Greater Monterey County Integrated Regional Water Management Program
Regional Water Management Group Meeting

August 18, 2021
Zoom Conference Call

RWMG Entity Attendees:
Horacio Amezquita – San Jerardo Cooperative, Inc.
Jenny Balmagia – Central Coast Wetlands Group
Melanie Beretti – Monterey County Housing and Community Development Department
Shandy Carroll – Monterey County Housing and Community Development Department
Ross Clark – Central Coast Wetlands Group
Beth Febus – Big Sur Land Trust
Emily Gardner – Salinas Valley Basin Groundwater Sustainability Agency
Bridget Hoover – Monterey Bay National Marine Sanctuary
Donna Meyers – Salinas Valley Basin Groundwater Sustainability Agency (GSA)
Zane Mortensen – Rural Community Assistance Corporation
Heidi Niggemeyer – City of Salinas
Shinobu Okano – City of Salinas (Stormwater Technician)
John Olson – California State University Monterey Bay
Paul Robins – Resource Conservation District (RCD) of Monterey County
Rachel Saunders – Big Sur Land Trust
Brian True – Marina Coast Water District

Non-RWMG Attendees:
Doug Cardian
Doug Dowden – City of Marina
Larry Harlan – Central Coast Regional Water Quality Control Board
John Hunt – UC Davis
Shanta Keeling – Central Coast Regional Water Quality Control Board
Sarah Lopez – Preservation, Inc.
Kelli McCune – Sustainable Conservation
Jennifer Morales – Department of Water Resources (Climate Change)
Abby Ostovar – Montgomery and Associates
Susan Robinson – Greater Monterey County IRWM Program Director

Meeting Minutes

1. Brief Introductions.

2. Central Coast Water Board TMDL Projects in the Elkhorn Slough and Lower Salinas River Watersheds: Central Coast Water Board staff Shanta Keeling and Larry Harlan provided a summary of TMDLs under development for biostimulation in the Elkhorn Slough, and organophosphate pesticides and turbidity in the lower Salinas River watershed. In addition, they discussed a previously-adopted TMDL for nutrients in the Salinas River watershed and provided information on how to stay informed of TMDL projects.

3. CSUMB Water Quality Research: John Olson, Assistant Professor of Freshwater Ecology in the

Department of Applied Environmental Science at California State University Monterey Bay, presented research that he and his team conducted last fall to assess the relative impacts of different agricultural management practices on water quality in the Salinas and Pajaro Valleys.

4. Salinas Valley Basin Groundwater Sustainability Plans: Abby Osovar, Montgomery and Associates on behalf of the Salinas Valley Basin Groundwater Sustainability Agency, presented the Draft Groundwater Sustainability Plan Overviews for the Langley, Eastside, Upper Valley and Forebay Subbasins.

The next RWMG meeting will be held on October 20, 2021, 1:30PM – 3:30PM.

TMDL Projects in the Greater Monterey County Region

Regional Water Management Group Meeting
August 18, 2021

CALIFORNIA
Water Boards

Larry Harlan and Shanta Keeling

Objectives

- Describe what a TMDL project is
- Summarize TMDLs:
  - Currently under development in the Greater Monterey County area
  - Projects that have been completed
- Provide information on how you can participate in TMDLs under development
- Describe how you can obtain more information about all TMDL projects

Why do a TMDL?..

Federal Clean Water Act:

States Must "List" Impaired Waterbodies
Not Meeting WQ Standards

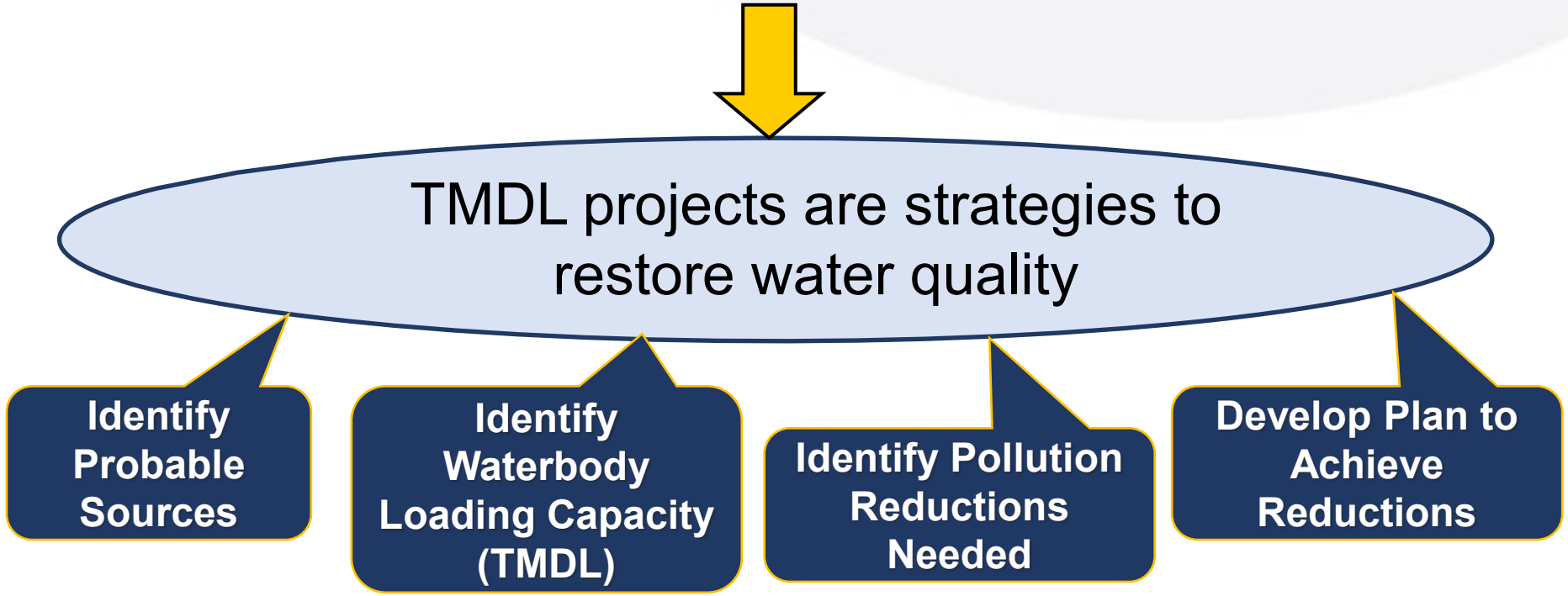
"Listed" or "Impaired" Waterbodies:

States (Water Board) must address = TMDL

State TMDL Policy

What is a TMDL?..

The maximum amount of a pollutant(s) that a surface waterbody can receive and still meet water quality standards…



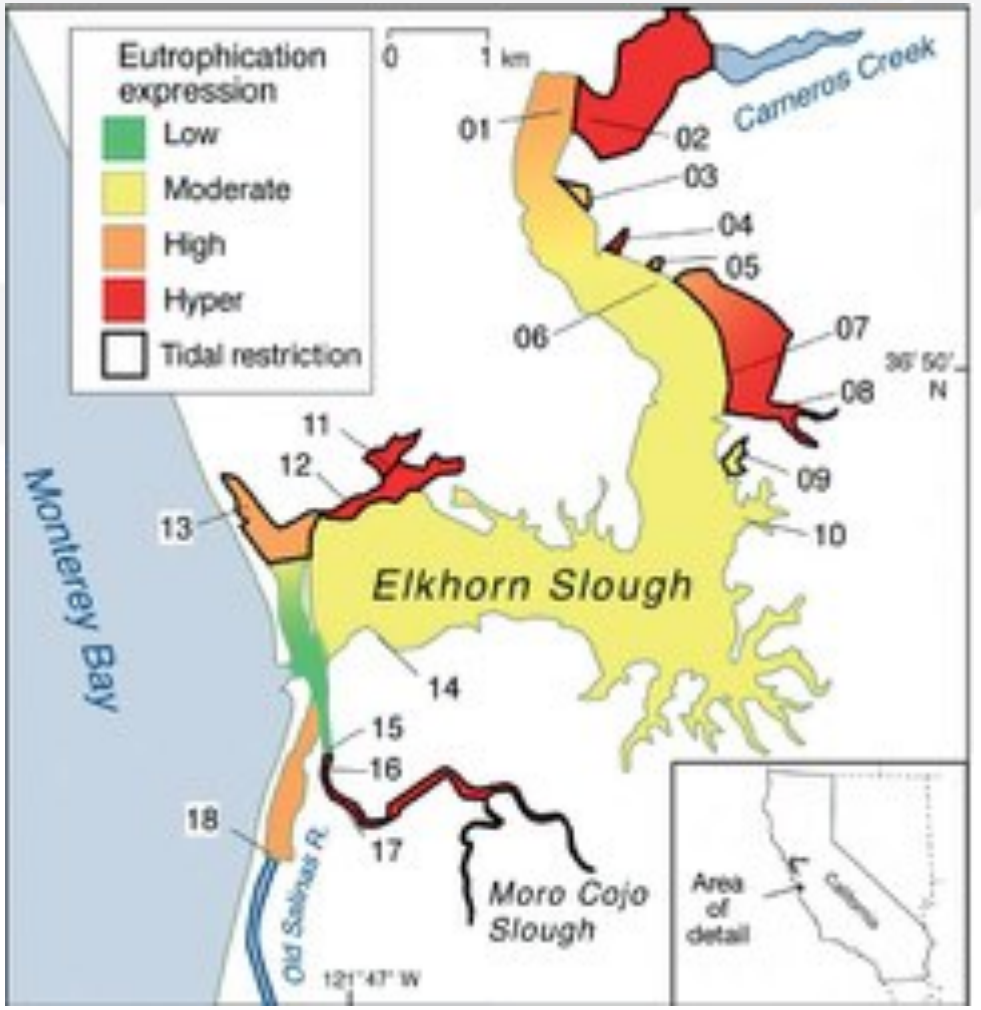
TMDLs in development

- Elkhorn Slough/Bennet Slough biostimulatory substances
- Lower Salinas River watershed organophosphate pesticides and toxicity
- Gabilan Creek watershed turbidity

Elkhorn Slough/Bennet Slough biostimulatory substances

Elkhorn Slough, Bennet Slough, Moss Landing Harbor, Los Carneros Creek;

- Dissolved oxygen
- pH
- Un-ionized ammonia
- Chlorophyll-a
- Nitrate
- Turbidity



Elkhorn Slough/Bennet Slough biostimulatory substances

July 2019, Kick-off meeting

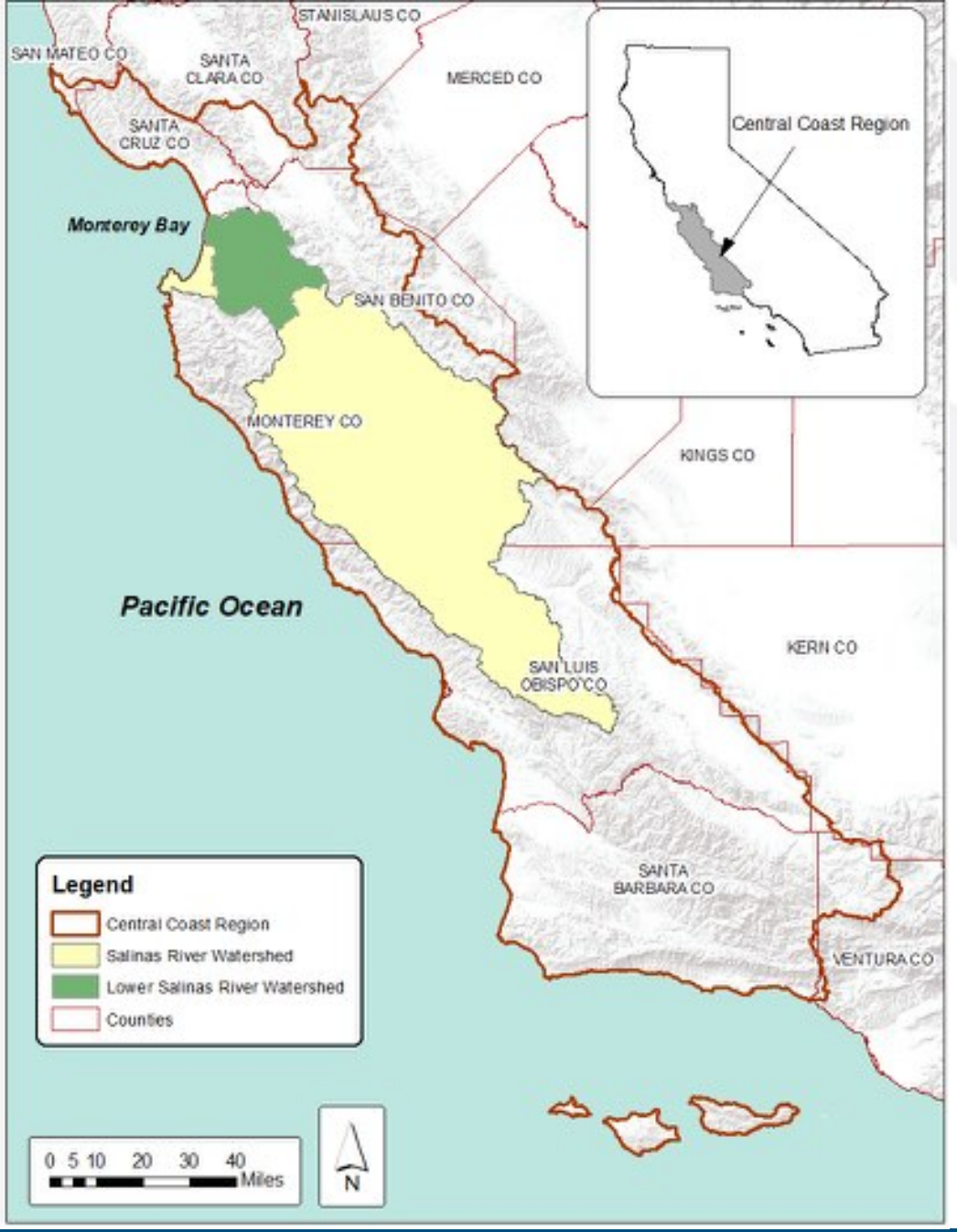
1. October 2019 - First meeting
2. March 2021 – Workplan, progress on modeling
3. June 2021 - Biostimulatory targets (biologically-focused)
4. Summer 2021 - update/calibration findings focused on water quality of watershed and estuary
5. Early fall 2021 - feedback on calibration report?? Water Board proposal on biostimulatory targets
6. Late fall 2021 - Calculation of TMDL and source attribution analyses
   a) Discussion/revised biostimulatory targets
   b) Discussion of how load allocations would be parsed
7. Winter 2021 - Load and waste load allocations
8. Early Spring 2022 - Stakeholder feedback on technical reports

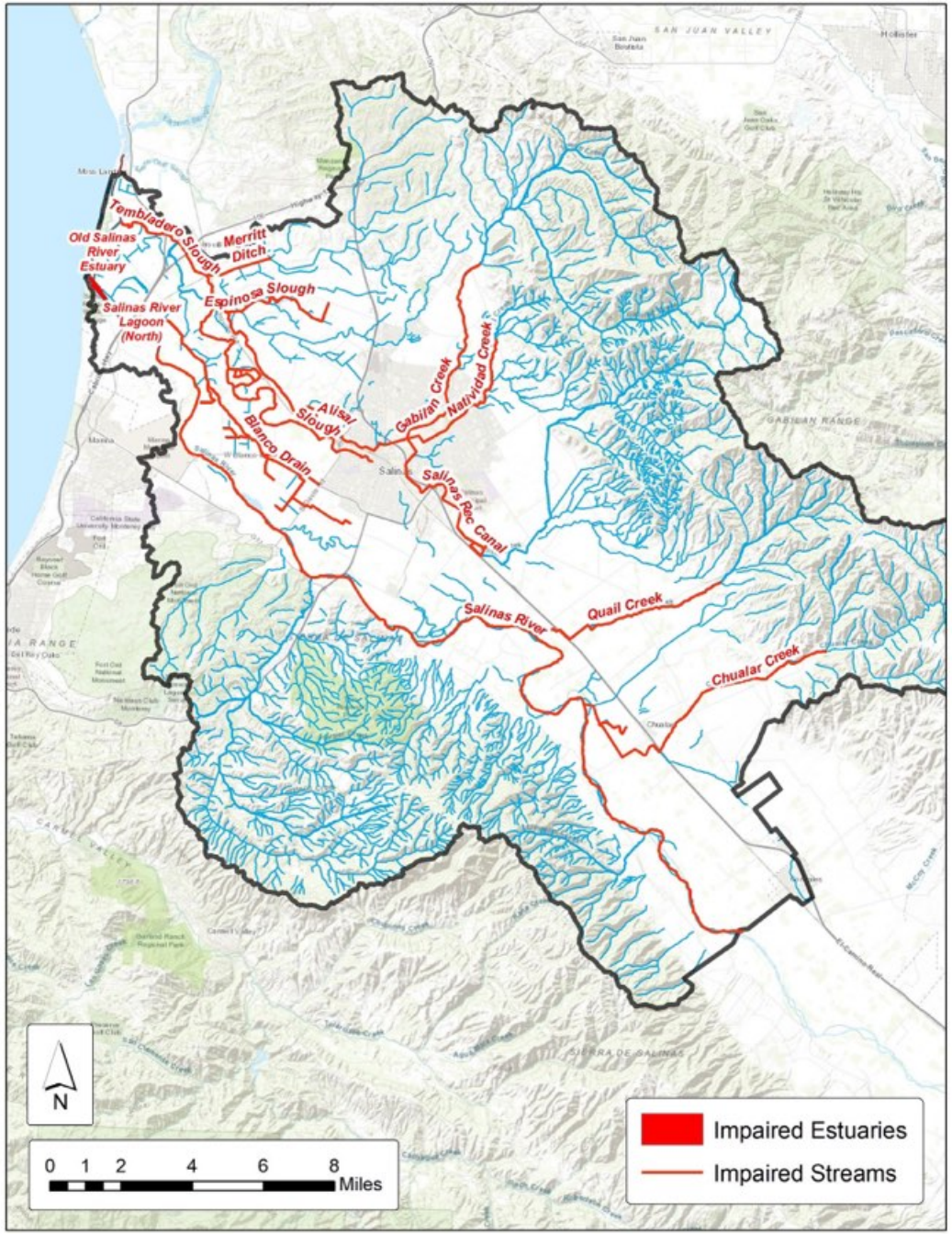
Elkhorn Slough/Bennet Slough biostimulatory substances

Item	Target Dates
Technical Support Services (SCCWRP Contract)	July 2019 - April 2022
Draft TMDL Project Report	early 2023?
Scientific Peer Review	mid 2023?
Public Comment on TMDL Project Report	late 2023?
Central Coast Water Board Adoption	early 2024?

Lower Salinas River Organophosphate Pesticides and Toxicity TMDLs

- Current TMDL will address chlorpyrifos, diazinon, malathion, and toxicity impairments
- Data analysis report completed October 2020 (includes impairment assessment and proposed numeric targets)
- Draft TMDL documents for review in fall/winter 2021


STANISLAUS CO
SAN MATEO CO
SANTA CLARA CO
MERCED CO
SANTA CRUZ CO
Central Coast Region
Monterey Bay
SAN BENITO CO
MONTEREY CO
KINGS CO
Pacific Ocean
KERN CO
SAN LUIS OBISPO CO
SANTA BARBARA CO
VENTURA CO
Legend
Central Coast Region
Salinas River Watershed
Lower Salinas River Watershed
Counties
0 5 10 20 30 40
Miles
N


Tembladero Slough
Old Salinas River Estuary
Merritt Ditch
Espinosa Slough
Salinas River Lagoon (North)
Gabilan Creek
Natividad Creek
Alisal Slough
Blanco Drain
Salinas Rec Canal
Salinas River
Quail Creek
Chualar Creek
N
0 1 2 4 6 8
Miles
Impaired Estuaries
Impaired Streams

18 WB's

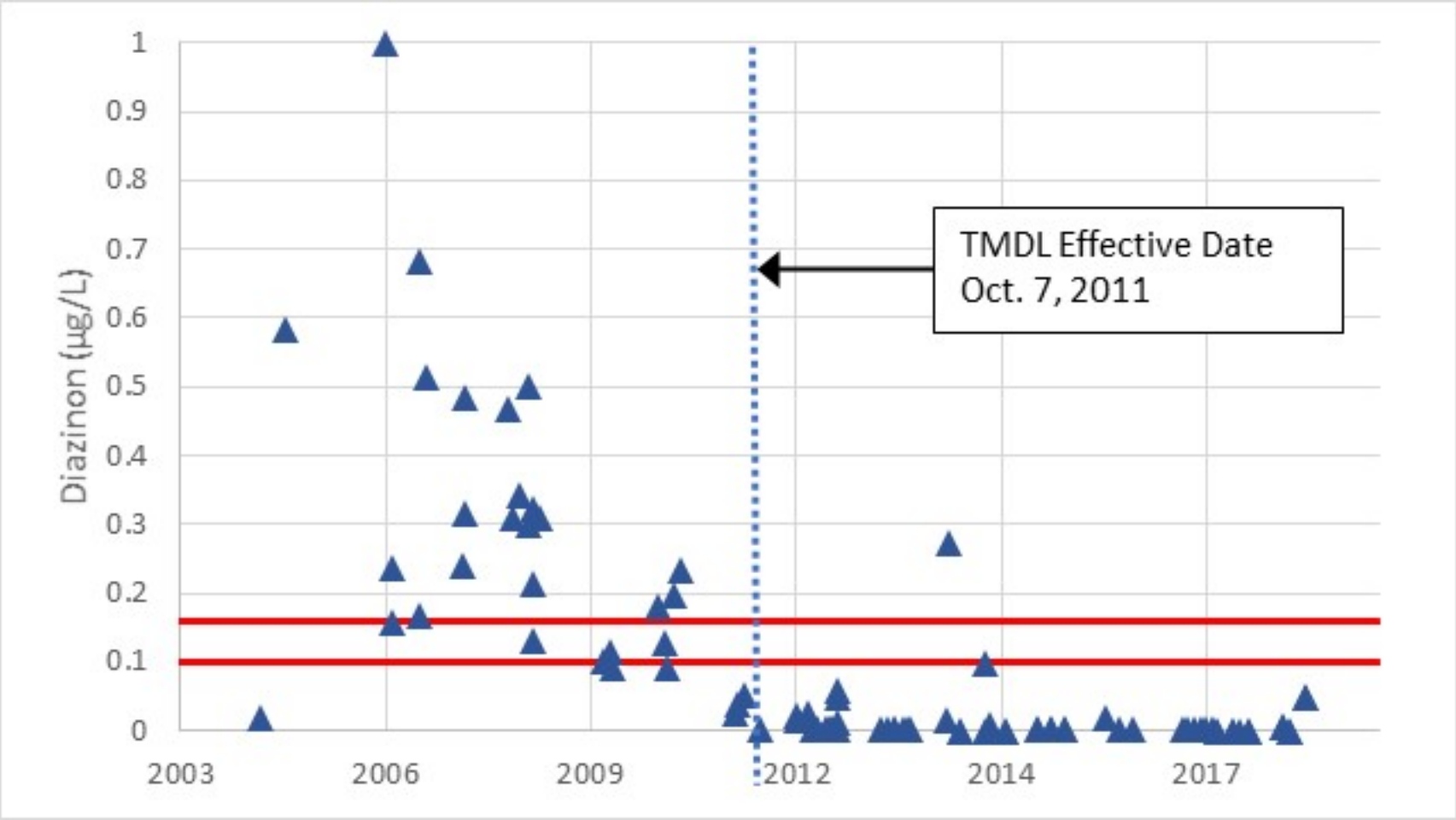
Water Body Name	Water Body Identification	Impairment
Alisal Creek	CAR309700951999022213053 7	toxicity
Alisal Slough	CAR3091101020090311204028	diazinon, toxicity
Blanco Drain	CAR3091101019981209161509	chlorpyrifos, diazinon, toxicity
Chualar Creek	CAR3091900020080604161337	chlorpyrifos, diazinon, malathion, toxicity
Espinosa Lake	CAL3091900020020117151744	chlorpyrifos, diazinon,
Espinosa Slough	CAR3091101019981230135152	diazinon, malathion, toxicity
Gabilan Creek	CAR3091900019990304092345	toxicity
Merritt Ditch	CAR3091101020080604152147	diazinon, toxicity
Moro Cojo Slough	CAE3060001519981209132246	toxicity
Moss Landing Harbor	CAB3060001419981214121135	chlorpyrifos, diazinon
Old Salinas River Estuary	CAE3060001419981214143807	chlorpyrifos, diazinon
Natividad Creek	CAR3091101020050531125140	diazinon, toxicity
Old Salinas River	CAR3091101020080611145518	chlorpyrifos, diazinon, toxicity
Quail Creek	CAR3091900020011227140647	chlorpyrifos, diazinon, malathion, toxicity
Salinas Reclamation Canal	CAR3091101019980828112229	chlorpyrifos, diazinon, malathion, toxicity
Salinas River (lower, estuary to near Gonzales Rd)	CAR3091101020021007193102	chlorpyrifos, diazinon, toxicity
Salinas River Lagoon (North)	CAE3091101019980828143232	chlorpyrifos, toxicity
Tembladero Slough	CAR3091101019981209131830	chlorpyrifos, diazinon, malathion, toxicity

45 Impairments

Numeric Targets

- The TMDL will establish targets for:
  - Specific pesticide concentrations,
  - Additive toxicity (a measure of synergistic effects of multiple OP pesticides), and
  - Toxicity to invertebrate test organisms.

