u>underlines</u> for additions.

ACKNOWLEDGEMENTS: The SWRCB, CDPH, and OEHHA appreciate the continued participation of the stakeholders in the State-wide Blue-Green Algae Workgroup, including those who represent the following groups: Siskiyou County Environmental Health, Humboldt County Environmental Health, Del Norte County Environmental Health, the Department of Water Resources, the Central Valley Regional Water Quality Control Board, the North Coast Regional Water Quality Control Board, US Environmental Protection Agency (Region 9), the Karuk Tribe, the Yurok Tribe, Metropolitan Water District of Southern California, and PacifiCorp. Some of these stakeholders also comprise the Klamath Blue-Green Algae Workgroup, which is addressing local concerns in the Klamath River watershed.

Appendix to the CCHAB Preliminary Changes to the Statewide Voluntary Guidance on CyanoHABs in Recreational Waters, January 2016.

Appendix A. Description of cyanotoxin triggers in recreational waters.

This appendix describes the basis for the concentration levels selected to trigger the actions in the decision tree. The voluntary guidance relies on the science presented in OEHHA's risk assessment for microcystin, anatoxin-a and cylindrospermopsin (OEHHA 2012). Risk management decisions were used to integrate and expand the OEHHA action levels into a tiered response framework. Under this framework, increasing concentrations of cyanotoxins in recreational waters will prompt increasing public health warnings to users of the waterbody. Some of the triggers are not based on OEHHA's risk assessment but consider other important information such as animal poisoning reports and successful approaches used in other areas.

Development of this framework was a collaborative effort within CCHAB. Risk management decisions involve balancing the risk of low-level toxin exposures with the risks of closing waterbodies to the public, including economic, social and health impacts. Policy issues are also considered in risk management. The approach described here is designed to be feasible, useful and protective of public health.

Table A.1. CyanoHAB Triggers for Recreational Water.

	Toxin (µg/L)		
	Caution Trigger Level	Warning Tier I	Danger Tier II
Microcystins[1]	0.8	6	20
Anatoxin-a	Detect[2]	20	90
Cylindrospermopsin	1	4	17

[1]Microcystins refers to the sum of all measured microcystin variants.

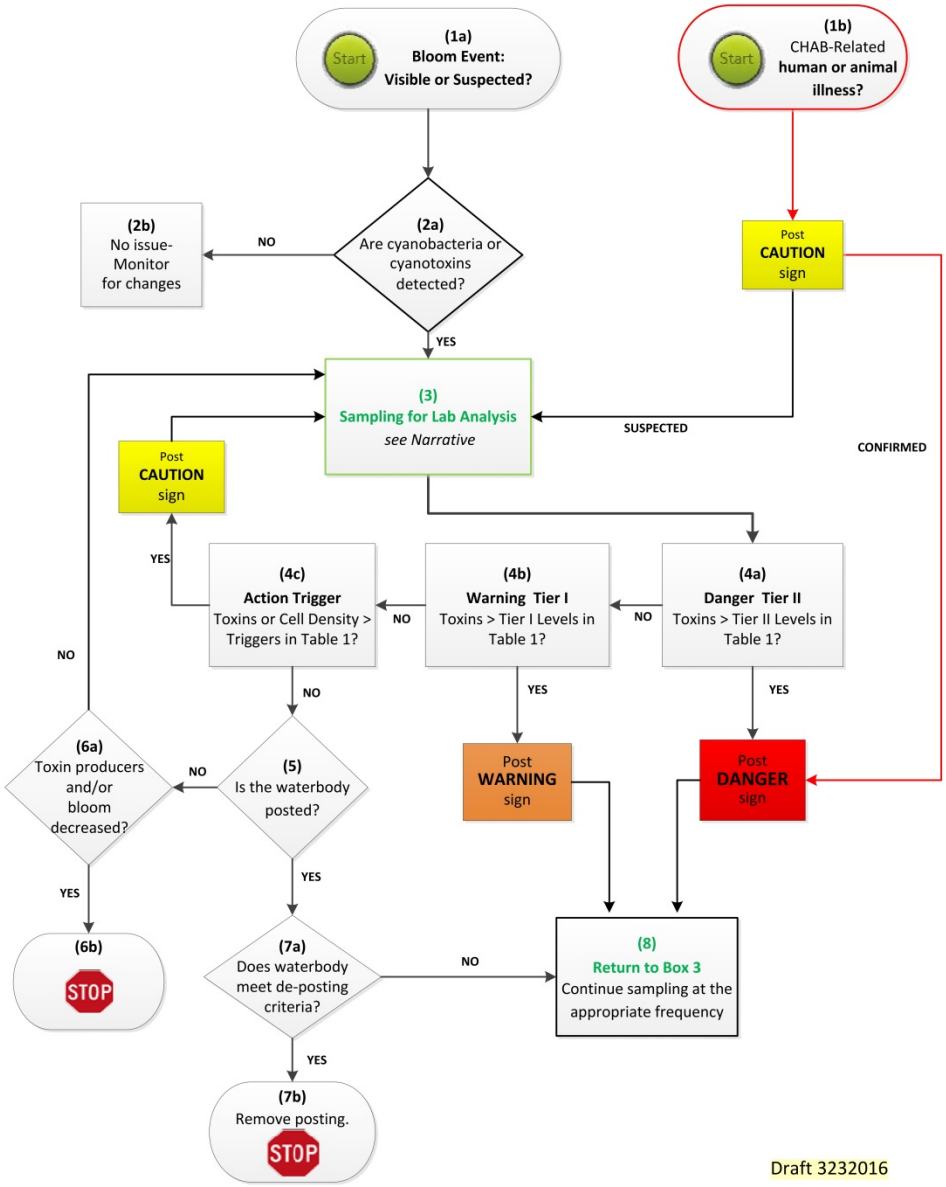
[2]Must use an analytical method that detects <1 µg/L anatoxin-a.

