# Revision of the Lake Elsinore & Canyon Lake Nutrient TMDL

CDM Smith Team & Risk Sciences

# Numeric Targets TMDL Allocations

February 16, 2017 Lake Elsinore/Canyon Lake Task Force Meeting



### **Presentation Outline**

- Canyon Lake Numeric Target
- Allocations for Canyon Lake and Lake Elsinore TMDLs
  - External Runoff Allocations
  - Overflow from Canyon Lake to Lake Elsinore
  - External Runoff Load Reduction Estimates
  - Allocations for Internal Loads
  - Supplemental Water Allocation

### **CANYON LAKE NUMERIC TARGET**

### **Reference Watershed Approach**



### Numeric Targets: Lake Elsinore Chlorophyll-a

 Algae numeric target expressed as cumulative distribution function (CDF) of chlorophyll-a concentration



### Numeric Targets: Canyon Lake Chlorophyll-a

 Algae numeric target expressed as CDF of chlorophyll-a concentration



### Numeric Targets: Lake Elsinore DO

• CDF of volume meeting Basin Plan objective for WARM use



### Numeric Targets: Canyon Lake DO

• CDF of volume meeting Basin Plan objective for WARM use



### ALLOCATIONS

### Changes from 2004 TMDL that Affect Allocations

- Planning level pollutant load model
- Reference watershed approach for TMDL
- Long-term hydrologic averaging
- Update to retention estimates (e.g. CAFO, Mystic Lake)
- WLAs and LAs for responsible agencies
- No implementation measures assumed (e.g. LEAMS)

### Planning Level Pollutant Load Model

- Source assessment model fitted to existing conditions
- Remove development to estimate reference condition nutrient loads



### **Reference Watershed Approach**

 Allowable watershed nutrient load (Volume \* Concentration)



Date	Flow (cfs)	Event Mean Concentration from Cranston Guard Station (Reference Site)			
		TP (mg/L)	TN (mg/L)		
2/12/2003	3.4	0.13	0.60		
2/25/2003	15	0.92	1.41		
10/27/2004	26	4.13	3.80		
1/12/2005	300	0.16	0.98		
3/23/2005	192	0.11	0.58		
1/5/2008	273	0.39	1.15		
1/27/2008	228	1.22	4.00		
2/4/2008	352	0.43	1.03		
1/20/2010	340	10.13	7.09		

### **Reference Watershed Volume**

• Watershed-wide pervious land runoff coefficient = 0.065





 Subwatershed variability from different rainfall and downstream retention parameters

### Allowable Nutrient Loads in Watershed Runoff

Watershed	Modeled Reference	Refer Nuti Concer	rence rient ntration	Allowable Nutrient Loads from Runoff		
	(AFY)	TP (mg/L)	TN (mg/L)	TP (kg/yr)	TN (kg/yr)	
San Jacinto River to Canyon Lake Main Lake (Zones 2, 5-9)	7,140	0.31	0.95	2,730	8,370	
Salt Creek to Canyon Lake East Bay (Zones 3,4)	2,200	0.31	0.95	1,057	3,240	
Local Lake Elsinore (Zone 1)	1,870	0.31	0.95	720	2,190	

# **OVERFLOW**

### **Canyon Lake Retention and Overflow**



### **Canyon Lake Retention and Overflow**



### **Canyon Lake Retention and Overflow**



### Allocations for Watershed Runoff

- Allocations apportioned to lake segments based on retention
- Estimated (2000-2015) average nutrient (TP, TN) retention ~ 65%



Lake Segment	Allowable Nutrient Loads from Runoff			
	TP (kg/yr)	TN (kg/yr)		
Canyon Lake (Main Lake)	1,774	5,438		
Canyon Lake (East Bay)	687	2,106		
Canyon Lake overflow to Lake Elsinore	1,325	4,062		
Local Lake Elsinore	715	2,190		



# Allocation for Watershed Nutrients to Lake Segments

- MS4s: 54.8%
- Federal: 27.5%
- Ag CWAD: 7.3%
- State, Caltrans: 6.8%
- Tribal: 1.7%
- Ag-Small: 1.0%
- CAFO: 0.5%
- March JPA: 0.5%