Salinas Rec Canal De-listing Diazinon

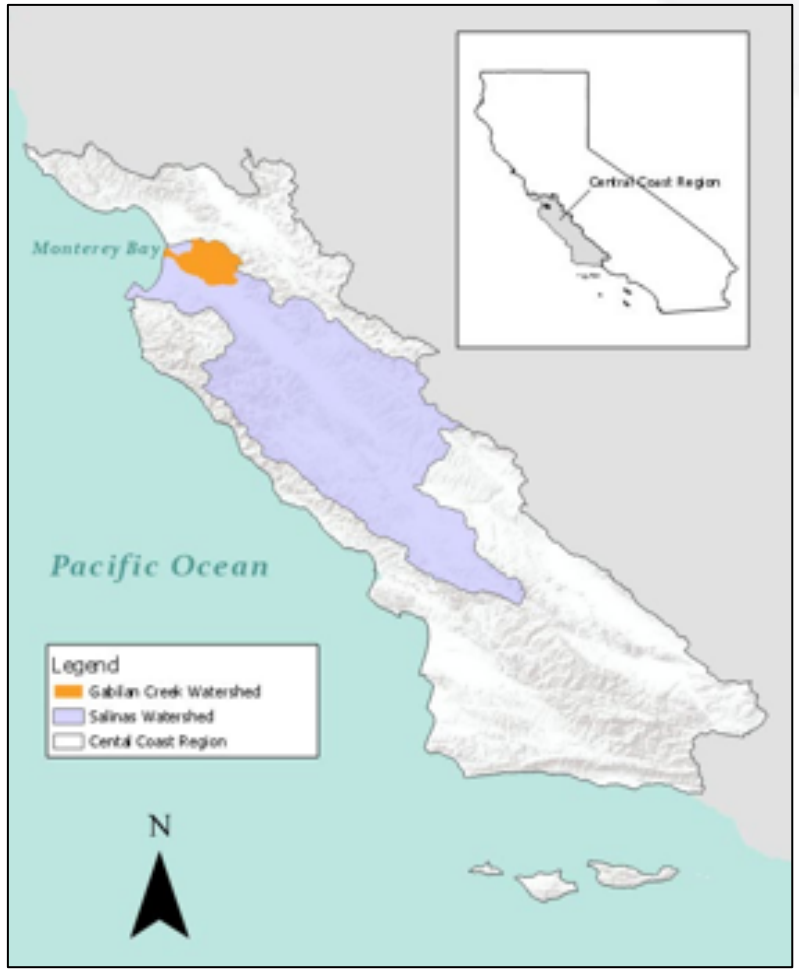


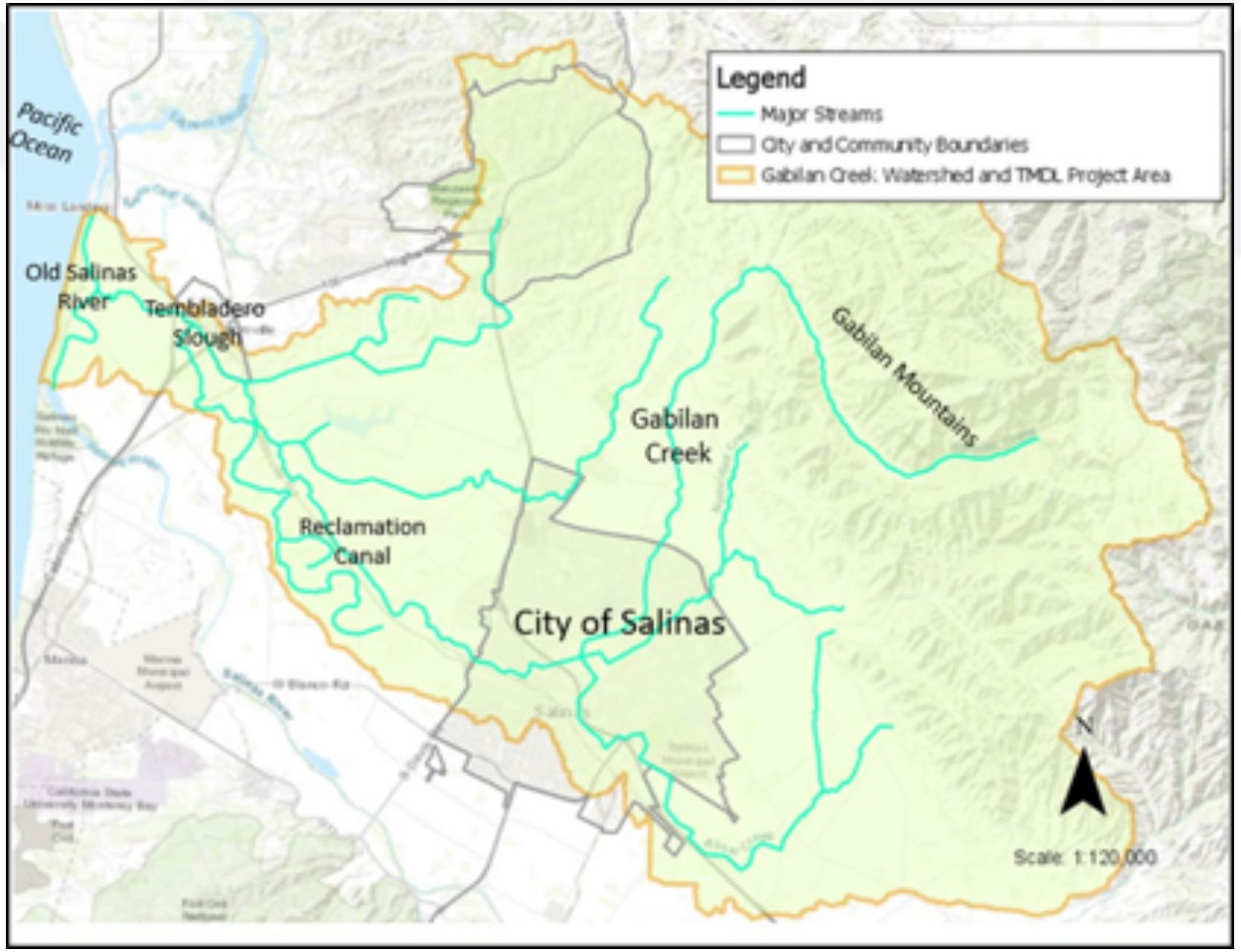
Graph of diazinon concentrations for all Salinas Reclamation Canal monitoring sites.

Gabilan Creek Watershed Turbidity TMDLs

- TMDL Project will address turbidity listings/impairments
- Draft Project report completed and scientific peer reviewed
- Draft documents available for review in Fall 2021

Gabilan Creek Watershed Turbidity TMDLs





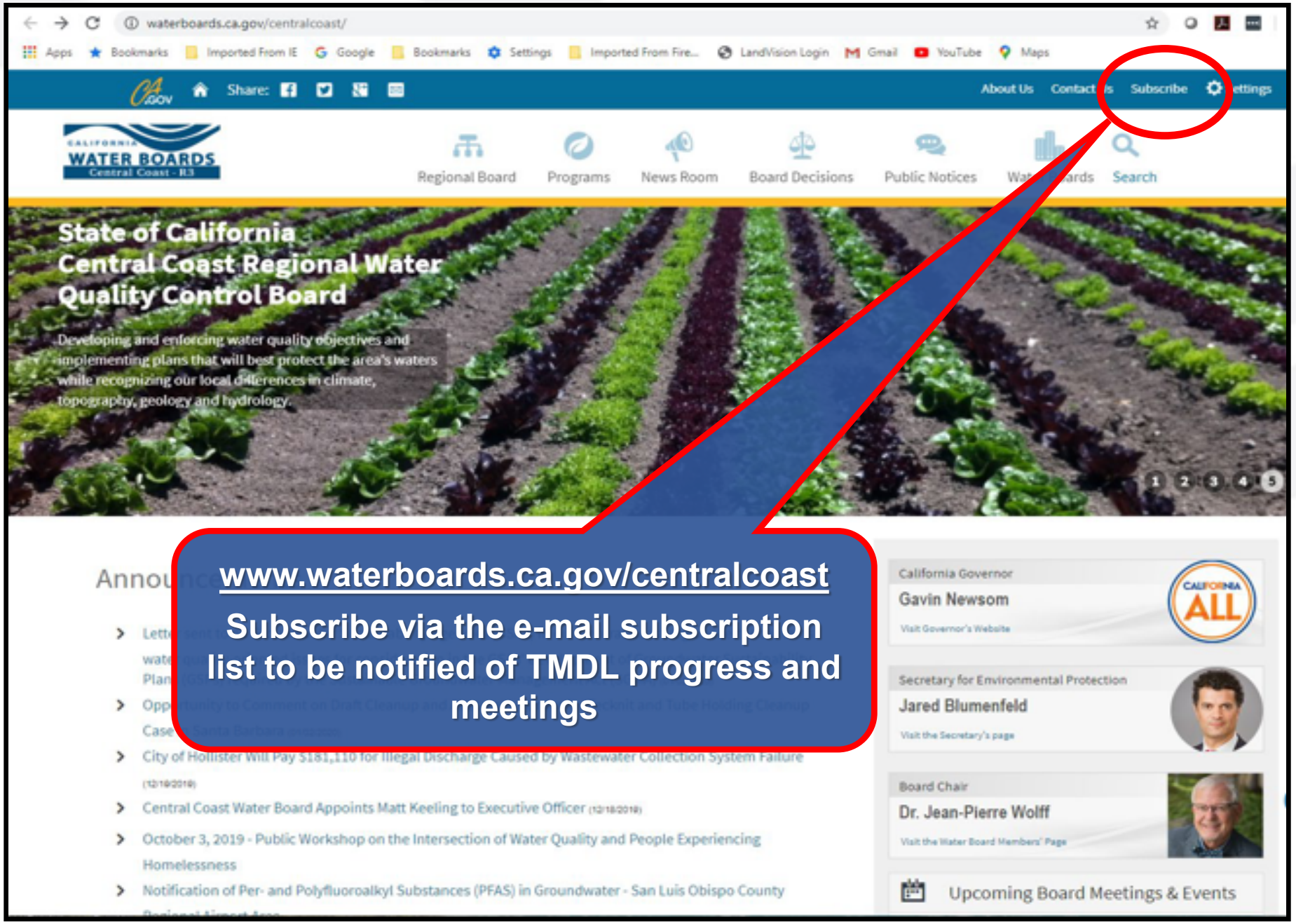
WATERBODY	SITE ID.	NUMBER OF SAMPLES	COLD % OF SAMPLES ≥ 25 NTU	WARM % OF SAMPLES ≥ 40 NTU	50TH PERCENTILE MEDIAN (NTU)
Gabilan Creek	309GAB	92	**91%**	**86%**	**259**
Natividad Creek	309NAD	164	**88%**	**76%**	**100**
Alisal Creek	309ALG	158	**89%**	**81%**	**119**
Salinas Reclamation Canal	309JON	161	**n/a**	**57%**	**52**
Tembladero Slough	309TEH	162	**n/a**	**90%**	**114**
Old Salinas River Channel	309OLD	299	**81%**	**70%**	**74**
Alisal Slough	309ASB	157	**65%**	**45%**	**36**
Merrill Ditch	309MER	162	**93%**	**86%**	**107**
Santa Rita Creek	309RTA	60	**90%**	**83%**	**200**

Potential Sources

Photo sources: CCOWS Sediment Study

To participate in TMDLs under development Use our e-mail subscription lists

- Visit the Central Coast Water Board website https://www.waterboards.ca.gov/centralcoast/
- And subscribe to our e-mail subscription services https://www.waterboards.ca.gov/resources/email_subscriptions/reg3_subscribe.html
  - “Elkhorn Slough Watershed biostim TMDL”
  - “Salinas River Pesticide TMDLs”
  - “Gabilan Creek Turbidity TMDL”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Subscribe via the e-mail subscription list to be notified of TMDL progress and meetings
State of California
Central Coast Regional Water Quality Control Board
Developing and enforcing water quality objectives and implementing plans that will best protect the area's waters while recognizing our local differences in climate, topography, geology and hydrology.
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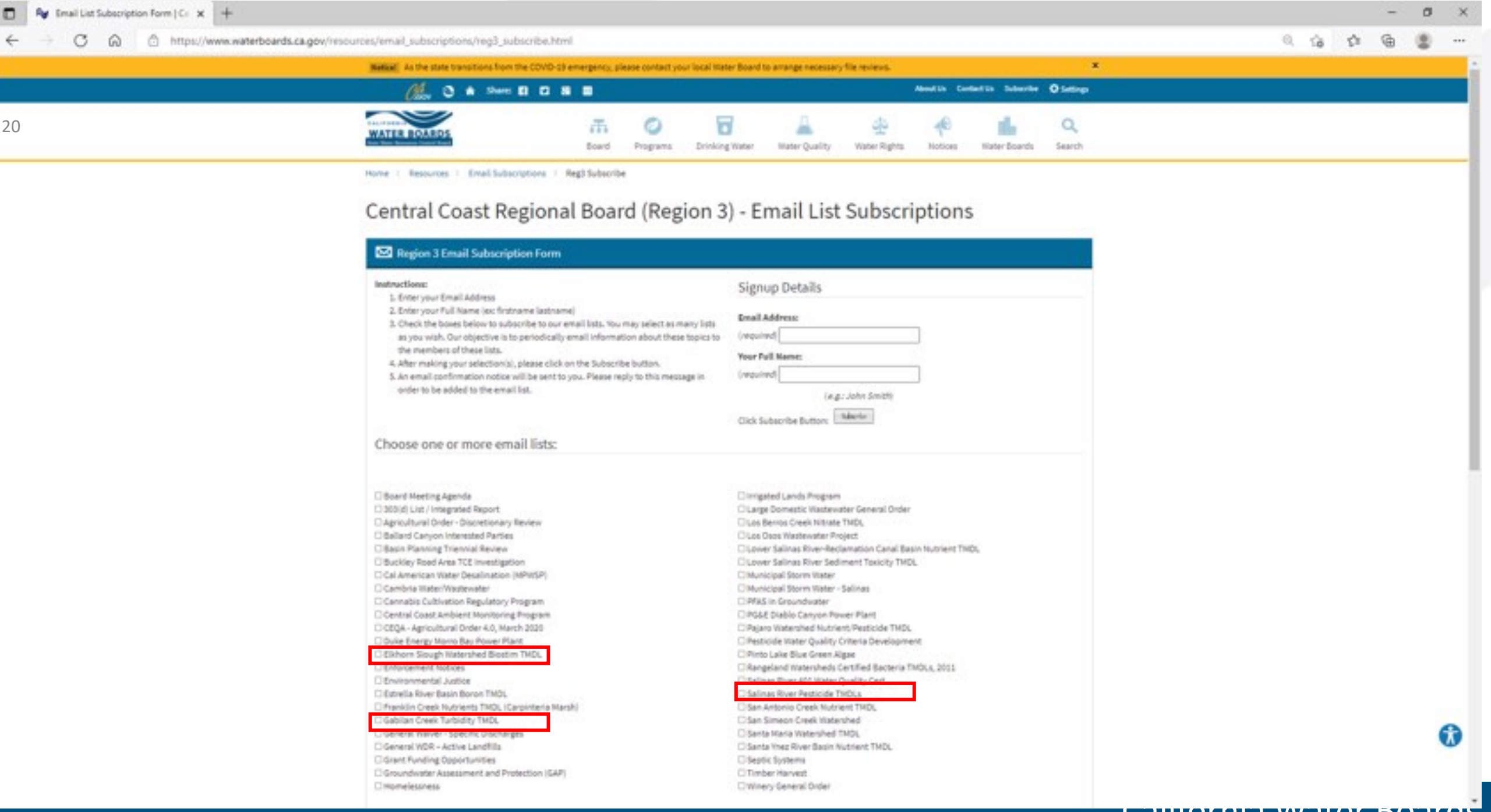
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Programs
Drinking Water
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Reg3 Subscribe
Central Coast Regional Board (Region 3) - Email List Subscriptions
Region 3 Email Subscription Form
Instructions:
1. Enter your Email Address
2. Enter your Full Name (ex: firstname lastname)
3. Check the boxes below to subscribe to our email lists. You may select as many lists as you wish. Our objective is to periodically email information about these topics to the members of these lists.
4. After making your selection(s), please click on the Subscribe button.
5. An email confirmation notice will be sent to you. Please reply to this message in order to be added to the email list.
Signup Details
Email Address:
(required)
Your Full Name:
(required)
(e.g.: John Smith)
Click Subscribe Button:
Choose one or more email lists:
Board Meeting Agenda
303(d) List / Integrated Report
Agricultural Order - Discretionary Review
Ballard Canyon Interested Parties
Basin Planning Triennial Review
Buckley Road Area TCE Investigation
Cal American Water Desalination (MPWSP)
Cambria Water/Wastewater
Cannabis Cultivation Regulatory Program
Central Coast Ambient Monitoring Program
CEQA - Agricultural Order 4.0, March 2020
Duke Energy Morro Bay Power Plant
Elkhorn Slough Watershed Biostim TMDL
Enforcement Notices
Environmental Justice
Estrella River Basin Boron TMDL
Franklin Creek Nutrients TMDL (Carpinteria Marsh)
Gaviian Creek Turbidity TMDL
General Waiver - Specific Discharges
General WDR - Active Landfills
Grant Funding Opportunities
Groundwater Assessment and Protection (GAP)
Homelessness
Irrigated Lands Program
Large Domestic Wastewater General Order
Los Berros Creek Nitrate TMDL
Los Osos Wastewater Project
Lower Salinas River-Reclamation Canal Basin Nutrient TMDL
Lower Salinas River Sediment Toxicity TMDL
Municipal Storm Water
Municipal Storm Water - Salinas
PFAS in Groundwater
PG&E Diablo Canyon Power Plant
Pajaro Watershed Nutrient/Pesticide TMDL
Pesticide Water Quality Criteria Development
Pinto Lake Blue Green Algae
Rangeland Watersheds Certified Bacteria TMDLs, 2011
Salinas River Pesticide TMDLs
San Antonio Creek Nutrient TMDL
San Simeon Creek Watershed
Santa Maria Watershed TMDL
Santa Ynez River Basin Nutrient TMDL
Septic Systems
Timber Harvest
Winery General Order

TMDLs Completed

- Sediment toxicity (2017)
- Nutrients (2013)
- Chlorpyrifos and diazinon (2011)
- Fecal coliform (2010)

To find information regarding completed TMDLs

- Visit the Central Coast Water Board “TMDL Program” website

  https://www.waterboards.ca.gov/centralcoast/water_issues/programs/tmdl/303d_and_tmdl_projects.html

waterboards.ca.gov/centralcoast/water_issues/programs/tmdl/303d_and_tmdl_projects.html

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Notice! As the state transitions from the COVID-19 emergency, please contact your local Water Board to arrange necessary file reviews.

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TMDL Projects

Central Coast - TMDL Projects

For more information on Total Maximum Daily Loads (TMDLs), please see our general information page on TMDLs.

Please see the lower section of this page called "TMDL Resources" for other TMDL related links.

TMDL Projects Currently in Development

- Elkhorn Slough and Bennett Slough biostimulatory substances TMDL
- Pinto Lake catchment TMDL addressing cyanobacterial blooms
- Gabilan Creek Watershed Turbidity TMDL
- Santa Ynez River basin nutrients TMDL
- Pesticide Water Quality Criteria Development
- Salinas River watershed organophosphate pesticides and toxicity TMDL

The section below is a list of the all the TMDL Projects approved or in development.

TMDL Project Names - listed in alphabetical order

Approval dates indicate Central Coast Water Board approval.

- Aptos/Valencia Creek pathogen TMDL, *approved May 8, 2009*
- Arroyo de la Cruz indicator bacteria TMDL, *approved May 17, 2011*
- Arroyo Paredon diazinon TMDL, *approved March 14, 2013*
- Arroyo Paredon nitrate TMDL, *approved December 5, 2013*

Web Map of TMDL Project Areas

Contacts

- Mary Hamilton, Manager TMDL and NPS Programs 805-542-4768
- Larry Harlan, 594-6195
- Shanta Keeling, 549-3464
- Peter Meertens, 549-3869
- Pete Osmolovsky, 549-3699
- Melissa Daugherty, 542-4643

Questions/Discussion

Contact Info

- Shanta Keeling, Shanta.Keeling@waterboards.ca.gov, or 805-549-3464
- Larry Harlan, Larry.Harlan@waterboards.ca.gov, or 805-594-6195

Assessment of agricultural management practices on water quality
Salinas and Pajaro Valleys

Applied Environmental Science
California State University Monterey Bay

Gilbert Mak, Savannah Johnson Peña, and Dr. John Olson

Tasks

1. Obtain and format Irrigated Lands Regulatory Program (ILRP) farm management practice data
2. Revise hydrologic framework to better link farming locations to water quality observations
3. Use the revised hydrologic framework to characterize the farming practices and environment (e.g., topography, climate, soils, etc.) of each watershed.
4. Develop empirical models relating water quality to both farming practices and environmental factors (e.g., soils, climate, geology)
5. Determine which farming practices are related to changes in water quality and how natural factors interact with these relationships

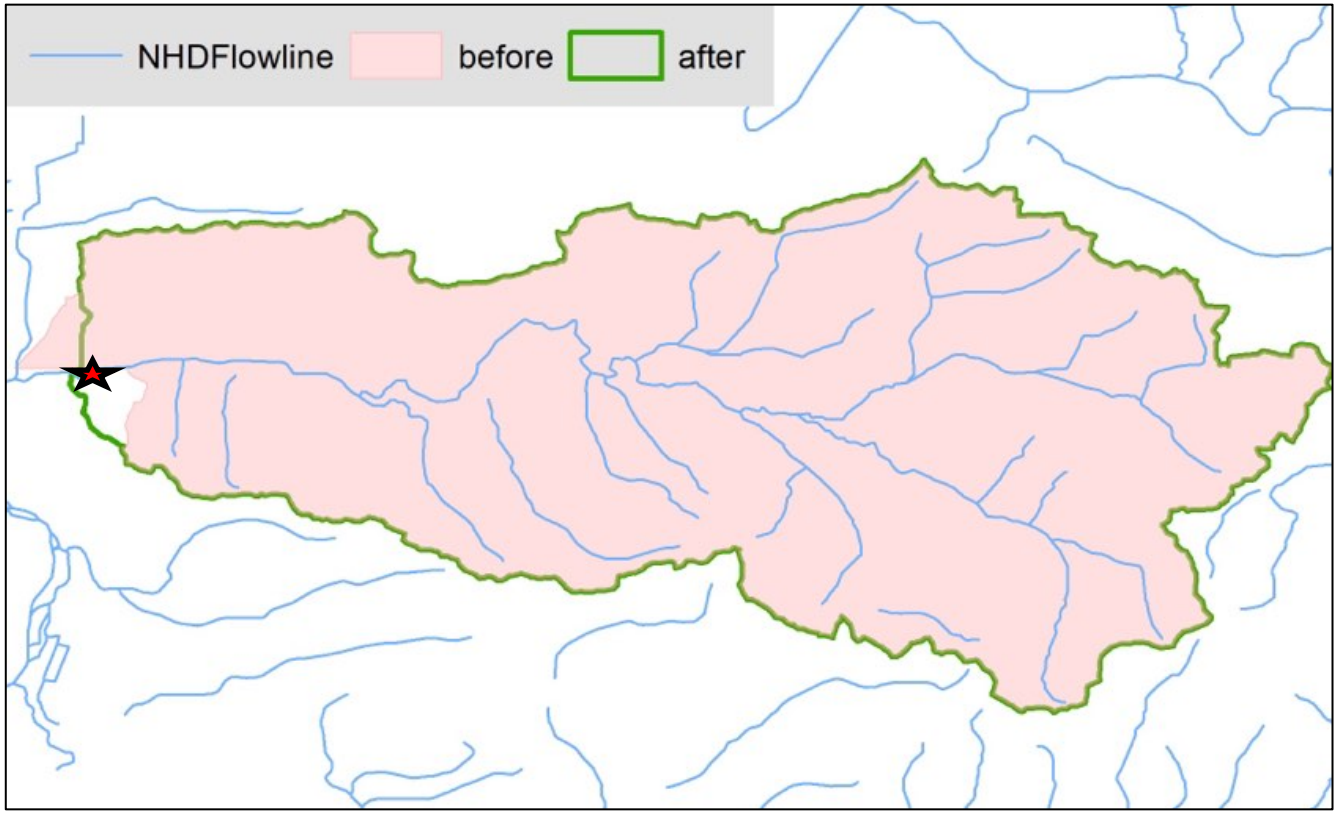
Analysis Overview

- CMP nutrient data downloaded from CEDEN for WY2016 to WY2018
- Received ILRP data from Central Coast Water Board
- Delineated watersheds using CMP monitoring locations to account for upstream practice effects
- Download publicly available environmental data and aggregate by watershed
- Cleaned and combined CMP (response) and ILRP BMP (predictor) data and aggregate by watershed
- Developed Random Forest models identify correlations between farming practices, environmental factors, and water quality

