Salt and Nutrient Management Plan for the San Juan Creek Watershed

SOCWA
South Orange County Wastewater Authority

WEI
Wildermuth Environmental, Inc.

Stakeholder Workshop:
September 28, 2020

Agenda

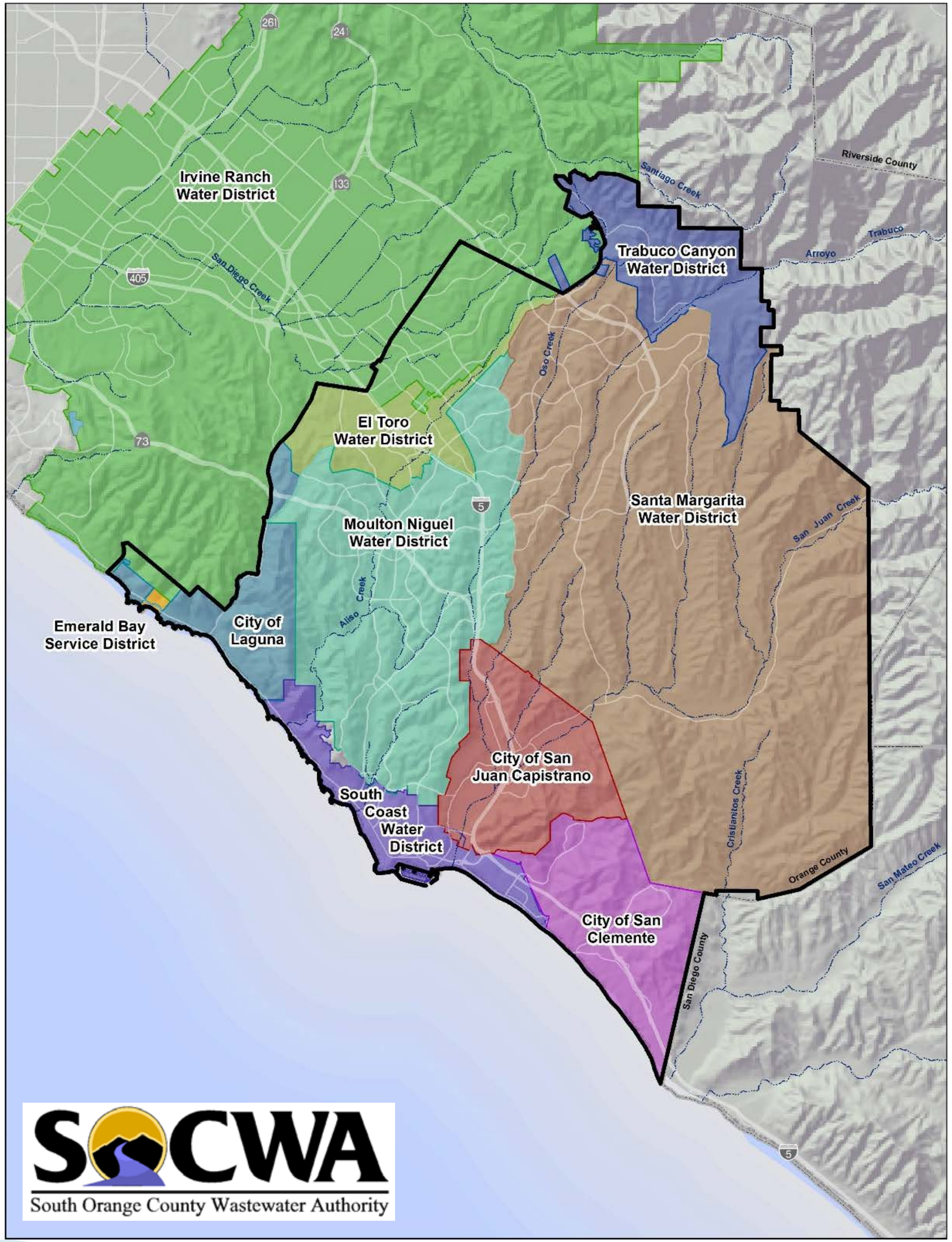
- Introductions and Overview of Regional Stakeholders
- 2018 Recycled Water Policy and 2020 SNMP Update
- Timeline for the 2020 SNMP Update
- SNMP Study Area: San Juan Creek
- Current and Projected Water Quality Analysis Methods
- SNMP Monitoring Program – Results to Date
- Additional Q & A

Introductions

- Regional Board
- SOCWA and Member Agencies
- SNMP Consultants
- Interested Stakeholders

SOCWA – Lead Agency

- 220 square mile service area in south Orange County
- 10 member agencies
- Regulated agency holding NPDES and WDR permits for the disposal of treated wastewater and use of recycled water by its member agencies



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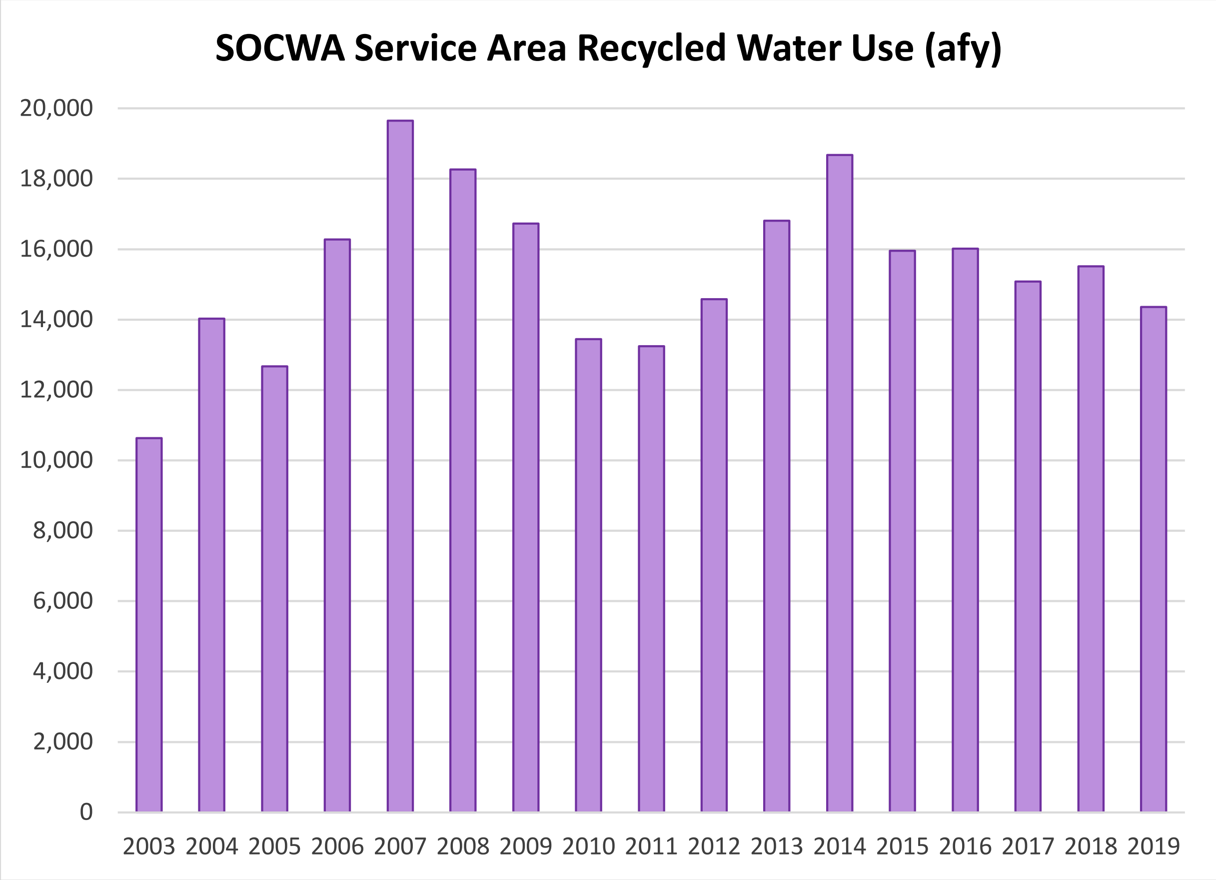
SOCWA – Recycled Water Use

- Recycled water use began in 1980s
- Critical to local supply reliability
- Offsets the use of potable imported water supply
- The first region-wide WDR permit for recycled water use issued in 1992, at which time member agencies use was about 7,200 afy use
- Current WDR permit, issued in 1997, supports up to 46,150 afy of recycled water use

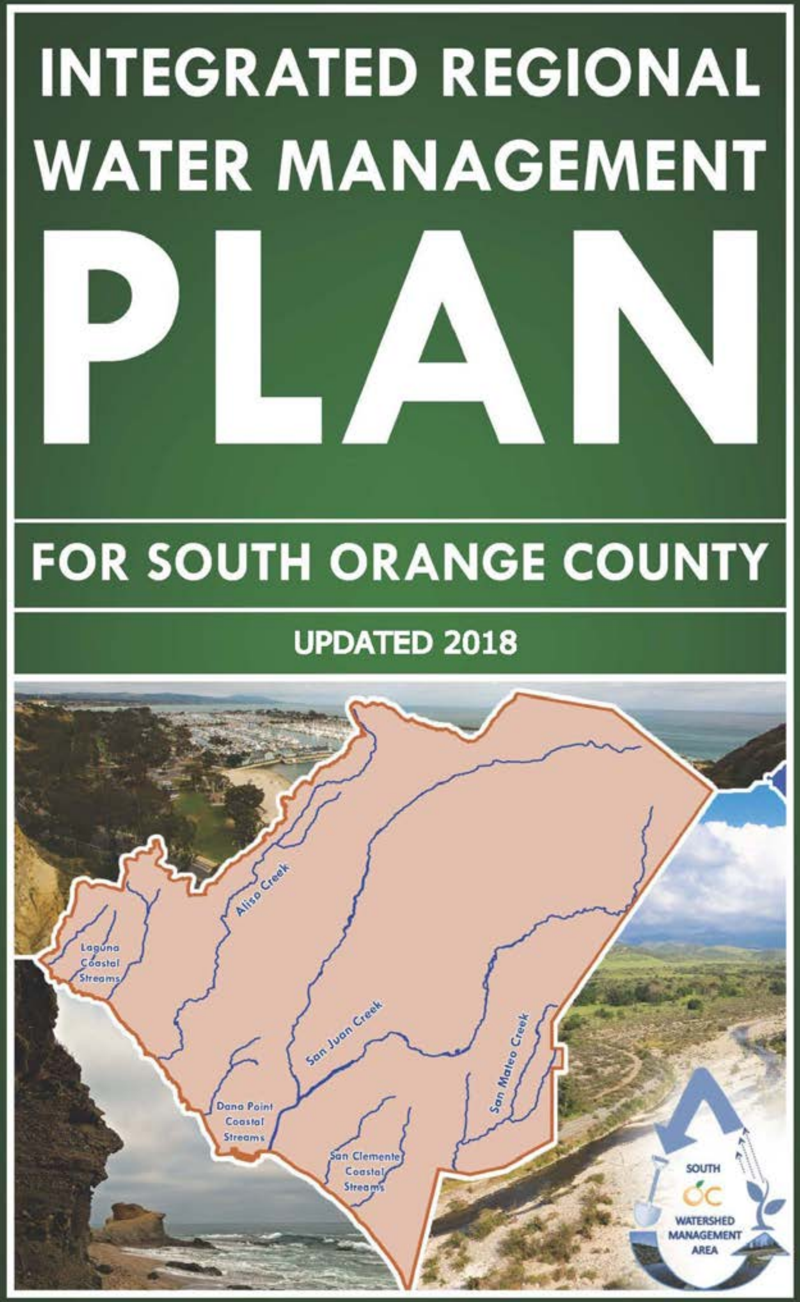


Regional Collaboration

- Section 6.2.1 of the 2018 Recycled Water Policy :

"encourages local water suppliers, wastewater treatment agencies, and recycled water producers, together with local salt and nutrient contributing stakeholders, to continue locally driven and controlled, collaborative processes open to all stakeholders and the regional water board…"

- SOCWA's stakeholder outreach goal is to ensure opportunity for input from all regional stakeholders
- SNMP updates are incorporated into the South Orange County IRWM Plan to accomplish Regional Collaboration through management oversight



Recycled Water Policy and the 2020 SNMP Update

- What is the reason for and purpose of the SNMP and what is the goal of the 2020 SNMP Update?

State Board Recycled Water Policy

- To encourage increased use of stormwater and recycled water in a manner that is consistent with regional Basin Plans
- Acknowledged not all Basin Plans include adequate implementation procedures for achieving or ensuring compliance with the groundwater quality objectives for salts and nutrients
- Recognized that salt and nutrients in groundwater can not be managed through regulation of recycled water discharges alone
- Mandated the development of SNMPs
- Locally-driven, locally-controlled process

SNMPs Must Include:

- Description of water recycling goals and objectives
- Characterization of the groundwater resources of the study area to determine the complexity of salt and nutrient management planning
- Salt and nutrient loading analysis: source identification, description of fate and transport of salt and nutrients, and estimation of loading
- Estimation of current water quality and future water quality, based on reasonably foreseeable projects

SNMPs Must Include:

- Comparison of current and future groundwater quality to Basin Plan Objectives
- Implementation measures to manage salts and nutrients on a sustainable basis
- Demonstrations that the implementation measures included within the plan satisfy the State Board Antidegradation Policy
- Monitoring plan for assessing water quality and compliance with applicable water quality objectives

2014 SOCWA SNMP

- 2012-2014: Stakeholder driven process
- Addressed all requirements of the 2009 Policy
- Implementation Plan
  - Maximize recycled water use and continue to comply with existing WDR permit
  - Develop and implement expanded watershed-wide SNMP groundwater and surface water monitoring program to support SNMP development
  - Perform Middle San Juan Analysis consistent with methods in 2014 SNMP when data is made available
  - Amend the TDS Objectives in the Basin Plan: Raise TDS objective in Middle Trabuco and Middle San Juan HSAs to 1,200 mg/L
  - Re-evaluate compliance with the Basin Plan objectives every 5 years and update the SNMP as necessary

2018 Recycled Water Policy Amendments to Address Lesson Learned, New Conditions

- Administrative challenges with SNMP Development
  - Tie to recycled water use resulted in limited coverage of plans and stakeholder involvement
  - Agencies that developed SNMPs often lacked the regulatory or administrative authority to implement the management actions listed in the SNMPs
- Technical challenges with SNMP Development
  - Limitations of data used for SNMP analyses: limited data available and data not always representative of the full aquifer system
  - Methods used for SNMP analyses: simplification using mass-balance approaches that could over or underestimate basin concentrations of TDS/N
  - Inadequate monitoring and reporting plans to support SNMP implementation

New requirements of the 2018 Recycled Water Policy

- Provided direction to Regional Boards on approving plans
- Monitoring program must be representative – designed to address SNMP
- Monitoring data must be submitted every year
- Analyze monitoring data every five years:
  - Compare observed trends with projections,
  - Evaluate ability of monitoring network to representatively characterize groundwater quality,
  - Evaluate ability of models to adequately simulate groundwater quality,
  - Revaluate compliance with Basin Plan objectives based on data and trends, and
  - Consider impacts of new projects and changed conditions.
- The Regional Board must review the SNMP to determine if it should be updated based on five-year assessment results

2020 SNMP Update

- In 2019 the update of the SNMP pursuant to 2014 SNMP Implementation Plan began
- Scope of the update modified in 2020 per input from the San Diego Regional Board
- Revised scope of work for the 2020 Update is intended to address:
  - The requirements of the 2018 Recycled Water Policy,
  - Improved descriptions of the scientific rationale for the analysis methods proposed, and
  - Improved rationale, including required policy demonstrations, for proposing changes to Basin Plan objectives.