Decoorcible Agency	Canyon Lake Main Lake		Bay		Local Lake	Elsinore	to Lake Elsinore	
Responsible Agency	TP (kg/yr)	TN (kg/yr)	TP (kg/yr)	TN (kg/yr)	TP (kg/yr)	TN (kg/yr)	TP (kg/yr)	TN (kg/yr)
Ag-CWAD	180	552	80	246	0	1	140	429
Ag-Small	27	81	14	43	1	4	22	67
BANNING	0	1	-	-	-	-	0	0
BEAUMONT	3	9	-	-	-	-	2	5
CAFO	5.9	18.0	1.9	6	0	0	4	13
California Department of Fish and Wildlife	54	165	-	-	-	-	29	89
Caltrans	12	37	4	12	6	17	9	26
CANYON LAKE	12	36	14	44	7	23	14	43
Federal - DOD	26	79	-	-	-	-	14	43
Federal - National Forest	107	327	2	5	121	371	58	179
Federal - Other	42	129	7	21	-	-	26	81
Federal - Wilderness	21	64	-	-	-	-	11	34
НЕМЕТ	3	8	48	147	-	-	27	84
LAKE ELSINORE	15	44	6	19	317	971	11	34
March Joint Powers Authority	28	87	-	-	-	-	15	47
MENIFEE	74	227	279	854	10	30	190	582
MORENO VALLEY	278	852	-	-	-	-	150	459
MURRIETA	-	-	5	16	-	-	3	9
PERRIS	198	607	1	2	-	-	107	328
RIVERSIDE	6	18	-	-	-	-	3	9
Riverside County	615	1,885	220	674	139	427	450	1,378
SAN JACINTO	8	26	1	2	-	-	5	15
State Land	46	141	-	-	-	-	25	76
Tribal Reservations	6	18	-	-	-	-	3	10
Western RivCo Conservation Authority	9	27	4	13	-	-	7	21
WILDOMAR	-	-	0	0	113	345	0	0
Total Allowable Watershed Load	1,774	5,438	687	2,106	715	2,190	1,325	4,062

### Allocation for Watershed Nutrients to Lake Segments

• Allowable nutrient loads by categories of responsible agency

Responsible Agency	Canyon Lak	e Main Lake	Canyon Lake East Bay		Local Lak	e Elsinore	Canyon Lake Overflow to Lake Elsinore	
	TP (kg/yr)	TN (kg/yr)	TP (kg/yr)	TN (kg/yr)	TP (kg/yr)	TN (kg/yr)	TP (kg/yr)	TN (kg/yr)
Ag-CWAD	180	552	80	246	0	1	140	429
Ag-Small	27	81	14	43	1	4	22	67
MS4 Permittees	1,212	3,714	574	1,760	586	1,796	962	2,948
Federal	195	598	9	26	121	371	110	336
State	120	369	8	25	6	17	69	212
March JPA	28	87	-	-	-	-	15	47
Tribal	6	18	-	-	-	-	3	10
CAFO	6	18	2	6	0	0	4	13
Total Allowable Watershed Load	1,774	5,438	687	2,106	715	2,190	1,325	4,062

# Alternative LA for overflows from Canyon Lake to Lake Elsinore

- Consider an alternative of having mass OR concentration based LA
  - Encourage larger overflow
    volumes that provide water
    quality benefits in Lake Elsinore
- Concentration based LA for overflows from Canyon Lake to Lake Elsinore



 $Offset Demand = Volume_{overflow} * (C_{measured} - C_{reference}); C_{measured} > C_{reference}$  $Reduction Credit = Volume_{overflow} * (C_{measured} - C_{reference}); C_{measured} < C_{reference}$ 

### LOAD REDUCTION ESTIMATES

### Load Reduction by Lake Segment

 Required load reduction = estimated existing load minus allowable load (i.e. incremental load above reference condition)



### Load Reductions by Group

• Load reductions for all developed land / impervious areas, including those within federal and state jurisdiction (e.g. National Forest)



### Load Reductions by Group

• Load reductions as percent of existing load, not accounting for implementation of AgNMP or CNRP