Study Area

- Pajaro and Salinas watersheds
  - ~ 26,202,469 acres
- Spans five counties
- ~ 3,000 farming operations (Tiers 1-3)
- 52 CMP stations

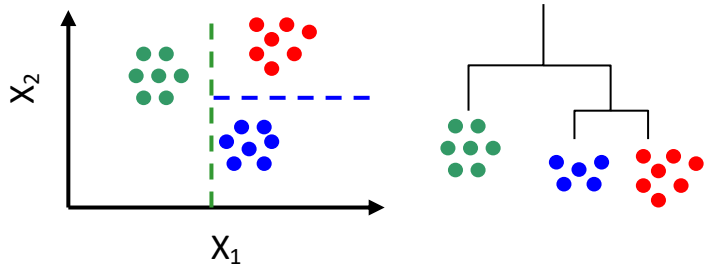
Watershed Delineations

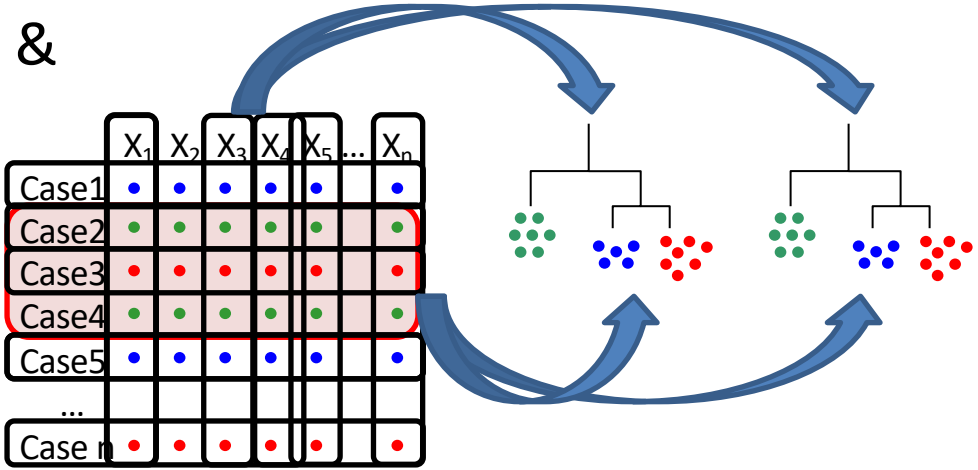


Predicting Water Chemistry

Random Forest (RF) Modeling

- Recursive partitioning creates regression trees (CART)
- Trees built on random subsets of data & predictors
- Unused data used to evaluate

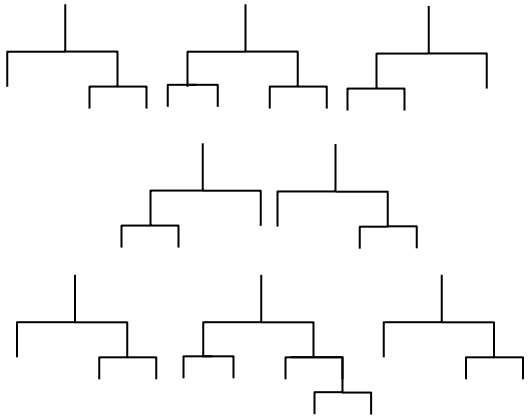




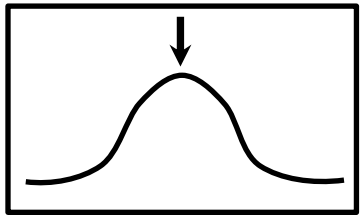
Predicting Water Chemistry

Random Forest (RF) Modeling

- Build 1000s of trees
- Predicts outcomes by averaging across trees



- Advantages:
  - Does not overfit
  - Effectively models non-linear data
  - Incorporates interactions
  - But cannot extrapolate!



Response Variables

32 Random Forest models

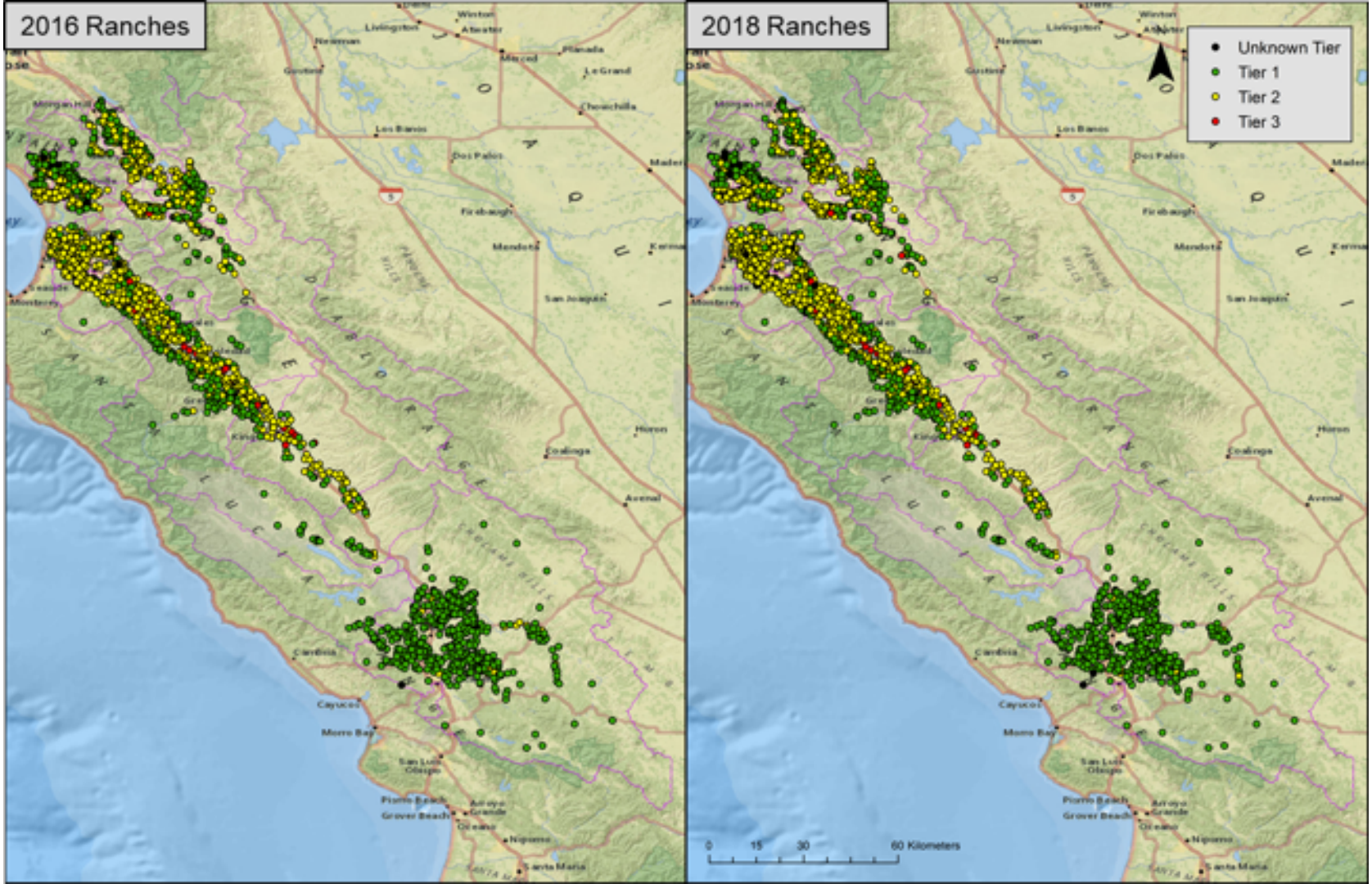
A	Ammonia as N total	Concentration	Annual (Oct – Sep)
N2	Nitrate + Nitrite as N, Total	Load	First Flush (Oct)
N	Nitrogen, Total		Winter (Oct – Mar)
P	Phosphorus as P, Total		Summer (Apr – Sep)

Predictors

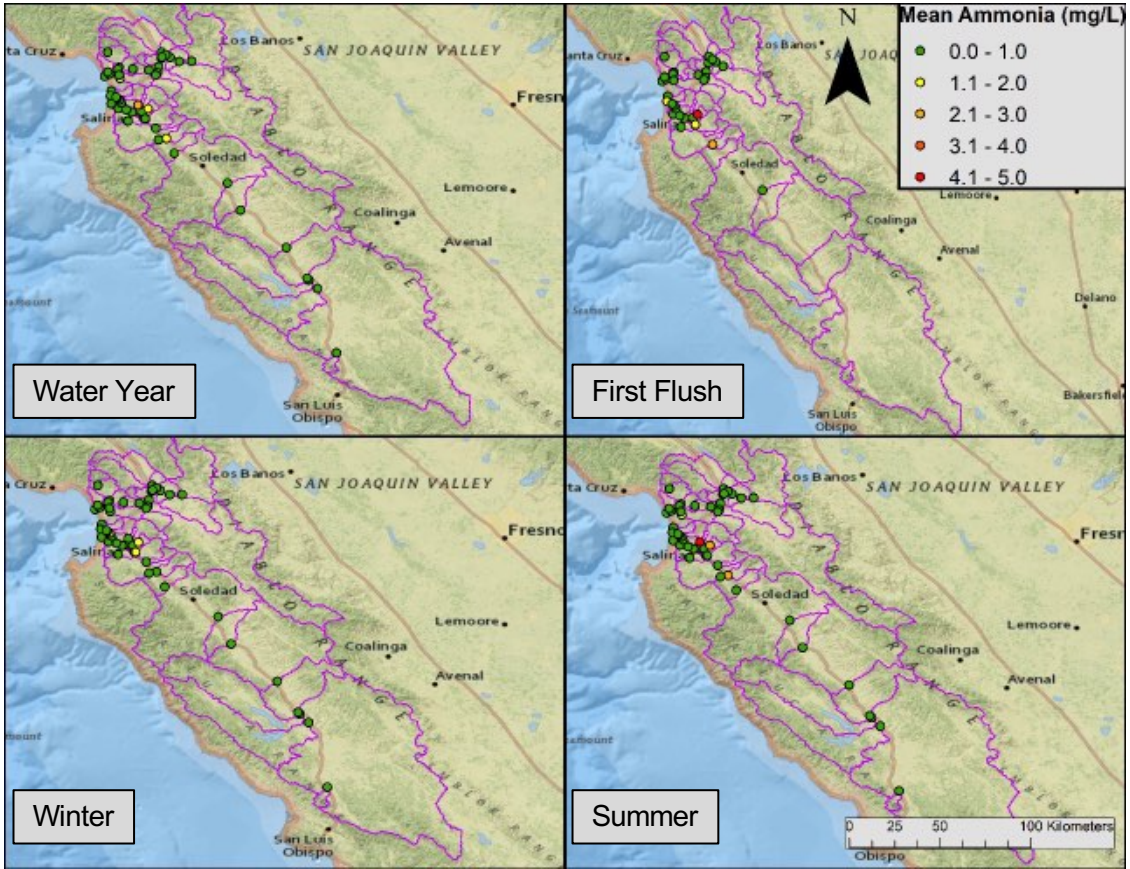
- Nutrient Management: Practice Implementation – 15
- Drainage – 5
- General ranch characteristics – 6
- Irrigation – 3
- Ground water – 3
- Nitrogen present or applied – 2
- Geologic and environmental – 11

Nutrient Management – Practice Implementation

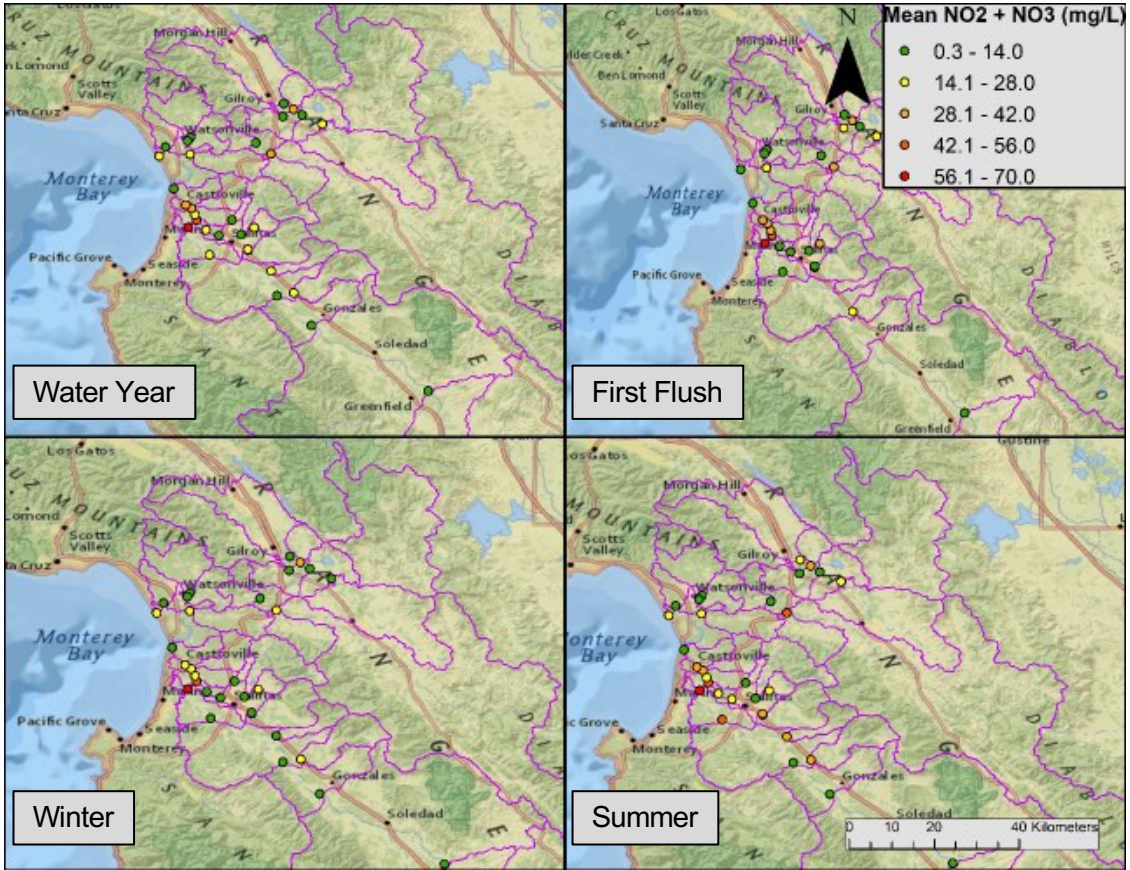
Abbreviation	Definition
IA1	Evaluated fertilizer needs and timing of application
IA2	Scheduled fertilizer applications to match crop requirements
IA3	Nitrogen concentration in irrigation water
IA4	soil nitrate or soil solution nitrate
IA5	Used precision techniques to place fertilizer in the root zone
IA6	Nitrogen in plant tissues
IA7	Phosphorus in soil
IA8	Nitrogen and phosphorous content of organic amendments
IA9	Mixed and loaded fertilizers on low runoff hazard sites
IA10	Used urease inhibitors and/or nitrification inhibitors
IA11	Modified crop rotation
IA12	Treatment systems (eg wood chip bioreactor)
IA13	Other
IA14	None
IA15	Answer left blank or No ACF


2016 Ranches
2018 Ranches
Unknown Tier
Tier 1
Tier 2
Tier 3
0 15 30 60 Kilometers

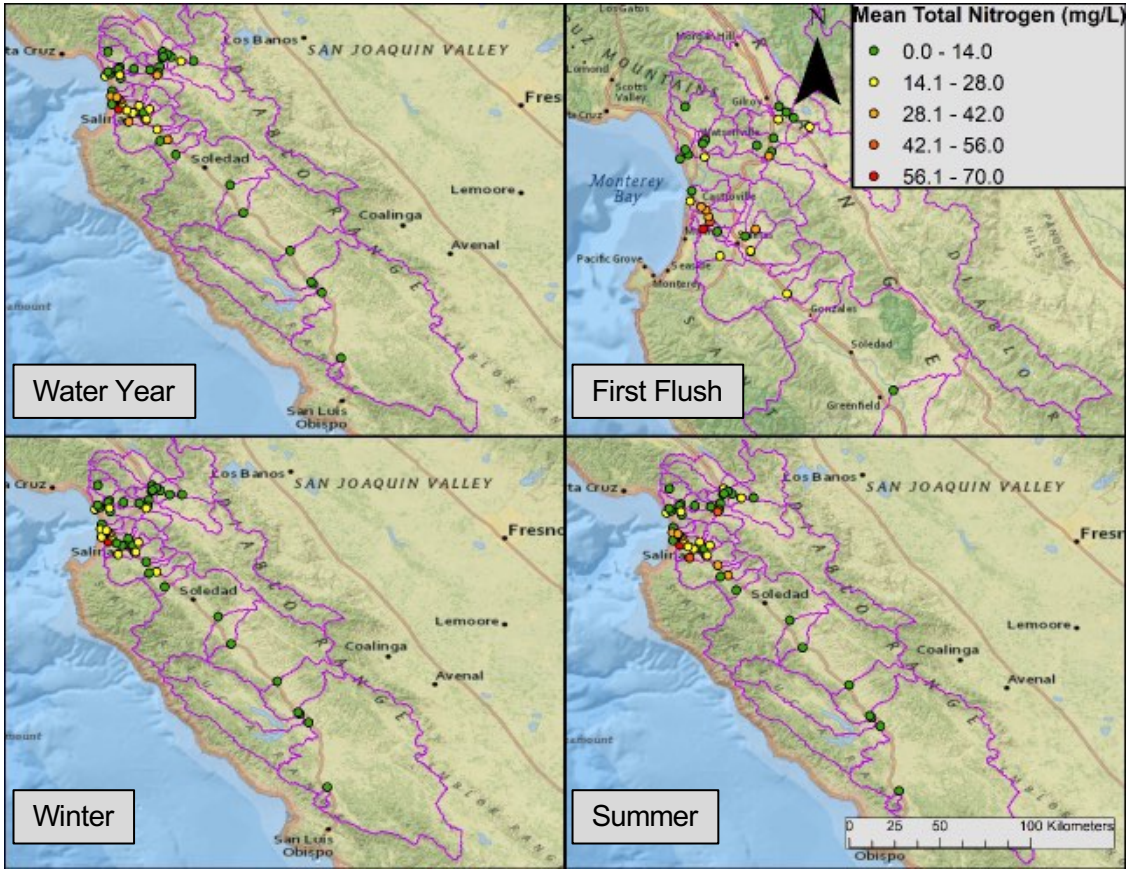
CMP water quality: Ammonia



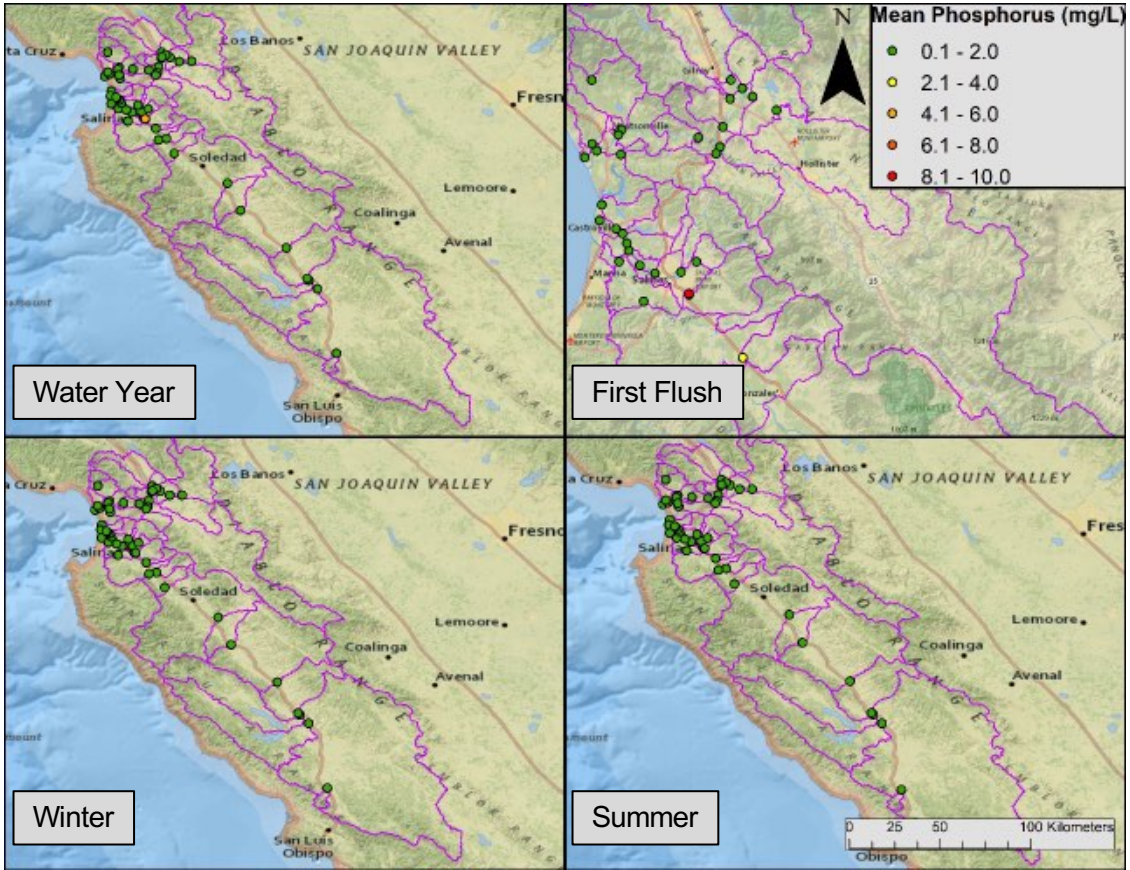
CMP water quality: Nitrate + Nitrite



CMP water quality: Total Nitrogen



CMP water quality: Phosphorus

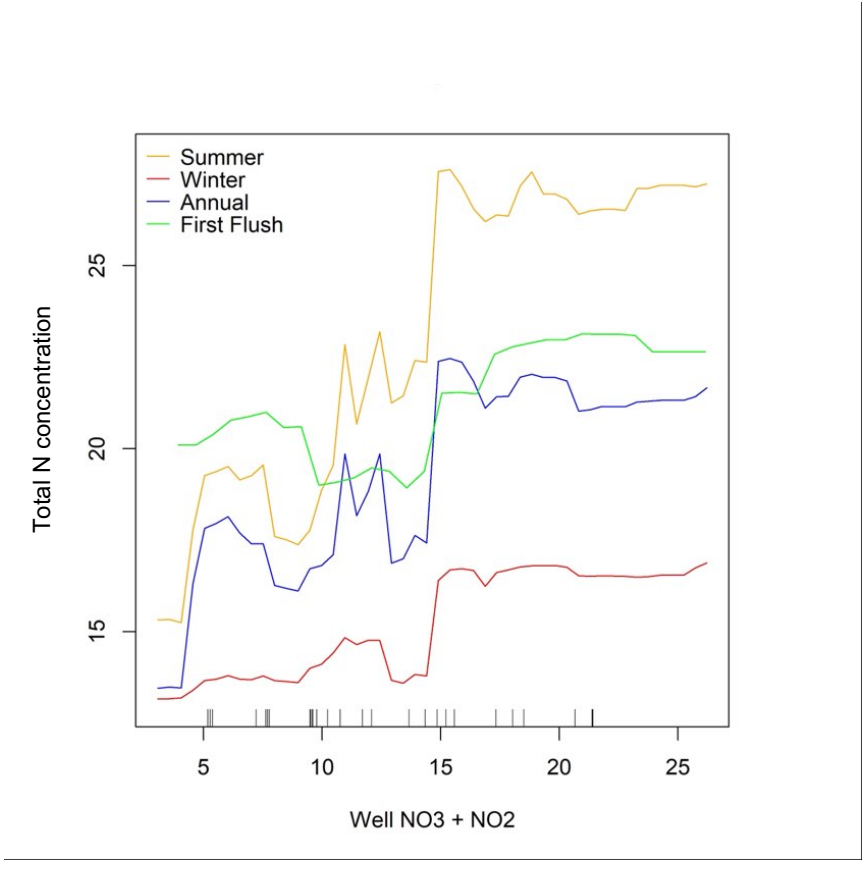


Model Performance

% Var Explained					
Analyte		Annual	First Flush	Summer	Winter
Ammonia	Concentration	30.8	35.27	0.63	10.84
	Load	10.01	-4.58	42.23	5.94
Nitrate +Nitrite	Concentration	71.38	38.18	72.49	55.73
	Load	11.45	41.2	71.02	-0.8
Total Nitrogen	Concentration	72.31	46.31	61.72	68.19
	Load	13.62	40.76	72.23	6.81
Phosphorus	Concentration	26.71	30.6	63.43	20.03
	Load	23.67	41.53	48.4	5.58