Timeline for the 2020 SNMP Update

- What are the next steps to complete the 2020 SNMP?

Revised Scope of Work

- Task 1 – Meetings and Project Administration
- Task 2 – Stakeholder Outreach
- Task 3 – Update Characterizations of the Study Area
- Task 4 – Estimate Current Water Quality and Project Future Water Quality
- Task 5 – Perform Antidegradation Analysis to Support Recycled Water Projects and Basin Plan Amendment(s)
- Task 6 – Prepare 2020 SNMP Report

Approach

- Develop technical memorandums (TMs) documenting approaches for review with Regional Board staff
  - Task 3.1 TM – Study Area *(delivered and reviewed with RB)*
  - Task 4.1 TM – Water Quality Analysis Methods *(delivered to RB)*
  - Task 5.1 TM – Approach to Assessing Antidegradation Requirements and Support Basin Plan Amendment *(in progress)*
- Implement approaches described in TMs in consideration of preliminary comments received from Regional Board staff
- Document results in 2020 SNMP Report

2020 SNMP Report

- Section 1 – Introduction
- Section 2 – Process to Develop the SNMP
- Section 3 – SNMP Study Area Setting
- Section 4 – Hydrologic Sub-Area Characterization, Current Water Quality, and Assimilative Capacity
- Section 5 – Evaluation of Salt and Nutrient Management Plan Actions
- Section 6 – Antidegradation Analysis
- Section 7 – Implementation Plan

2020 SNMP Schedule

- June – August 2020
  - Review Task 4.1 Memo with Regional Board
- September – October 2020
  - Review Task 4.1 Memo with Regional Board
  - Submit Task 5.1 Memo for Regional Board review
- November–December 2020
  - Review Task 5.1 Memo with Regional Board
  - Perform SNMP analysis per methods in Task 4.1 memo
  - Submit Sections 1, 2, 3 and 4 for the Regional Board review
- January – February 2021
  - Perform analyses per methods in Task 5.1
  - Prepare and submit draft Sections 5, 6, and 7 for the Regional Board review
- March – April 2021
  - Finalize and submit 2020 SNMP for the Regional Board review

SNMP Study Area: San Juan Creek Watershed

- Identification of the study area based on the groundwater resources in the region

Regional Board Management Boundaries

- San Juan Hydrologic Unit (HU)
- Hydrologic Areas (HA)*

San Juan Hydrologic Area (HA)

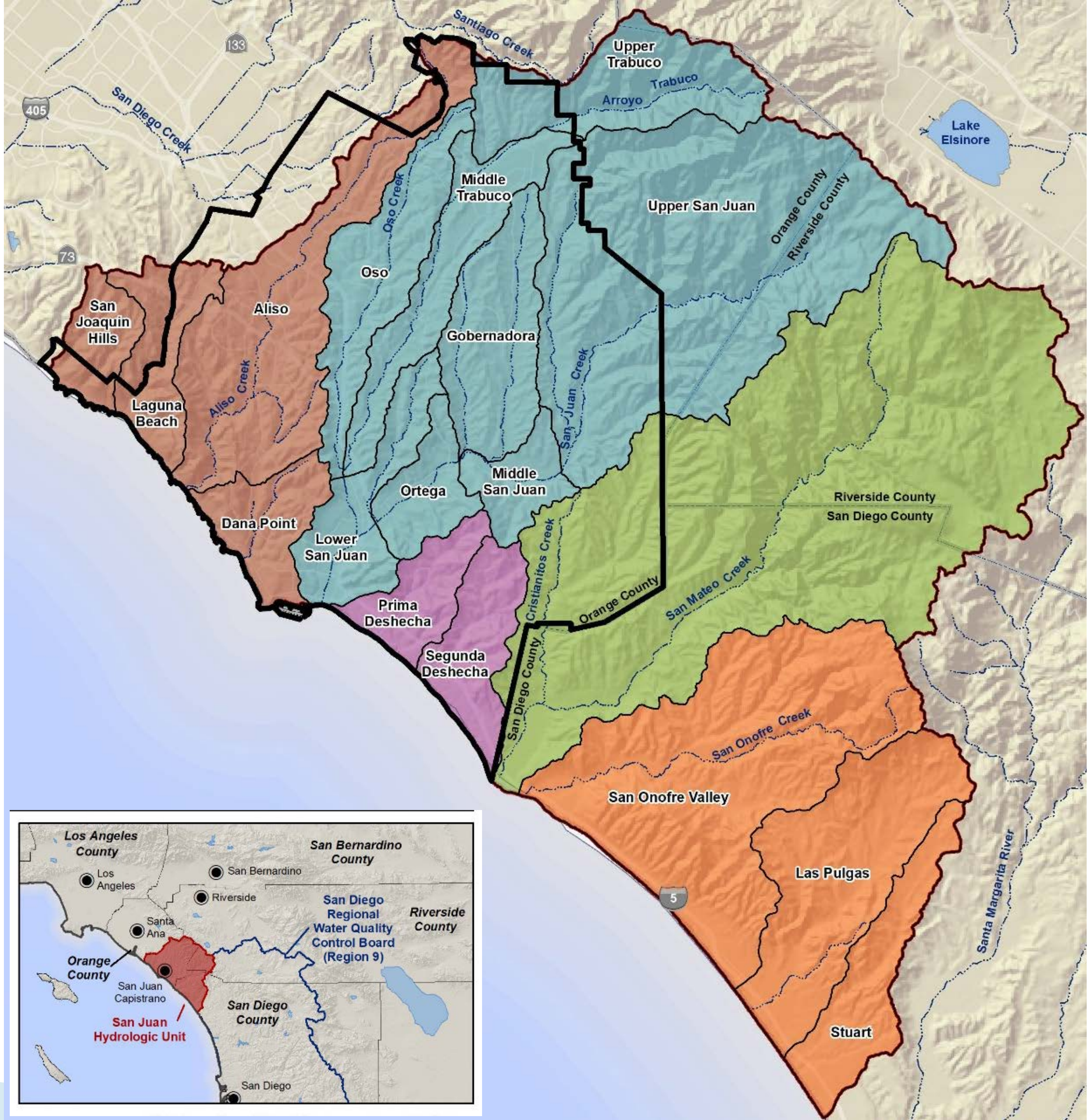
Laguna	Mission Viejo
San Mateo Canyon	San Onofre
San Clemente	

- Hydrologic Sub-Areas – the sub-watersheds within each HA
- Beneficial uses and water quality objectives defined for HAs or HSAs

Mission Viejo HA is the San Juan Creek Watershed

Task 3.1 Technical Memorandum

- Background and Purpose
- San Diego Regional Board: Water Quality Management Boundaries
- 2014 SNMP: Levels of Analysis Based on the 2009 Recycled Water Policy
- Basin Evaluation and Prioritization Criteria in the 2018 Recycled Water Policy
- 2020 SOCWA SNMP Update – Recommended Levels of Analysis within the San Juan HU



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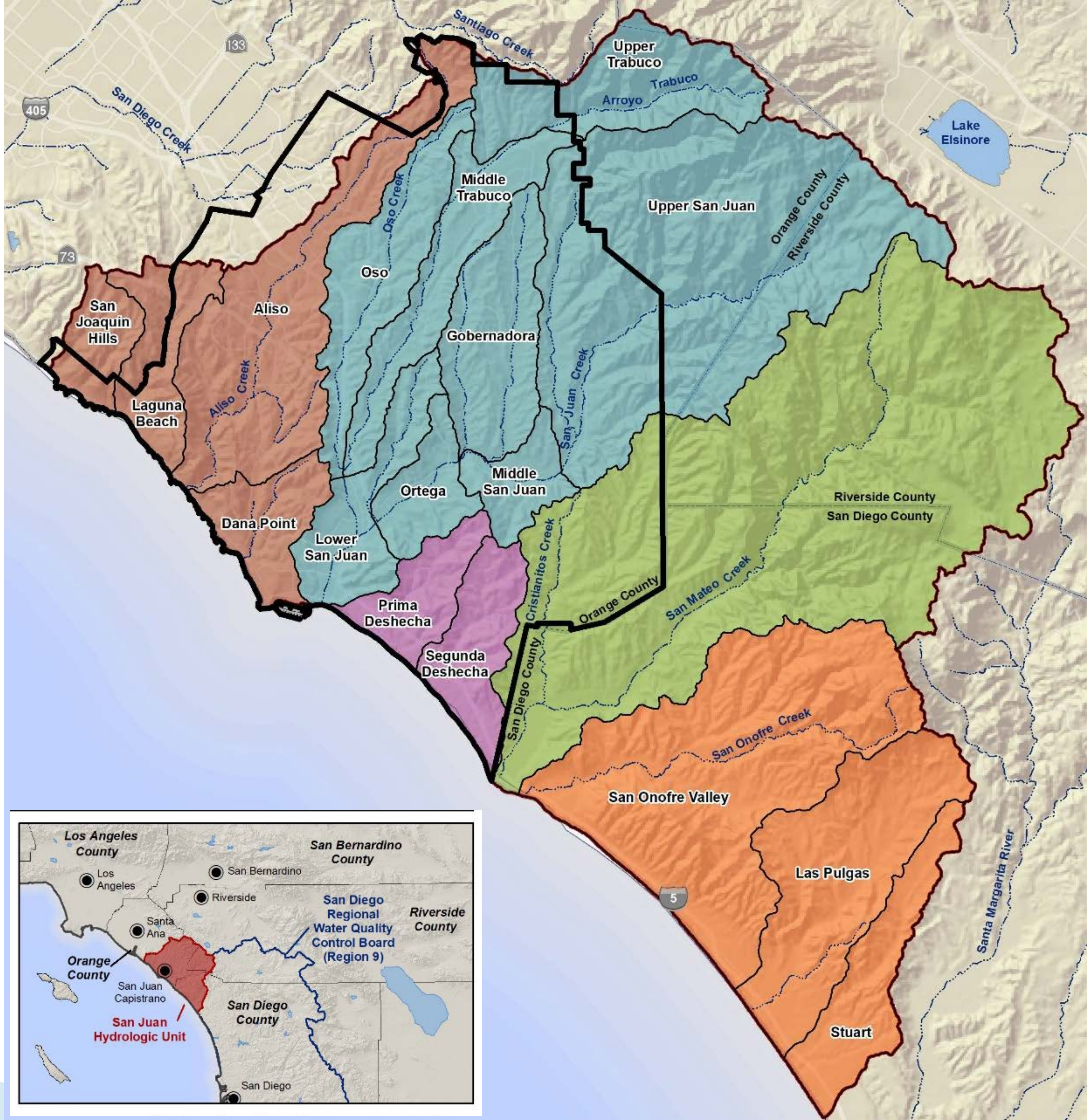
Basin Prioritization

- 2009 and 2018 Policy provides for prioritizing groundwater basins for salt and nutrient management planning (Section 6.3.1)
- All groundwater basins are different in size, hydrogeologic complexity, and loading factors, which necessitates allowing variable levels of analysis and management efforts in developing and implementing SNMPs



Basin Prioritization

- In November 2010, the Regional Board adopted Order R9-2010-0125, endorsing SNMP guidelines that included a tiered approach to developing SNMPs based on the size and complexity of the regional groundwater basins.
- The groundwater basins characterized for prioritization in the San Diego SNMP Guidelines are the alluvial groundwater basins defined by the California Department of Water Resources (DWR) in its Bulletin 118.

Basin Prioritization

- 2014 SNMP relied on tiered approach and focus of technical work and management plan was the Mission Viejo HA
- For 2020, revisited hydrologic and planning information to affirm levels of analysis

Hydrologic and Planning Characteristics of the HAs within the SOCWA Service Area

Hydrologic and Planning Characteristics	Hydrologic Areas (HA)			
	Laguna	Mission Viejo	San Clemente	San Mateo Canyon
Area (sq. miles)	62.8	177.0	19.9	133.4
% of HA Overlain by SOCWA Service Area	84%	60%	99%	14%
DWR Bulletin 118 Groundwater Basins in HA	None	San Juan Valley	None	San Mateo Valley
Area of HA with Young Alluvium Surficial geologic Deposits (sq. miles)[a]	9.2[b]	20.4	0.8	7.6
% of Area of HA with Young Alluvium Surficial geologic Deposits	15%	12%	4%	6%
Area of HA with Urban Land Uses	27.0	41.9	10.47	30.0
% of Area Covered by Urban Land Uses	43%	24%	53%	22%
Current Recycled Water Reuse Over HA (afy) (average AF from 2014-2019)	5,510	8,040	813	< 150[c]
Planned Recycled Water Reuse (afy)	10,219	9,842	1,650	690[d] (2035)
Recycled Water TDS Discharge Limits for treatment plants providing recycled water to the HA	1,100-1,200	1,100	1,100	1,100
TDS Basin Plan Objective (mgl)	1,200	500-1,200	1,200	500
Groundwater and surface water TDS and nitrate data available for characterizing assimilative capacity?	No	Yes	No	No

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Table 5

Proposed Levels of Analysis for High, Medium, and Low Priority Hydrologic Areas for the 2020 SOCWA SNMP Update

Priority Level	Priority Level Characteristics	HAs in the San Juan HU, by Priority Level	SNMP Analyses to Perform				
			Perform salt and nutrient loading analysis	Compute current ambient TDS and nitrate and assess assimilative capacity	Prepare projections of future TDS and nitrate concentrations	Perform antidegradation analyses to support recycled water reuse	Develop/revise monitoring program to support SNMP analyses and updates
High	HAs with Bulletin 118 groundwater basins and significant volumes of current and planned recycled water reuses	Mission Viejo HA	Yes	Yes	Yes	Yes	Yes
Medium	HAs with Bulletin 118 groundwater basins and no current recycled water reuse	San Mateo HA: *(Cristianitos Creek sub-watershed only)*	In 2030 5-year Update	In 2030 5-year Update	In 2030 5-year Update	In 2030 5-year Update	In 2025 5-year Update
Low	HAs with no Bulletin 118 groundwater basins and current recycled water discharge limitation are less than or equal to the Basin Plan groundwater objectives for TDS	Laguna HA San Clemente HA	No	No	No	No	No

Current and Projected Water Quality Analysis Methods

- How will water quality conditions be analyzed to make the demonstrations required by the Recycled Water Policy?

