Lake Elsinore and Canyon Lake TMDL Revision Monitoring Requirements Chapter Update

amec foster wheeler

October 19, 2017

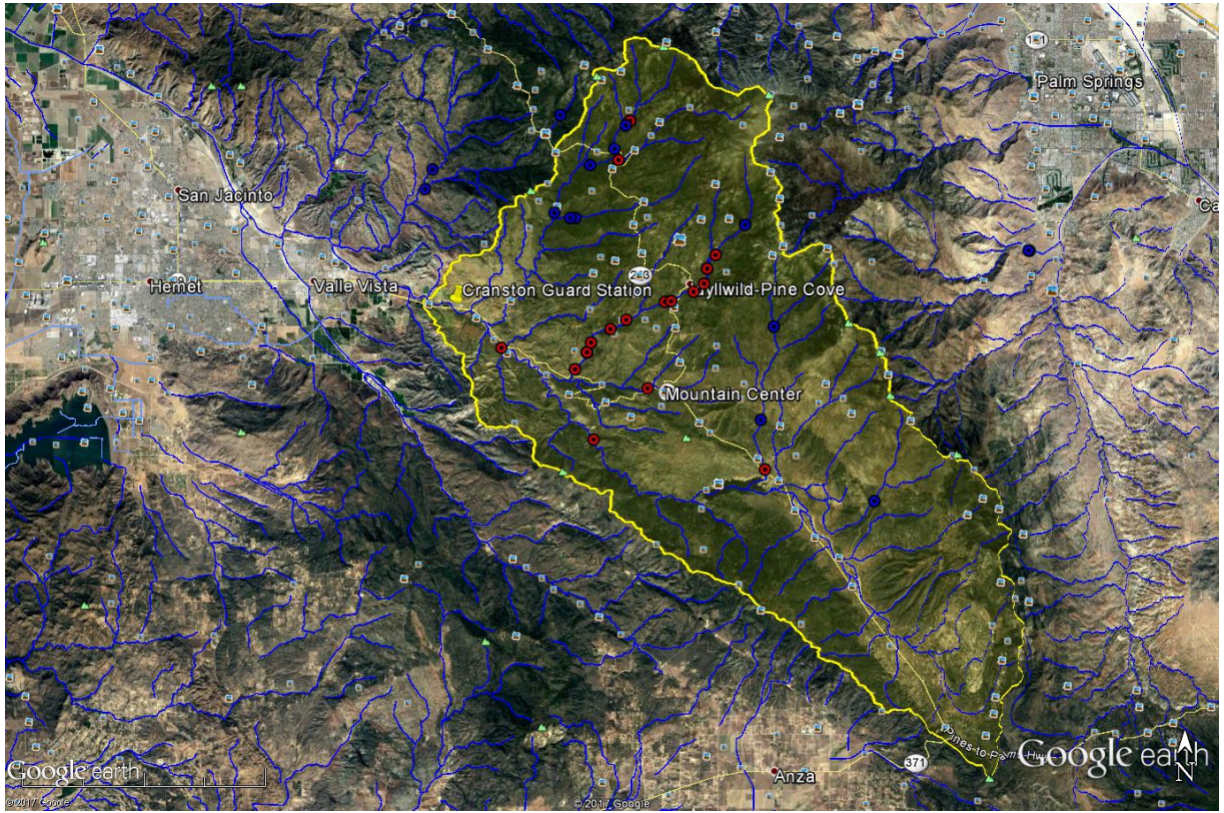
Lake Elsinore and Canyon Lake TMDL Revision Monitoring Requirements Chapter Update

Watershed Monitoring

Addition of Reference Sites

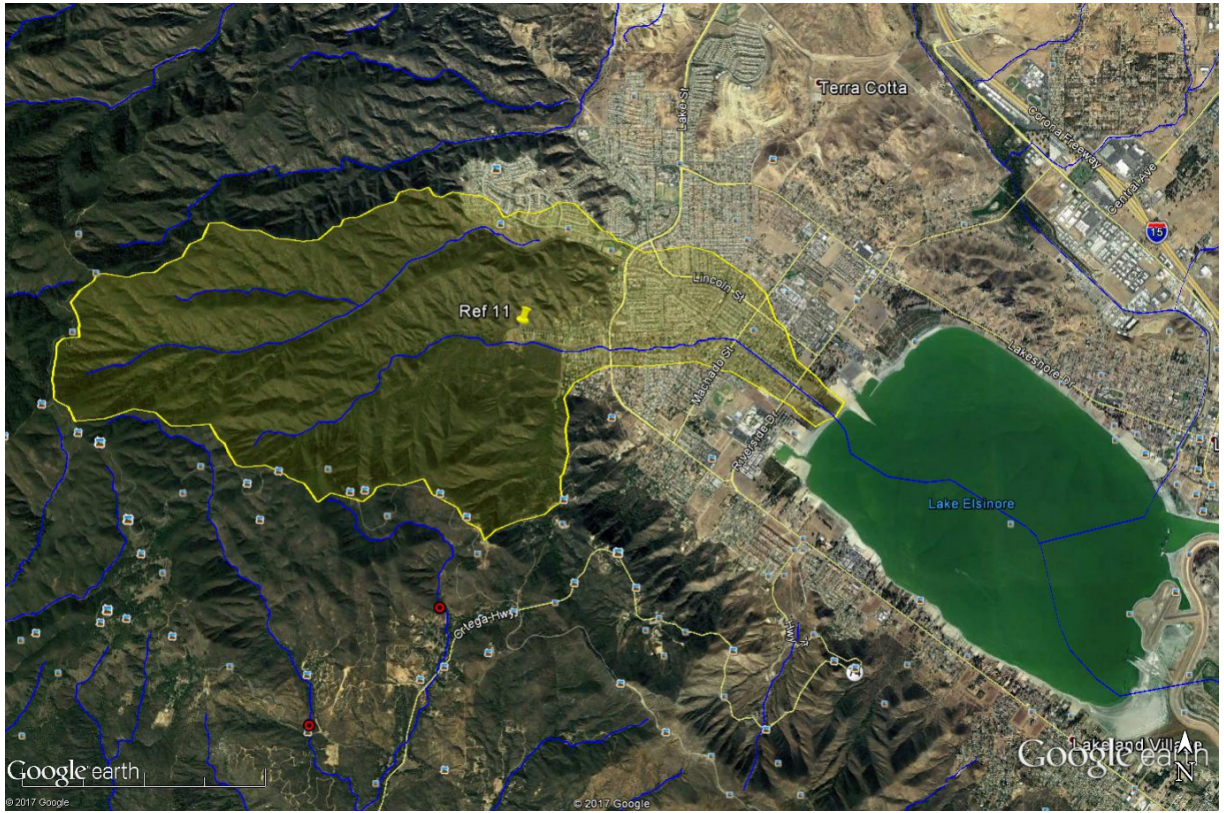
Site	Lat	Long	Comments
1	33.845423	-117.06861	Too much Ag. Site is in the middle of Ag fields
2	33.787016	-117.07173	Very small watershed above this point. Unlikely to flow long enough for sample. Some residential in area.
3	33.956046	-117.17789	Too much urban influence
4	33.946354	-117.17622	Too much urban influence
5	33.958877	-117.1842	Might be Ok, but watershed has 6.28% low intensity residential
6	33.945045	-117.19216	Too much urban influence
7	33.786614	-117.20136	Too much urban influence
8	33.780265	-117.30297	Too much urban influence
9	33.676906	-117.398736	A little too much residential just upstream
10	33.673042	-117.39859	Not sure where to sample from.
11	33.678833	-117.40911	Gate at Leach Canyon road precludes access to creek, otherwise good if gate access granted.
12	33.714292	-116.971751	Salt Creek @ State St. – low density residential, small watershed
13	33.890439	-117.070250	Good. 2.86% low intensity residential
14	33.843347	-116.996918	A little too much urban: incorporates part of Beaumont: 6.0% low intensity residential, 3.9% commercial
15	33.759484	-116.872380	Great site, but wet weather access an issue. SWAMP verified reference sites in watershed
16	33.862848	-117.025500	Great site. 2.7% low intensity residential
17	33.736812	-116.826491	Cranston Guard Station. 4.4% low intensity residential. Cities of Idyllwild and Mountain Center in watershed