Responsible Agency	Canyon Lake Main Lake		Canyon Lake East Bay		Local Lake Elsinore		Canyon Lake Overflow to Lake Elsinore	
	TP	TN	TP	TN	ТР	TN	ТР	TN
Ag-CWAD	70%	59%	76%	66%	83%	77%	72%	61%
Ag-Small	76%	67%	81%	73%	77%	64%	78%	69%
MS4 Permittees	56%	74%	60%	74%	43%	67%	58%	74%
Federal	18%	44%	8%	4%	1%	1%	18%	43%
State	22%	52%	37%	81%	61%	89%	23%	56%
March JPA	40%	62%	0%	0%	0%	0%	40%	62%
Tribal	9%	17%	0%	0%	0%	0%	9%	17%
CAFO	66%	51%	42%	12%	69%	56%	62%	45%
Total Percent Load Reduction	55%	70%	63%	73%	39%	63%	58%	71%

### WLA and Load Reduction for CAFOs

- CAFO permits require on-site retention capacity to capture runoff from 25 year return period storm
- 25yr,24hr rain depth for region is ~4.2 inches (NOAA Atlas 14)
- On average, ~300 inches of rainfall over a 25 year period
- Overflow factor is estimated as 4.2 in / 300 in = 0.014

Condition	Volume (AFY)	TP (kg/yr)	TN (kg/yr)
Existing	6.8	29.0	61.3
Reference	31.2	12.0	36.6

# COMPARISON OF 2004 TMDL AND REVISED TMDL ALLOCATIONS

### Changes from 2004 TMDL – Existing Load

- 2014 mapping reflects significant conversion of land use
- Different source assessment methods
- Uniform land use based EMCs



### Allocations in 2004 TMDL

• Flow-frequency basis for allocations in 2004 TMDL

Water Vear	Frequency	Overflow (AFY) Canyon Lake to Lake Elsinore			
vvaler fear	Frequency	Estimated ( <mark>EFDC</mark> )	USGS Gauge Data <sup>1</sup>		
1994 (mod)	41%	2,483	2,483		
1998 (wet)	16%	133,981	17,230		
2000 (dry)	43%	0	69		
Frequen	cy-weighted Average	22,520	3,948		

1) Includes a small (<1 mi<sup>2</sup>) drainage area downstream of Railroad Canyon Dam



### Allocations in 2004 TMDL

• EFDC model (from Tetra Tech, 2003. Lake Elsinore and Canyon Lake Nutrient Source Assessment)



### Changes from 2004 TMDL – Canyon Lake

- Higher allowable TP and TN in 2004
   Canyon Lake TMDL
   from overestimated
   WY 1998 runoff
   volume
- Separate TMDLs for East Bay and Main Lake



### Changes from 2004 TMDL – Lake Elsinore



### Changes from 2004 TMDL – Lake Elsinore

 Increased allowable load to reference
 levels for local Lake
 Elsinore watershed
 runoff inflows



Not including atmospheric deposition or supplemental water

### **ALLOCATIONS FOR INTERNAL LOADS**

### Sediment Nutrient Flux

- Estimates from Anderson
   chamber
   studies
- Values are key inputs to linkage analysis models

Sediment nutrient flux	Existing (	Condition	<b>Reference Condition</b>		
(mg/m²/day)	SRP	NH4-N	SRP	NH4-N	
Canyon Lake	12	34	6.0	15.0	
Lake Elsinore	10	100	6.0	60.3	



### **Atmospheric Deposition**

Same rates for wet deposition as used in 2004 TMDL (Anderson, 2001; Anderson and Oza, 2003)

	Wet Deposition Rate	TP (mg/m2/day)	TN (mg/m2/day)	
Sediment nutrient flux		0.73	0.52	
	Surface Acres	TP (kg/yr)	TN (kg/yr)	
Canyon Lake - Main Lake	187	201	144	
Canyon Lake – East Bay	100	107	77	
Lake Elsinore	3000	3,222	2,307	

## SUPPLEMENTAL WATER ALLOCATION

### **Recycled Water**

- Permit requirements
  - TN: 1.0 mg/L and no more than 7,442 kg/yr
  - TP: 0.5 mg/L and no more than 3,721 kg/yr
- Water quality benefit of lake level stabilization offsets nutrient loading