Microcystin

The trigger level of 0.8 µg/L microcystin prompts increased monitoring and the placement of a caution sign stating that people should stay away from scum and pets and livestock should be kept away from the water and scum. The trigger level is based on the Office of Environmental Health Hazard Assessment's (OEHHA) action level of 0.8 µg/L (OEHHA 2012). The action level represents a concentration in recreational water that is not expected to lead to adverse health effects. This is based on the best available science and very health-protective assumptions. OEHHA's action level is based on the short-term Heinze 1999 study in rats, which reported a Lowest Observable

Figure 1. Decision Tree for Posting and De-posting Health Advisories for CyanoHABs

Proposed changes to consider for Voluntary CHAB Guidance

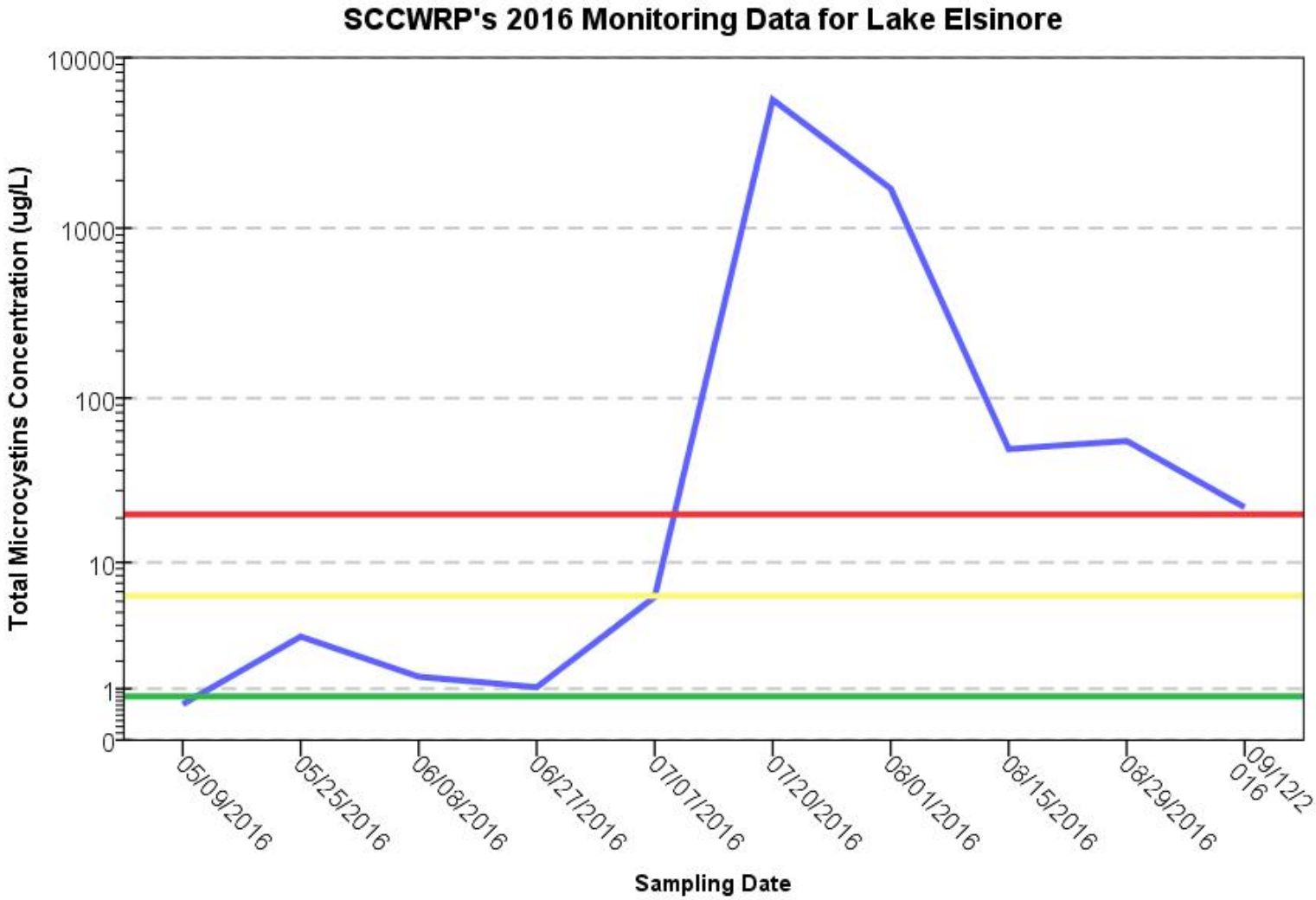


Current Regulatory Status

- No federal 304(a) criteria, yet.
- No water quality objective, yet.
- No official state “guidance,” yet.
- No formal peer review of draft triggers, yet.
- No CEQA Scoping or CEQA Review, yet.
- No CWC §13241 Analysis, yet.
- No formal public comment opportunity, yet.

TMDL Targets Strategy

- Lake Elsinore is already listed for "Unknown Toxicity"
- Toxicity was indirectly linked to nutrients & algae
  (assumed to be ammonia but cyanotoxins may also be a factor)
- Narrative objective = "Waste discharges shall not contribute to excessive algae growth in receiving waters."
- New TMDL target = "algae ≤ pre-development levels"
- Reducing algae to pre-development levels is also expected to reduce cyanotoxin concentrations to pre-development levels…
- We do not know if this will meet the draft "trigger levels"


SCCWRP's 2016 Monitoring Data for Lake Elsinore