Addition of Reference Sites – Cranston Guard



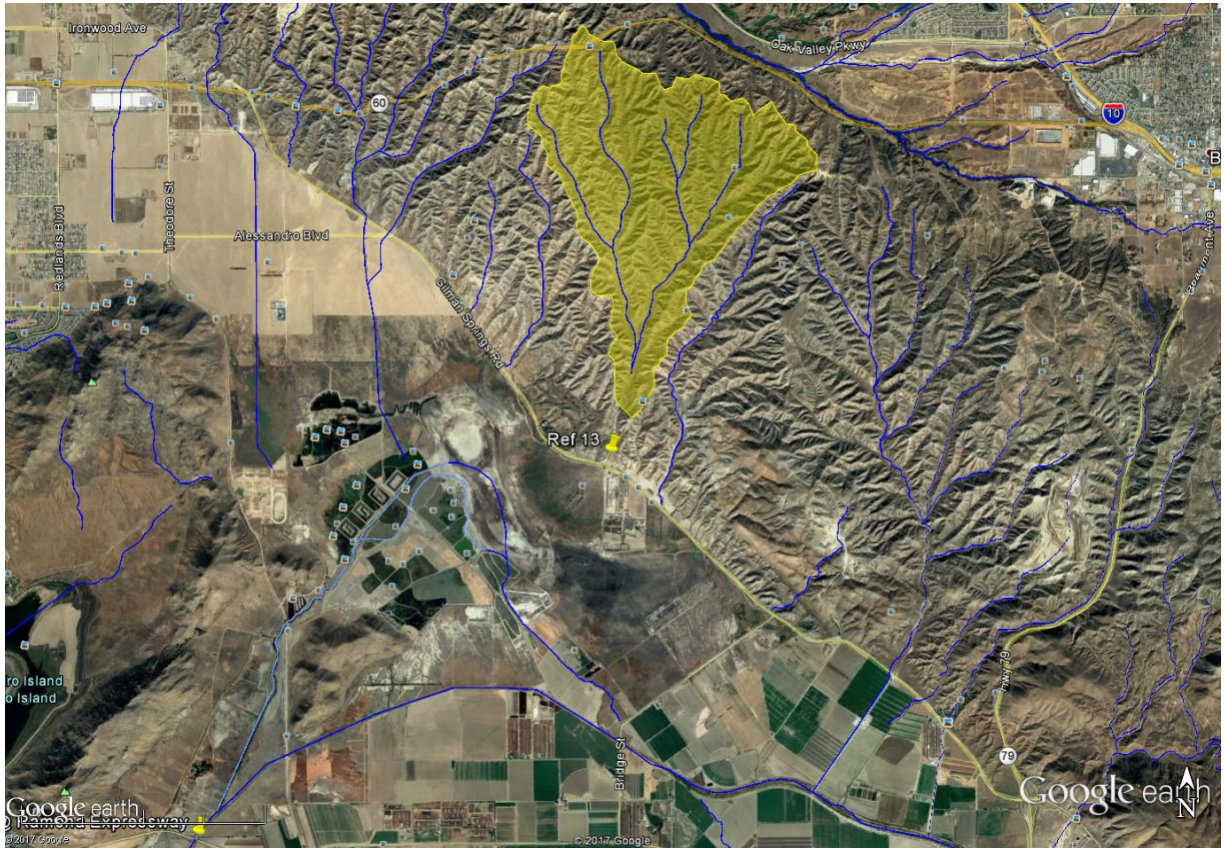
Land Use	Watershed Total
Open Water	0.43%
Low Intensity Residential	4.39%
Commercial	0.03%
Deciduous Forest	0.00%
Evergreen Forest	34.19%
Mixed Forest	3.64%
Other	57.31%

Addition of Reference Sites



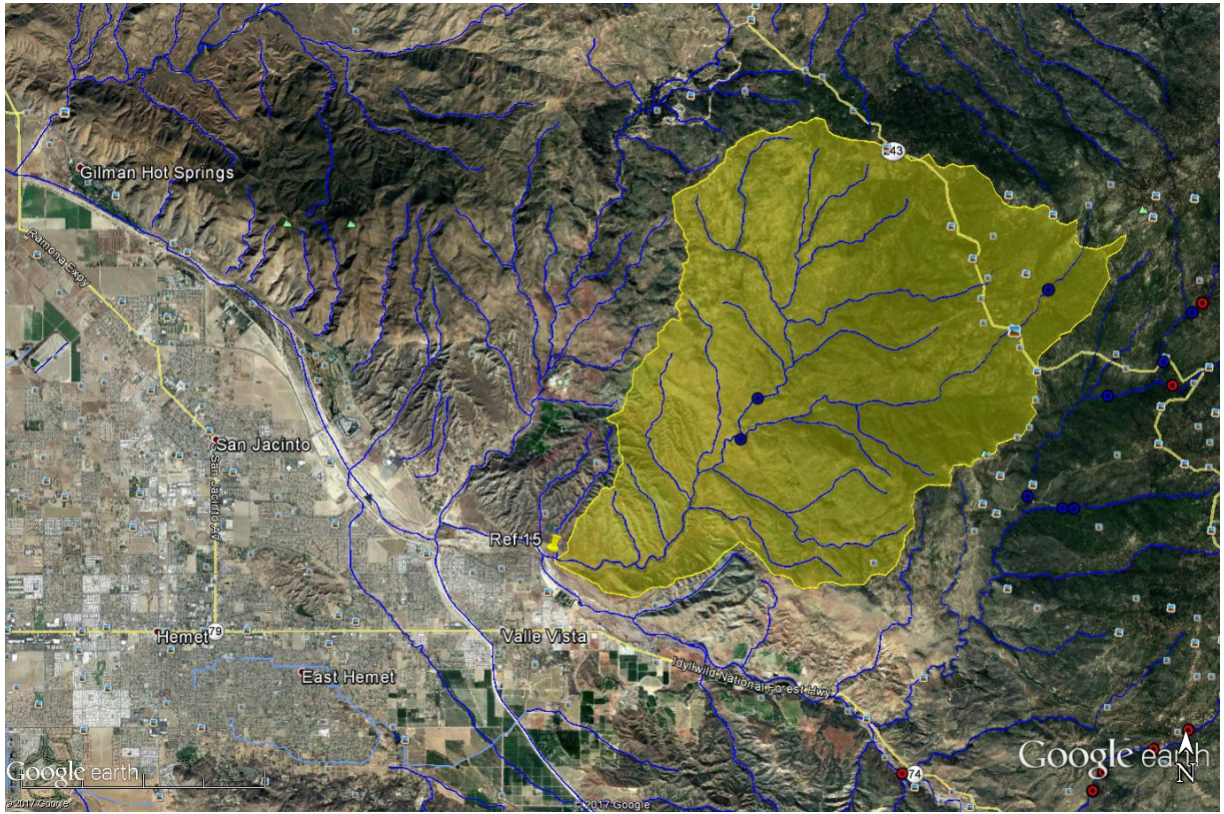
Land Use	Watershed Total
Open Water	0.10%
Low Intensity Residential	4.65%
Commercial	8.75%
Deciduous Forest	0%
Evergreen Forest	5.48%
Mixed Forest	2.69%
Other	78.33%

Addition of Reference Sites



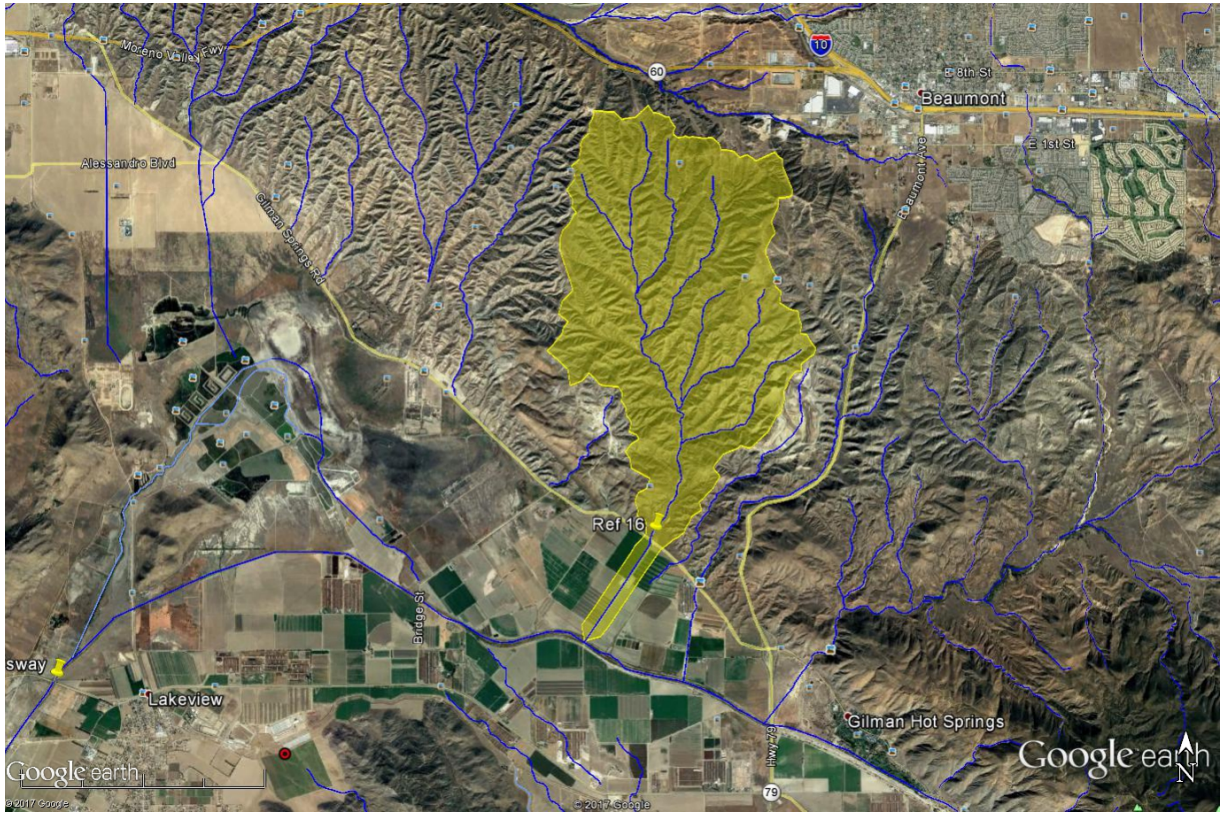
Land Use	Watershed Total
Open Water	0%
Low Intensity Residential	2.86%
Commercial	0%
Deciduous Forest	0%
Evergreen Forest	0%
Mixed Forest	0%
Other	97.14%

Addition of Reference Sites



Land Use	Watershed Total
Open Water	0.01%
Low Intensity Residential	2.53%
Commercial	0%
Deciduous Forest	0%
Evergreen Forest	12.86%
Mixed Forest	5.50%
Other	79.10%

Addition of Reference Sites



Land Use	Watershed Total
Open Water	0%
Low Intensity Residential	0.27%
Commercial	0%
Deciduous Forest	0%
Evergreen Forest	0%
Mixed Forest	0%
Other	99.73%

Lake Elsinore and Canyon Lake TMDL Revision Monitoring Requirements Chapter Update

In-Lake Monitoring

Changes to In-lake Monitoring

Both Lakes

- Utilize Sentinel-2 satellite imagery (10-meter resolution) for chlorophyll-a and turbidity measurements during months in which it is available (September through May), and LandSat 8 satellite imagery (30-meter resolution) during all other months (June through August)
- Add cyanobacterial toxin sampling to the analyte list for each monitoring event
- Discontinue the morning/afternoon water column profiles at each TMDL station