Task 4.1 Technical Memorandum

TM 4.1 – Water Quality Analysis Methods for the 2020 SNMP

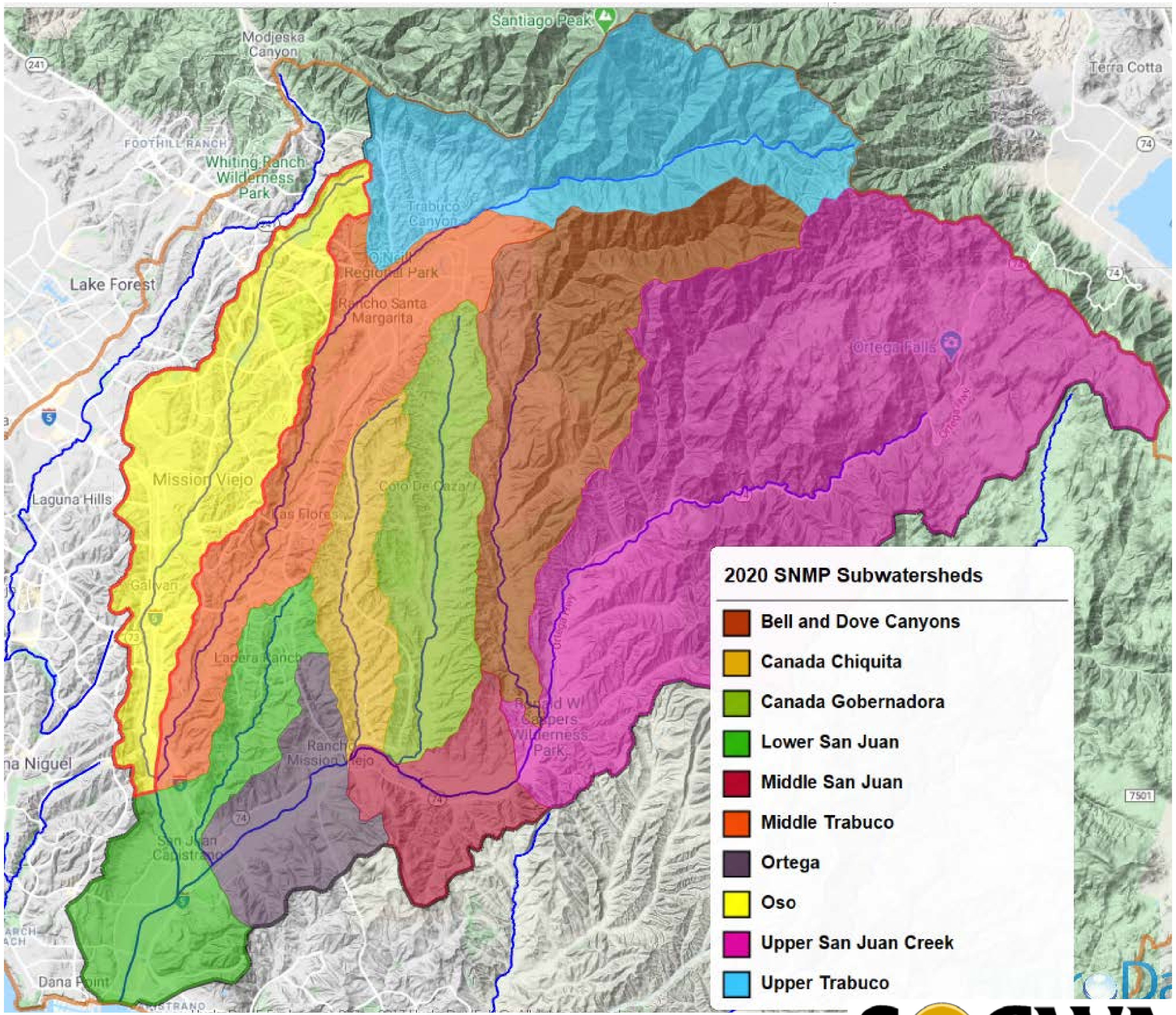
- 1.0 Background and Purpose
- 2.0 Analysis Requirements of the Recycled Water Policy
- 3.0 Technical Methods Used in the 2014 SNMP and their Perceived Challenges
- 4.0 Considerations for Selecting Technical Methods for the 2020 SNMP
- 5.0 Proposed Technical Methods for the 2020 SNMP

Technical Analysis Requirements of the 2018 Policy

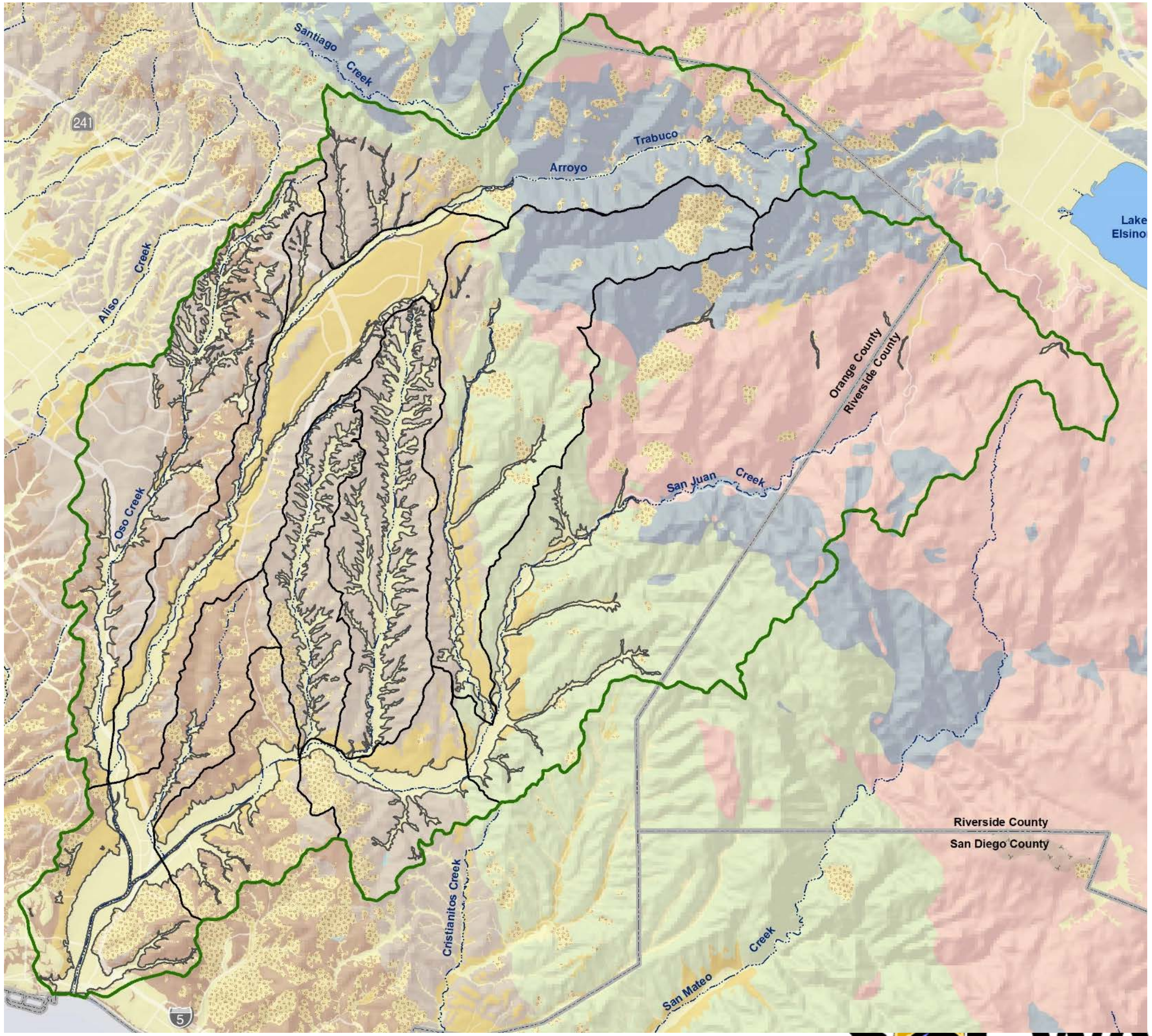
- Characterization of current concentrations of salts and nutrients in groundwater.
- Characterization of the mechanisms of salt and nutrient loading and their fate and transport in the groundwater system.
- Quantification of salt and nutrient loading, by source.
- Estimation of future changes to concentrations of salts and nutrients in groundwater basins based on expected salt and nutrient loading under existing and future water management conditions.

Considerations for Selecting Technical Methods

- Hydrogeologic Considerations
- Fate and Transport of Salts and Nutrients in the San Juan Creek Watershed
- Information Required to Compute Salt and Nutrient Loading

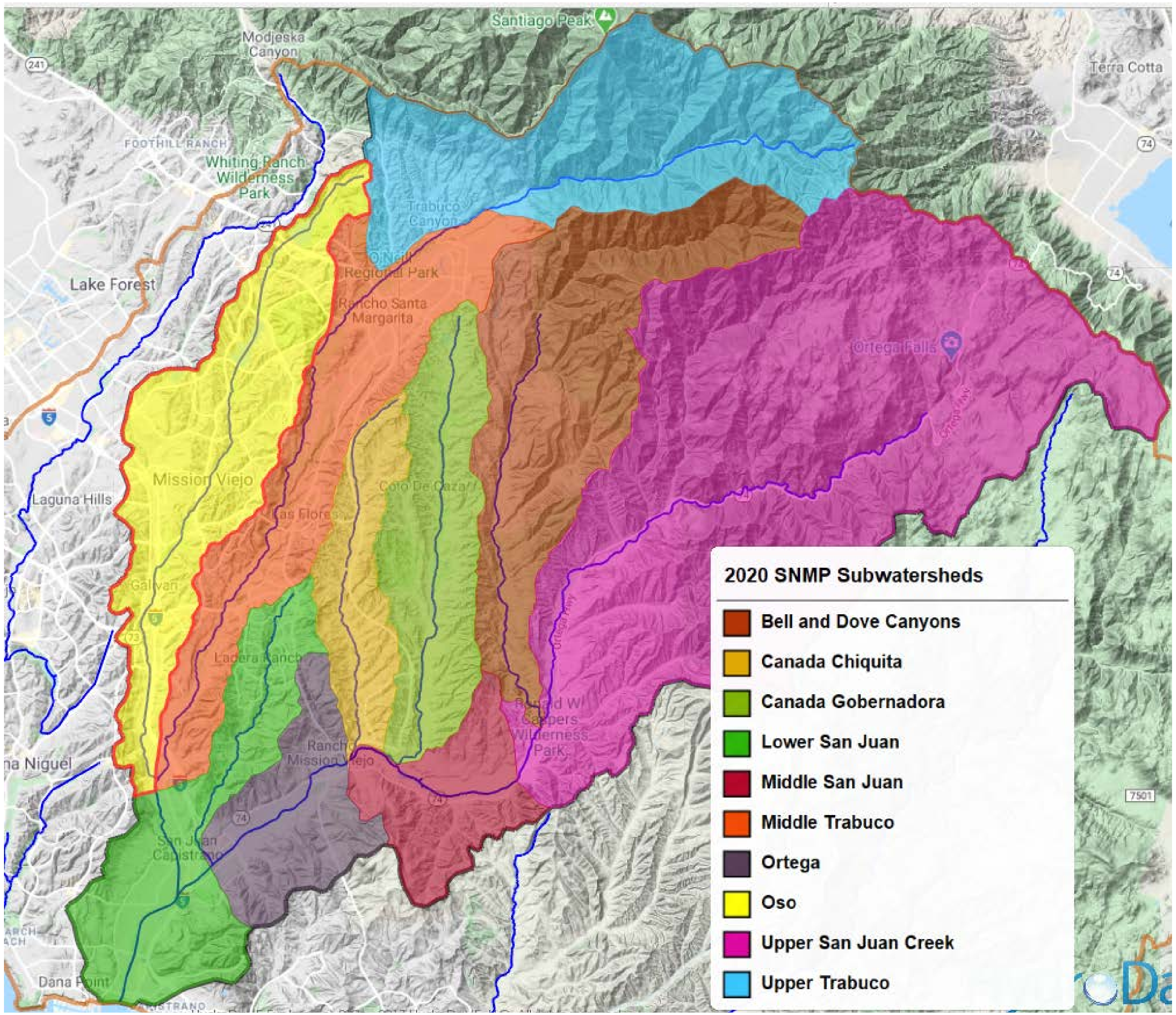


HSA *(sub-watershed)*	Storage Volume (af) *(as Estimated by DWR in 1972)*
Oso	6,550
Upper Trabuco	1,580
Middle Trabuco	16,770
Gobernadora *Chiquita Canyon* *Gobernadora Canyon*	14,030 *4,850* *9,180*
Upper San Juan *Bell Canyon* *Upper San Juan*	6,850 *3,490* *3,360*
Middle San Juan	10,850
Ortega/Lower San Juan	33,320
Total	**89,950**



Hydrogeologic Considerations

- Recharge
  - Streambed infiltration
  - Deep infiltration of precipitation and applied water for irrigation
  - Bedrock inflow
  - Subsurface inflow from adjacent basins
- Discharge
  - Groundwater pumping
  - Surfacing (rising) groundwater
  - Evapotranspiration
  - Subsurface Outflow to adjacent Basins and the Pacific Ocean



Model-Estimated Recharge – Lower San Juan and Ortega HSA

Table 1b

Annual Water Budget for the Alluvial Groundwater Basin in the Lower San Juan and Ortega HSAs

Year	Recharge Components (af)					Discharge Components (af)						Recharge minus Discharge (af)	Ratio of Recharge to Storage Capacity (%)
	Constant Head Inflow from Pacitic Ocean	Streambed Infiltration	Deep Infiltration of Precip. and Applied Water	Subsurface Inflow from Adjacent HSAs and Bedrock	Total Recharge	Constant Head Outflow to Pacitic Ocean	Ground-water Pumping	Rising Groundwater Discharge	Ground-water ET	Subsurface Outflow to HSAs and Bedrock	Total Discharge		
2001	11	4,268	83	877	5,239	351	143	4,487	353	146	5,480	-240	20%
2002	11	2,531	56	856	3,453	266	234	3,040	372	103	4,014	-562	13%
2003	8	4,725	117	818	5,668	370	99	4,102	307	116	4,994	674	21%
2004	10	3,547	68	780	4,404	313	849	3,708	381	96	5,347	-943	17%
2005	7	12,497	276	822	13,601	808	3,280	9,197	282	127	13,694	-93	51%
2006	10	8,202	93	804	9,108	365	6,645	1,829	284	66	9,190	-81	34%
2007	13	2,425	39	573	3,050	220	3,774	637	289	38	4,959	-1,909	12%
2008	16	5,073	64	724	5,877	268	2,677	1,360	241	51	4,597	1,280	22%
2009	39	5,460	102	668	6,268	225	4,412	1,647	267	66	6,617	-348	24%
2010	48	6,120	68	757	6,993	248	3,570	1,820	296	68	6,001	991	26%
2011	28	11,496	169	990	12,683	645	3,046	7,774	297	125	11,887	796	48%
2012	24	6,488	78	992	7,582	250	6,661	1,980	314	71	9,277	-1,694	29%
2013	26	5,567	77	914	6,584	251	6,756	1,403	261	71	8,742	-2,158	25%
2014	42	5,085	67	916	6,110	157	6,932	538	184	71	7,882	-1,772	23%
2015	53	3,580	27	729	4,389	170	3,770	422	129	73	4,564	-175	17%
2016	11	4,365	58	605	5,039	291	2,009	1,230	167	77	3,773	1,266	19%
Average	22	5,714	90	802	6,628	325	3,429	2,823	276	85	6,939	-311	25%
Median	14	5,079	72	811	5,994	267	3,425	1,824	287	72	5,740	-208	23%
Max	53	12,497	276	992	13,601	808	6,932	9,197	381	146	13,694	1,280	51%
Min	7	2,425	27	573	3,050	157	99	422	129	38	3,773	-2,158	12%
												Approximate Storage Capacity (af)	**26,500**
												Groundwater in Storage Replacement Time	**(yrs)**
												Average	**4.0**
												Median	**4.4**
												Max	**1.9**
												Min	**8.7**