Total Microcystins Concentration (ug/L)
10000
1000
100
10
1
0
05/09/2016
05/25/2016
06/08/2016
06/27/2016
07/07/2016
07/20/2016
08/01/2016
08/15/2016
08/29/2016
09/12/2016
Sampling Date

Other TMDL Implications

- **Water Quality Monitoring Program**
  - Cyantoxin Analytes
  - Sampling Frequency
  - Sampling Locations
  - Sampling Media (water, scum, foam)
  - Reporting & Notification
- **TMDL Implementation Program**
  - Posting Warnings to the Public
  - Restricting Public Access

of certain treatment processes]. They: include n-butylbenzene, sec-butylbenzene, tert-butylbenzene, carbon disulfide, chlorate, 2-chlorotoluene, 1,4-dioxane, formaldehyde, isopropylbenzene, n-propylbenzene, 1,2,4 - trimethylbenzene, and 1,3,5-trimethylbenzene. They also include certain nitrosamines, discussed in Endnote 4.

ENDNOTE 4. Additional chemicals for analysis

Diazinon has been moved from the list of chemicals with notification levels to the list of archived advisory levels. Nevertheless, CDHS continues to include analysis for diazinon in this section. Monitoring for nitrosoamines also continues, because of the CDHS' experience with N-nitrosodimethylamine (NDMA) and other nitrosamines. For example, NDMA has been introduced into groundwater via a recycled water recharge project. CDHS has established notification levels for NDMA, N-nitrosodiethylamine (NDEA), and N-nitrosodi-n-propylamine (NDPA). NDMA and NDPA are priority pollutants, along with another nitrosamine, N-nitrosodiphenylamine. Nitrosamines with EPA methods for drinking water are NDEA, NDMA, NDPA, N-Nitrosdi-n-buylamine (NDBA), N-Nitrosomethylethylamine (NMEA), N-Nitrosopiperidine (NPIP), and N-Nitrospyrrolidine (NYPR).

ENDNOTE 5. Endocrine disrupting and other chemicals.