Lake Elsinore

- Utilize the two EVMWD multi-depth in-lake water quality sondes in combination with fixed depth dissolved oxygen sondes mounted just under the surface at both EVMWD sondes to replace the morning/afternoon water column profiles

Canyon Lake

- Utilize a combination of fixed depth in-lake dissolved oxygen and temperature sondes to replace the morning/afternoon water column profiles
- Add Station CL09 to sites being monitored for full analyte list
- Add total and dissolved aluminum to the analyte list

Outline of Revised Monitoring Design Chapter

1. INTRODUCTION AND BACKGROUND
   a) Describe prior iterations of the monitoring program. How it has changed.
   b) How this former data was used to look at trends/identify data gaps
   c) How those gaps got addressed in latest monitoring design 2015-2018

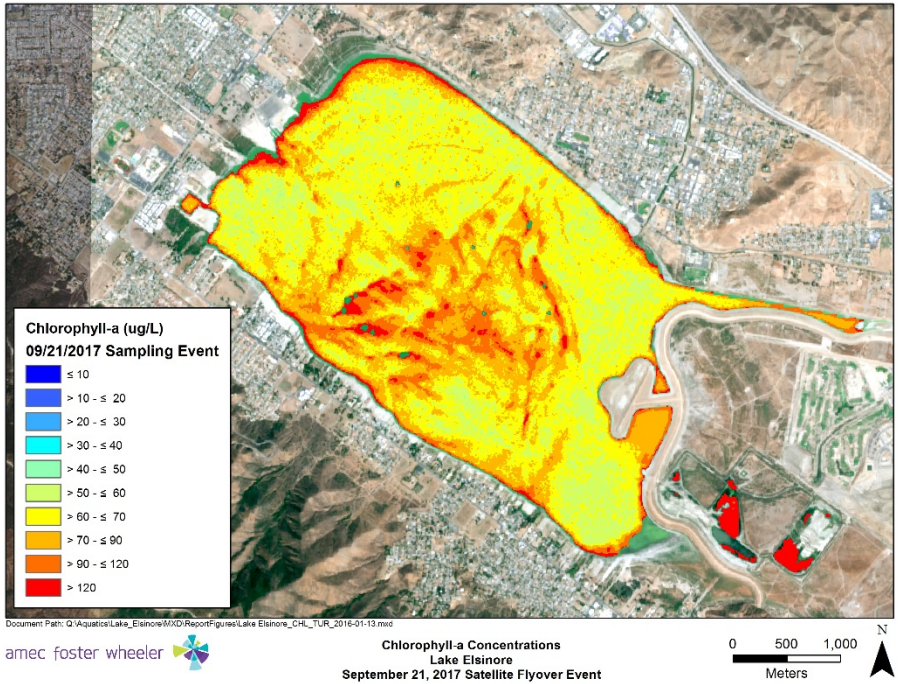
2. REVISED TMDL MONITORING APPROACH
   a) Why the need for a new monitoring approach? Integrate with Ch. 3 - Numeric Targets Reference Watershed Approach
   b) Layout new monitoring approach

3. DEMONSTRATING COMPLIANCE WITH NUMERIC TARGETS
   a) Sections on each of the TMDL monitoring targets (DO, TN, TP, CHL, NH3).
   b) How the new monitoring approach will generate data to determine TMDL compliance.
   c) Example plots to show compliance.

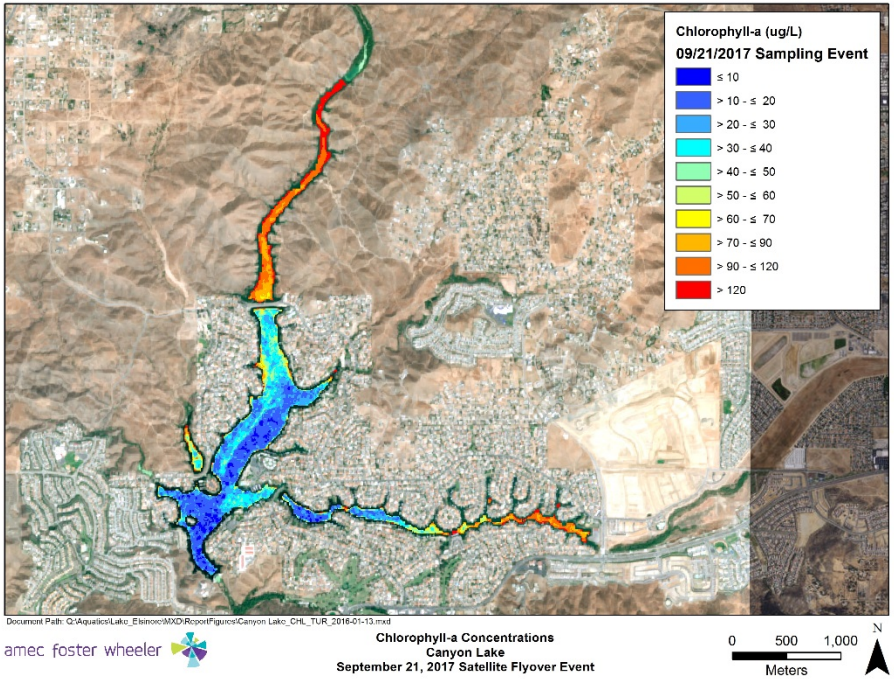
Questions?