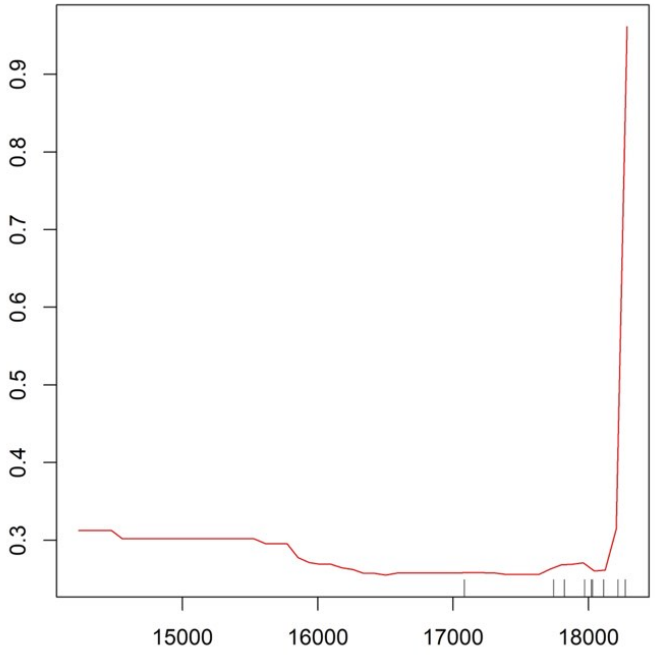
Red cells $R^2 < 0.3$

Partial Dependence: Well NO3 + NO2

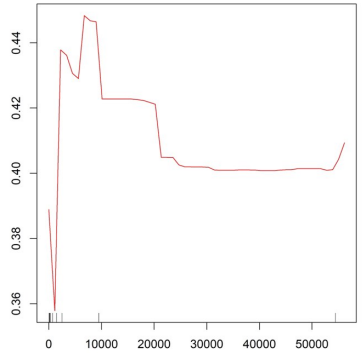


Partial Dependence: Annual Ammonia Concentration

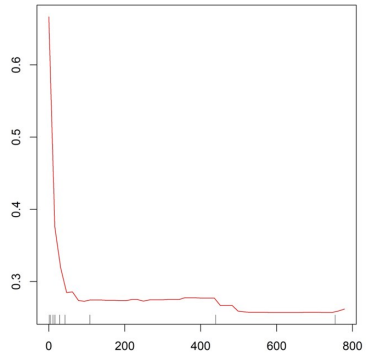
- R^2 = 0.308
- Predictors
  - Water table Depth (+)
  - IA15 – no answer (+)
  - Tier 1 (-)
  - Well NO3 (+)



Water table depth



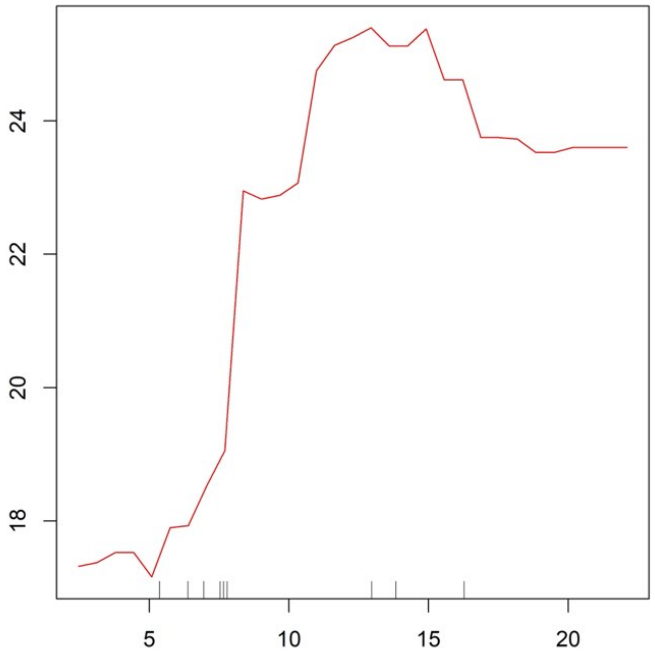
IA15 – no answer

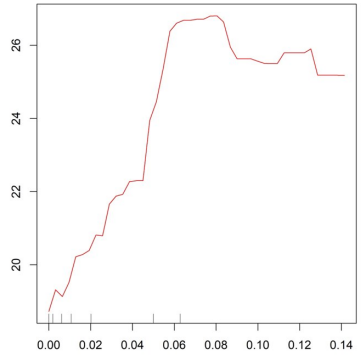


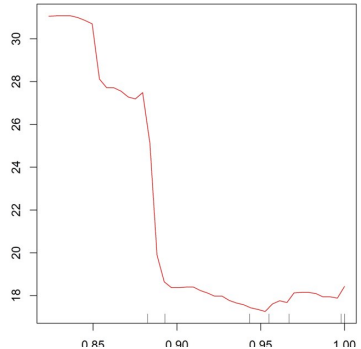
Tier 1

Partial Dependence: First Flush Total Nitrogen Concentration

- $R^2 = 0.463$
- predictors
  - Well NO3 (+)
  - Ditch and tile drain (+)
  - Non-surface irrigation (-)
  - Well NO2 (+)
  - Well NO3 + NO2 (+)
  - Precipitation (+)

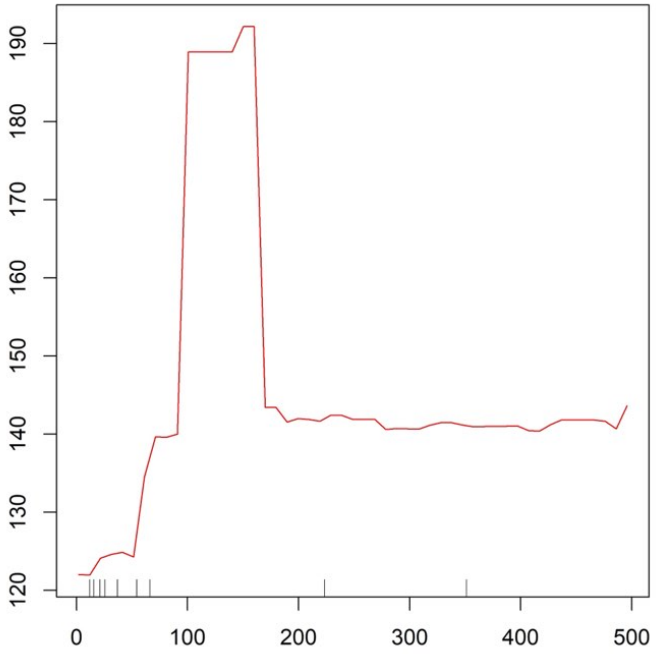




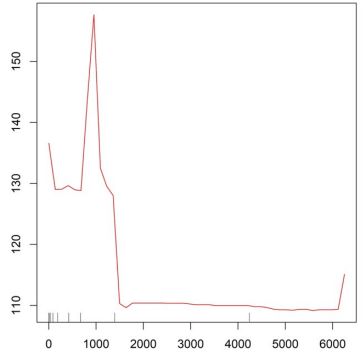


Partial Dependence: Summer Total Nitrogen Load

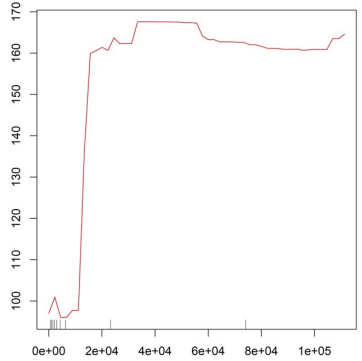
- $R^2 = 0.722$
- Predictors
  - Tier 2 (+)
  - IA2, scheduled fert (-)
  - IA5, precision fert (+)
  - Crop acres (-)
  - Irrigated acres (+)
  - IA1, evaluated fert (+)
  - IA9, prep in low runoff (+)
  - IA3, Irrig water N (+)
  - IA6, N in plants (+)



Tier 2

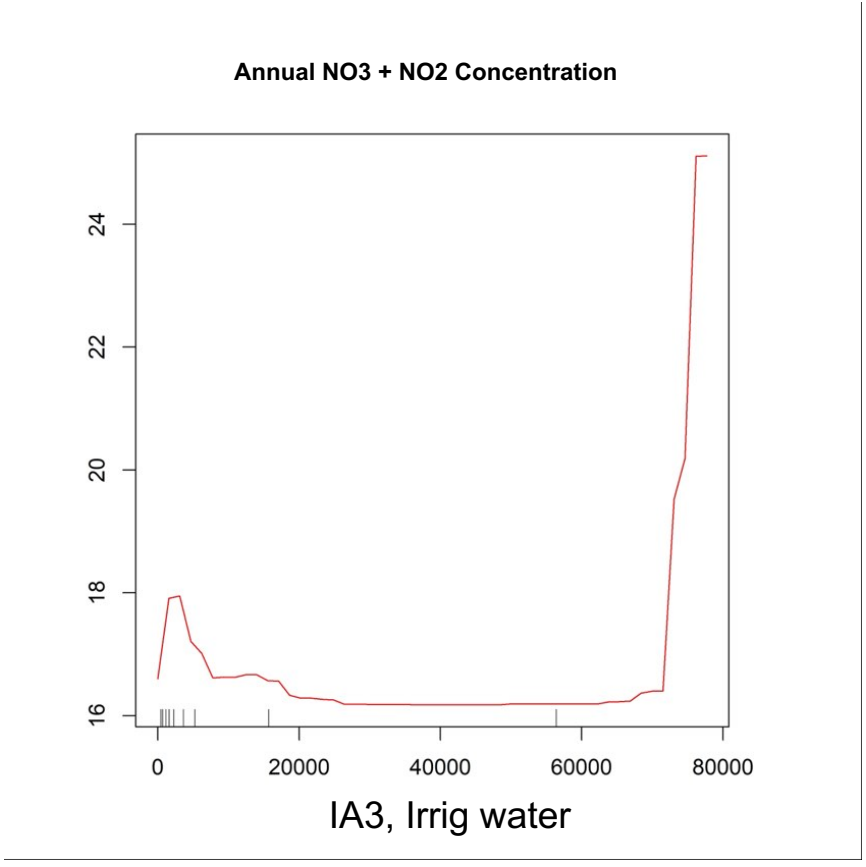


IA2, scheduled fert

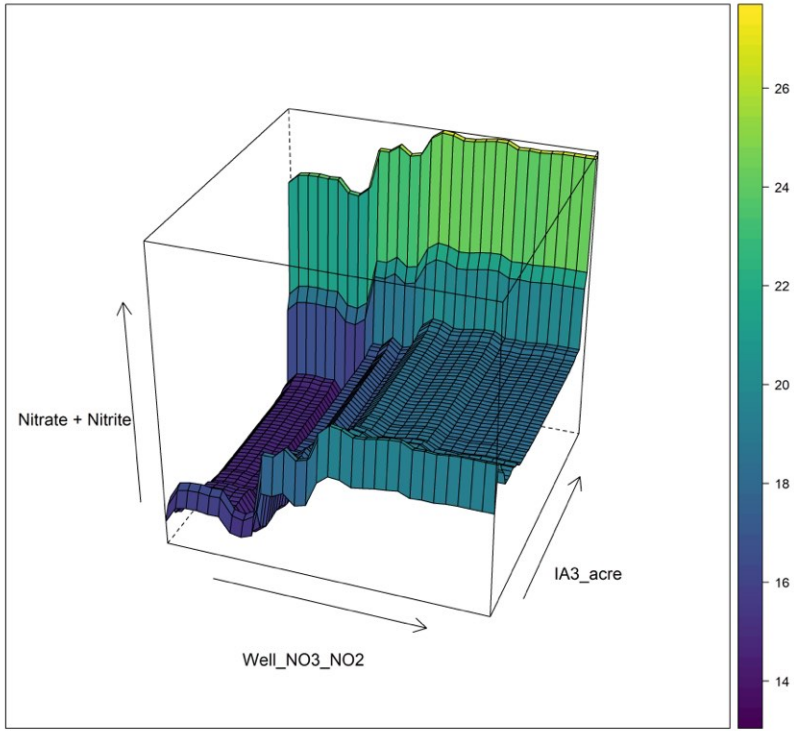


IA5, precision fert

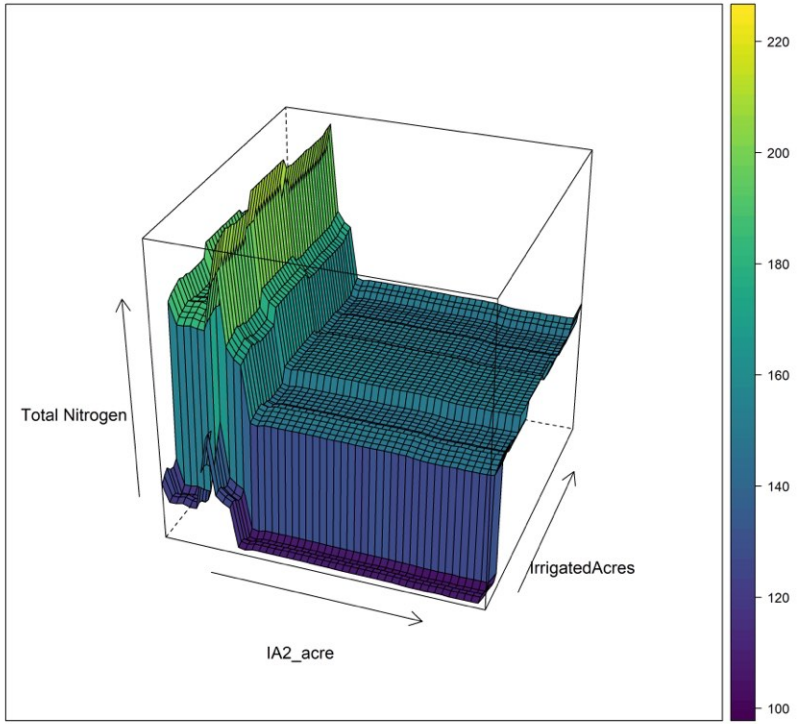
Partial Dependence: Nitrogen In Irrigation Water



Predictor Interaction



Annual - Concentration



Summer - Load

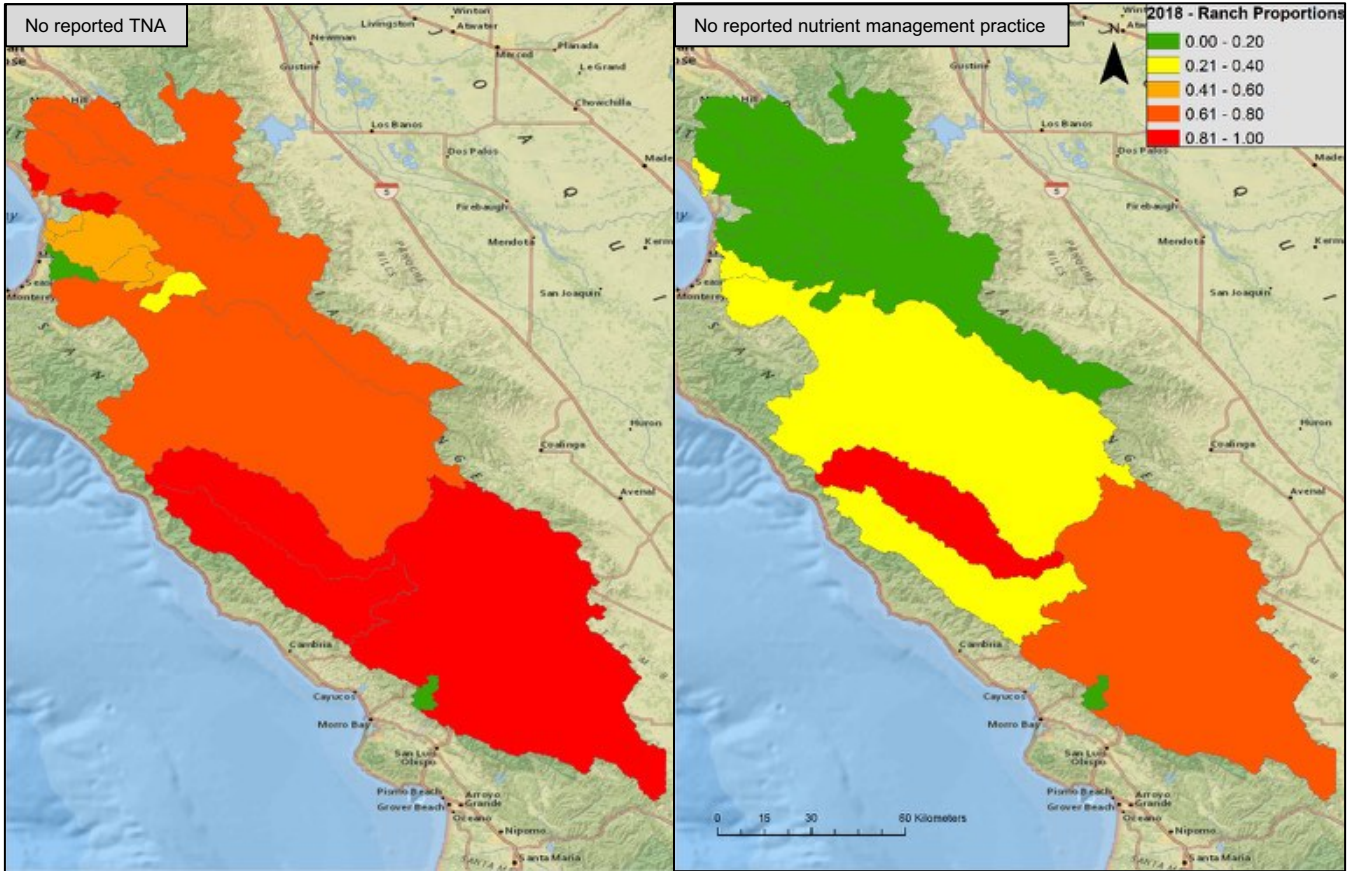
Top Predictors - Concentration

- Well Nitrite
  - Nitrate + Nitrite (+)
  - Total Nitrogen (+)
  - Phosphorus (-)
- Well Nitrate
  - Ammonia (+)
  - Nitrite + Nitrate (+)
  - Total Nitrogen (+)
  - Phosphorus (+)
- Well Nitrate + Nitrite
  - Ammonia (+)
  - Nitrate + Nitrite (+)
  - Total Nitrogen (+)
  - Phosphorus (+)
- Unknown management practice
  - Ammonia (-/+)
  - Nitrate + Nitrite (+)
- Tailwater
  - Total Nitrogen (+)
  - Phosphorus (+)
- Water Table Depth
  - Ammonia (+)
  - Phosphorus (+)

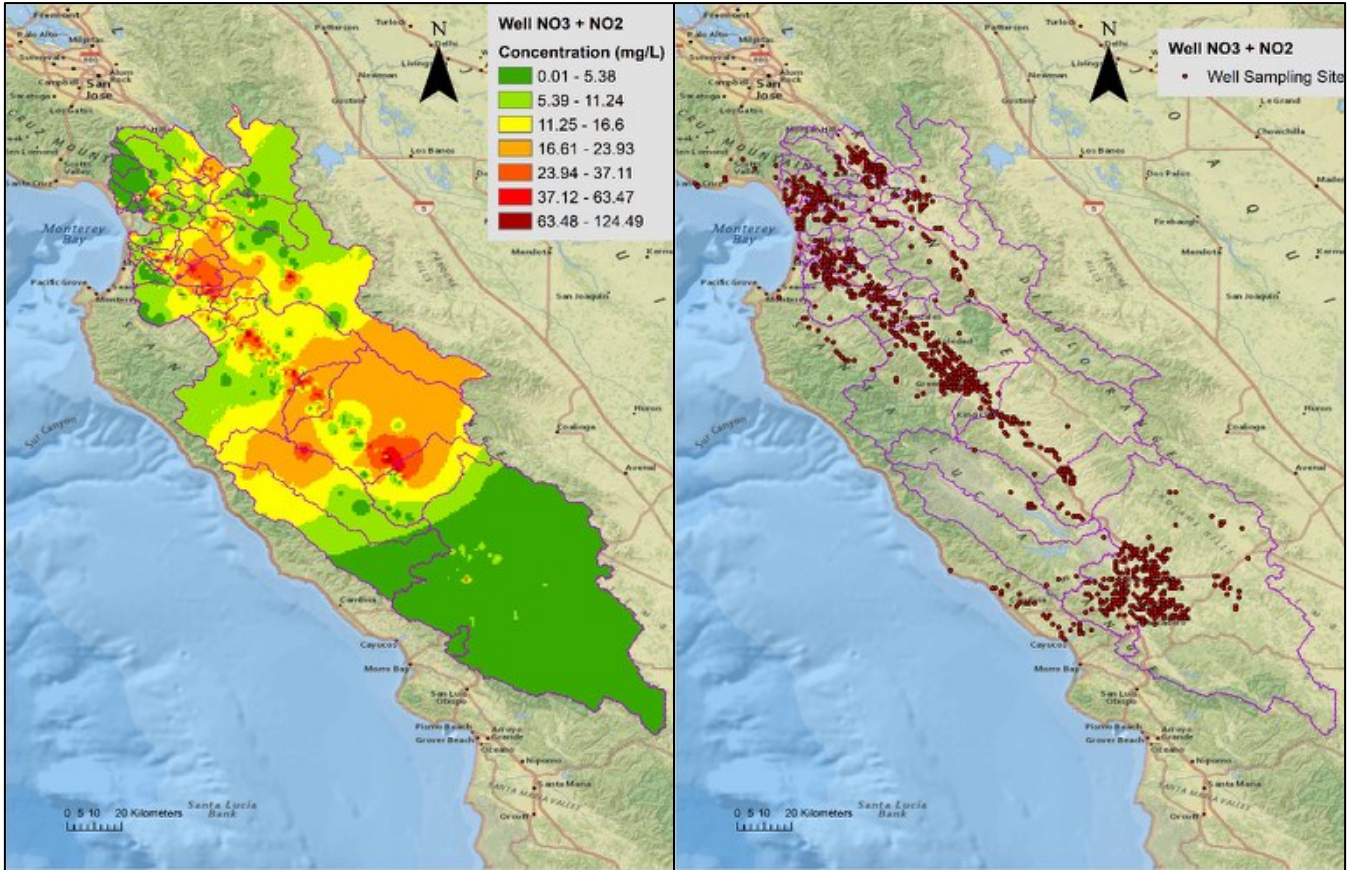
Top Predictors - Load

- Scheduled fertilizer application
  - Nitrate + Nitrite (+)
  - Total Nitrogen (+/-)
  - Phosphorus (+/-)
- Urease and/or nitrogen inhibitors
  - Nitrate + Nitrite (+)
  - Total Nitrogen (+)
  - Phosphorus (+)

2018 – Ranch Reporting



Well: NO_3 + NO_2


Well NO3 + NO2
Concentration (mg/L)
0.01 - 5.38
5.39 - 11.24
11.25 - 16.6
16.61 - 23.93
23.94 - 37.11
37.12 - 63.47
63.48 - 124.49
Well NO3 + NO2
Well Sampling Site
N
0 5 10 20 Kilometers

Summary

- Surface water quality is related to ground water
- Non-reporting is related to high analyte concentrations
- Other management practices not widely used
- Total nitrogen applied and in soil is not a predictor
- Limitations
  - Based on correlations
  - Limited robust models describing load
  - Limited well data / interpolation
  - Farm practices may be more related to trends in data than to co-occurring water quality.

Thank you!

Questions?