CDHS has specified the following endocrine disrupting chemicals, pharmaceuticals, personal care products, and other "indicator" chemicals for monitoring:

- *Hormones: Ethinyl estradiol, 17-B estradiol, estrone*
- *"Industrial" endocrine disruptors: bisphenol A, nonylphenol and nonylphenol polyethoxylate, octylphenol and octylphenol polyethoxylate, polybrominated diphenyl ethers.*
- *Pharmaceuticals and others substances: acetaminophen, amoxicillin, azithromycin, caffeine, carbamazepine, ciprofloxacin, ethylenediamine tetra-acetic acid (EDTA), gemfibrozil, ibuprofen, iodinated contrast media, lipitor, methadone, morphine, salicylic acid, and triclosan.*

These samples are being collected for information purposes; there are no standards for the contaminants listed below and no standards are anticipated at this time and analytical methods may not be widely available (See Endnote 2).

Some interested parties have asked for some clarification of what would happen if any of these contaminants are found. In response, we offer this: Monitoring for these chemicals is viewed as a diligent way of assessing and verifying recycled water quality characteristics, which can be useful in addressing issues of public perception about the safety of recharge projects. Further, should there be a positive finding, the recharge agency and CDHS can give the result due consideration as to whether it is of concern or not. Just what such consideration might entail would depend on what is known and what is not known about the

ATTACHMENT K – LIST OF UNREGULATED CHEMICALS: ENDOCRINE DISRUPTING CHEMICALS & PHARMACEUTICALS AND OTHER CHEMICALS

Chemicals with State Notification Levels:	
n-butylbenzene	1,4-dioxane
sec-butylbenzene	formaldehyde
tert-butylbenzene	isopropylbenzene
carbon disulfide	n-propylbenzene
chlorate	1,2,4 –trimethylbenzene
2-chlorotoluene	1,3,5-trimethylbenzene
diazinon	

Nitrosoamines	
N-Nitrosodiethylamine (NDEA)	N-Nitrosopyrrolidine

Hormones:	
Ethinyl estradiol	estrone
17-B estradiol	

"Industrial" Endocrine Disruptors:	
bisphenol A	octylphenol and octylphenol polyethoxylate
nonylphenol and nonylphenol polyethoxylate	polybrominated diphenyl ethers

Pharmaceuticals and others substances:	
acetaminopen	ibuprofen
amoxicillin	iodinated contrast media
azithromycin	lipitor
caffience	methadone
carbamazepine	morphine
ciprofloxacin	salicylic acid
ethylenediamine tetra-acetic acid (EDTA)	triclosan
gemfibrozil	

NOTES:

1. Analytical Methods for Unregulated Chemicals. The Discharger shall select methods for unregulated chemicals according to the following approach:

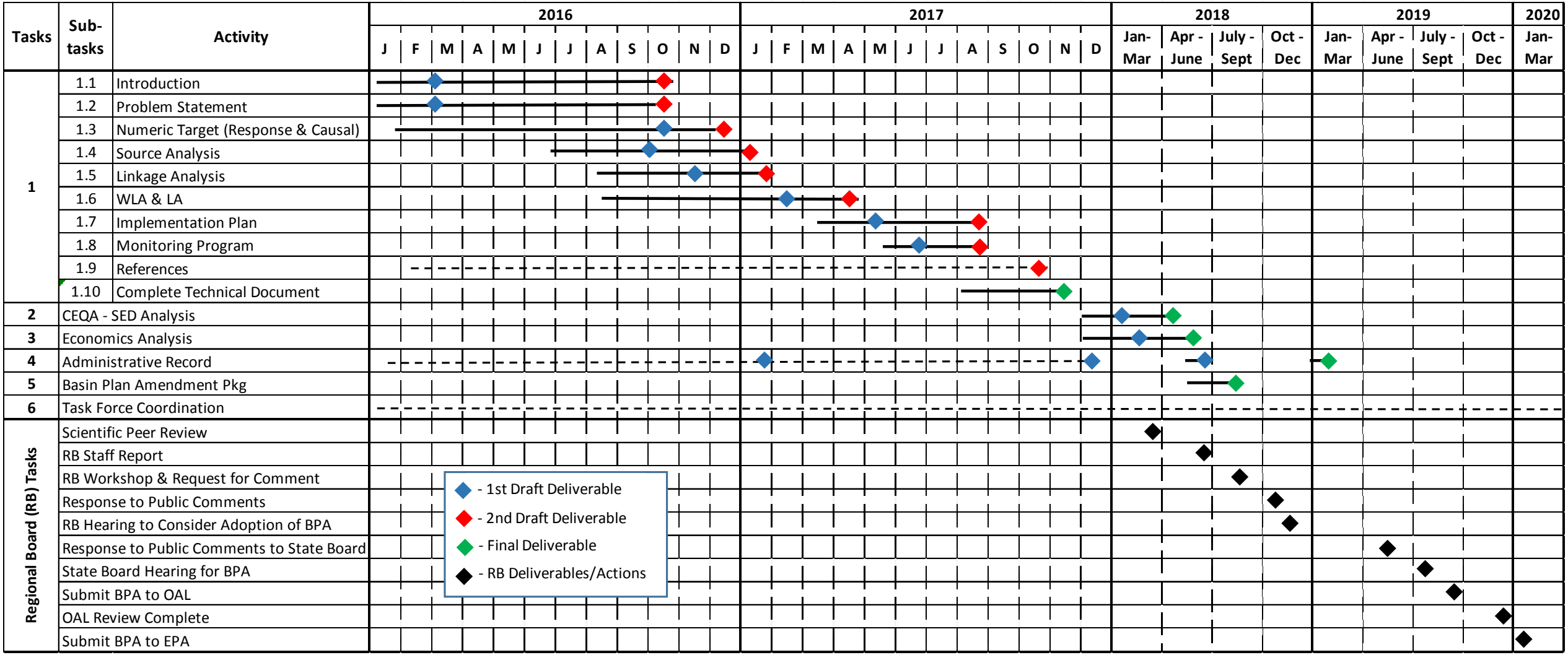
   a. Use drinking water methods, if available.