Satellite Imagery – Chlorophyll Sept 2017

Lake Elsinore

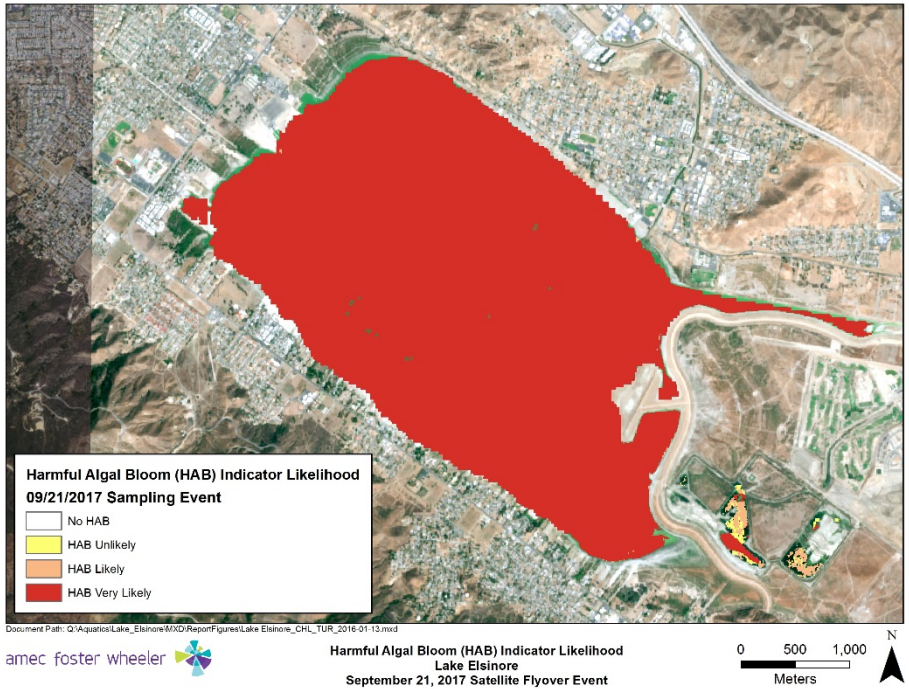


Canyon Lake

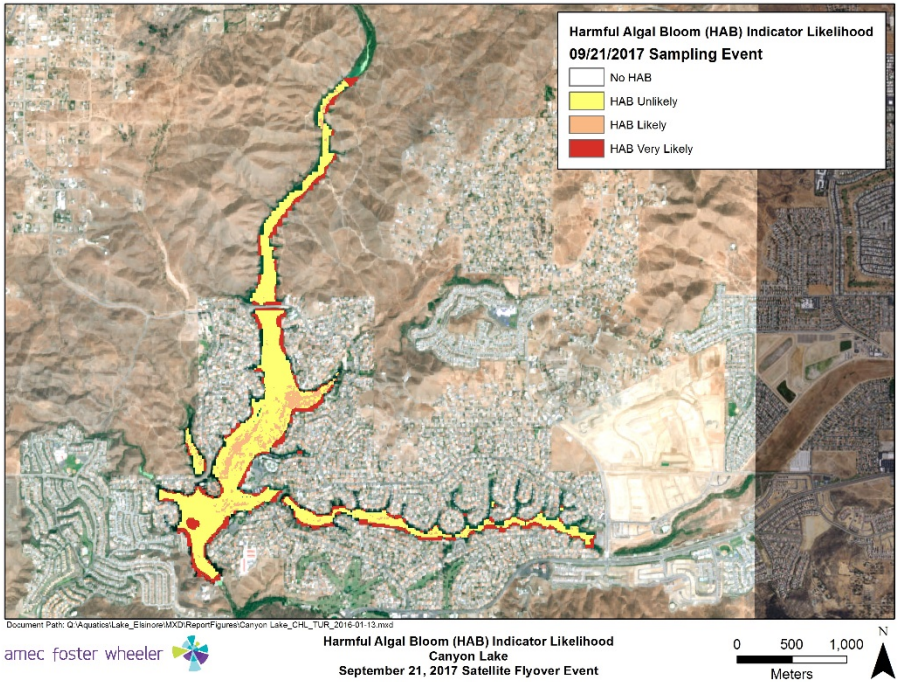


Satellite Imagery – Cyanobacterial Bloom Indicator Sept 2017

Lake Elsinore

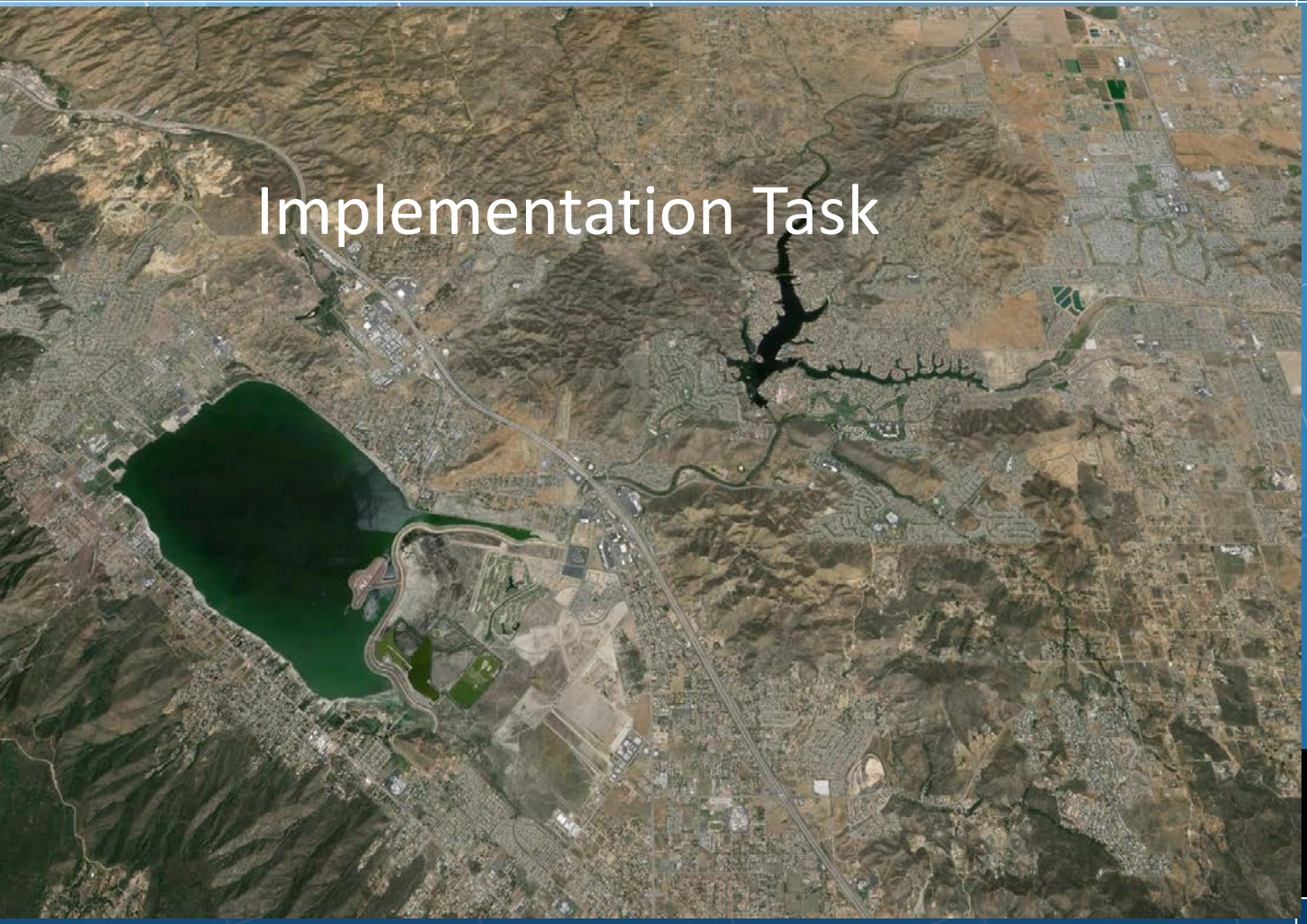


Canyon Lake



Revision of the Lake Elsinore & Canyon Lake Nutrient TMDL

CDM Smith
Team & Risk Sciences



Implementation Task

October 19, 2017

Lake Elsinore/Canyon Lake Task Force Meeting

RISK SCIENCES

CDM Smith

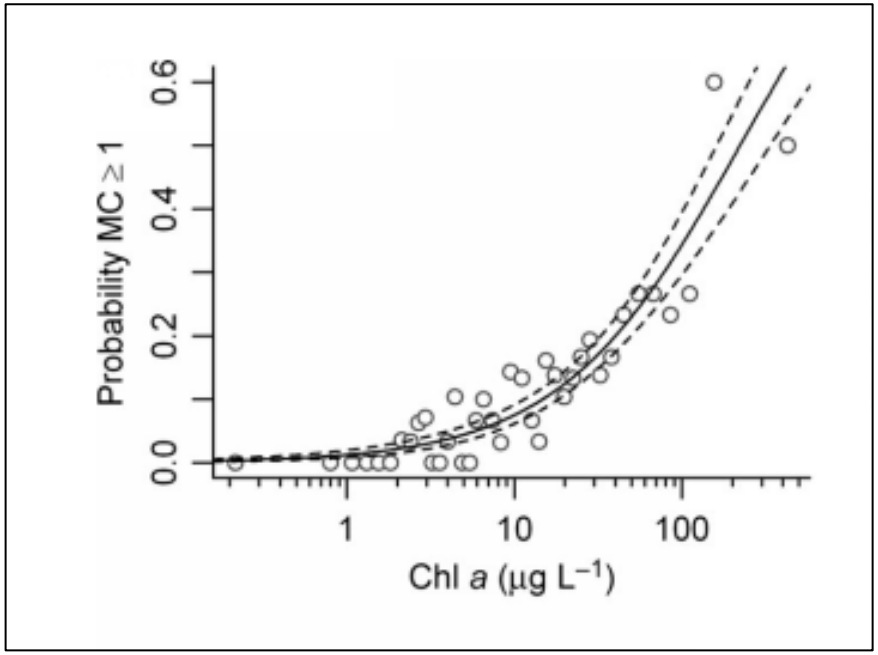
Presentation Outline

- Cyanotoxins in Reference Condition
- Watershed Monitoring Data
- Reasonable Assurance Analysis – Update
- Implementation Framework
- Supplemental project characterization
- Monitoring Chapter Update

Cyanotoxins in Reference Condition

Cyanotoxins in Reference Condition

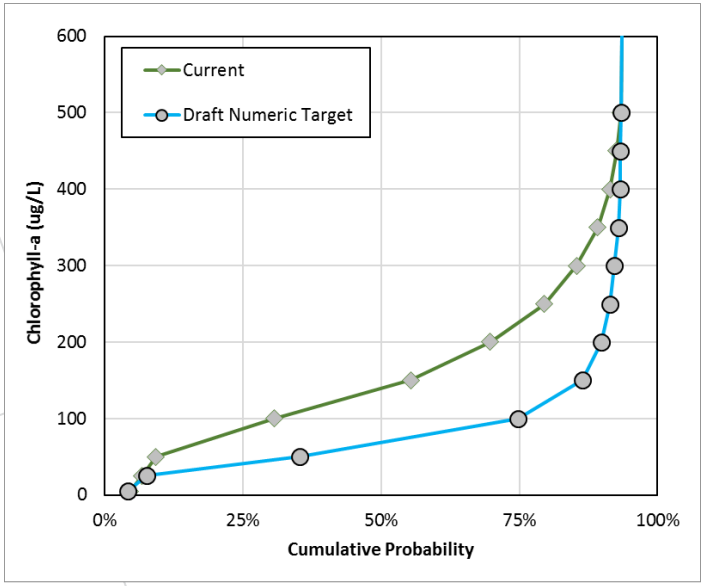
- Statistical analysis of 2007 National Lake Assessment for 1077 lakes Yuan et al (2014)
- Microcystin detected 32 percent of samples
- Microcystin >1.0 ug/L in 12 percent of samples

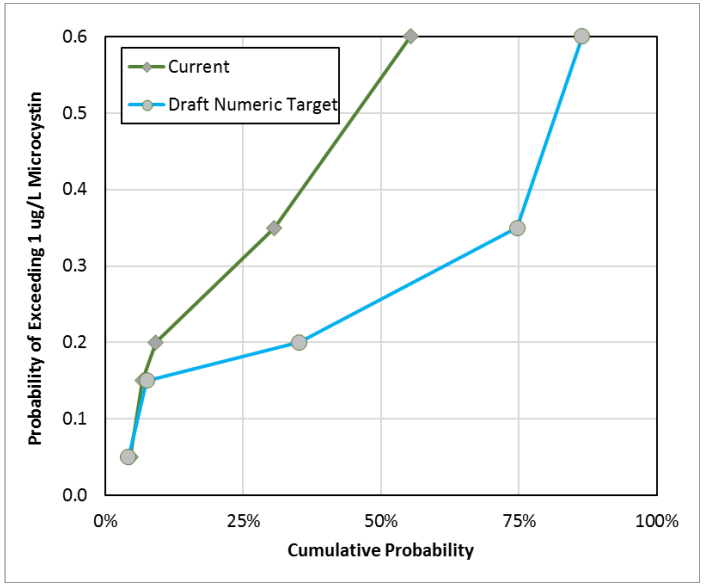


Source: Yuan, Lester L., Amina I. Pollard, Santhiska Pather, Jacques L. Oliver, and Lesley D'Anglada (2014). Managing microcystin: identifying national scale thresholds for total nitrogen and chlorophyll-a, *Freshwater Biology*, v59 (1970-1981).