Salinas Valley Basin GSA
GSP Overviews

August 18, 2021

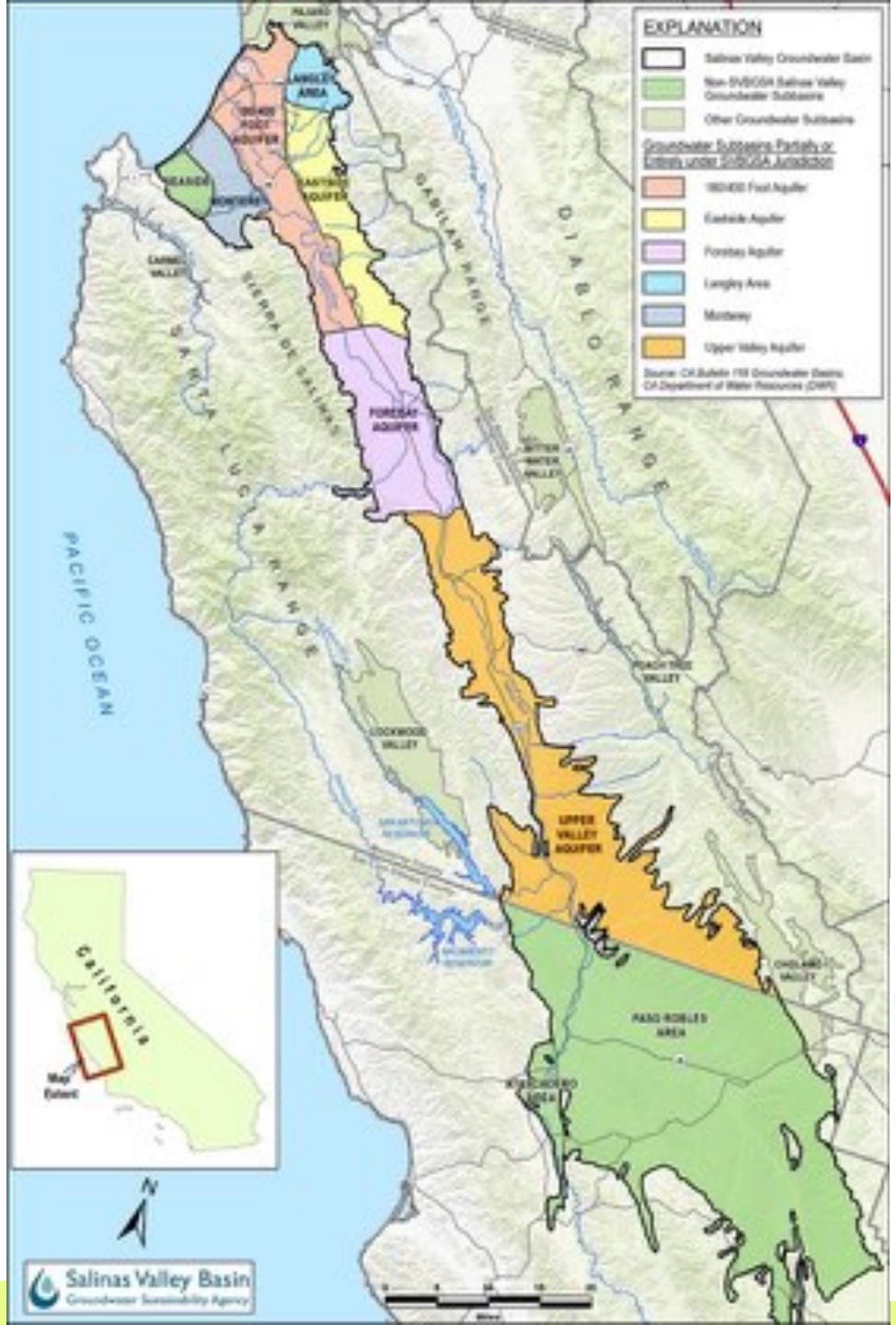
Prepared by

MONTGOMERY & ASSOCIATES

Local Basins

Six subbasins fall partially or entirely under SVBGSA jurisdiction:

- 180/400-Foot Aquifer
- East Side Aquifer
- Langley Area
- Monterey
- Forebay Aquifer
- Upper Valley Aquifer



SUBBASIN (DWR No)	State-Designated Priority
180/400 Ft. Aquifer (3-4.01)	High / Critical Condition of Overdraft
East Side Aquifer (3-4.02)	High
Langley Area (3-4.09)	High
Monterey (3-4.10)	Medium
Forebay Aquifer (3-4.04)	Medium
Upper Valley Aquifer (3-4.05)	Medium

SGMA Timeline and Steps to Sustainability

SGMA Start
Jan 1, 2015

Basin Modification
2016

GSA Formation
2017

GSP Development
2018 – Jan, 31 2020 (or 2022)

2020 – 2040 Achieve Sustainability within **20 years**

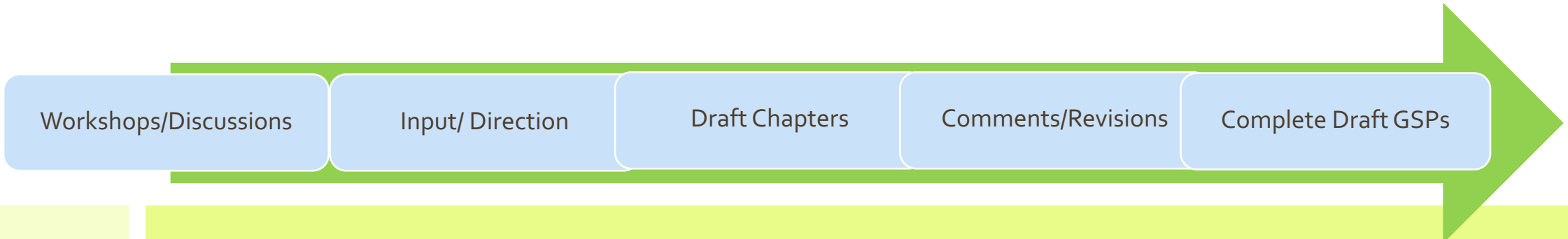
2040 – 2070 Maintain Sustainability for next **30 years**

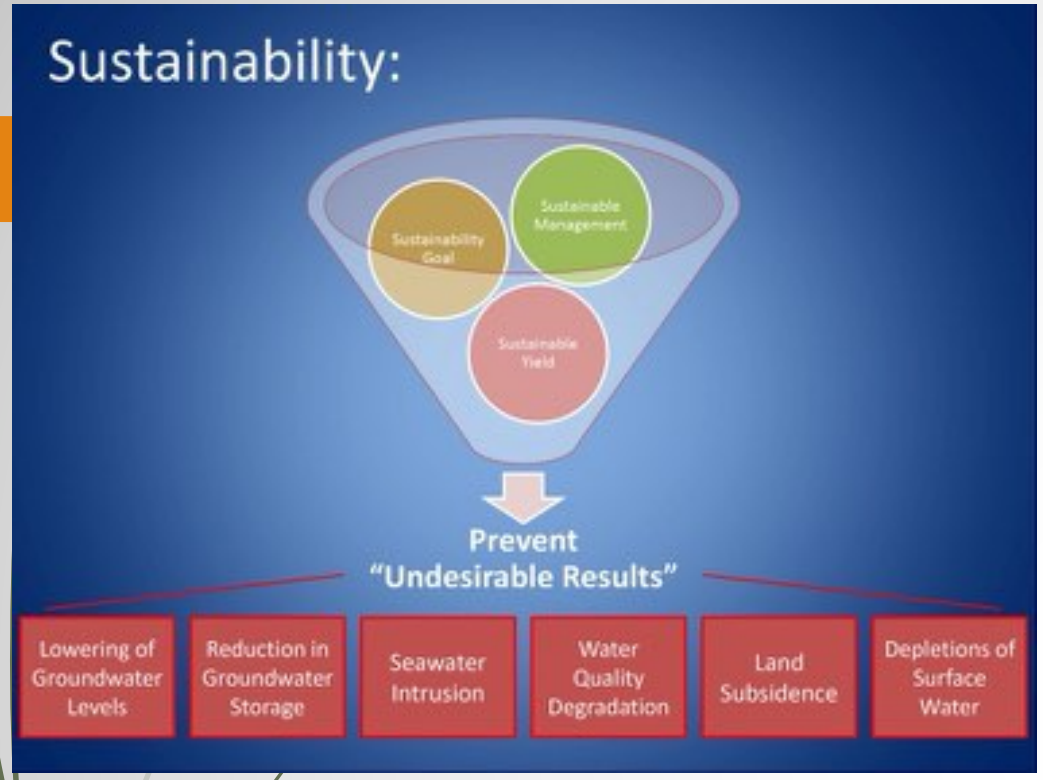
GSP Development: Discussions, Input & Direction

- Subbasin Committees:
- Draft Chapters: Released June 2020 – August 2021
- Comments:
  - Comments received throughout the process
  - Comment table, comment letters and responses
- Board of Directors released four draft GSPs for public comment
- Board of Directors Public Hearing: December 9th, 2021
- GSPs to be submitted to DWR: January 2022

Workshops

Brown Act and Conflict of Interest
Sustainable Management Criteria
Water Law
Watershed Overview
GSP Web Map
Small Drinking Water Systems
Pumping Allocations
Funding Mechanisms
Water Budgets and Modeling
Communications and Implementation
SVIHM/SVOM Model Workshop



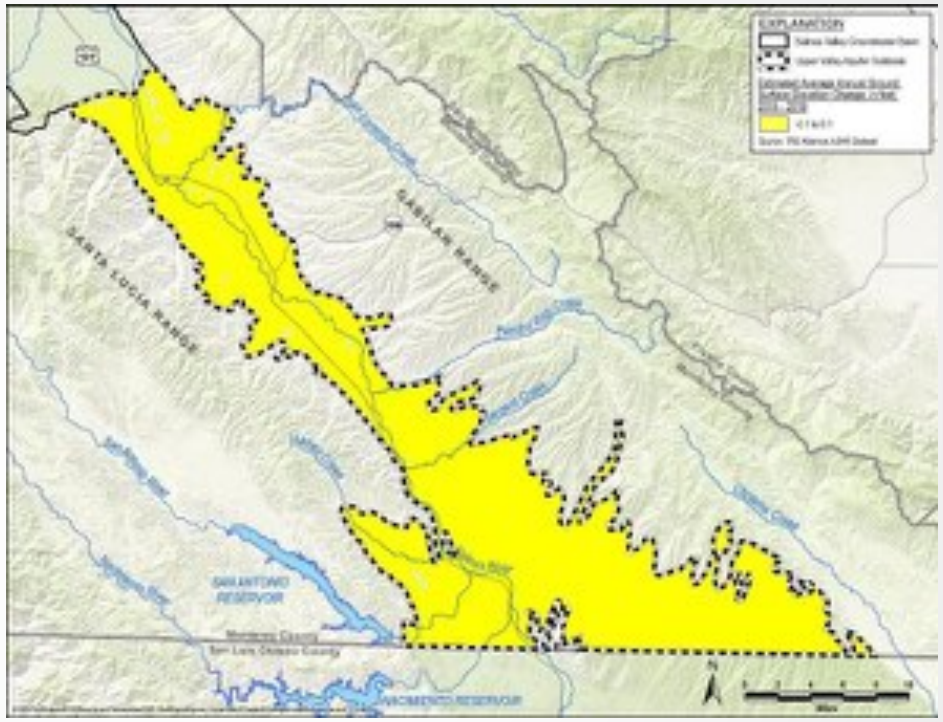


Each of the Six Sustainability Indicators has:

- A statement of what is ***significant and unreasonable*** for the GSP
- ***Minimum thresholds*** - quantitative value that define what is significant and unreasonable at every measuring point
- ***Undesirable results*** - combination of minimum thresholds exceedances for the whole subbasin
- ***Measurable objectives*** are quantitative goals
- *GSPs must clearly define a planned pathway to reach sustainability in the form of interim milestones towards measurable objectives, and show actual progress in annual reporting*

Groundwater conditions SMC – **Subsidence**

Subsidence	Subsidence
Measurable Objective (MO): Zero net long-term subsidence, with no more than 0.1 foot per year of estimated land movement to account for InSAR errors	**Measurable Objective (MO):** 0.1 feet per year. This is a long-term rate of zero feet per year plus 0.1 feet per year of estimated land movement to account for InSAR measurement errors.
Minimum Threshold (MT): Zero net long-term subsidence, with no more than 0.1 foot per year of estimated land movement to account for InSAR errors	**Minimum Threshold (MT):** 0.133 feet per year. This is the rate that results in less than one foot of cumulative subsidence over a 30-year implementation horizon, plus 0.1 feet per year of estimated land movement to account for InSAR measurement errors.
Undesirable Result: There is an exceedance of minimum thresholds for subsidence.	**Undesirable Result:** There is no exceedance of minimum threshold for subsidence.



- Negligible current subsidence
- Future subsidence due to groundwater conditions is unlikely

Groundwater conditions SMC – **Groundwater Quality**

Still being developed

Degraded Groundwater Quality

Measurable Objective (MO)

Zero additional exceedances of either the regulatory drinking water standards (potable supply wells) or the Basin Plan objectives (irrigation supply wells) beyond those observed in 2019 for groundwater quality constituents of concern.

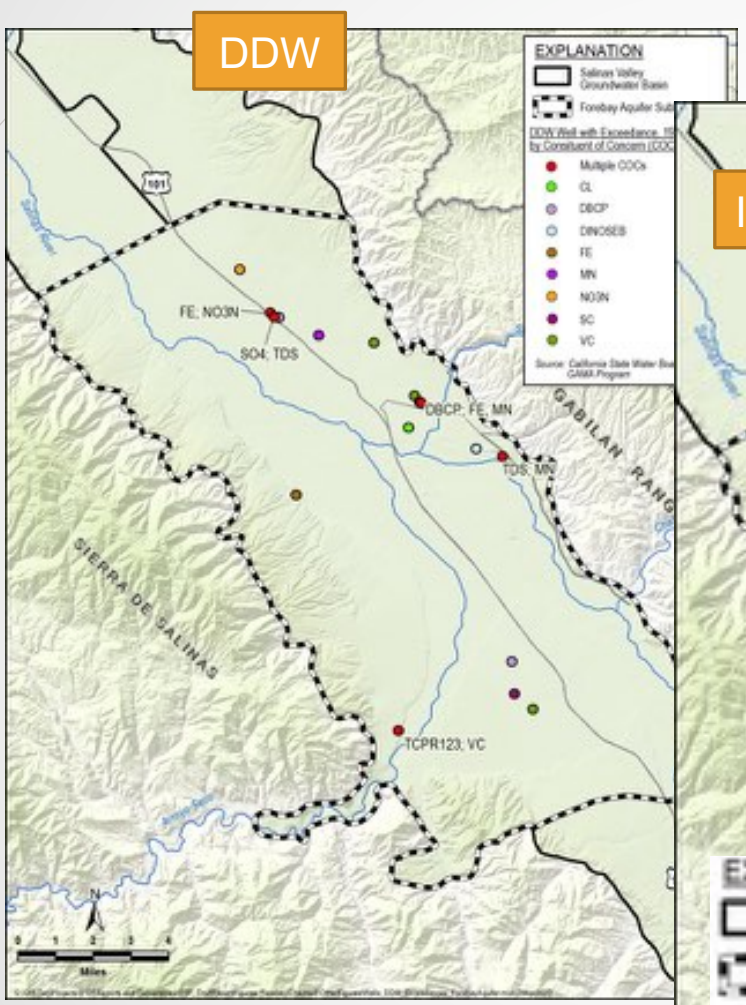
Minimum Threshold (MT)

Same as the measurable objective.

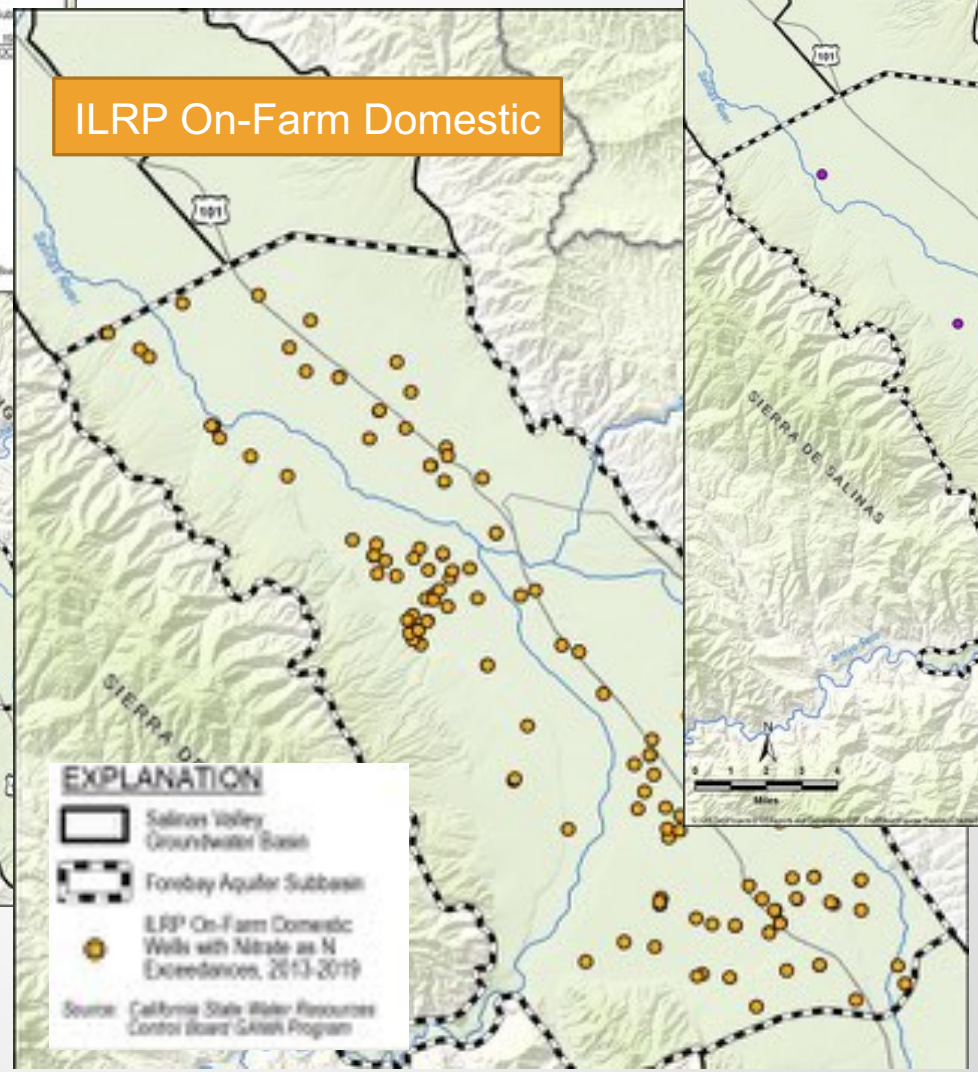
Undesirable Result:

The minimum threshold is exceeded as a direct result of projects or management actions taken as part of GSP implementation.

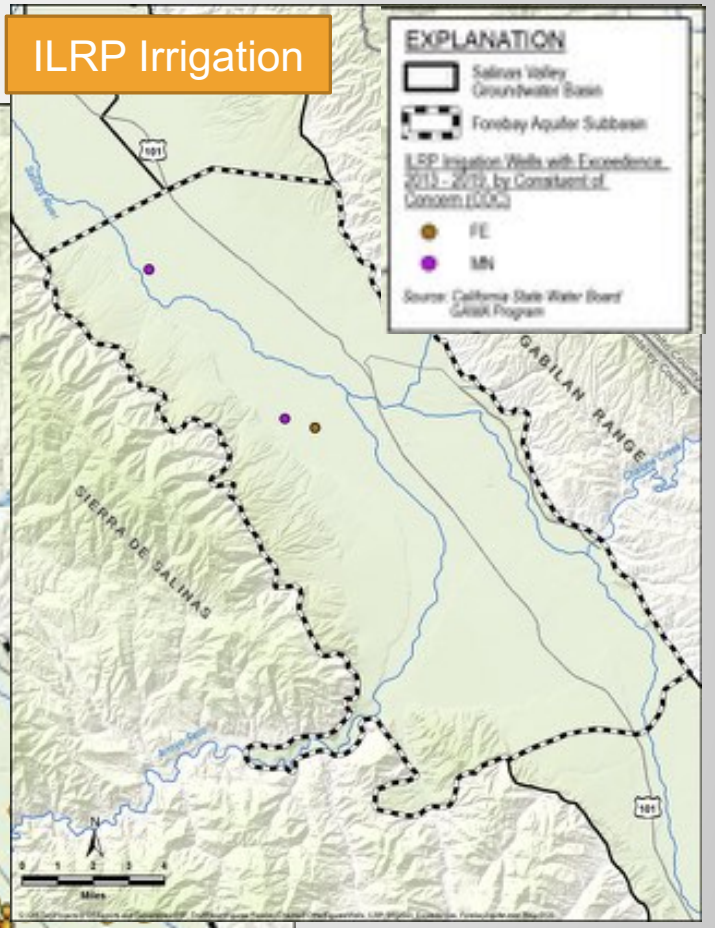
DDW



ILRP On-Farm Domestic



ILRP Irrigation

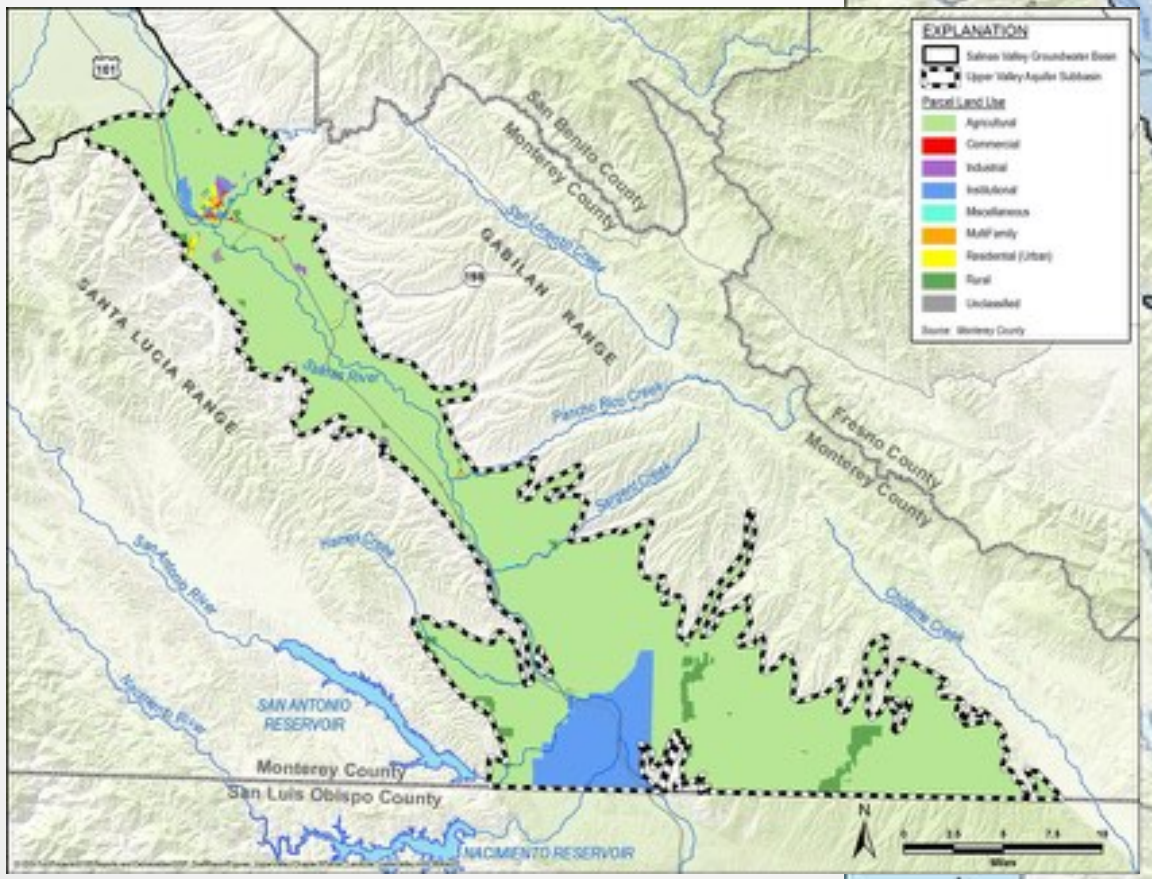


Upper Valley GSP Overview

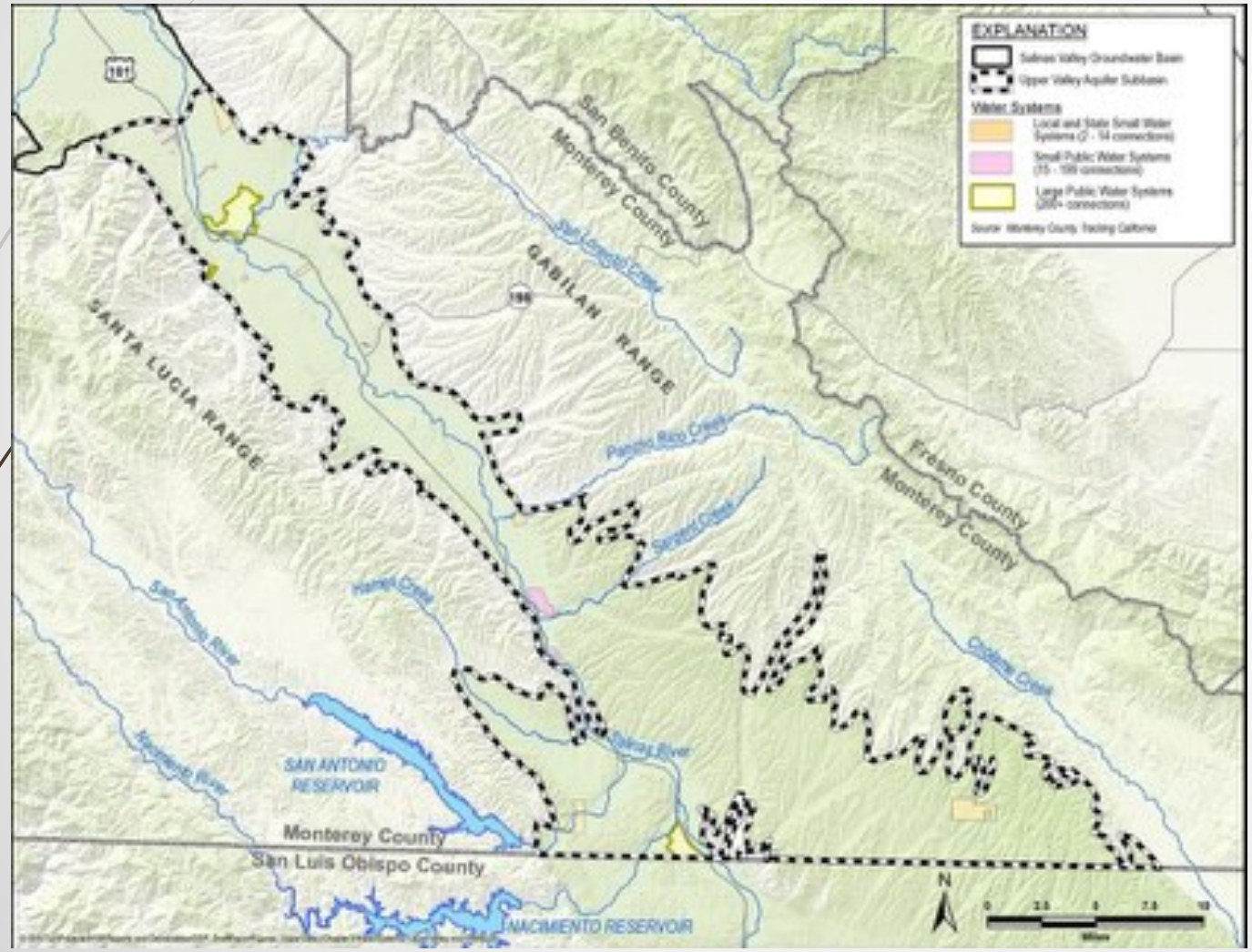
MONTGOMERY & ASSOCIATES

Upper Valley Aquifer Subbasin

- 237,670 acres
- Most land designated agricultural (72,102, irrigated; 136,496, dry)