Model-Estimated Recharge – Lower San Juan and Ortega HSA

Subsurface Outflow to HSAs and Bedrock	Total Discharge	Recharge minus Discharge (af)	Ratio of Recharge to Storage Capacity (%)
146	5,480	-240	20%
103	4,014	-562	13%
116	4,994	674	21%
96	5,347	-943	17%
127	13,694	-93	51%
66	9,190	-81	34%
38	4,959	-1,909	12%
51	4,597	1,280	22%
66	6,617	-348	24%
68	6,001	991	26%
125	11,887	796	48%
71	9,277	-1,694	29%
71	8,742	-2,158	25%
71	7,882	-1,772	23%
73	4,564	-175	17%
77	3,773	1,266	19%
85	6,939	-311	25%
72	5,740	-208	23%
146	13,694	1,280	51%
38	3,773	-2,158	12%

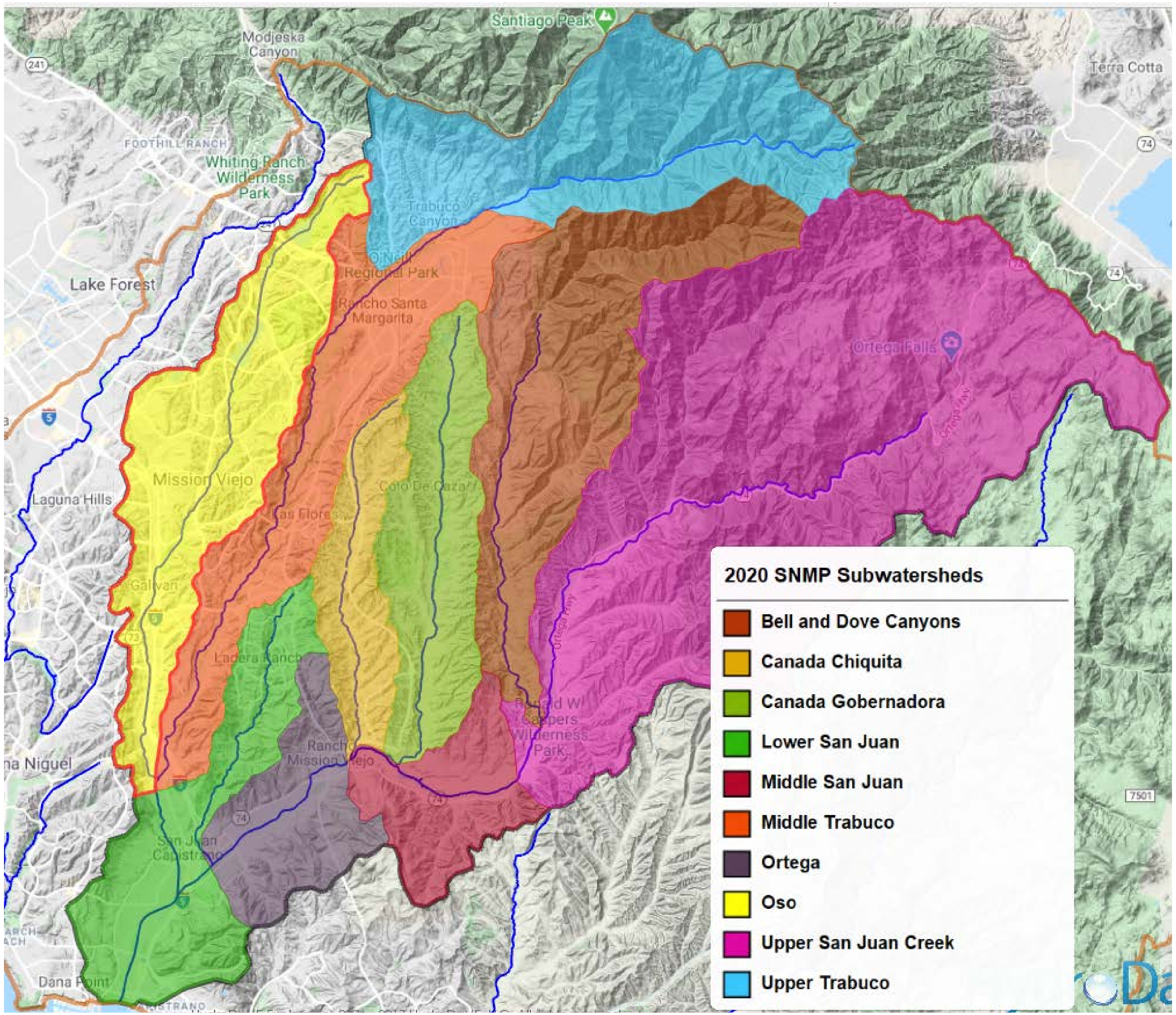
Approximate Storge Capacity (af)	26,500
roundwater in Storage Replacement Time	(yrs)
Average	4.0
Median	4.4
Max	1.9
Min	8.7

38 3,773 -2,158 12%

Approximate Storge Capacity (af)	26,500
Groundwater in Storage Replacement Time	(yrs)
Average	4.0
Median	4.4
Max	1.9
Min	8.7

Hydrogeologic Considerations Summary

- Storage volume is small
- Recharge volume is large relative to storage, resulting in fast turnover (replacement) of water in storage
- Steep topography
- Aquifers fill completely in winter and spring
- Aquifers deplete in summer and fall



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Fate and Transport of Salt and Nutrients in the San Juan Creek Watershed

- The most significant source of recharge to groundwater is from streambed infiltration (the recharge of surface flow in streams).
- Stream discharges (Q) in the San Juan Creek Watershed are comprised of:
  - Precipitation and applied water runoff from the land surface (RO),
  - interflow from the soil zone (IF), and
  - rising groundwater (RGW):
- The constituent concentration of stream discharge will be a function of the relative proportion of each component contributing to flow

Fate and Transport of Salt and Nutrients in the San Juan Creek Watershed

Given, $Q = RO_P + RO_{AW} + IF + RGW$

- the primary drivers of salt and nutrient loading and transport in the San Juan Creek Watershed are:
  - Precipitation
  - ET
  - land use
  - irrigation practices, and
  - natural sources of loading from the environment (including from the land surface and sedimentary bedrock).

Fate and Transport of Salt and Nutrients in the San Juan Creek Watershed

Undeveloped Watersheds (precipitation only – no applied water)

- Winter/Spring: groundwater in storage will be predominantly from streambed infiltration of precipitation runoff and interflow, therefore:

$$cGW_{U,W} = cRO_P + = cP + a$$

cGW_{UW} is the constituent concentration of groundwater in wet-weather conditions

cRO_P is the constituent concentration of precipitation runoff

cP is the natural constituent concentration of precipitation

a is the constituent increment added via dissolution of minerals from the land surface and soil zone

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Fate and Transport of Salt and Nutrients in the San Juan Creek Watershed

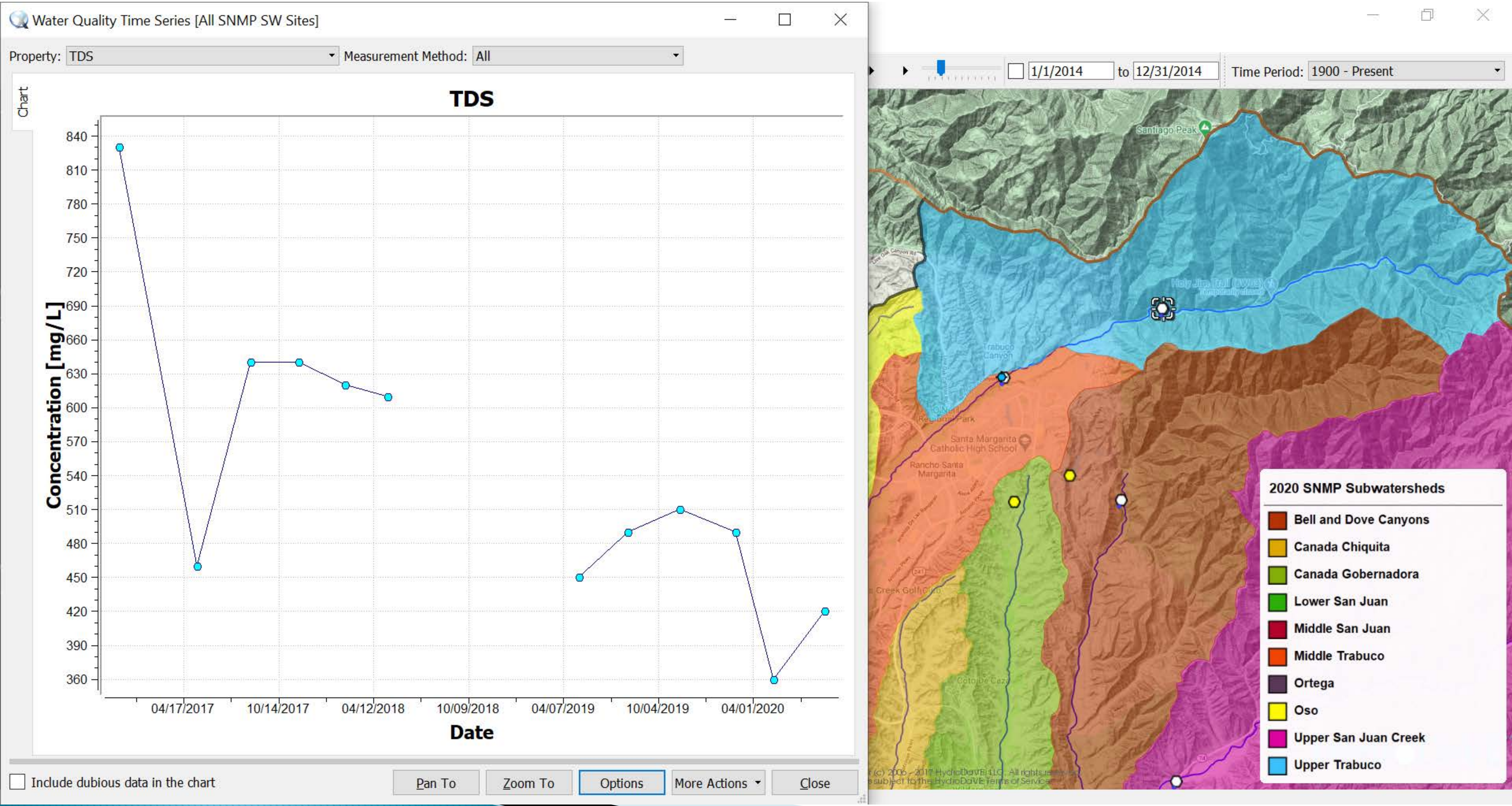
Undeveloped Watersheds (precipitation only – no applied water)

- Summer/Fall: streamflow discharge is composed of rising groundwater, therefore :

$$cQ_{U,D} = cGW_{U,W} + b$$

$cQ_{U,D}$ is the constituent concentration of stream discharge in dry-weather conditions

b is the constituent increment added via additional dissolution of minerals due to residence time in the aquifer and/or inflow from adjacent and underlying sedimentary bedrock


Water Quality Time Series [All SNMP SW Sites]
Property: TDS
Measurement Method: All
Chart
TDS
Concentration [mg/L]
840
810
780
750
720
690
660
630
600
570
540
510
480
450
420
390
360
04/17/2017
10/14/2017
04/12/2018
10/09/2018
04/07/2019
10/04/2019
04/01/2020
Date
Include dubious data in the chart
Pan To
Zoom To
Options
More Actions
Close
1/1/2014
to
12/31/2014
Time Period:
1900 - Present
Santiago Peak
Trabuco Canyon
Santa Margarita Catholic High School
Rancho Santa Margarita
2020 SNMP Subwatersheds
Bell and Dove Canyons
Canada Chiquita
Canada Gobernadora
Lower San Juan
Middle San Juan
Middle Trabuco
Ortega
Oso
Upper San Juan Creek
Upper Trabuco

Fate and Transport of Salt and Nutrients in the San Juan Creek Watershed

Developed Watersheds (precipitation and applied water)

- Winter/Spring: groundwater in storage will be predominantly from streambed infiltration of precipitation runoff, interflow, and applied water runoff therefore:

$$cGW_{D,W} = cRO_{P,AW} = cAW + c$$

cGW_{DW} is the constituent concentration of groundwater in wet-weather conditions

cRO_{PAW} is the constituent concentration of precipitation and applied water runoff

cAW is the constituent concentration of applied water for irrigation

c is the constituent increment added via precipitation and the dissolution of fertilizers or other mineral sources on the land surface