Cyanotoxins in Reference Condition

- Translation of modeled chlorophyll-a for reference watershed condition to probability of exceeding 1 ug/L Microcystin based on relationship discovered in Yuan et al (2014)
- Microcystin in reference condition (numeric target)

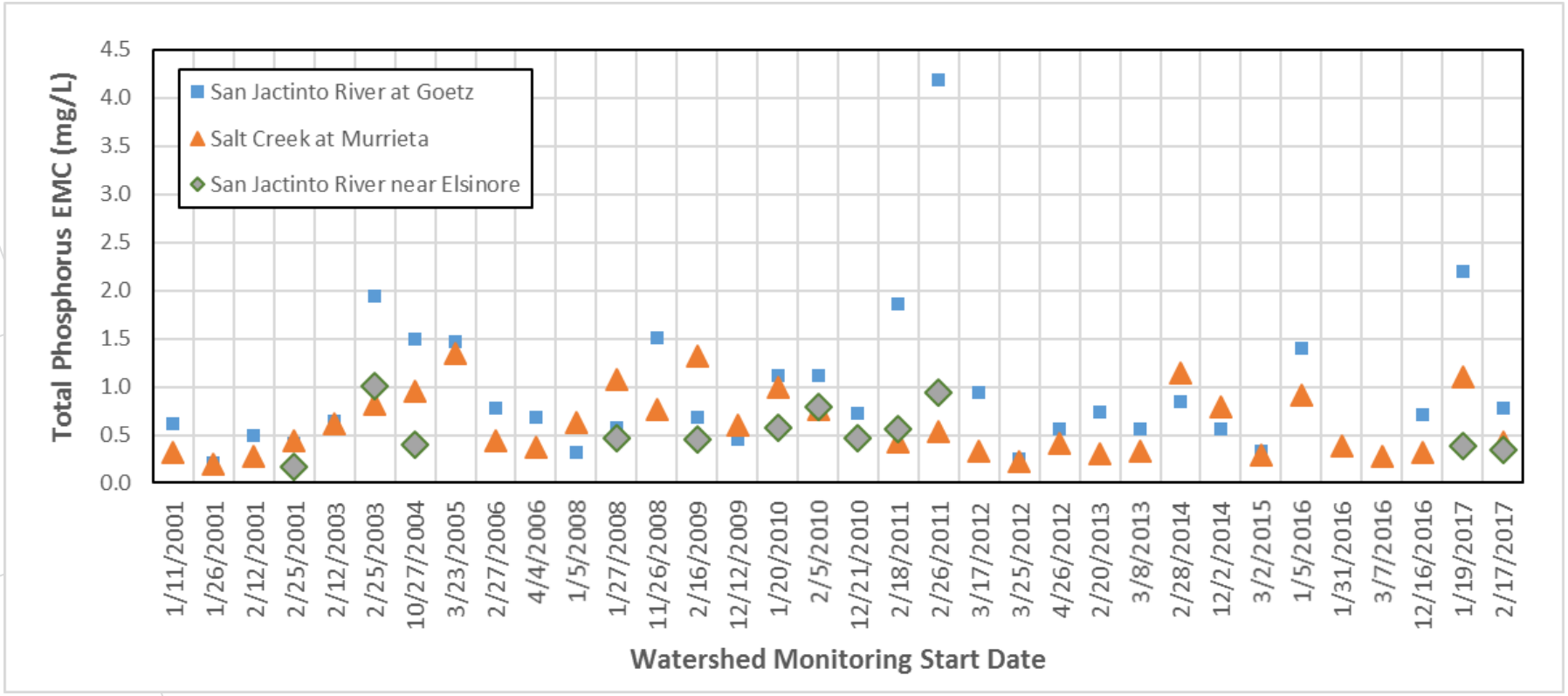




Watershed Monitoring Data

Watershed Monitoring Data

- 34 wet-weather sampling events 2001-2017



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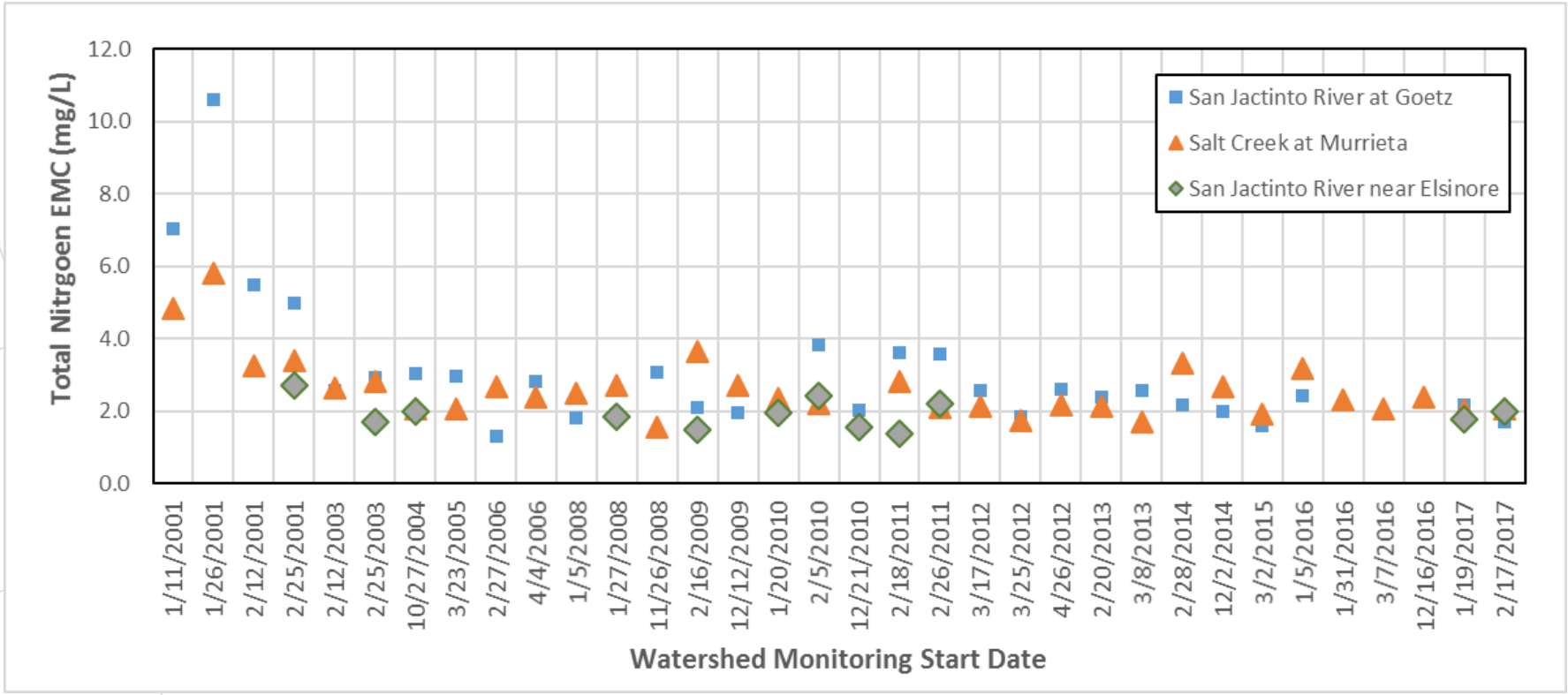


Watershed Monitoring Data

- Median of nutrient concentrations from recent events (2011-2017)
- Accounts for benefits of recent watershed BMP deployments
- RAA for 2017 TMDL does not apply watershed reduction credits prior to 2017

	San Jacinto River at Goetz		Salt Creek at Murrieta		San Jacinto River near Elsinore	
	TP (mg/L)	TN (mg/L)	TP (mg/L)	TN (mg/L)	TP (mg/L)	TN (mg/L)
MEDIAN (Post 2011)	0.73	2.22	0.39	2.12	0.46	1.78
MEDIAN (Pre 2011)	0.68	2.93	0.62	2.68	0.46	1.95