Recycled Water	Flow		Concen	tration	Nutrient Load		
Additions	MGD	AFY	TP (mg/L)	TN (mg/L)	TP (kg/yr)	TN (kg/yr)	
Current Permit	8.0	6,037	0.50	1.00	3,721	7,442	
TMDL Revision	9.5	10,642	0.31	0.95	4,067	12,463	









### SAN JACINTO RIVER WATERSHED NUTRIENT TMDL MONITORING PROGRAM UPDATE

GARTH ENGELHORN, CPSWQ, QISP/TOR

ALTA ENVIRONMENTAL

FEBRUARY 16, 2017

### **⊴USGS** USGS 11070365 SAN JACINTO R NR SUN CITY CA 2000 second 1500 feet per 1000 Discharge, cubic 500 Ø -500Oct 01 Oct 15 Oct 29 Nov 12 Nov 26 Dec 10 Dec 24 Jan 07 Jan 21 Feb 84 2016 2016 2016 2016 2016 2016 2016 2017 2617 2017 Discharge Period of provisional data Period of approved data

























### **≪USGS** USGS 11070500 SAN JACINTO R NR ELSINORE CA 4000 second 3500 3000 feet per 2500 2000 Discharge, cubic 1500 1000 500 8 -500 Nov 12 Nov 26 Dec 10 Dec 24 Jan 87 Oct 81 Oct 15 Oct 29 Jan 21 Feb 04 2016 2016 2016 2016 2016 2016 2016 2017 2617 2617 Discharge Period of provisional data Period of approved data













### USGS 11070210 SAN JACINTO R A RAMONA EXPRESSWAY NR LAKEVIEW CA



	Rai	ilroad Ca	nyon Da	am Daily	Rainfal	(inches)			
	Day	Sept	Oct	Nov	Dec	Jan	Feb		
	1					0.24			
	2								
	3								
	4								
	5							Railro	ad
	6							Carat	
	7						0.32	Sept	
	8							0.08	
	9					0.48		0.00	
	10					0.08			
	11						0.04		
	12					0.12			
	13					1.12			
	14								
	15								
	16				0.68		N/A	Event #	1
	17				0.08		N/A		_
	18						N/A		
	19					0.4	N/A		
	20					0.16		Event #	<b>‡2</b>
	21	0.08		0.68		1.04	N/A		
	22				1.76	0.04	N/A		
	23				0.24	2.56	N/A		
	24		0.12		0.72	0.08	N/A		
	25		0.36		0.08	0.04	N/A		
ĺ	26						N/A		
l	27			0.12			N/A	Riversid	e (
ĺ	28			0.04			N/A	Dictrict	c:
ĺ	29						N/A	DISTRICT:	21
l	30						N/A		
Ì	31				0.04		N/A	Source: h	ittp

Railroad Canyon Dam Monthly Rainfall (inches)					
Sept	Oct	Nov	Dec	Jan	Feb
0.08	0.48	0.84	3.60	6.36	0.36

Riverside County Flood Control and Water Conservation District: Site 163 Railroad Canyon Dam

Source: http://www.floodcontrol.co.riverside.ca.us/RainFallMap.aspx

### Strong Pacific Storm Friday through Saturday

### **Rainfall Details:**

- Starts Friday afternoon in northern areas and after dark for San Diego County.
- Heavy rainfall rates may cause flash flooding, debris flows, and possible river flooding.





### Wind Gust Details:

- Strongest winds will occur Friday afternoon through Friday night.
- Strong winds may cause downed trees and create hazardous boating conditions in the coastal waters.



Weather Forecast Office San Diego, CA

2/15/2017 12:20 pm PST

weather.gov/SanDiego

Follow Us: 📑 🏹





### GARTH ENGELHORN, CPSWQ, QISP/ToR

WATER RESOURCES PROJECT MANAGER / SR. CONSULTANT

Garth.Engelhorn@altaenviron.com

2110 S. Coast Hwy, Suite B, Oceanside, CA 92054 www.altaenviron.com

# The Effects on the Lakes in SJ Watershed from the January Storm

Prepared by: Riverside County Flood Control and Water Conservation District Prepared for: LE/CL TMDL Task Force



### Overview

- San Jacinto River Basin
- "Farmers" Levee Breach
- January 2017 Rain Event (19<sup>th</sup>-23<sup>rd</sup>)
- Summary

### San Jacinto River Basin



### San Jacinto River Watershed

542 sq mi
 Tributary to
 Canyon Lake.