Fate and Transport of Salt and Nutrients in the San Juan Creek Watershed

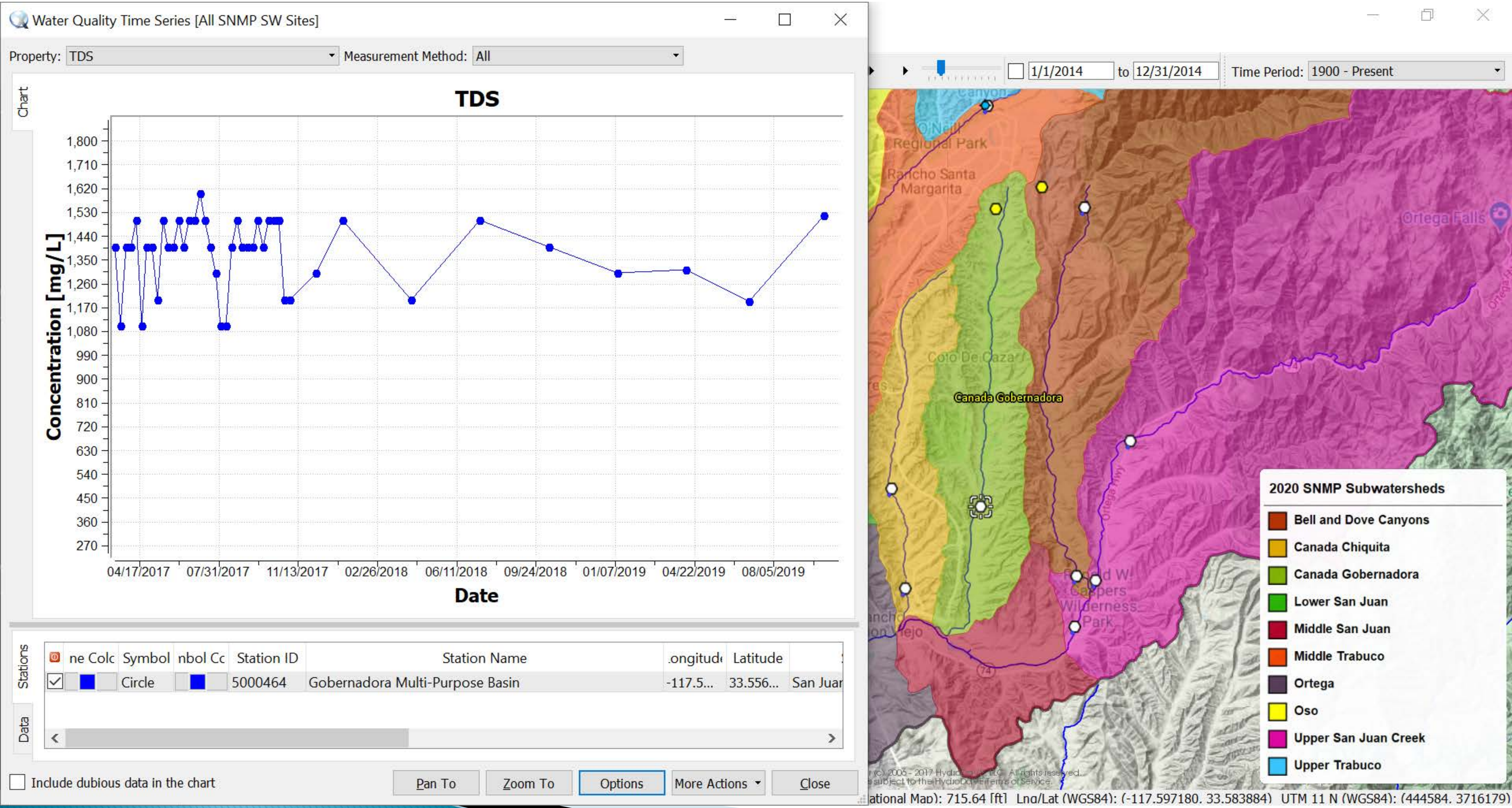
Developed Watersheds (precipitation and applied water)

- Summer/Fall: streamflow discharge is composed of rising groundwater and applied water runoff, therefore :

$$cQ_{D,D} = cGW_{U,W} + d$$

$cQ_{D,D}$ is the constituent concentration of stream discharge in dry-weather conditions

d is the constituent increment added via additional dissolution of minerals due to residence time in the aquifer and/or inflow from adjacent and underlying sedimentary bedrock



Water Quality Time Series [All SNMP SW Sites]
Property: TDS
Measurement Method: All
Chart
TDS
Concentration [mg/L]
1,800
1,710
1,620
1,530
1,440
1,350
1,260
1,170
1,080
990
900
810
720
630
540
450
360
270
04/17/2017
07/31/2017
11/13/2017
02/26/2018
06/11/2018
09/24/2018
01/07/2019
04/22/2019
08/05/2019
Date
Stations
Data
ne Colc
Symbol
nbol Cc
Station ID
Station Name
.ongitud
Latitude
Circle
5000464
Gobernadora Multi-Purpose Basin
-117.5...
33.556...
San Juar
Include dubious data in the chart
Pan To
Zoom To
Options
More Actions
Close
1/1/2014
to
12/31/2014
Time Period:
1900 - Present
Regional Park
Rancho Santa Margarita
Coto De Caza
Canada Gobernadora
Ortega Falls
Ortega Hwy
Caspers Wilderness Park
2020 SNMP Subwatersheds
Bell and Dove Canyons
Canada Chiquita
Canada Gobernadora
Lower San Juan
Middle San Juan
Middle Trabuco
Ortega
Oso
Upper San Juan Creek
Upper Trabuco
ational Map): 715.64 [ft] Lng/Lat (WGS84): (-117.597180, 33.583884) UTM 11 N (WGS84): (444584, 3716179)

Information Required to Compute Loading

- streambed infiltration
- deep infiltration of precipitation
- deep infiltration of applied water
- subsurface inflow from the sedimentary bedrock system
- subsurface inflow from upgradient HSAs
- subsurface outflow to downgradient HSAs
- groundwater pumping surfacing groundwater
- ET
- subsurface outflow to the sedimentary bedrock system subsurface outflow to the Pacific Ocean

Information Required to Compute Loading

- Except for groundwater pumping, **numerical surface and ground water flow modeling tools are required** to estimate the current and projected recharge and discharge volumes.
- The TDS and nitrate concentrations of the current and projected recharges and discharges can be estimated based on groundwater, surface water, and water supply monitoring data.

Methods for Analysis of Current Water Quality Conditions

- Comparison to Basin Plan objectives
  - Water quality summary statistics
  - Compliance analysis for TDS and nitrate in groundwater per Basin Plan method

Table 3
Annual Assessment of Basin Plan Compliance

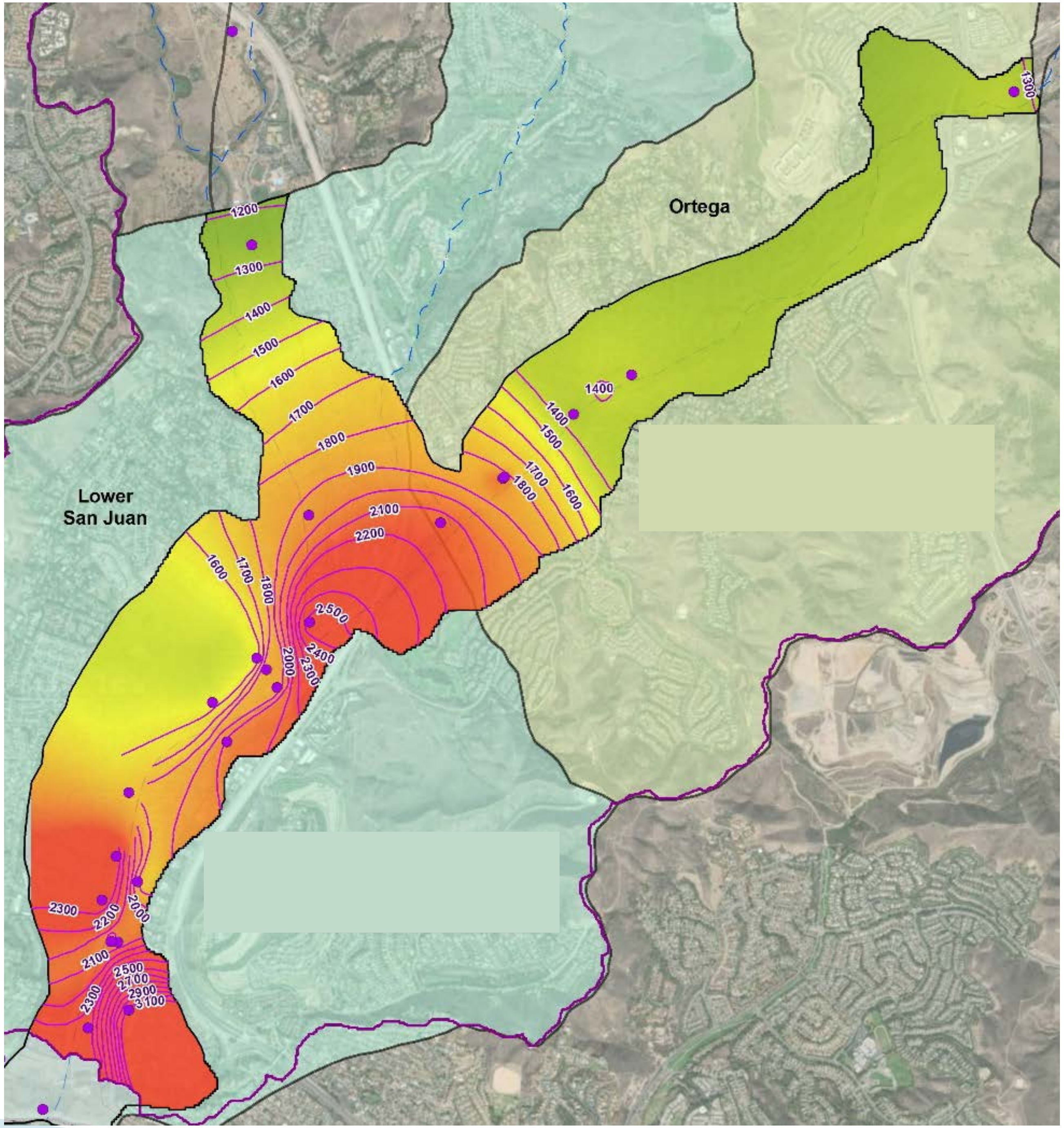
HSA: Lower San Juan
Well Name: SJBA-4
Basin Plan Objective (BPO): 1200 mgl
Assimilative Capacity: No

Well Construction and Aquifer Representativeness *(values in feet)*					
Bottom of Aquifer Depth at Well Location	*Total Depth of Well*	*Depth to Top of Well Screen*	*Depth to Bottom of Well Screen*	*Median Depth To Water*	*All, Deep, or Shallow Aquifer Represented*
150	128	81	124	82	All

Year (# of Years with Data for Summary)	Number of TDS Samples	Minimum Value (mgl)	Maximum Value (mgl)	Number of Samples >BPO	Percent of Samples >BPO
Summary of TDS Data for Period of Record					
16	140	1,180	2,200	139	99%
TDS Data by Year					
1978	1	1,250	1,250	1	100%
2005	4	1,180	1,770	3	75%
2006	6	1,320	1,680	6	100%
2007	19	1,260	1,880	19	100%
2008	6	1,570	1,800	6	100%
2009	10	1,610	2,100	10	100%
2010	8	1,800	2,200	8	100%
2011	11	1,700	2,000	11	100%
2012	9	1,500	1,800	9	100%
2013	12	1,600	1,800	12	100%
2014	11	1,800	1,900	11	100%
2015	7	1,700	2,000	7	100%
2016	6	1,800	1,900	6	100%
2017	10	1,700	2,000	10	100%
2018	11	1,800	2,000	11	100%
2019	9	1,520	1,960	9	100%

Methods for Analysis of Current Water Quality Conditions

- Spatial distribution of TDS and nitrate
  - TDS and nitrate statistical trend analysis
  - Point and raster maps of constituent concentrations
  - Estimates of Volume-Weighted TDS Concentrations
  - Derivation of waste increment coefficients *a, b, c, and d* from monitoring data



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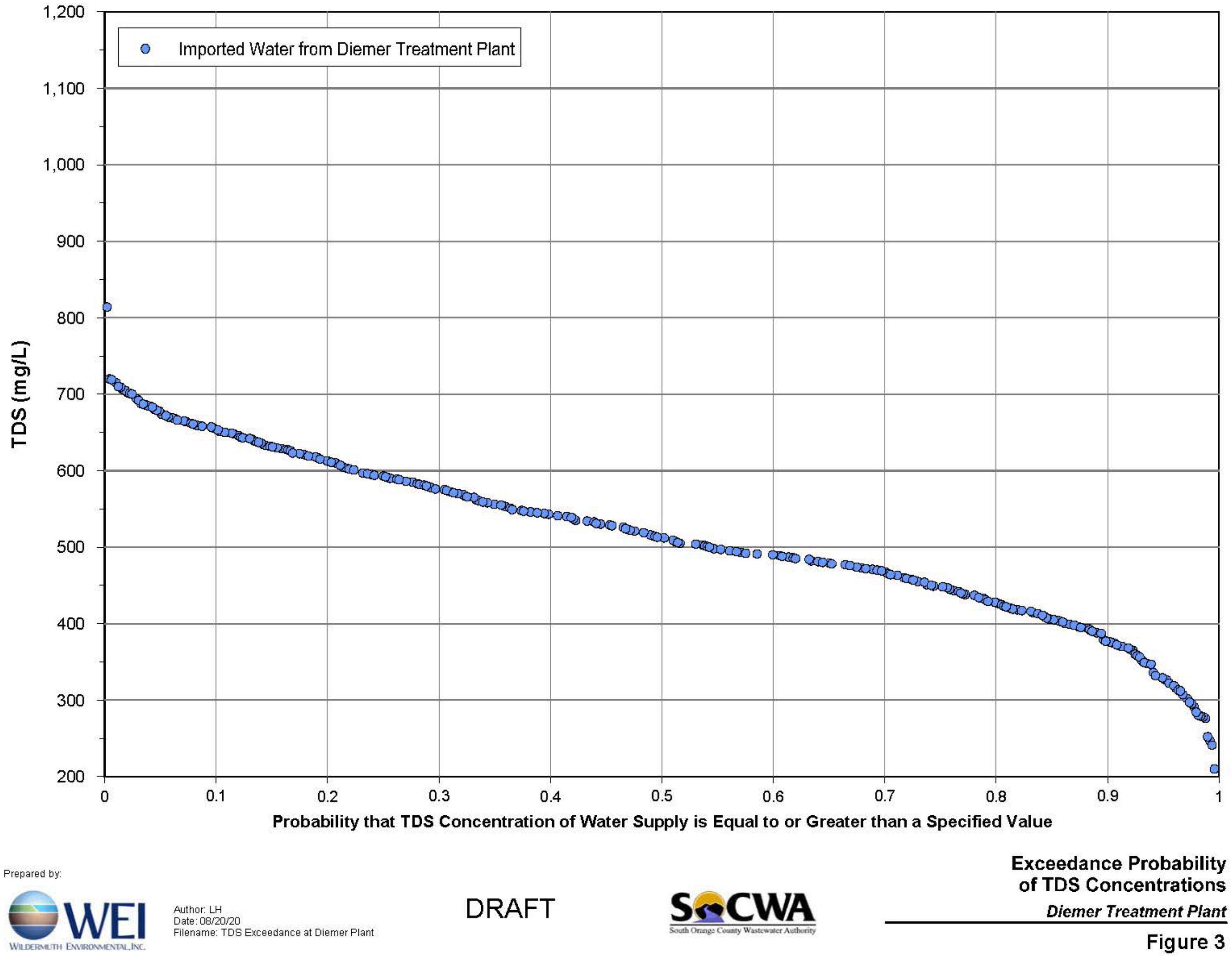
Methods for Analysis of Current Water Quality Conditions