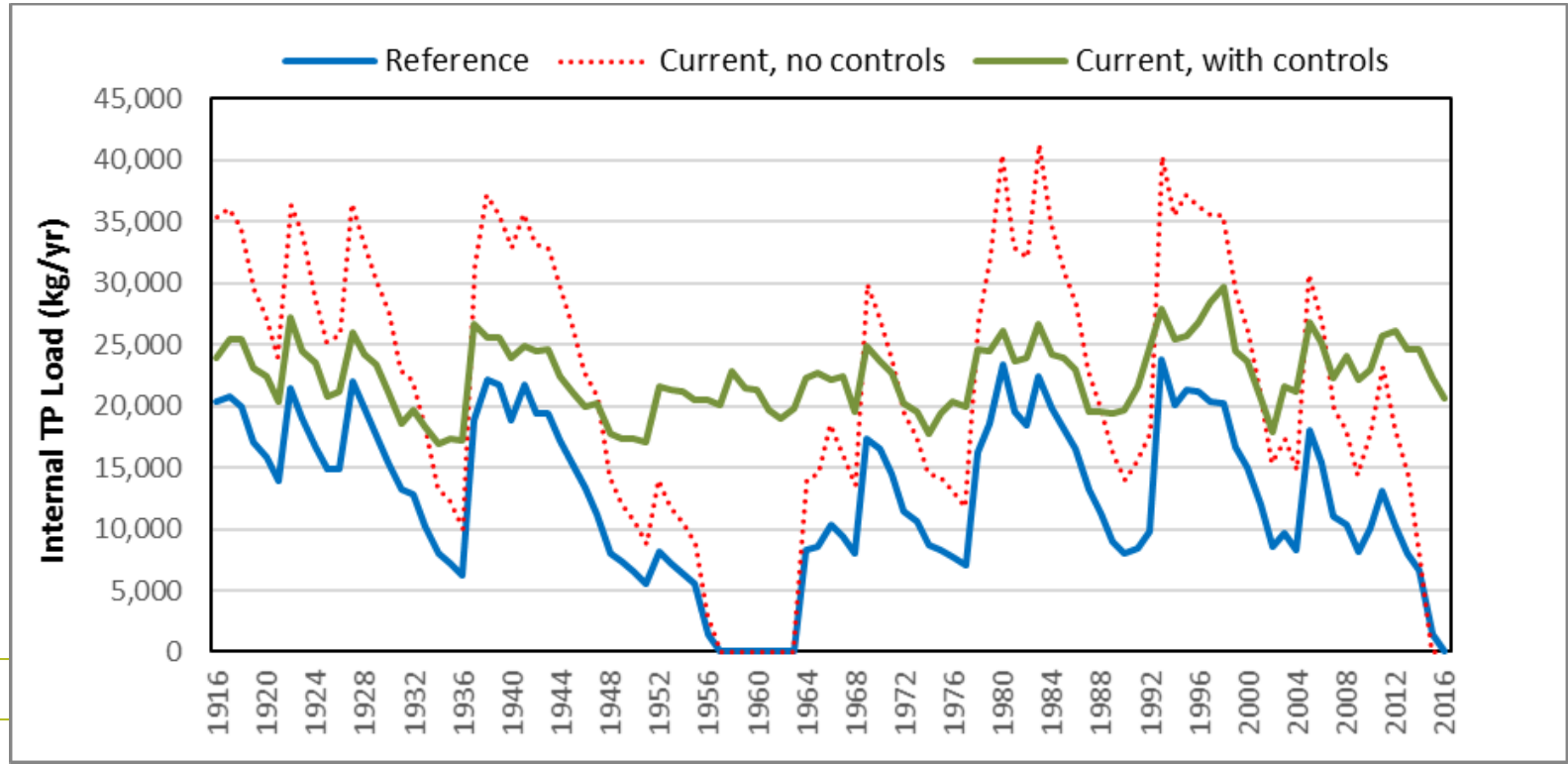
Historic versus Current Flux Rates

Sediment Diagenesis Analysis

- Limitation – No dynamic sediment diagenesis in CAEDYM (i.e. constant flux parameter)
- Independent sediment diagenesis analysis to quantify percent difference in internal loads for current or reference watershed conditions
- Result used for scaling of constant flux rate parameter in CAEDYM
  - 33% less TP; 50% less TN sediment nutrient flux for reference condition

Sediment Diagenesis Analysis – Lake Elsinore

- Greater influence to internal load comes from natural hydrologic variability
  - Challenging to detect change with infrequent core-flux measurements



CDM Smith

Sediment Diagenesis Analysis – Lake Elsinore

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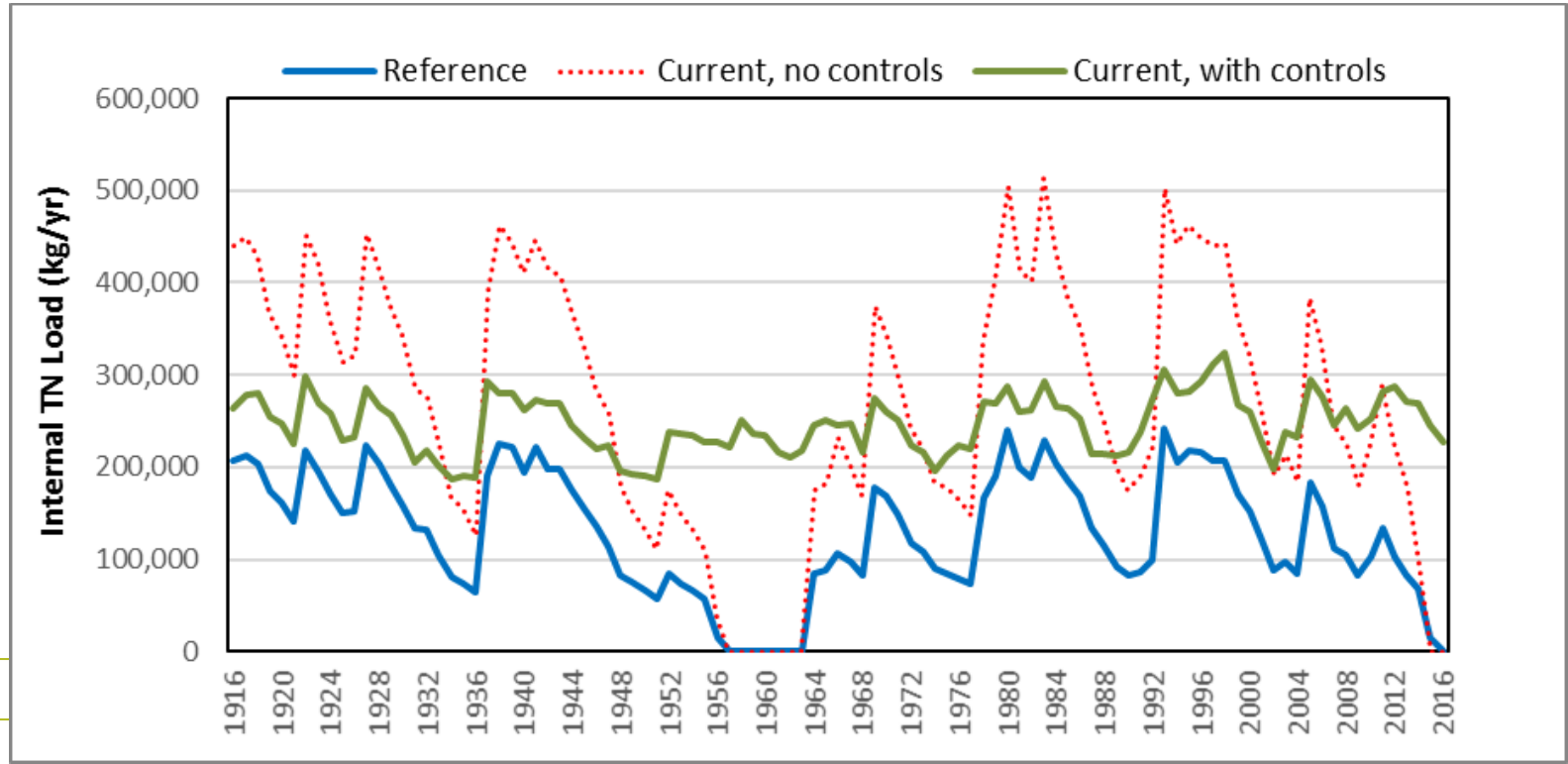
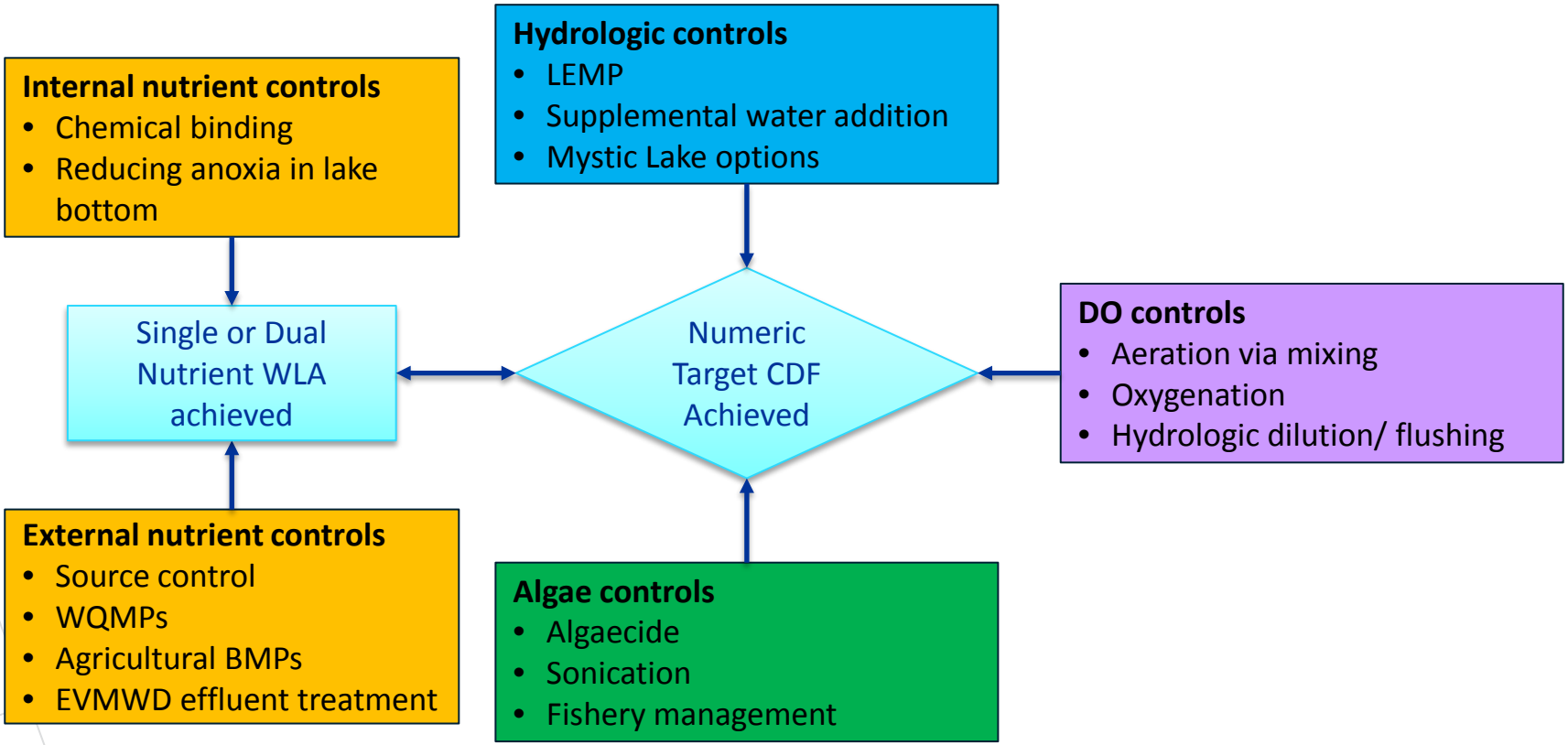


Sediment Diagenesis Analysis – Lake Elsinore

- Keeping lake fuller maintains a larger wetted bottom for flux to occur
- Managed lake condition precludes a nutrient mass based RAA