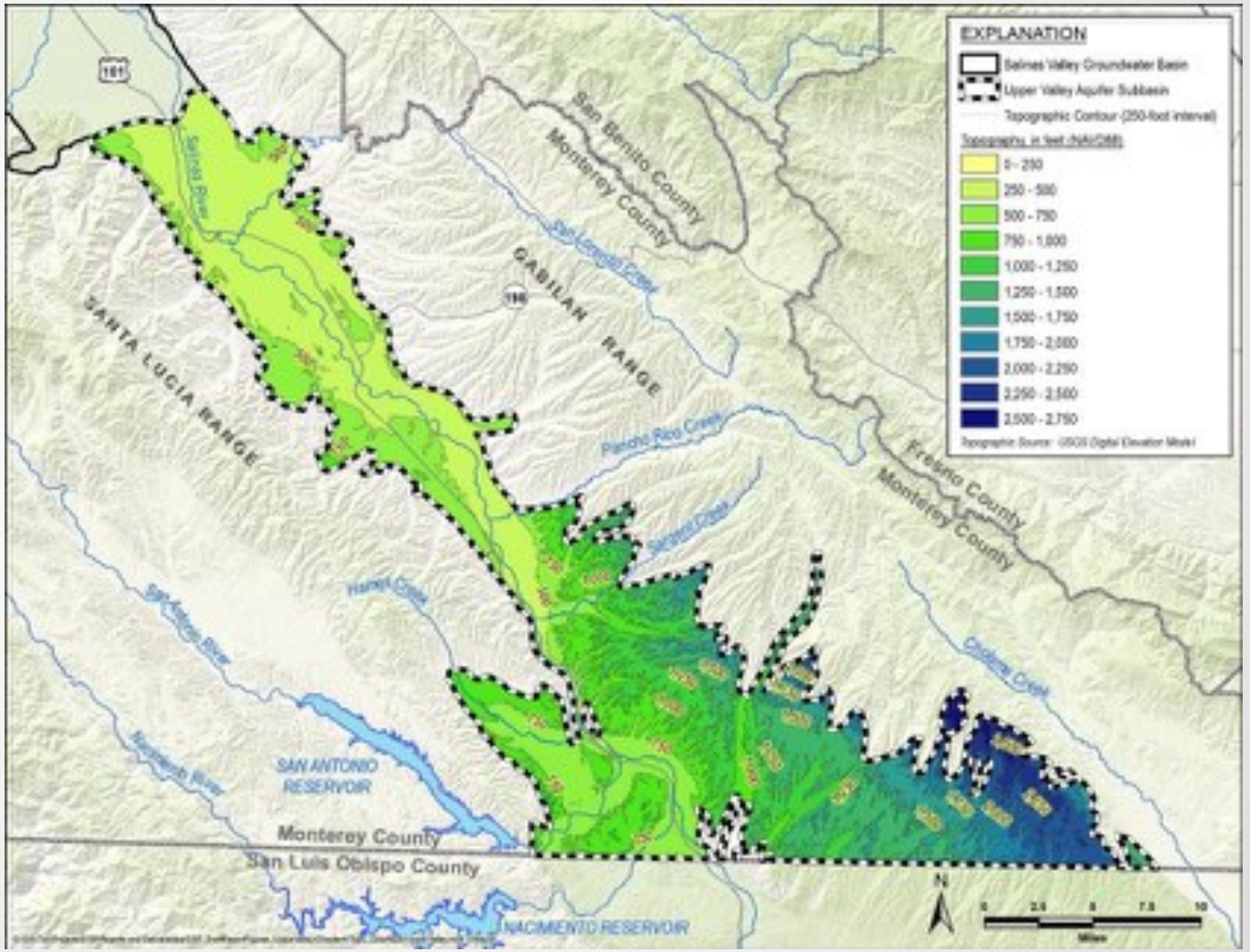


Drinking Water Systems Dependent on Groundwater

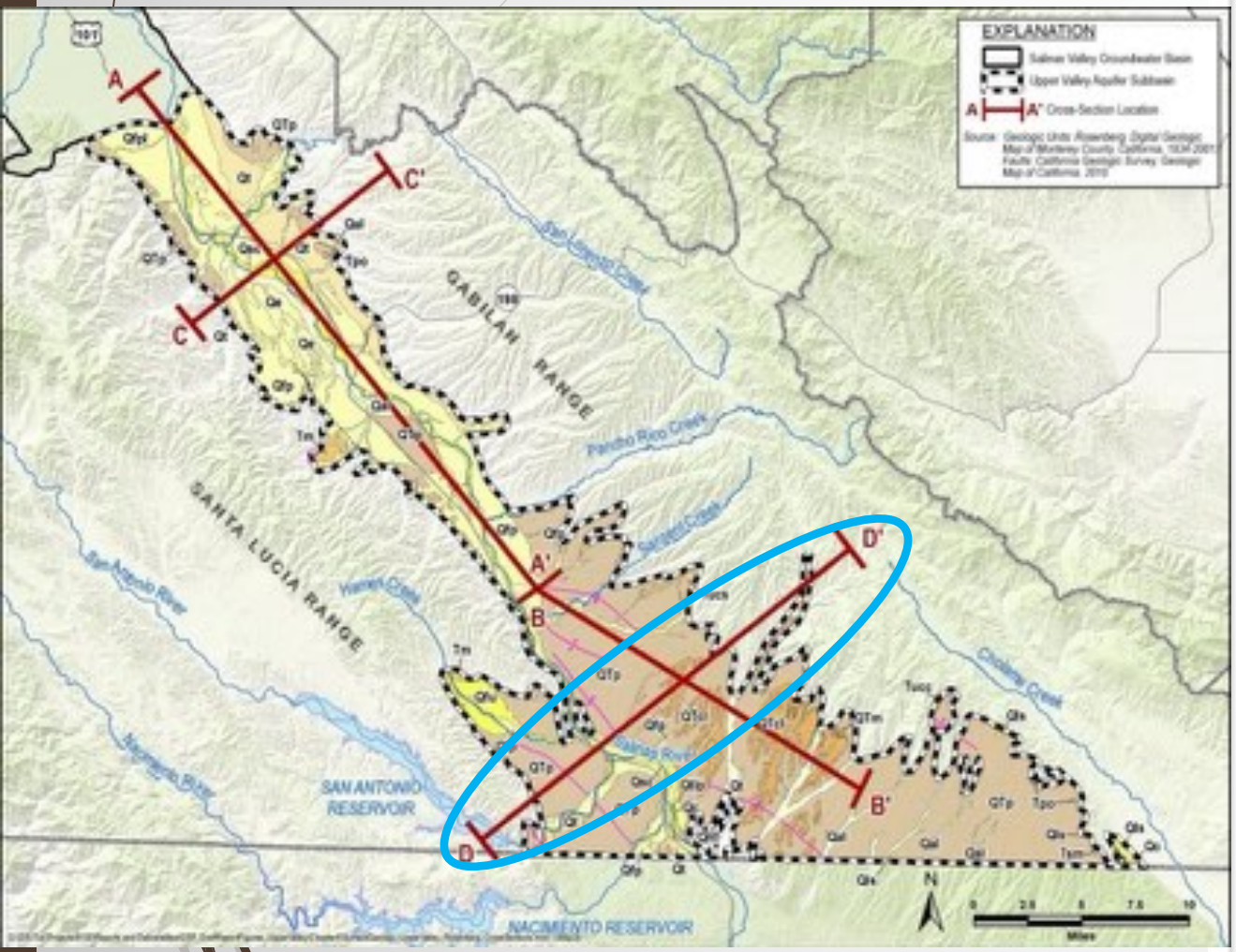


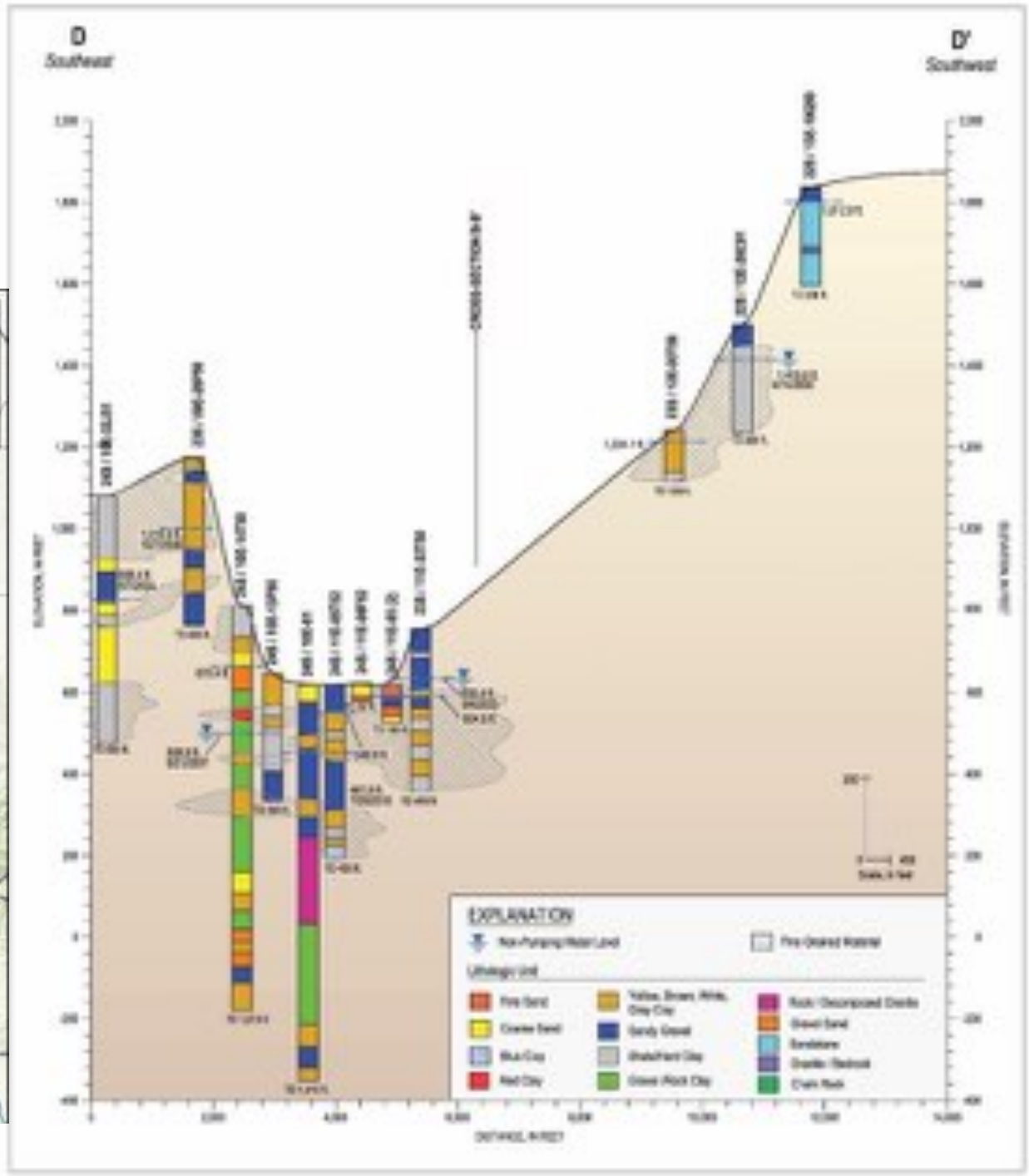
Water Systems	
Local and State Small (2 – 14 connections)	14
Small Public (15 – 199 connections)	9
Large Public (200+ connections)	3

Basin Setting - Topography

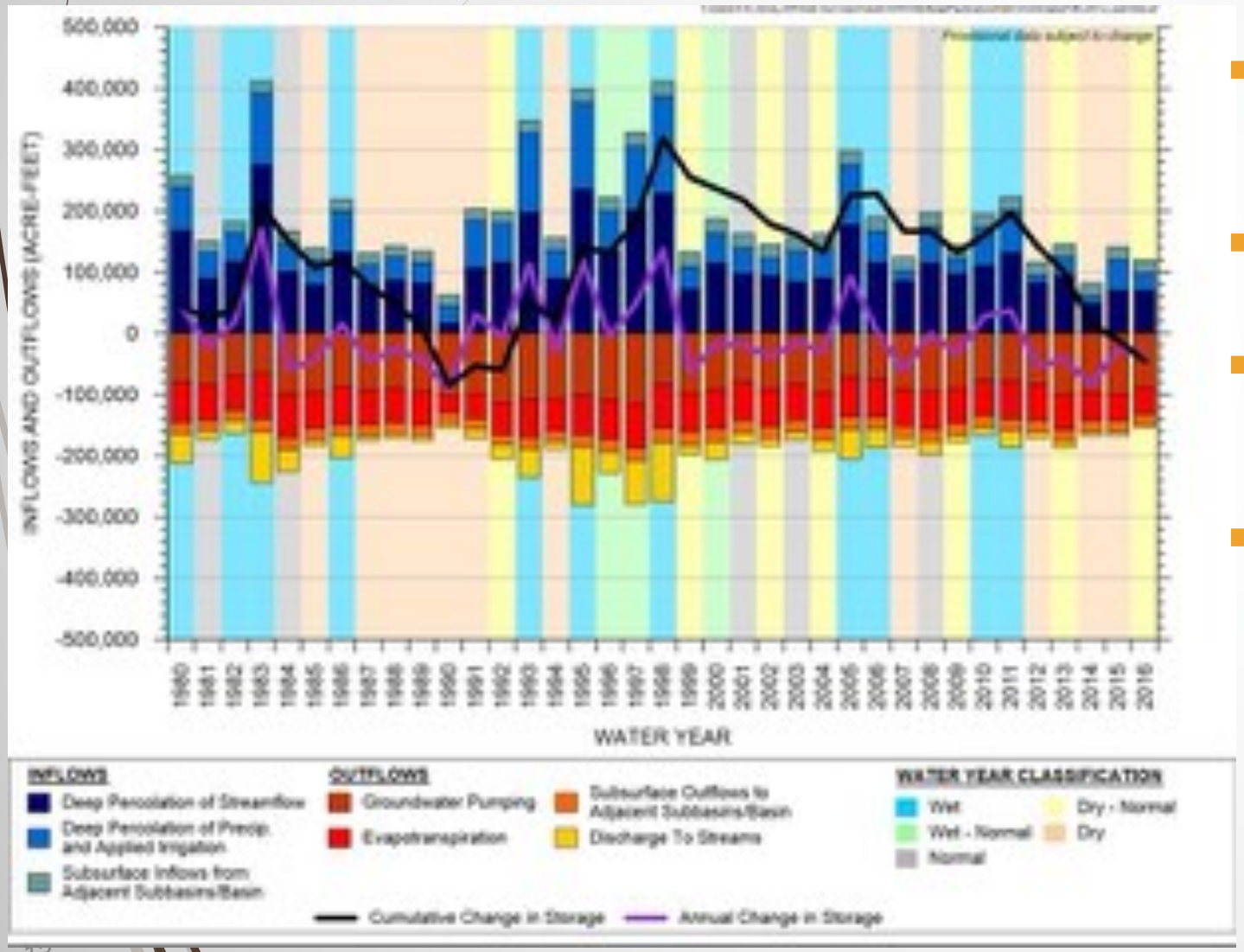


Hydrogeologic Conceptual Model





Upper Valley Groundwater Budget Summary



- Overall – there is no chronic decline in water levels or storage and the historical water budget shows the Upper Valley is in balance
- Historical and future water budgets are both averages of many years/hydrologic periods
- Future water budget incorporates average climate change, but does not represent short-term climate change effects
- The sustainable yield is the maximum amount of extraction that can occur without causing undesirable results as defined for each sustainability indicator
  - Historical sustainable yield/pumping ranges from 108,500 to 129,600 AF/yr.
  - Future sustainable yield is about 117,000 AF/yr.

Groundwater conditions/SMC – **Groundwater Levels**

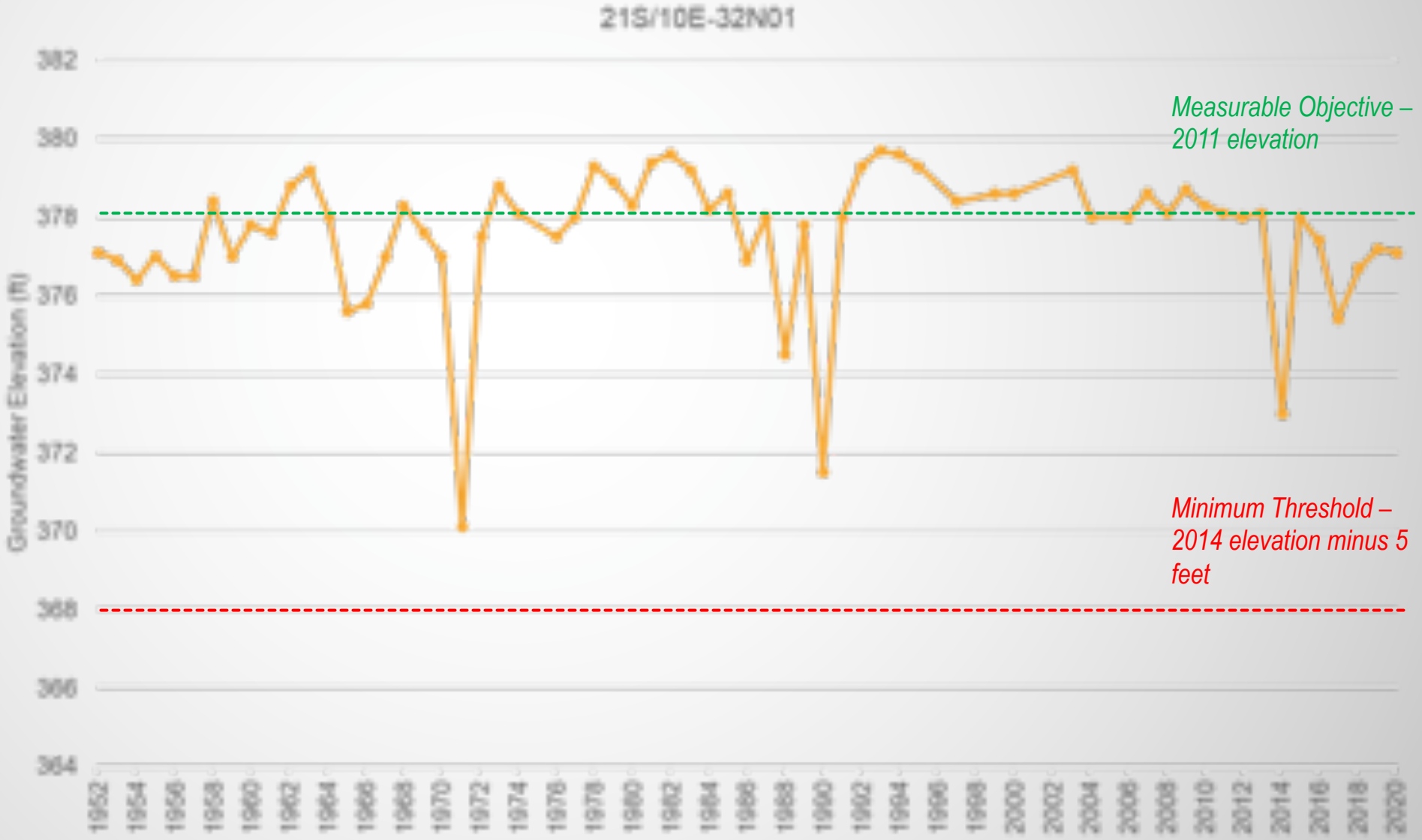
Chronic Lowering of Groundwater Levels

Measurable Objective (MO):
Set to 2011 groundwater elevations.

Minimum Threshold (MT):
Set to 5 feet below the lowest groundwater elevation between 2012 and 2016.