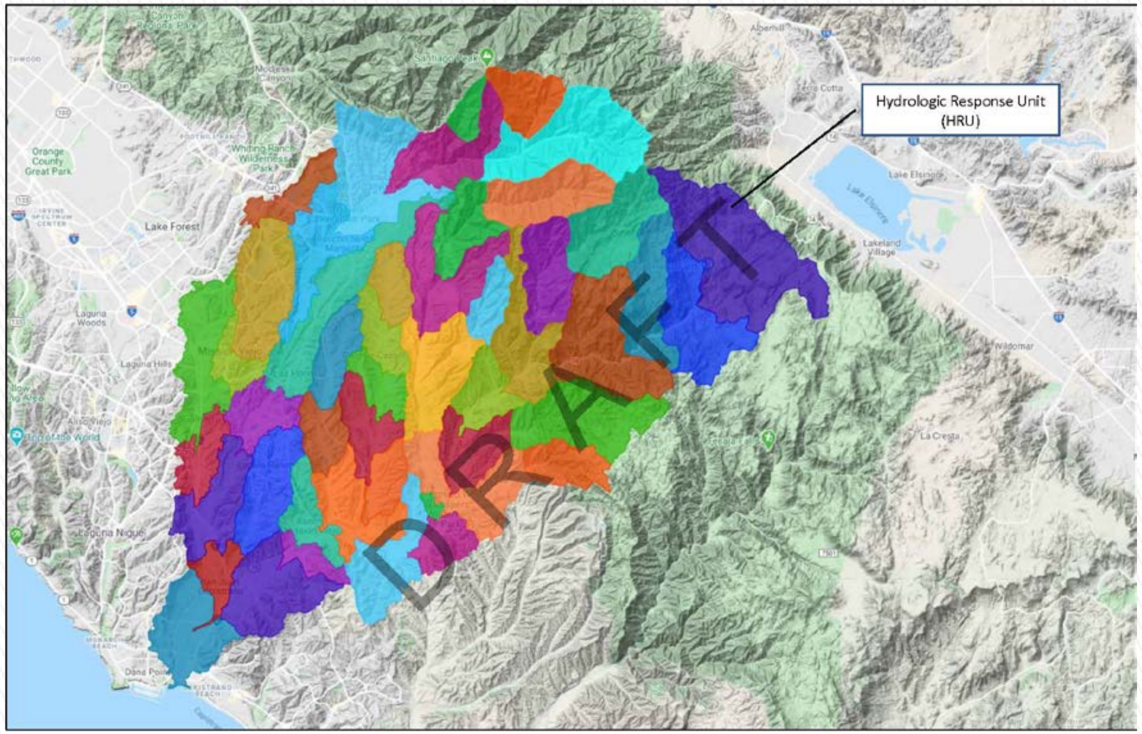
- Water Quality of Other Sources of Water Supply
  - Water quality summary statistics
  - Source water general chemistry
  - Time histories of TDS and nitrate
  - TDS and nitrate frequency distribution plots



Methods to Estimate Loading and Project Changes in Groundwater TDS Concentrations

- There are two ways to project changes in TDS in groundwater:
  - (1) applying the same or similar analytical mass-balance approaches applied in the 2014 SNMP, or
  - (2) build and calibrate a numerical fate and transport model to couple with a numerical groundwater flow model (such as MT3D-USGS built on the GSFLOW model).

GS Flow: Integrated Surface and Ground Water Numerical Flow Model



Numerical Model Boundary

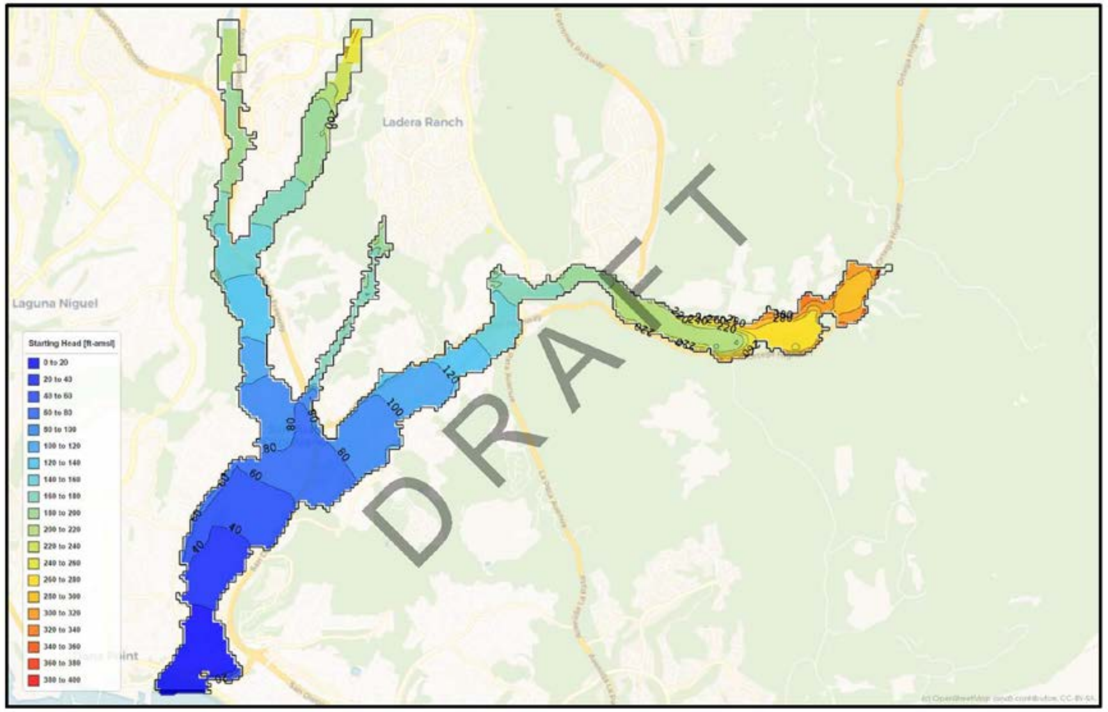


Figure 3-6. Initial Groundwater Elevation Contours for June 2000 of the First Layer of the Groundwater Flow Model

Alluvial Aquifer Boundary

Methods to Estimate Loading and Project Changes in Groundwater TDS Concentrations

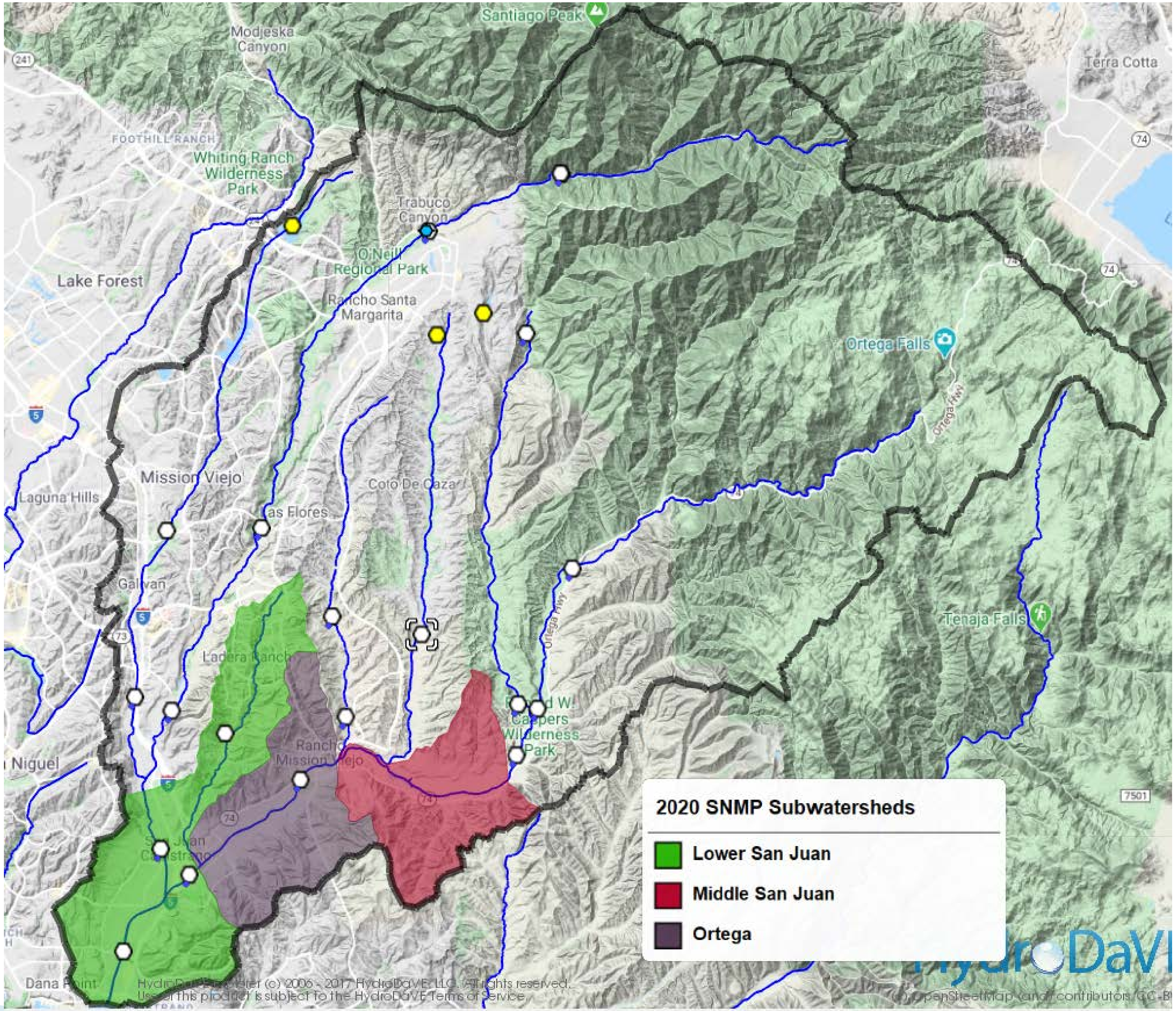
- Option (2) to build and calibrate numerical fate and transport is infeasible:
  - existing numerical groundwater-flow model, GSFLOW, cannot be uniquely calibrated to the upper watershed HSAs due to a lack of stream discharge data in these HSAs
  - The sedimentary bedrock can be a significant source of TDS to the alluvial system. The numerical model would be extremely difficult to calibrate due to the absence of data on its water quality.
  - The MT3D-USGS model has limitations in how it handles streams that dry up—it creates numerical errors that propagate throughout the model domain and render the model results useless.

Methods to Estimate Loading and Project Changes in Groundwater TDS Concentrations

- Because of the noted limitations, analytical mass-balance approaches to estimating future changes in TDS concentrations are necessary.
- Based on the hydrogeologic and fate and transport mechanisms, such methods are scientifically appropriate.
- Different approaches are proposed for the upper and lower watershed HSAs, as follows

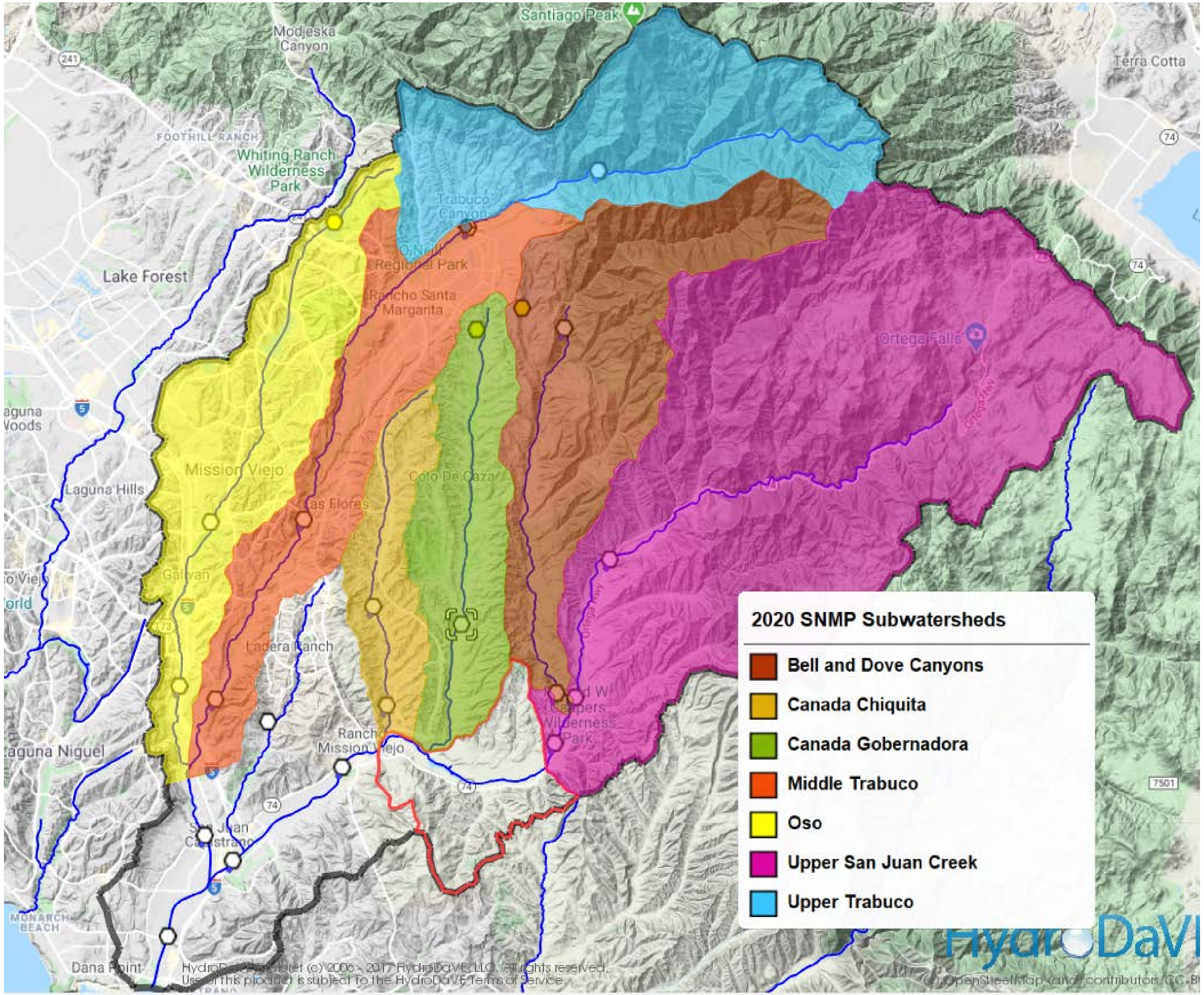
Lower Watershed HSAs

- CSRM mass-balance approach
- Mixing model based on water and salt budget
- Water budget driven by GS Flow model
- TDS concentrations based on monitoring data and current water quality analyses
- produces an annual time-history of TDS concentrations by HSA for variable hydrologic conditions (wet and dry periods)



Upper Watershed HSAs

- it is not possible to estimate the stream discharges or the recharges in the upper watershed HSAs.
- Changes to groundwater quality need to be estimated based on changes to concentration of streambed infiltration, which are a proxy for groundwater quality