400 sq mi
 Tributary to
 Mystic Lake



### Farmers Levee

Levee rise is caused by the Casa Loma fault?



### Farmers Levee

Slightly over bank just as the water surface crests the high point in the levee.





### Farmers Levee



### January 2017 Rain Event • 2.36 in. 4.14 in. Desert Ho Lost Horse (LTHC1) 3.0 in. White Water (WWAC1) Badlands 5.75 in. 2.53 in. 4.51 in. Prado Dam (PDMC1) Clark (CLHC1) Highland Springs (HSGC1) 0.99 in. 0.33 in. Reservoir 4601 (PMRC1) 3.52 in. 3.7 in. Mount San Jacinto (MSJC1) Lake Mathews (MHEC1) San Jacinto 2.2 in. 3.3 in. 8.4 in. Cathedral City (GCDC1) 7:21 in. Perris Temescal (TSCC1) Idyllwild 3.7 in. 2.8 in. 1.38 in. Paxton Road (PAXC1) Cranston (CNSC1) Hemet 4.32 in. 6.27 in. Railroad Canyon Dam 5.21 in. Keenwild (KNWC1) La Quinta El Cariso (ECSC1) ORANGE COUNTY 7.44 in. El Cariso (ELOC1) 3.31 in. Anza (NZAC1) 4.32 in. 0.6 in. Murrieta (WRSC1) Kent Sea Farms (KSFC1) 2.43 in. Z.43 III. Vail Lake (VLKC1) 4.09 in. 7.91 in. Santa Rosa Plateau (SRUC1) Temecula Ck - Aguanga (TEKC1) SAN DIEGO COUNTY **RADAR ESTIMATED PRECIPITATION TOTALS (INCHES)** THIS MAP IS AN INTERPOLATION OF ACTUAL REPORTED VALUES, AND SHOULD 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00 10.00 11.00 12.00 BE CONSIDERED AN ESTIMATION ONLY. RADAR IMAGE AND RAINFALL TOTALS **OBTAINED FROM CALIFORNIA NEVADA RIVER FORECAST CENTER**

Rainfall Summary

- Idyllwild 8.4"
- Cranston 3.7"
- San Jacinto 3.7"
- Highland Springs 4.5"

# January 2017 Rain Event

- Stage (2/01/2017) = 1411.4 FT
- Total storage volume is approx. 14,700 AC-FT at spill elevation (1422 FT).
  - 620 AC-FT storm water in Mystic Lake (2.4 FT deep)
  - Water surface elevation shot by RCFC&WCD Survey.



### January 2017 Rain Event



### January 2017 Rain Event



### Summary

- Average rainfall in the Mystic Lake tributary area was 5.1" over the multi day rain event.
- Mystic Lake stage increased 2.4 FT (620 AC-FT).
- Lake Hemet stage increased 3 FT.
- Lake Elsinore stage increased 3 FT.
- Canyon Lake Spilled.







# Improving the water quality and ecology Lake Elsinore & San Jacinto Watersheds Authority



For more information visit: www.MyWatersheds.com

Stormwater runoff carries high levels of nutrients including nitrogen and phosphorus into Canyon Lake, which can impact water quality.

> **Canyon Lake alum applications improve** the water quality and ecology of the lake, in order to comply with water quality regulations, enforced by the State through the local Santa Ana Regional Water Quality Control Board, the Lake Elsinore & Canyon Lake Nutrient Total Maximum Daily Load (TMDL) Task Force continues to conduct alum water treatments in Canyon Lake.

As the scientifically proven method to minimize algae blooms and maintain a healthy lake ecology, alum treatments are safe for human health and the environment.

Other agency logos



City of Lake Elsinore • City of Canyon Lake • County of Riverside Elsinore Valley Municipal Water District • Santa Ana Watershed Project Authority