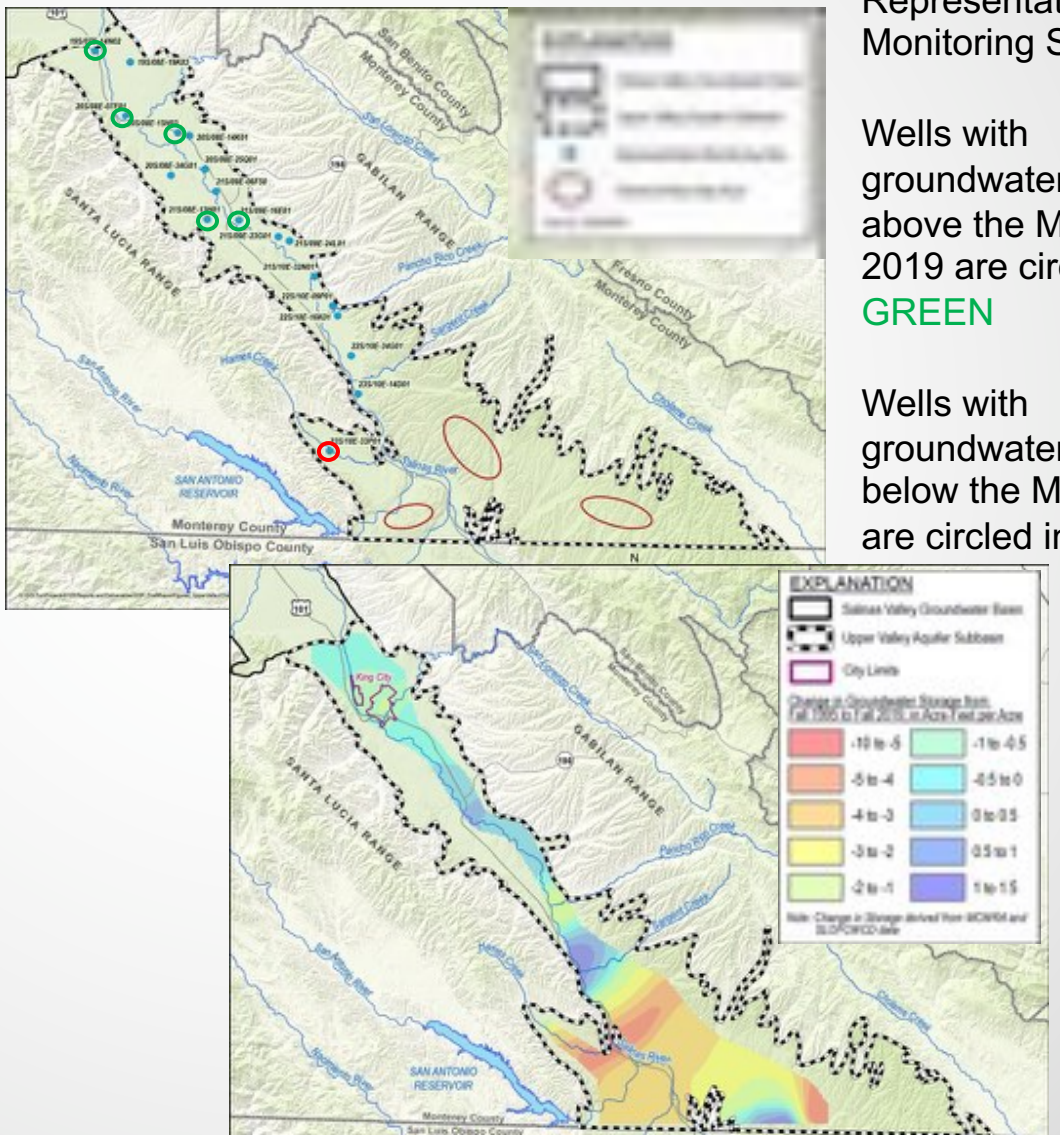
Undesirable Result:
More than 15% of groundwater elevation minimum thresholds are exceeded.

Example well



Groundwater conditions/SMC – **Groundwater Levels and Storage**

Chronic Lowering of Groundwater Levels	Reduction in Groundwater Storage
Measurable Objective (MO): Set to 2011 groundwater elevations.	**Measurable Objective (MO):** Established by proxy using groundwater elevations. Set to the same as groundwater levels measurable objectives
Minimum Threshold (MT): Set to 5 feet below the lowest groundwater elevation between 2012 and 2016.	**Minimum Threshold (MT):** Established by proxy using groundwater elevations. Set to the same as groundwater levels minimum thresholds
Undesirable Result: More than 15% of groundwater elevation minimum thresholds are exceeded.	**Undesirable Result:** More than 15% of groundwater elevation minimum thresholds are exceeded.



Representative Monitoring Sites

Wells with groundwater levels above the MO in 2019 are circled in GREEN

Wells with groundwater levels below the MT in 2019 are circled in RED

Groundwater conditions/SMC – **Interconnected Surface Water**

Depletion of Interconnected surface water (ISW)

Measurable Objective (MO):
Established by proxy using shallow groundwater elevations observed in 2011 near locations of ISW

Minimum Threshold (MT):
Established by proxy using shallow groundwater elevations observed in 2016 near locations of ISW

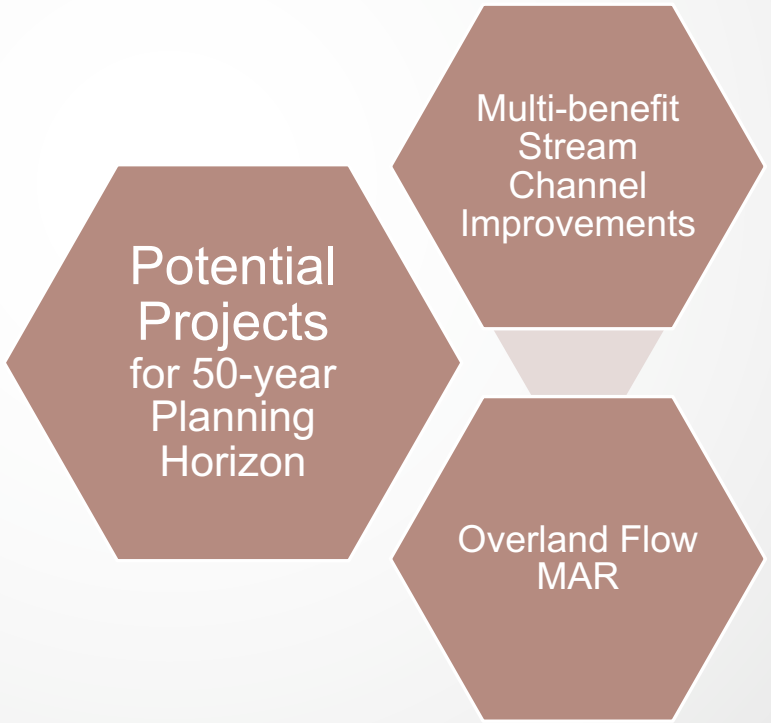
Undesirable Result:
There is an exceedance of the minimum threshold in a shallow groundwater monitoring well used to monitor ISW.

- No interconnected surface water monitoring points yet
  - Green dots are USGS gauge and MCWRA River Series measurement site
  - Pink dots are existing wells that will be added to network
- One new well will be added (pink star)

Summary of Current Conditions in Relation to SMC

- Upper Valley Aquifer Subbasin has not historically been in overdraft, nor experienced chronic lowering of groundwater levels
- From 1980 to 2016, the basin was in overdraft during only 5 years
- However, there are a few areas away from the river where groundwater elevations have been declining
- Given that the Subbasin's extraction is currently close to the sustainable yield, this GSP includes a robust set of potential management actions and projects that could be **undertaken if needed**

Management Actions and Projects



Upper Valley SMC TAC

Technical committee that reviews groundwater conditions and provides science-based advice on management actions & projects to Subbasin Planning Committee.

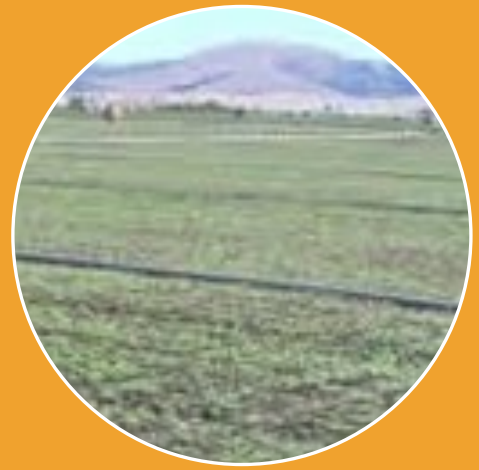
Will consider recharge projects, demand management, and groundwater quality mitigation.

Cost: staffing costs plus $10,000/yr.

Conservation & Ag BMPs

Promotes agricultural best management practices (BMPs) and supports use of evapotranspiration data as an irrigation management tool for growers.

Cost: Approximately $100,000 for 4 workshops, grant writing, and demonstration trials. Cost could be reduced if shared between subbasins.



Fallowing, Fallow Bank, & Ag Land Retirement

A voluntary program of incentives for fallowing or retiring agricultural land

Includes a fallow bank, whereby anybody fallowing land could draw against the bank to offset lost profit.

Cost: $195-$395/AF if land is fallowed, $810-$2,000/AF if land is retired (can be scaled to desired amount)

MANAGEMENT ACTIONS

MCWRA Drought Technical Advisory Committee

Support the existing Drought Technical Advisory Committee (D-TAC), which plans reservoir releases during drought conditions.

No additional costs since already formed.

Reservoir Reoperation

Collaborate with MCWRA to evaluate potential reoperation scenarios.

Could be paired with projects such as the MCWRA Interlake Tunnel and Winter Release with ASR projects.

Cost: approximately $400,000 - $500,000

Management Actions

Multi-benefit Stream Channel Improvements

Prune native vegetation and remove non-native vegetation, manage sediment, and enhance floodplains for recharge. Includes 3 components:

1. **Stream Maintenance Program**, Multi-subbasin cost of $0.6M-$1.0M/yr.

2. **Invasive Species Eradication**, Multi-subbasin benefits of 2,790-20,880 AF/yr., cost of $16.5M or $60-$600/AF

3. **Floodplain Enhancement and Recharge**, benefits of 400 AF/yr. for 4 basins in Upper Valley alone, cost of $4.5M or $930/AF

Managed Aquifer Recharge with Overland Flow

Description: Construct recharge basins for managed aquifer recharge of overland flow before it reaches streams.

Benefits: approximately 400 AF/yr. for 4 recharge basins; could be scaled up or down

Cost: $4,128,000 for 4 recharge basins, or $870/AF

Project Options Over 50 Year Planning Horizon

Implementation Actions

Well Registration

- Register all production wells, including domestic wells

Water Quality Partnership

- Form a working group for agencies and organizations to collaborate on addressing water quality concerns.

GEMS Expansion & Enhancement

- Update current MCWRA GEMS program, by collecting groundwater extraction data from wells in areas not currently covered by GEMS and improving data collection

Dry Well Notification System

- Develop a system for well owners to notify the GSA if their wells go dry. Refer those owners to resources to assess and improve their water supplies. Form a working group if concerning patterns emerge.

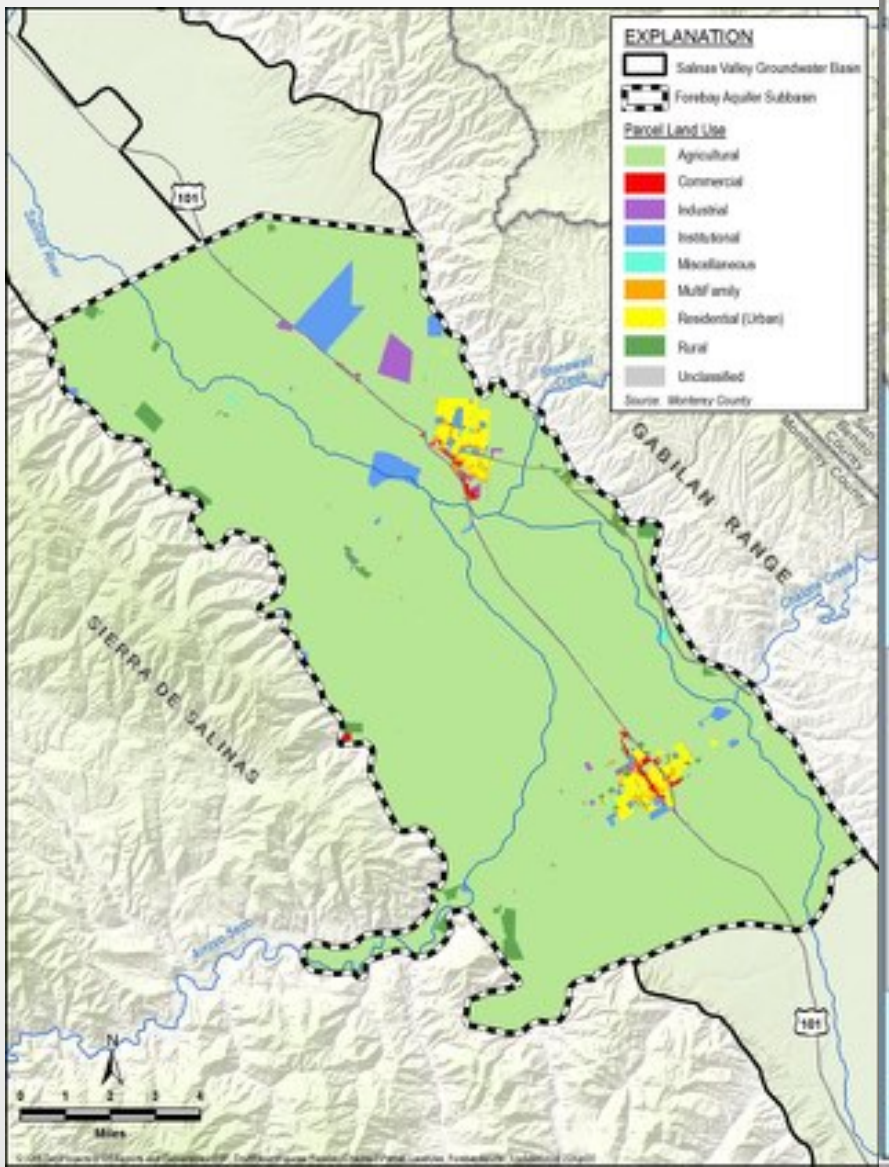
Forebay Aquifer Subbasin GSP Overview

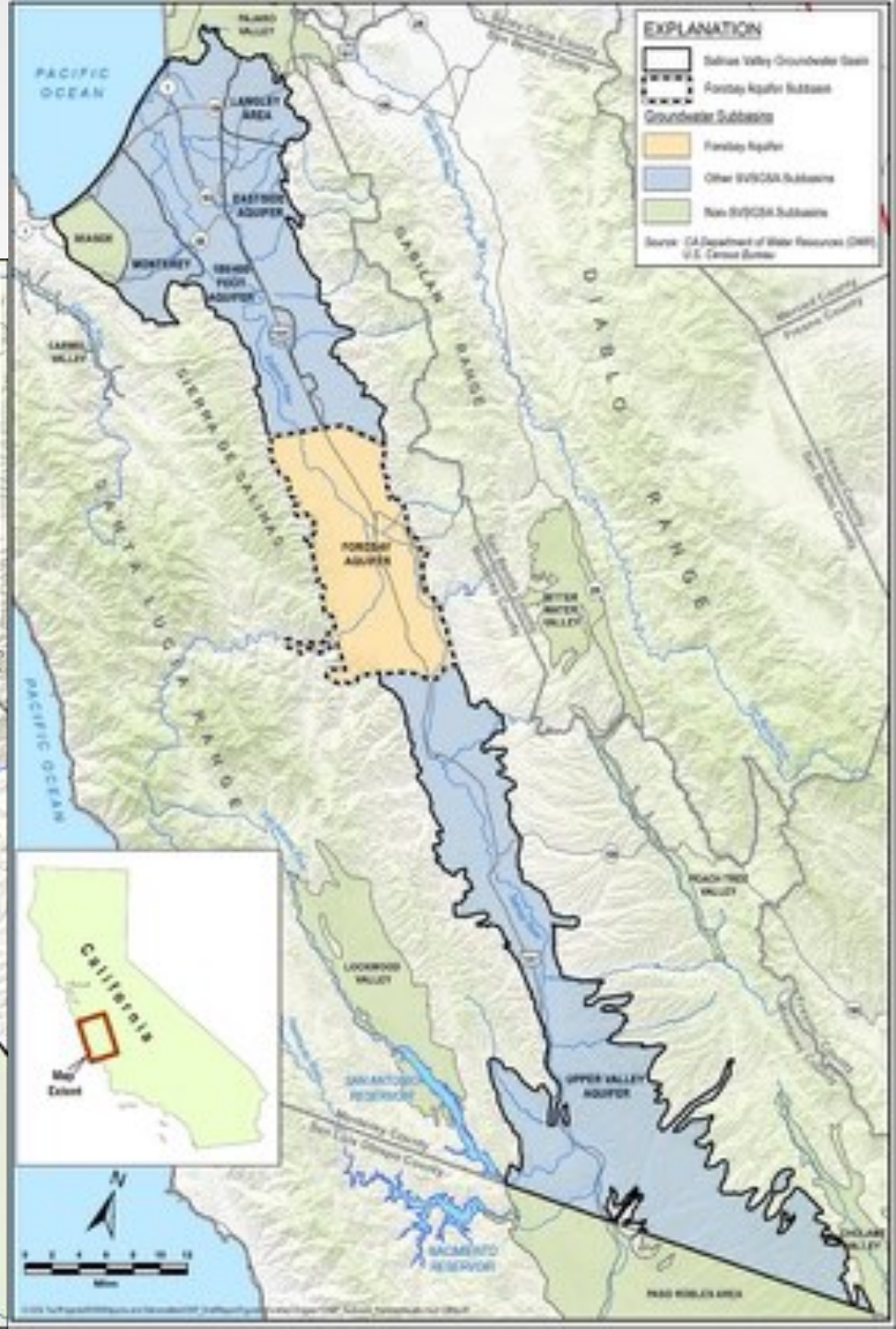
Prepared by

MONTGOMERY & ASSOCIATES

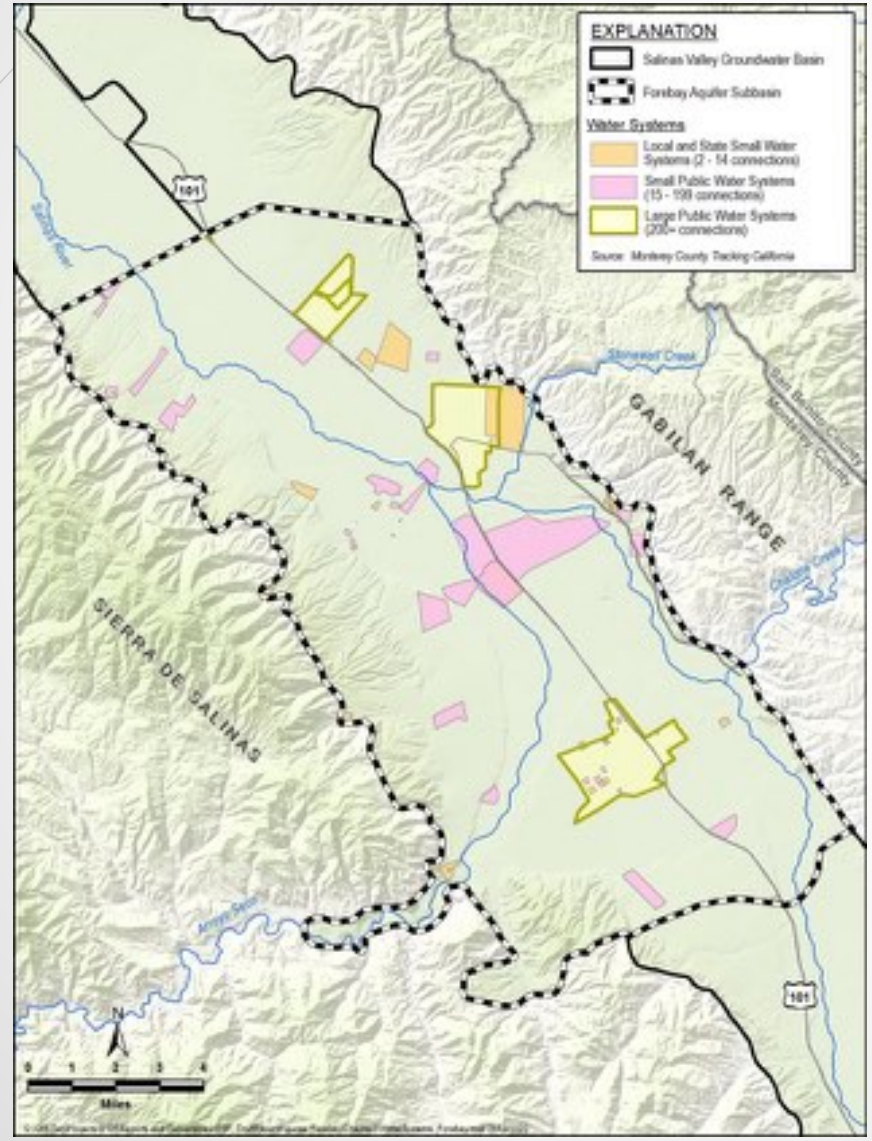
Forebay Aquifer Subbasin

- 94,000 acres
- Most land designated agricultural





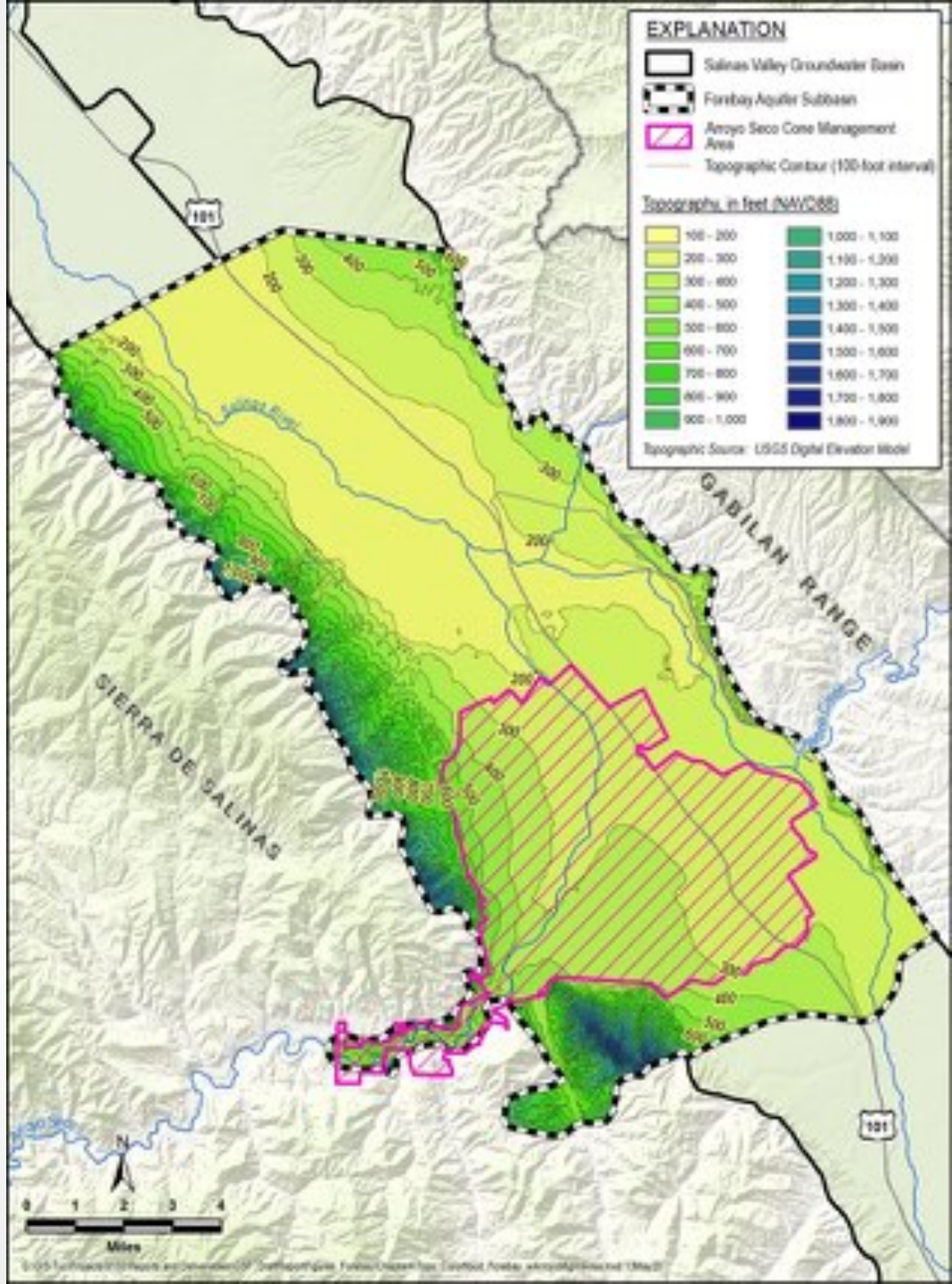
Drinking Water Systems Dependent on Groundwater