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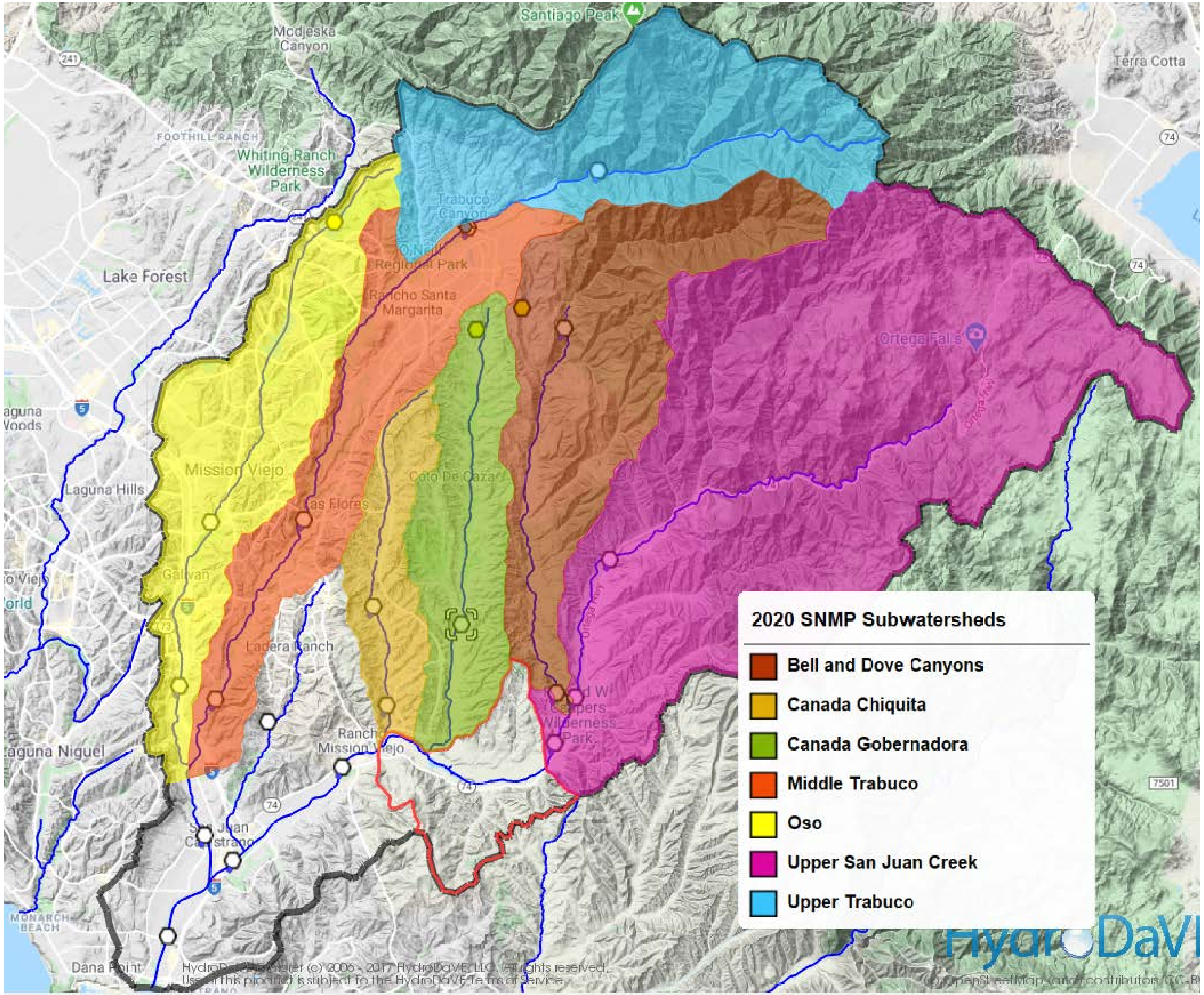
Upper Watershed HSAs

Changes driven by:

- changes to overlying land use (e.g. urban development that will increase the volume of applied water for irrigation)
- changes to the water supplies used to meet outdoor water demands (e.g. increased recycled water use to offset use of potable supplies).
- New groundwater recharge projects
- New groundwater pumping projects



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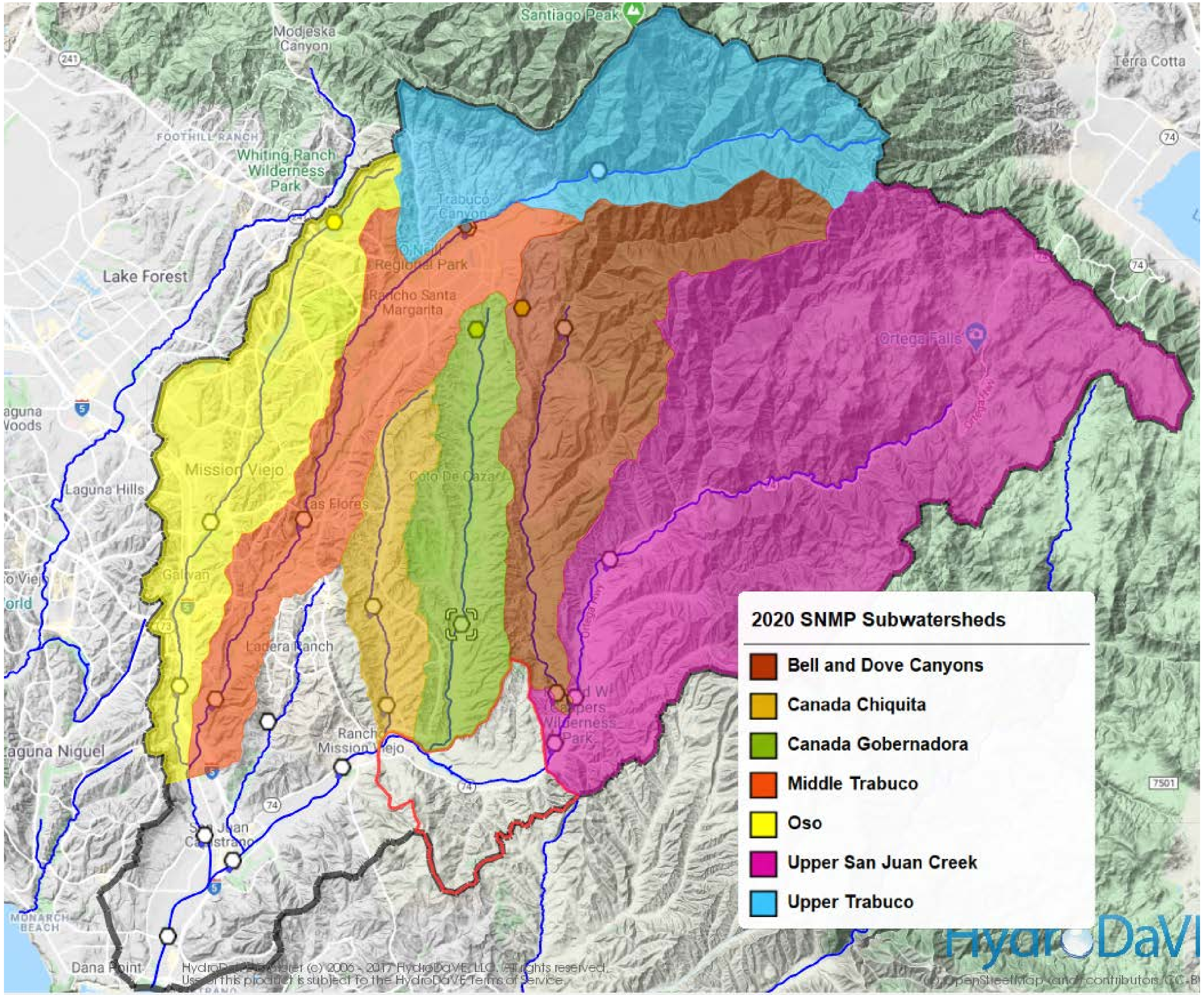
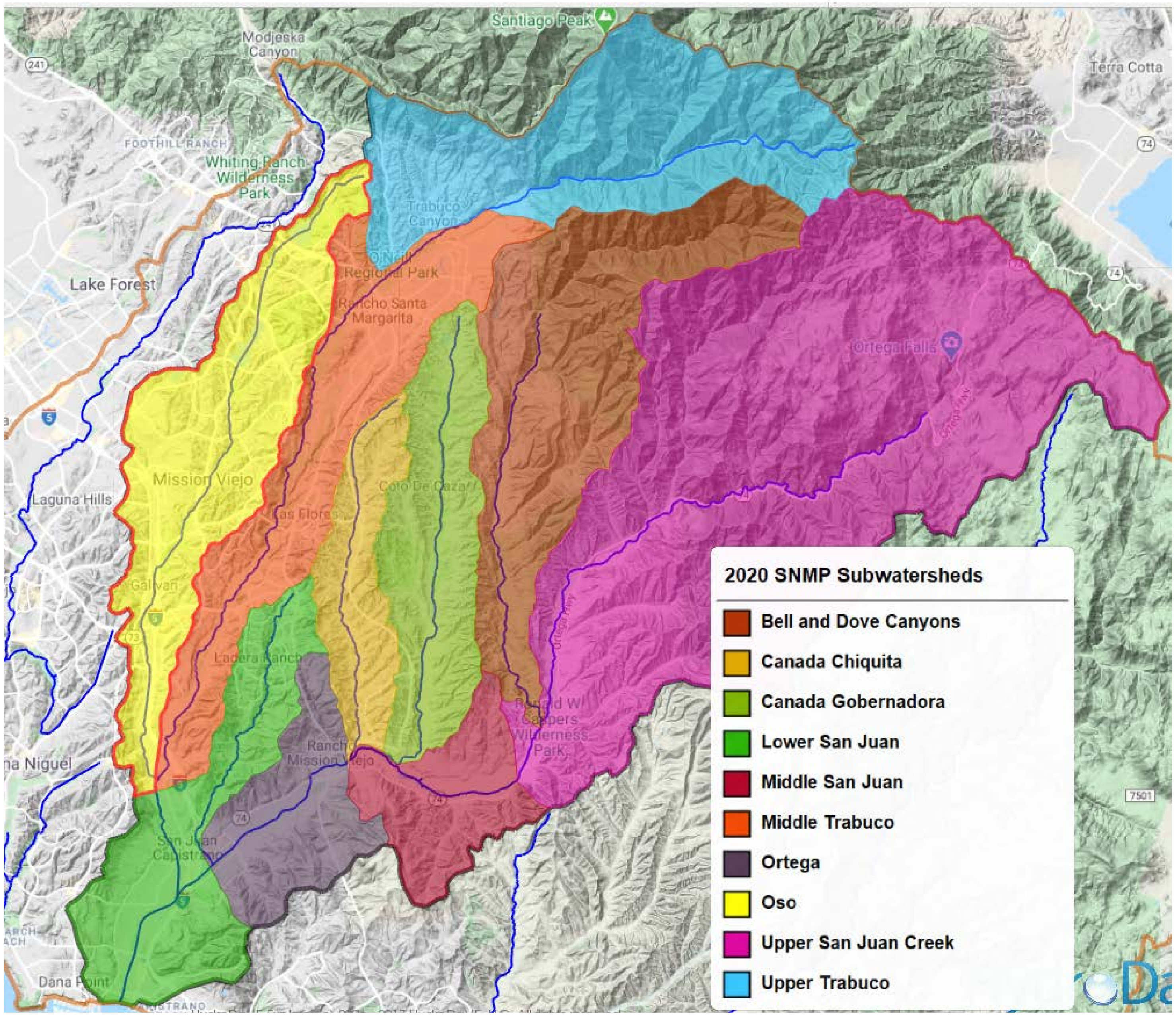
Upper Watershed HSAs

- Derive the TDS increment value(s) of *c* and *d* from data
- Estimate the projected volume-weighted TDS concentration of the outdoor applied water supply served in the HSA based on planning data
- Estimated the range of future TDS concentrations in groundwater in the HSA based on fate and transport equations



All Watershed HSAs

The projected TDS concentrations will be compared to historical and current water quality trends and conditions at individual monitoring sites to qualitatively assess the expected changes to water quality in a specific location based on the proximity to recharge stresses that are impacted by planning conditions, such as areas of increased recycled water use.



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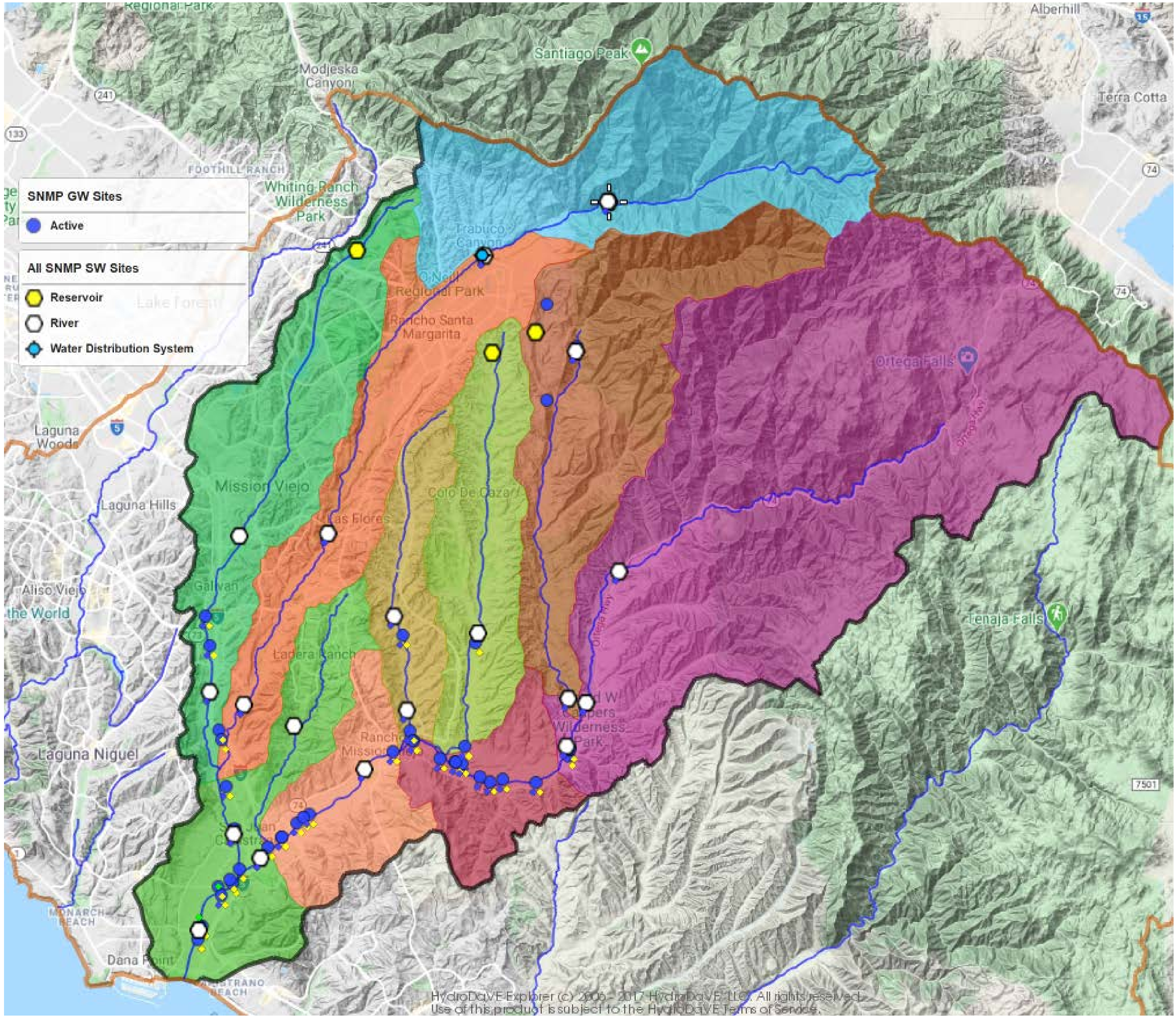
SNMP Monitoring Program