Reasonable Assurance Analysis

Reasonable Assurance Analysis



Reasonable Assurance Analysis – Canyon Lake

- Single nutrient control requires ~12,500 kg more dry alum/yr
- Consider alternative alum delivery methods
- Adaptive implementation with milestones to assess progress and any further control needs

Total Phosphorus (kg/yr)	East Bay	Main Lake
Current External Load Retained (with existing watershed BMPs)	516	2,548
Allowable Load	419	1,110
Load Reduction Required	97	1,437
Estimated Nutrient Reduction from Alum Additions	386	1091
Unmet Load Reductions	-289	346

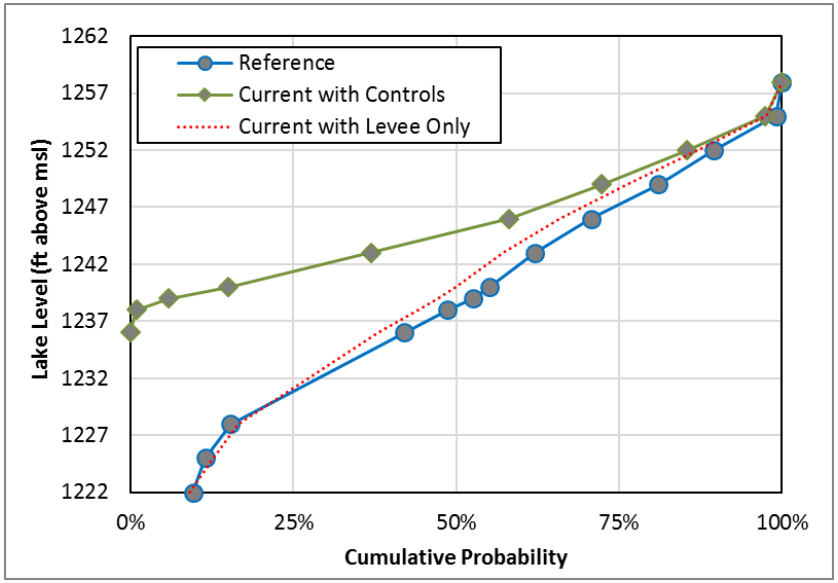
Reasonable Assurance Analysis – Lake Elsinore

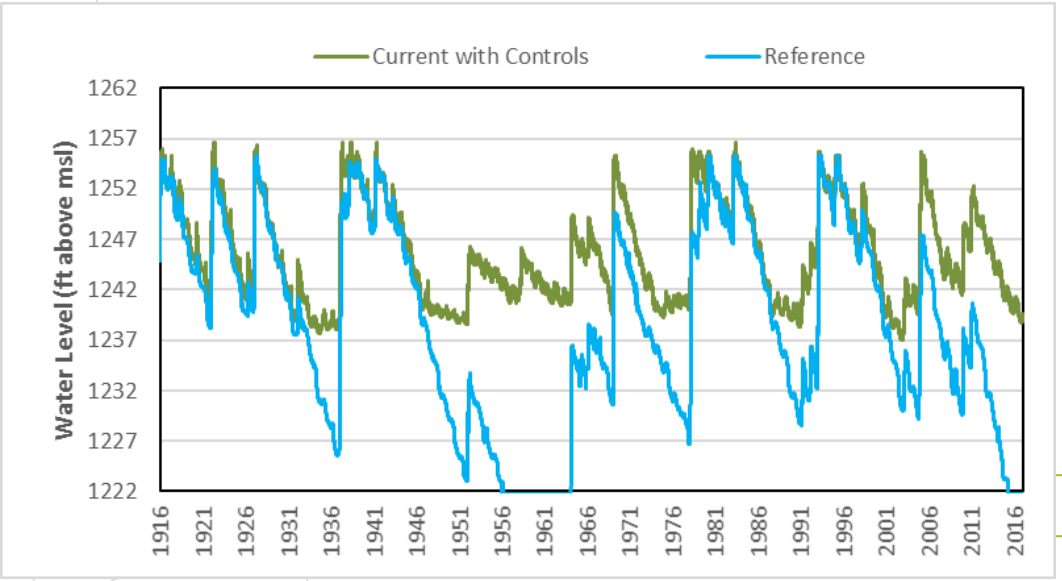
- Managed lake condition precludes a nutrient mass based RAA
- Linkage Analysis scenarios to evaluate implementation of all existing controls and assess need for supplemental project
  - Existing controls include 1) levee, 2) supplemental water, 3) LEAMS, and 4) fishery management

Parameter	Scenario 1: Reference Conditions	Scenario 2: Current development, no WQ controls	Scenario 3: Current development, with existing WQ controls
Lake Elsinore Spill Elevation (ft msl)	1255	1255	1255
Hypsography	Without levee	Without levee	With levee
Inflow TP (mg/L)	0.32	0.51	0.46
Inflow TN (mg/L)	0.92	1.89	1.78
Internal TP Flux (mg/m2/day)	7.1	9.0	5.4
Internal TN Flux (mg/m2/day)	50	100	58
EVMWD discharge	None	None	Reclaimed water – 7.5 mgd w/TDS 700, TP 0.5 mg/L, TN 3.0 mg/L
Runoff Flow	USGS gauge + local runoff estimate (1916-2016)		

Reasonable Assurance Analysis – Lake Elsinore

- Reclaimed water at 7.5 MGD over 1916-2016 hydrology would have maintained water levels above ~1237 all of the time

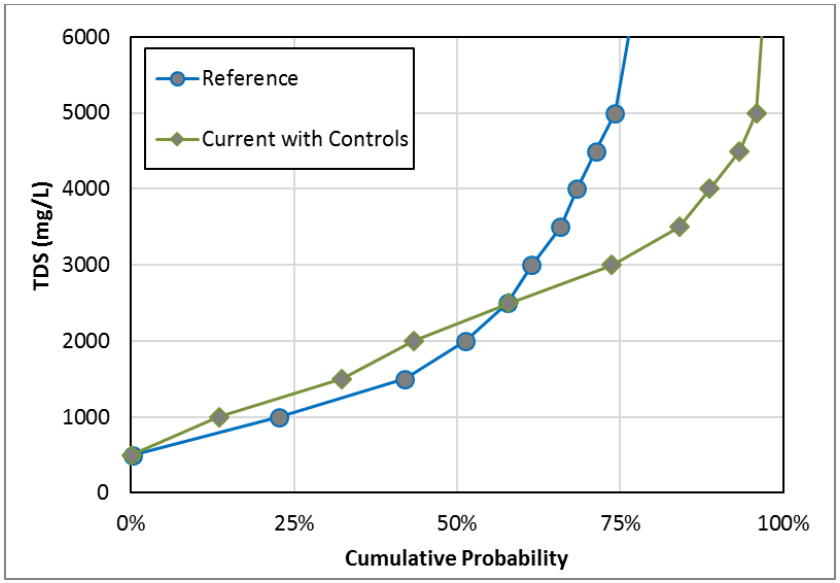


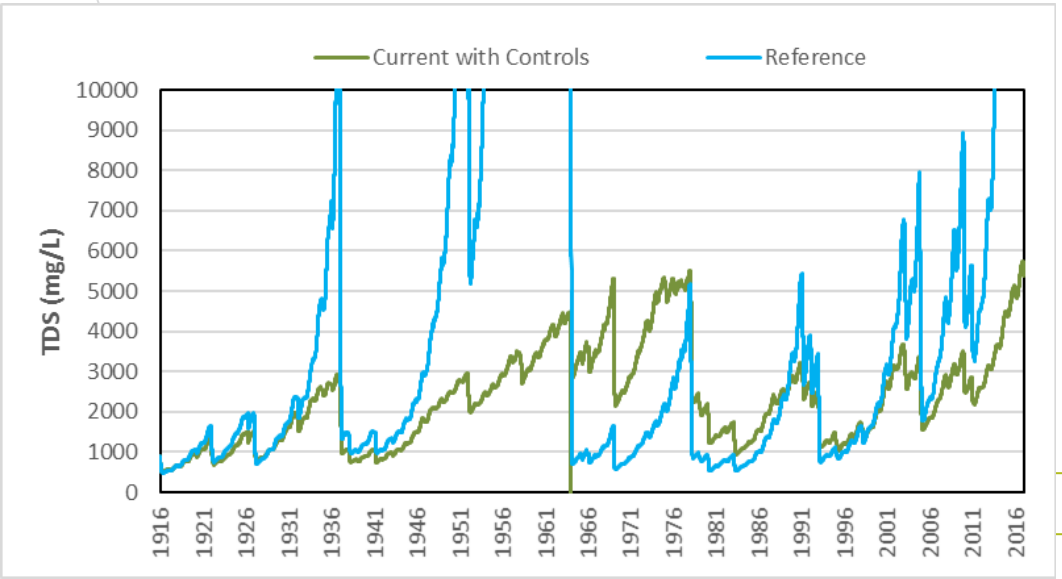


- Reference is Scenario 1 results – same as Scenario 2 for water level
- Current with Controls is Scenario 3 results
- Current with Levee only results from September TF meeting

Reasonable Assurance Analysis – Lake Elsinore

- Addition of reclaimed water creates lower TDS than reference condition 50 percent of time





- Reference is Scenario 1 results – same as Scenario 2 for water level
- Current with Controls is Scenario 3 results

Reasonable Assurance Analysis – Lake Elsinore

- Conduct assessment to evaluate progress towards TMDL compliance based on benefits obtained from supplemental project implementation
  - Develop a CDF from measured data collected during TMDL implementation
  - Run lake model for reference conditions during TMDL implementation period with no in-lake controls, initial conditions from Scenario 1 in 2020 (DRY)
  - Compare measured water quality (reflecting existing controls) with model results for reference condition for same hydrologic period (Volume weighted DO, surface chlorophyll-a, depth integrated ammonia-N)