   b. Use CDHS-recommended methods for chemicals in subsection (f)(e.g., 1,2,3-TCP).

   c. If there is no CDHS-recommended drinking water method for a chemical, and more than a single EPA-approved method is available, use the most sensitive of the EPA-approved methods (e.g., nitrosamines). If there is no EPA-approved method for a chemical, and more than one method is available from the scientific literature (e.g., peer-reviewed journals), after consultation with CDHS, use the most sensitive method.

Tasks	Sub-tasks	Activity	2016												2017				2018				2019				2020
			J	F	M	A	M	J	J	A	S	O	N	D	Jan-Mar	Apr - June	July - Sept	Oct - Dec	Jan-Mar	Apr - June	July - Sept	Oct - Dec	Jan-Mar	Apr - June	July - Sept	Oct - Dec	Jan-Mar
1	1.1	Introduction																									
	1.2	Problem Statement																									
	1.3	Numeric Target (Response)																									
	1.3	Numeric Target (Causal)																									
	1.4	Source Analysis																									
	1.5	Linkage Analysis																									
	1.6	WLA & LA																									
	1.7	Implementation Plan																									
	1.8	Monitoring Program																									
	1.9	References																									
	Complete Technical Document																										
2	CEQA - SED Analysis																										
3	Economics Analysis																										
4	Administrative Record																										
5	Basin Plan Amendment Pkg																										
6	Task Force Coordination																										
Regional Board (RB) Tasks	Scientific Peer Review																										
	RB Staff Report																										
	RB Workshop & Request for Comment																										
	Response to Public Comments																										
	RB Hearing to Consider Adoption of BPA																										
	Response to Public Comments to State Board																										
	State Board Hearing for BPA																										
	Submit BPA to OAL																										
	OAL Review Complete																										
	Submit BPA to EPA																										

- 1st Draft Deliverable
- 2nd Draft Deliverable
- Final Deliverable
- RB Deliverables/Actions


Tasks
Sub-tasks
Activity
2016
2017
2018
2019
2020
J F M A M J J A S O N D
Jan-Mar
Apr - June
July - Sept
Oct - Dec
1 1.1 Introduction
1.2 Problem Statement
1.3 Numeric Target (Response & Causal)
1.4 Source Analysis
1.5 Linkage Analysis
1.6 WLA & LA
1.7 Implementation Plan
1.8 Monitoring Program
1.9 References
1.10 Complete Technical Document
2 CEQA - SED Analysis
3 Economics Analysis
4 Administrative Record
5 Basin Plan Amendment Pkg
6 Task Force Coordination
Regional Board (RB) Tasks
Scientific Peer Review
RB Staff Report
RB Workshop & Request for Comment
Response to Public Comments
RB Hearing to Consider Adoption of BPA
Response to Public Comments to State Board
State Board Hearing for BPA
Submit BPA to OAL
OAL Review Complete
Submit BPA to EPA
- 1st Draft Deliverable
- 2nd Draft Deliverable
- Final Deliverable
- RB Deliverables/Actions