- How the monitoring program supports the implementation of the SNMP

SNMP Monitoring Program
San Juan Creek Watershed

- 2015 Work Plan, initiated program in 2016
- Recycled water use GIS by HSA
- Quarterly monitoring and data collection
  - 16 surface water sites
  - 16 groundwater sites
  - SW/GW data from additional sites already monitored by agencies
- Annual report of data to San Diego Regional Board



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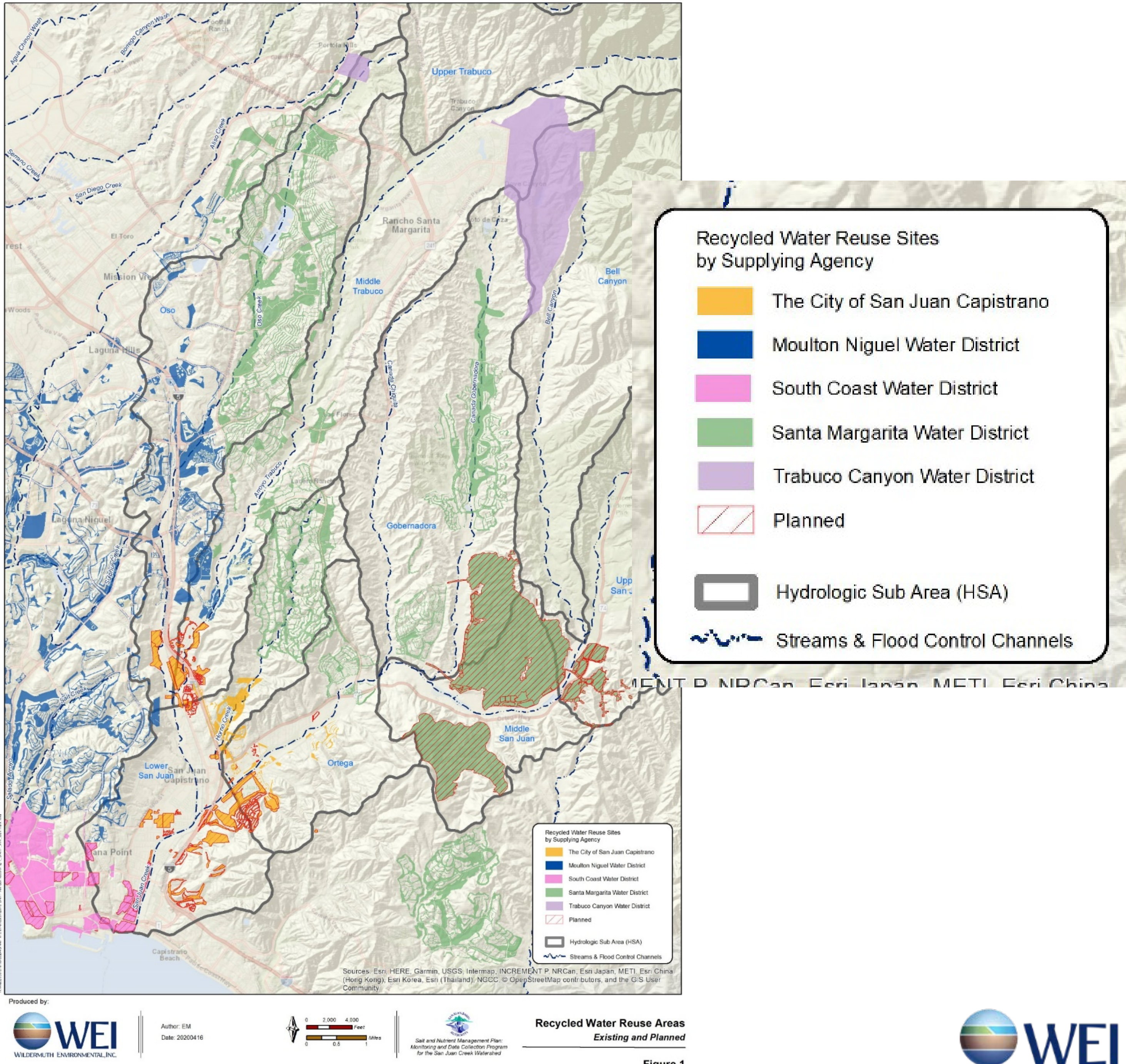
SNMP Monitoring Progra
San Juan Creek Watershe

Recycled Water Use in the San Juan Creek Watershed

Year	Total *(acre-feet)*
2014	9,336
2015	7,908
2016	9,504
2017	8,446
2018	8,617
2019	8,040



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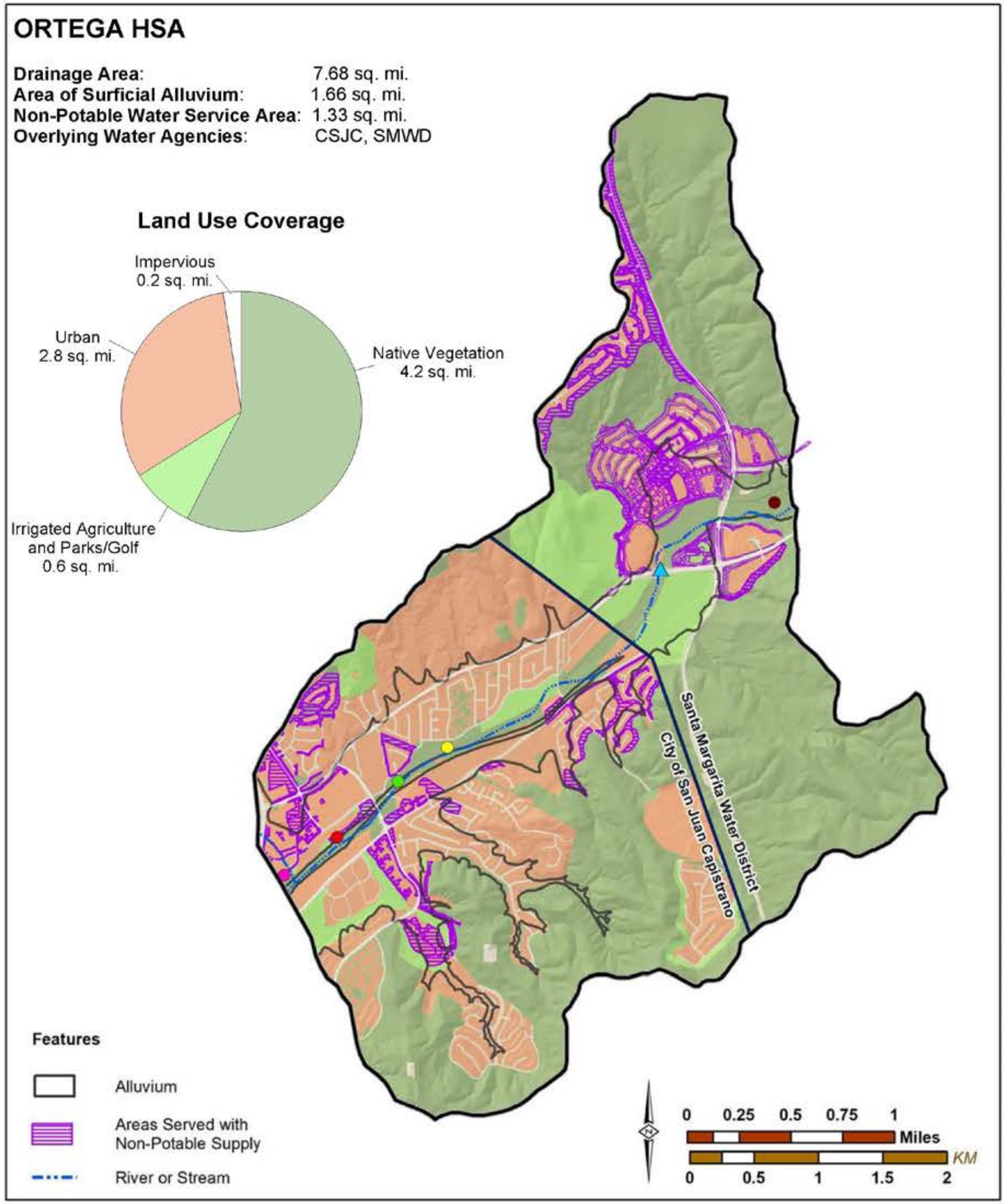
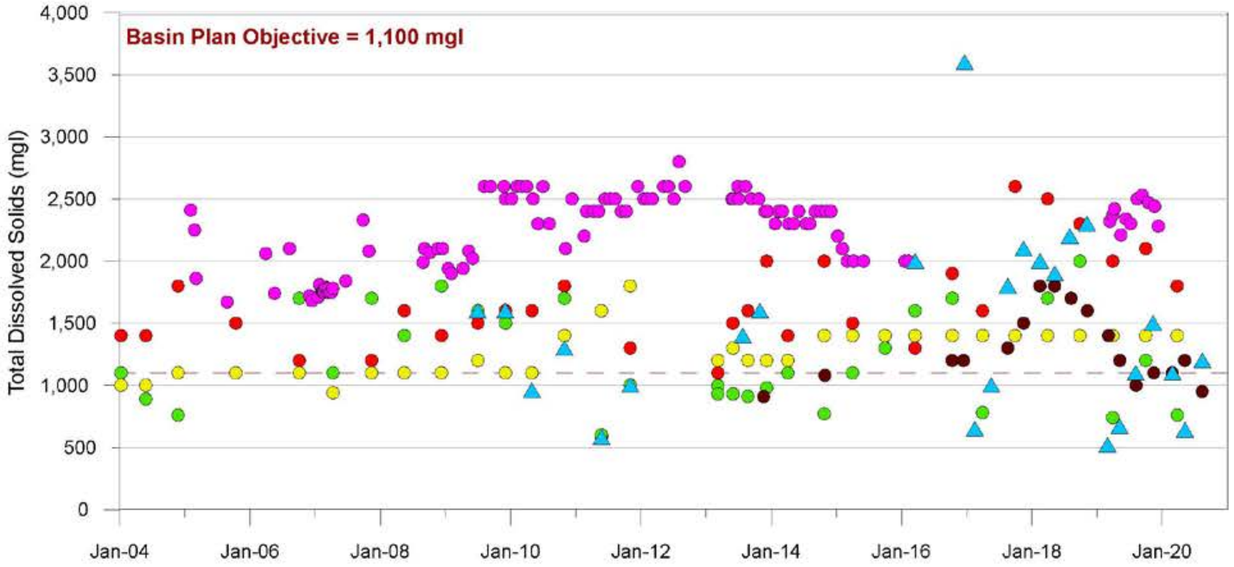
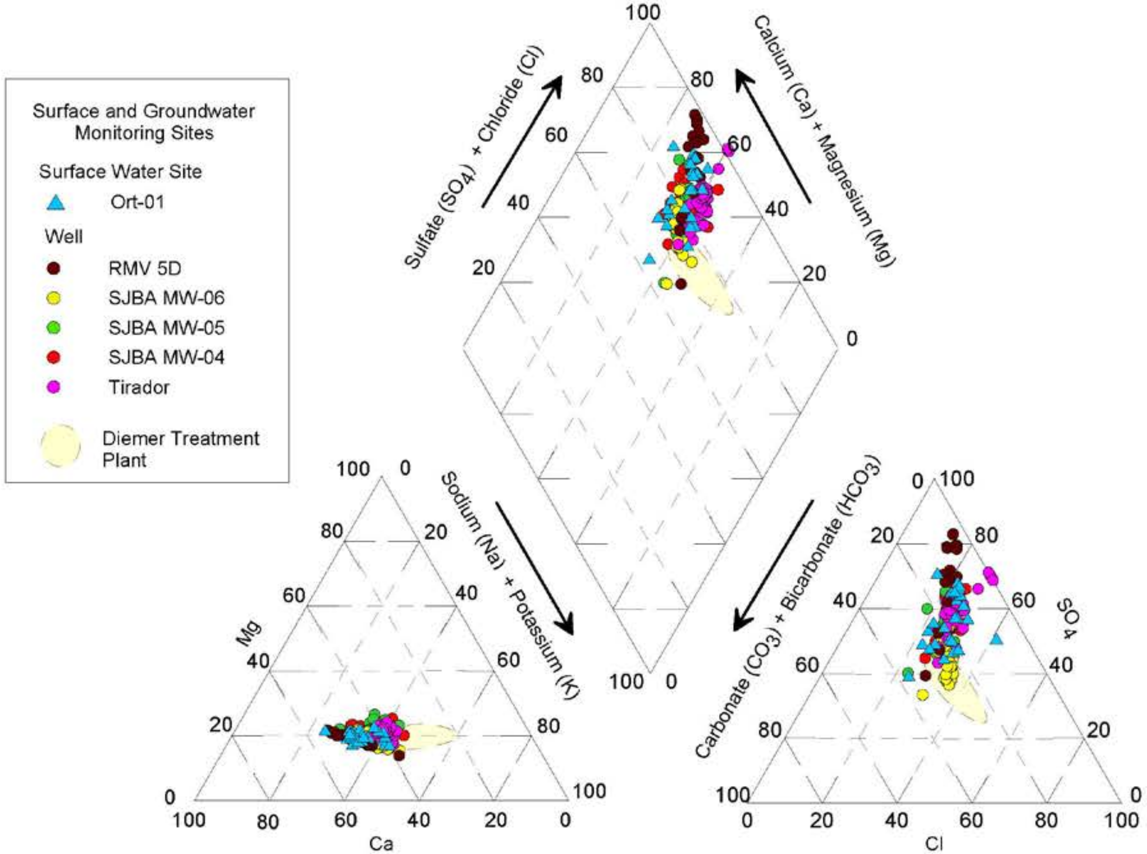

ORTEGA HSA
Drainage Area: 7.68 sq. mi.
Area of Surficial Alluvium: 1.66 sq. mi.
Non-Potable Water Service Area: 1.33 sq. mi.
Overlying Water Agencies: CSJC, SMWD
Land Use Coverage
Impervious 0.2 sq. mi.
Urban 2.8 sq. mi.
Native Vegetation 4.2 sq. mi.
Irrigated Agriculture and Parks/Golf 0.6 sq. mi.
Santa Margarita Water District
City of San Juan Capistrano
Features
Alluvium
Areas Served with Non-Potable Supply
River or Stream
0 0.25 0.5 0.75 1 Miles
0 0.5 1 1.5 2 KM


Basin Plan Objective = 1,100 mgl
Total Dissolved Solids (mgl)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
Jan-20


Surface and Groundwater Monitoring Sites
Surface Water Site
Ort-01
Well
RMV 5D
SJBA MW-06
SJBA MW-05
SJBA MW-04
Tirador
Diemer Treatment Plant
Sulfate (SO4) + Chloride (Cl)
Calcium (Ca) + Magnesium (Mg)
Sodium (Na) + Potassium (K)
Carbonate (CO3) + Bicarbonate (HCO3)
Mg
Ca
SO4
Cl

Additional Q&A

South Orange County Wastewater Authority

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