Implementation Schedule

Implementation Framework

- Phase 1 – Post-2004 TMDL project activities completed to date:
  - Alum applications
  - LEAMS
  - Fishery management
  - Watershed BMPs
  - Supplemental water additions
  - Special studies to support TMDL revision
- Phase 2 – Revised TMDL with updated schedule to be implemented over next 15-20 years
- Phase 3 – Implement, if needed, after completion of Phase 2; achieve attainment of water quality objectives by Year 40

Implementation Framework – Phase 2

- Implementation Program: 15-20 years
  - Considers time to update existing programs and conceptualize, design, permit, construct and assess effectiveness of new projects:
    - 3-5 years to complete concept, design, and permit (EIR)
    - 3-5 years to secure funding and build project
    - 5-10 years to assess effectiveness
  - Provides time to assess impact/benefit of processes that impact nutrients:
    - Expected increase in addition of supplemental reclaimed water
    - Reduction of nutrients in sediments (taking into account half life)
    - Continued conversion from agricultural to urban landscape
- Key elements
  - Update existing nutrient control programs, permits, management plans
  - Implement supplemental projects, as needed
  - Annual monitoring and reporting
  - Periodic assessment – every 5 years - to evaluate progress towards attainment of water quality objectives

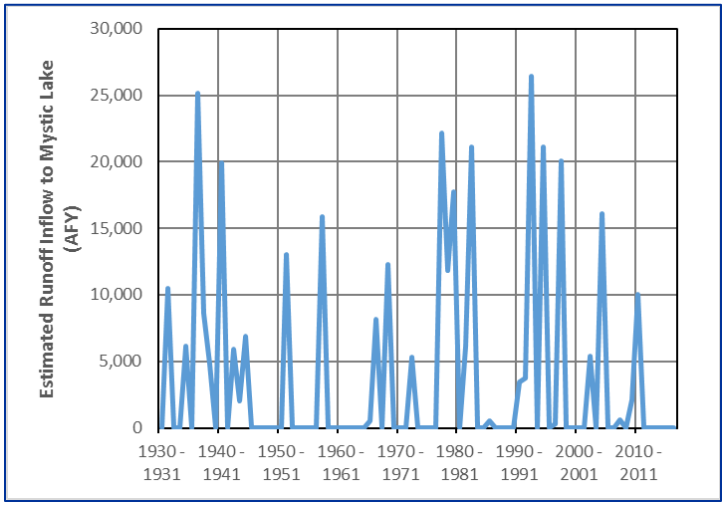
Implementation Framework – Phase 3

- Phase 2 implementation program will be at a crossroads by Year 20 (or sooner)
- Next steps dependent on periodic assessment evaluation:
  - Are we making adequate progress to attain water quality objectives by Year 40?
    - Continue existing program of implementation with annual monitoring and periodic assessments
  - Are we not making adequate progress?
    - Identify new solutions, including, e.g.,
      - Consider additional projects
      - Revise TMDL based on newest information
      - Consider regulatory options such as revised uses and/or objectives

Supplemental Projects

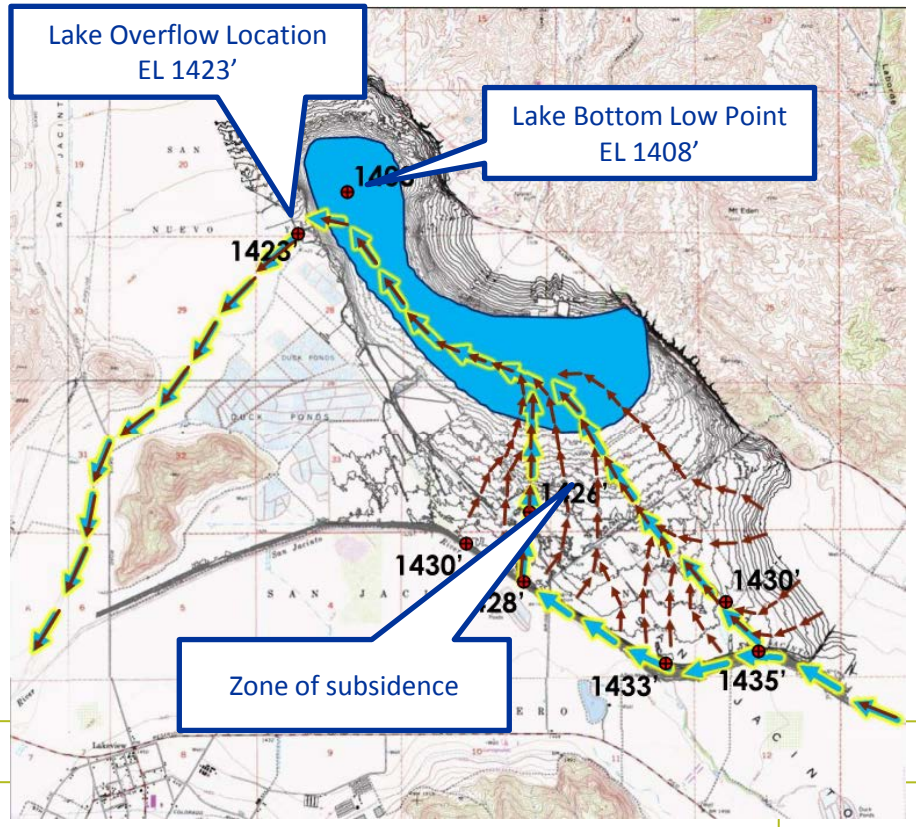
Mystic Lake Drawdown

- Multi-benefit project involving use of mountain front runoff capture in Mystic Lake
  - Increased water supply for EVMWD
  - Increased hydrologic flushing in Canyon Lake
  - Increased overflow and dilution of TDS in Lake Elsinore
- Highly variable estimated annual runoff from zero to over 20,000 AFY
  - Zero since 2010
  - Long term average ~3,000 AFY



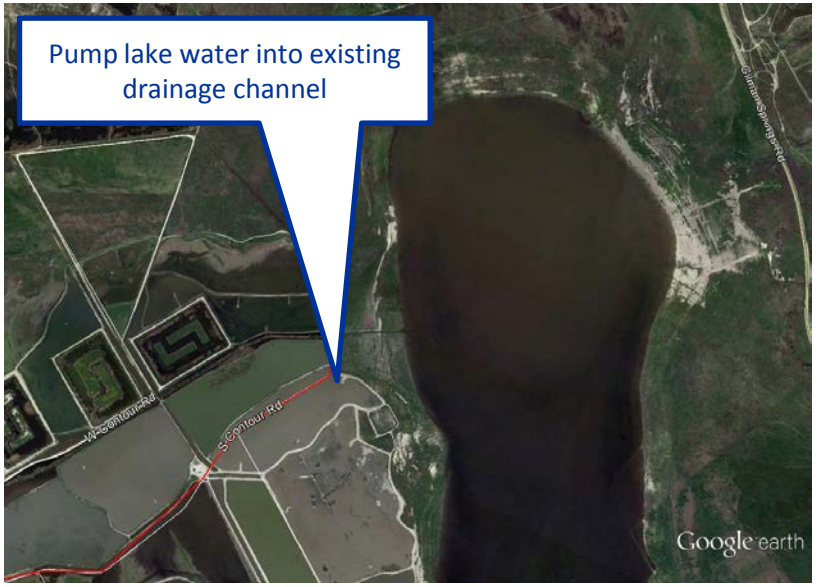
Mystic Lake Drawdown

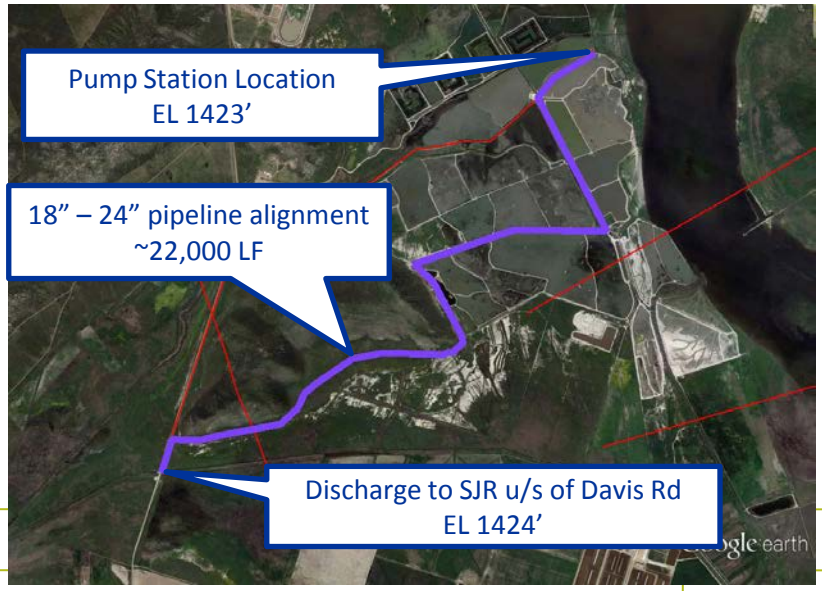
- Draining lake by gravity to SJR is not technically feasible
- Three pumping conveyance options considered
  - 4,000 AFY
  - 10,000 AFY
  - 17,000 AFY
- Anticipated facilities:
  - Intake pipeline (~2,500 LF trenchless construction)
  - Pump station with 15 ft deep wet well
  - Discharge pipeline to overflow channel or SJR



Mystic Lake Drawdown

- Low flow option (5 cfs)
  - Smaller pipelines and pump station sizes
  - Discharge to existing overflow channel
  - Rough cost estimate $2.1 million
- Higher flow options (14 -24 cfs)
  - Discharge pipeline to SJR upstream of Davis Road
  - Rough cost estimate $16-20 million





Others

- Enhanced treatment for reclaimed water additions
- Alum additions to wet weather inflows
- Treatment wetlands
- Oxygenation
- Dredging
- Indirect potable reuse
- Vegetation management
- Ultrasonic algae control
- Algaecide
- Physical harvesting

Monitoring Chapter