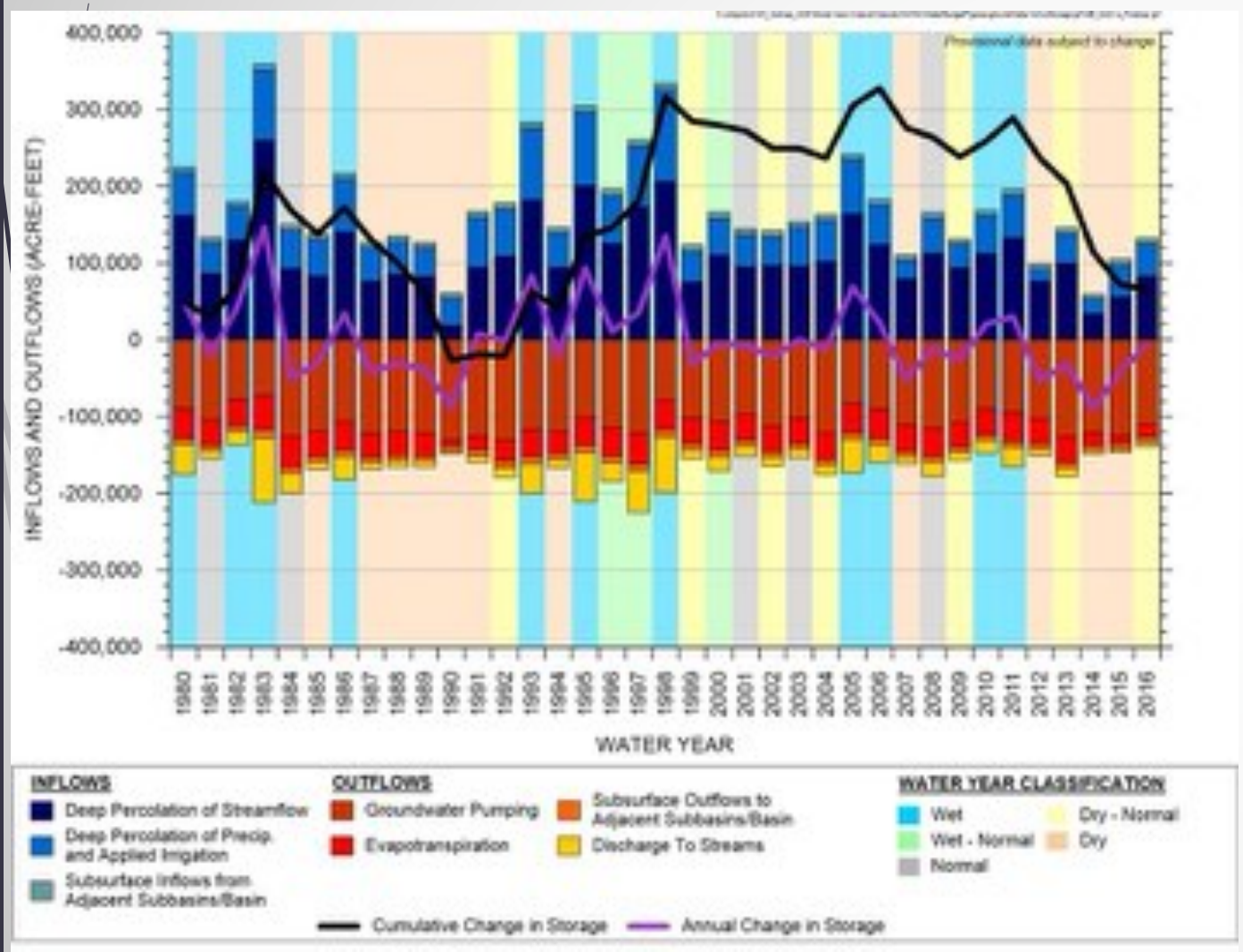
Water Systems	
Local and State Small (2 – 14 connections)	40
Small Public (15 – 199 connections)	21
Large Public (200+ connections)	5

Basin Setting - Topography

- Arroyo Seco Cone
  - Alluvial fan
  - Coarser material than greater Forebay Subbasin
- Arroyo Seco Cone Management Area is outlined in pink



Forebay Groundwater Budget Summary



- Overall – there is no chronic decline in water levels or storage and the historical water budget shows the Forebay is in balance
- Historical and future water budgets are both averages of many years/hydrologic periods
- Future water budget incorporates average climate change, but does not represent short-term climate change effects
- The sustainable yield is the maximum amount of extraction that can occur without causing undesirable results as defined for each sustainability indicator.
  - Greater Forebay Subbasin historical sustainable yield/pumping ranges from 151,100 to 174,500 AF/yr and 44,400 to 53,000 AF/yr for the ASMCA
  - Future sustainable yield is about 179,200 AF/yr. for the Greater Forebay Subbasin and about 55,400 AF/yr. for the ASMCA

Groundwater conditions/SMC – *Groundwater Levels and Storage*

Chronic lowering of groundwater levels SMC

Measurable Objective (MO):
2015 groundwater elevations + 75% of difference between 2015 and 1998

Minimum Threshold (MT):
Set to December 2015 groundwater elevations

Undesirable Result:
Over the course of any one year, more than 15% of groundwater elevation minimum thresholds are exceeded.

Reduction of groundwater storage

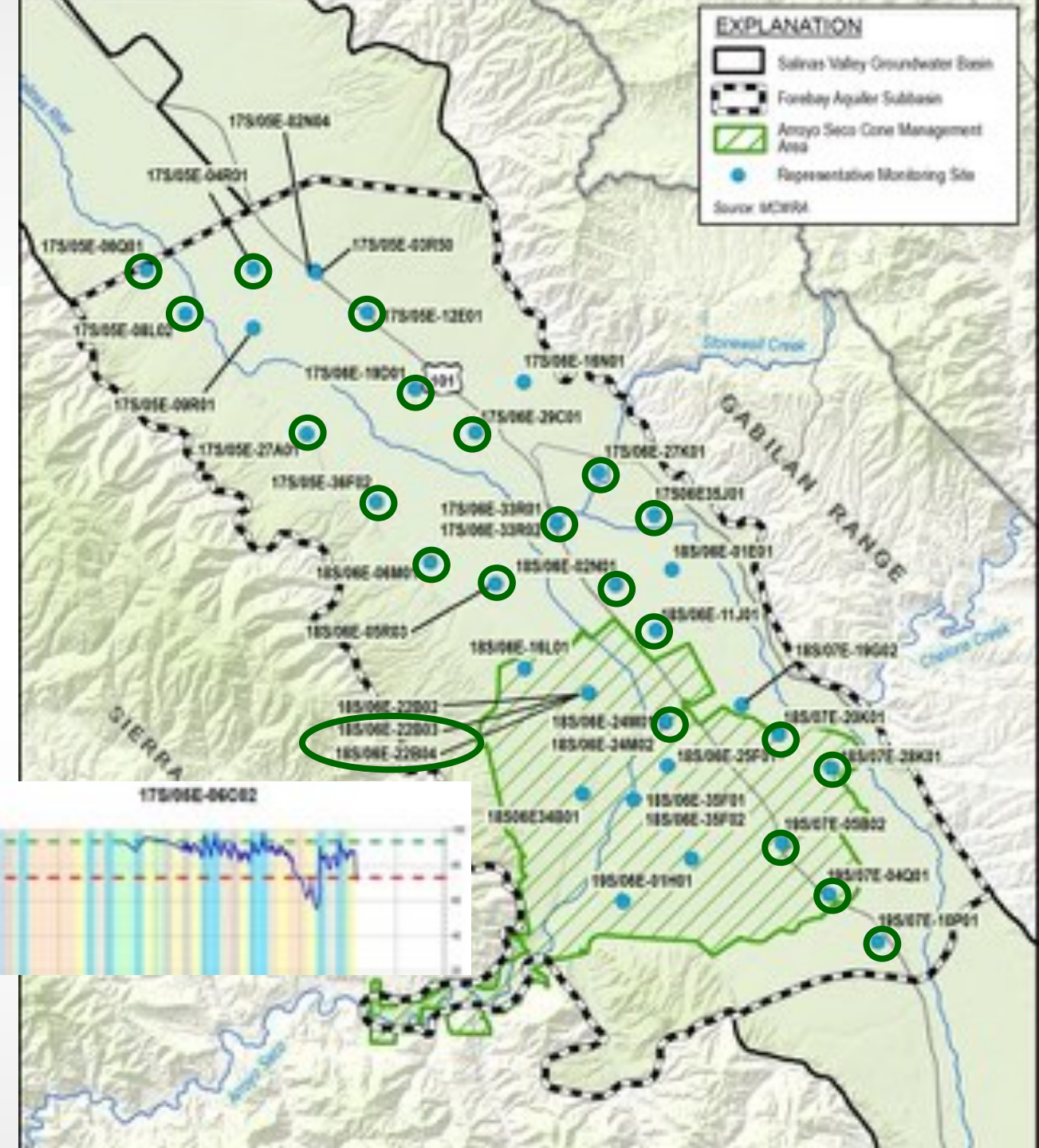
Measurable Objective (MO):
Set to zero when the groundwater elevations are held at the groundwater level measurable objectives.

Minimum Threshold (MT):
Set to -267,000 acre-feet below the measurable objective. This reduction is based on the groundwater level minimum thresholds.

Undesirable Result:
There is an exceedance of the minimum threshold.

No wells were below the MT in 2019

Wells circled in green were above the MO in 2019



Groundwater conditions/SMC – **Interconnected Surface Water**

Depletion of Interconnected Surface Water (ISW)

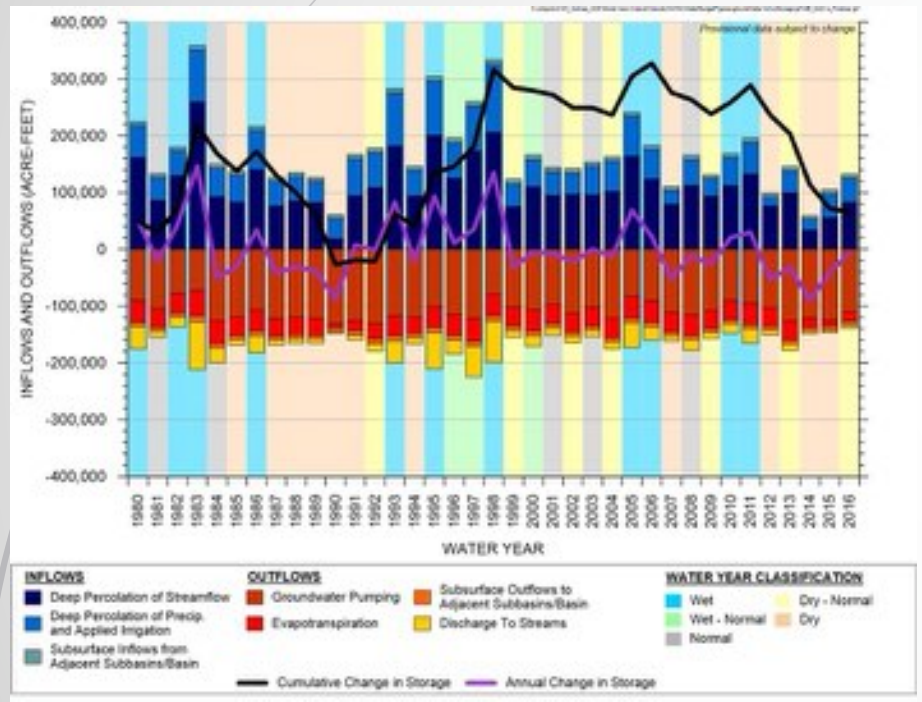
Measurable Objective (MO):
Established by proxy using shallow groundwater elevations near locations of ISW, are set to 75% of the distance between 2015 and 1998 shallow groundwater elevations.

Minimum Threshold (MT):
Established by proxy using shallow groundwater elevations near locations of ISW, are set to groundwater elevations observed in December 2015.

Undesirable Result:
There is an exceedance of the minimum threshold in a shallow groundwater monitoring well used to monitor ISW.

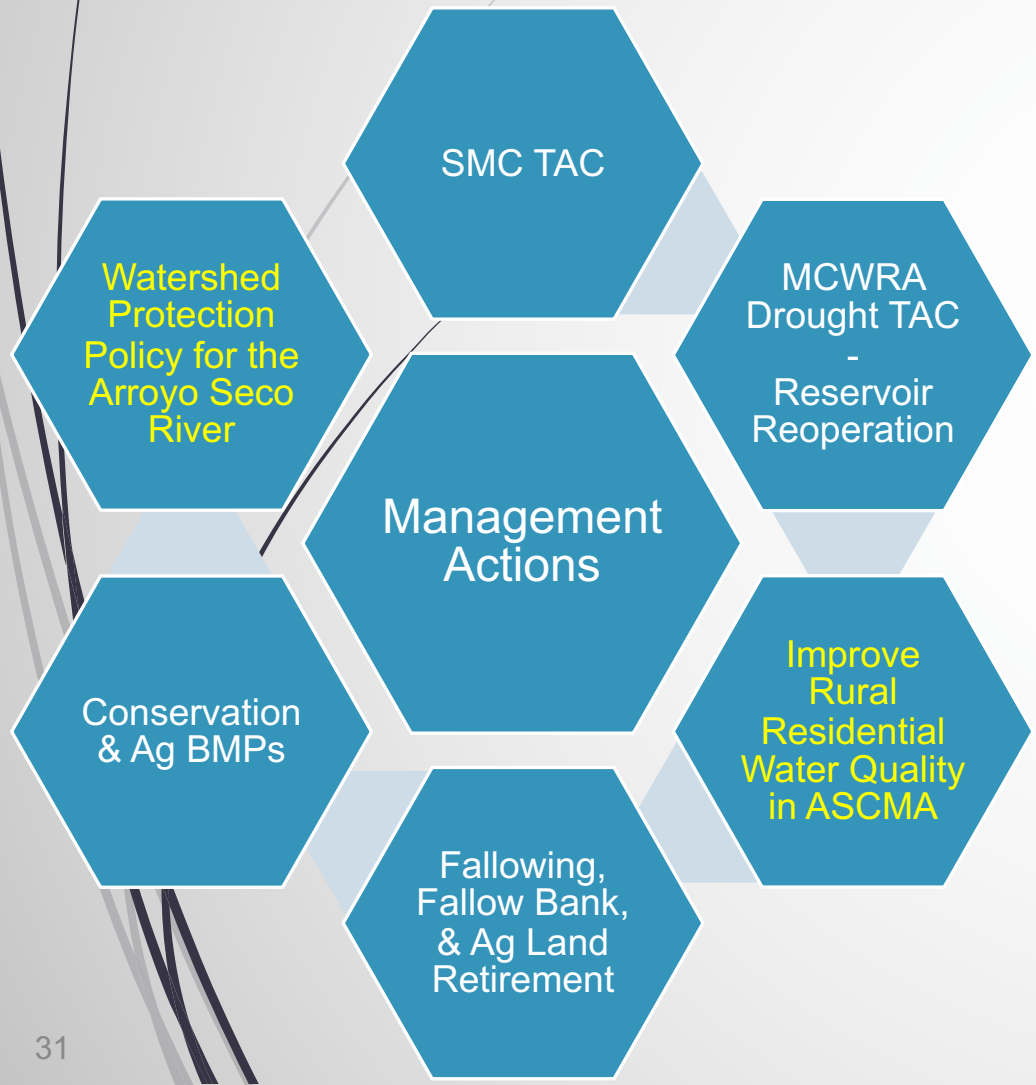
- No interconnected surface water monitoring points yet
  - Green dots are USGS gauge and MCWRA River Series measurement site
  - Pink dots are existing wells that will be added to network
- One shallow well will be added on Arroyo Seco (pink star)

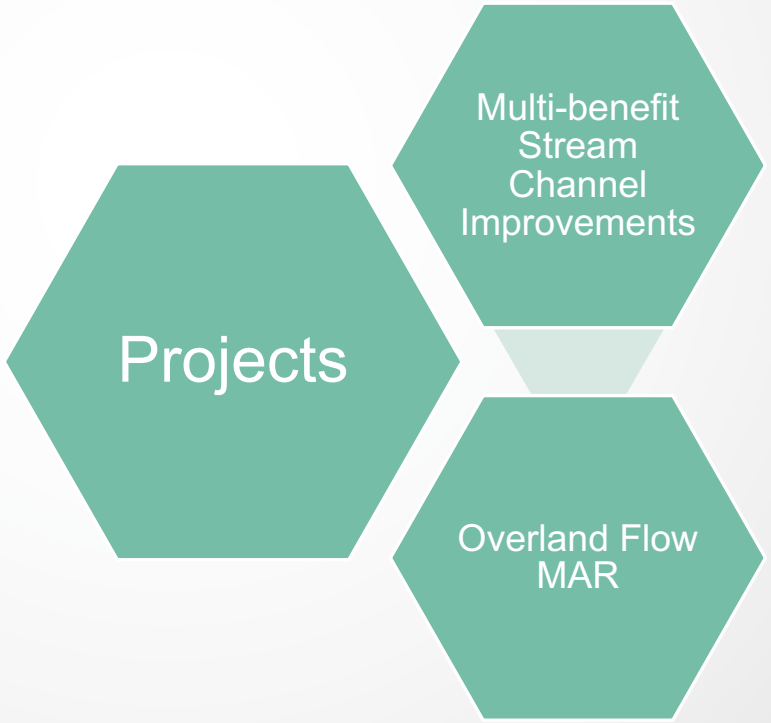
Summary of Current Conditions in Relation to SMC



- Forebay Aquifer Subbasin has not historically been in overdraft, nor experienced chronic lowering of groundwater levels
- From 1980 to 2016, the subbasin was in overdraft during only 3 years
- The Arroyo Seco Cone Management Area has not historically been in overdraft, nor experienced chronic lowering of groundwater levels
- Given that the Subbasin's extraction is currently close to the sustainable yield, this chapter includes a robust set of potential management actions and projects that could **be undertaken if needed**

Management Actions and Projects





Improve Rural Residential Water Quality in Arroyo Seco Cone Management Area

Description: Educate rural residents about common groundwater quality issues and options for obtaining safe and aesthetic water.

Benefits: Bottled water, in-home reverse osmosis, and/or an expansion of public water systems

Costs: $3,000 for outreach and education.

Watershed Protection Policy for the Arroyo Seco River

- Ensure continued recharge from Arroyo Seco River and habitat for threatened fish
- Costs would be staff time only to prepare policy resolutions for the ASGSA and SVBGSA Board of Directors

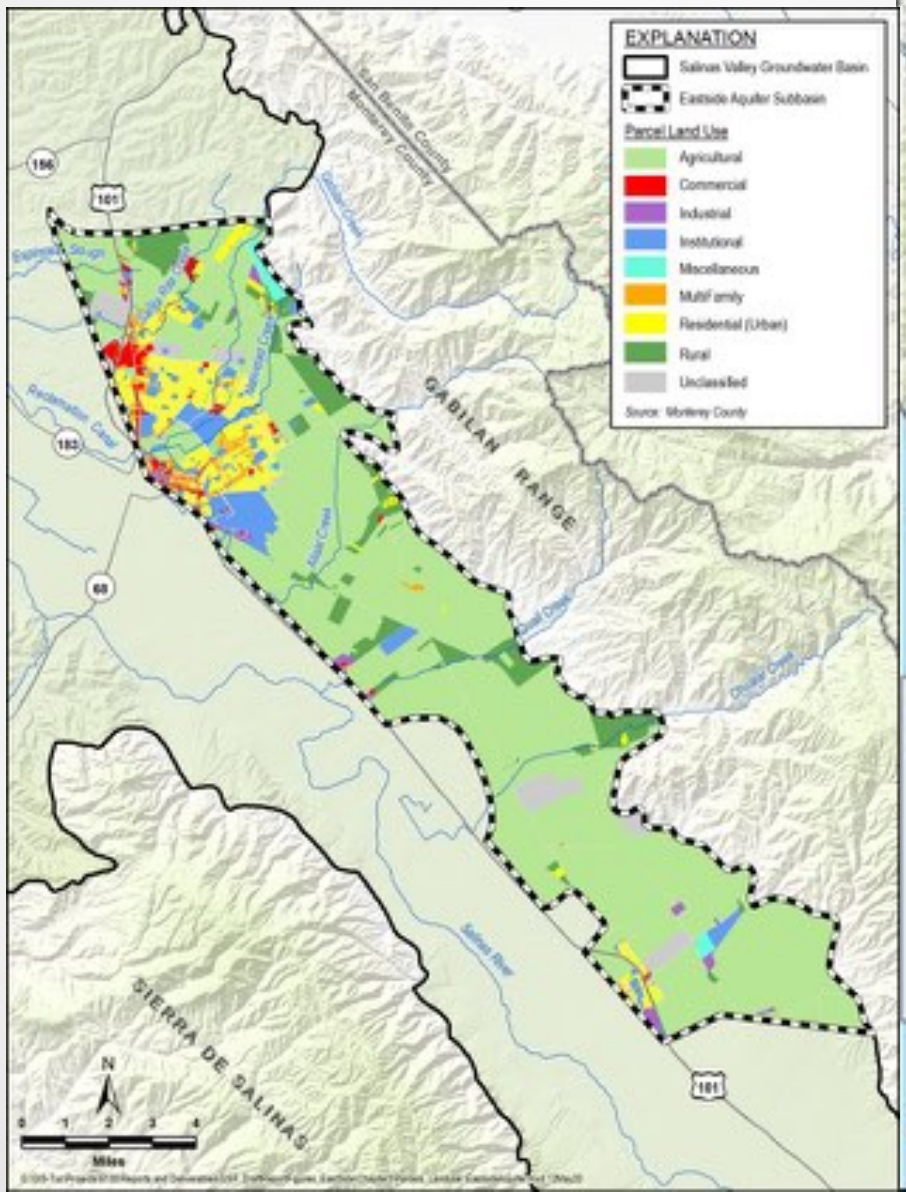
MANAGEMENT ACTIONS FOR ASCMA

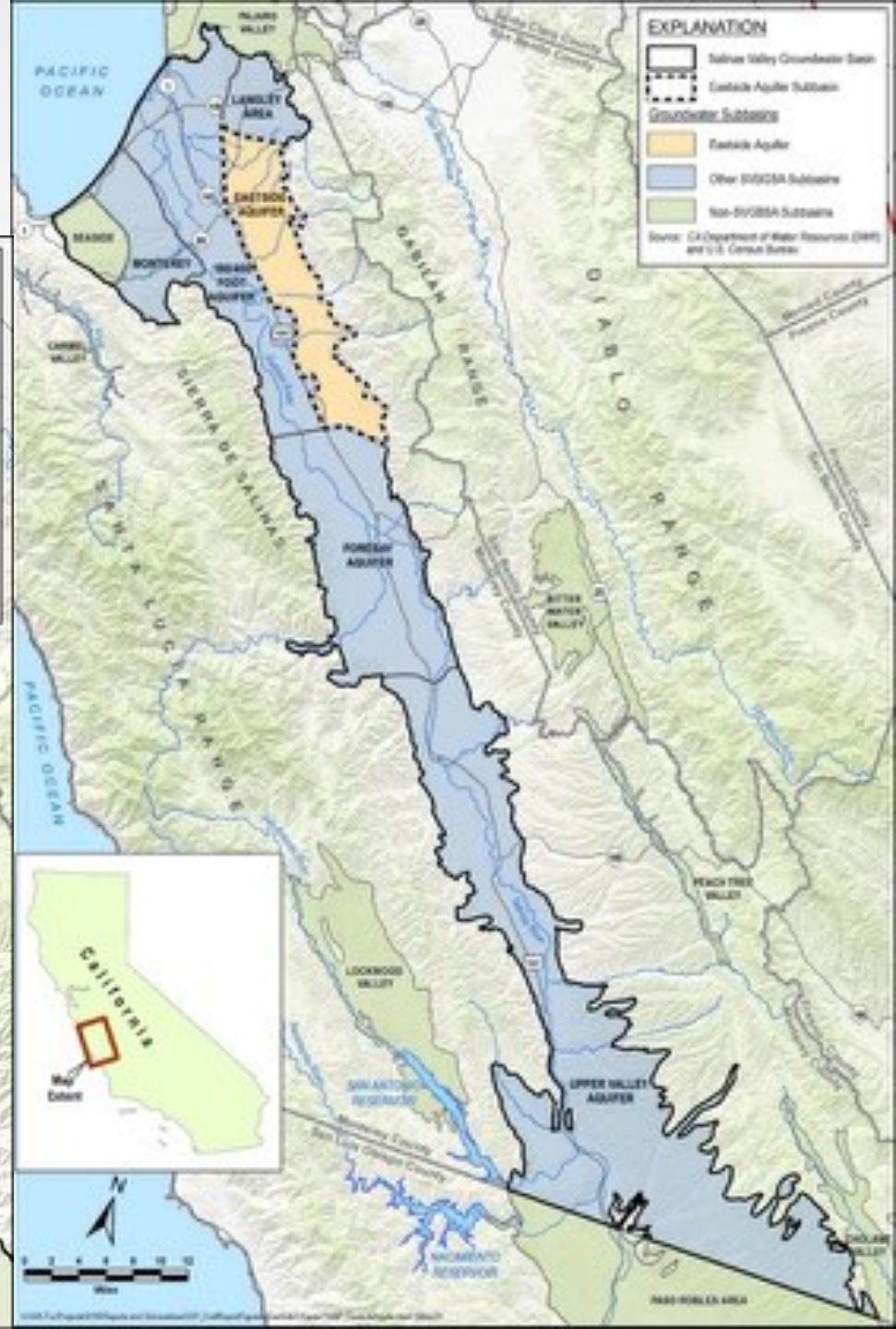
Eastside Aquifer Subbasin GSP Overview

MONTGOMERY & ASSOCIATES

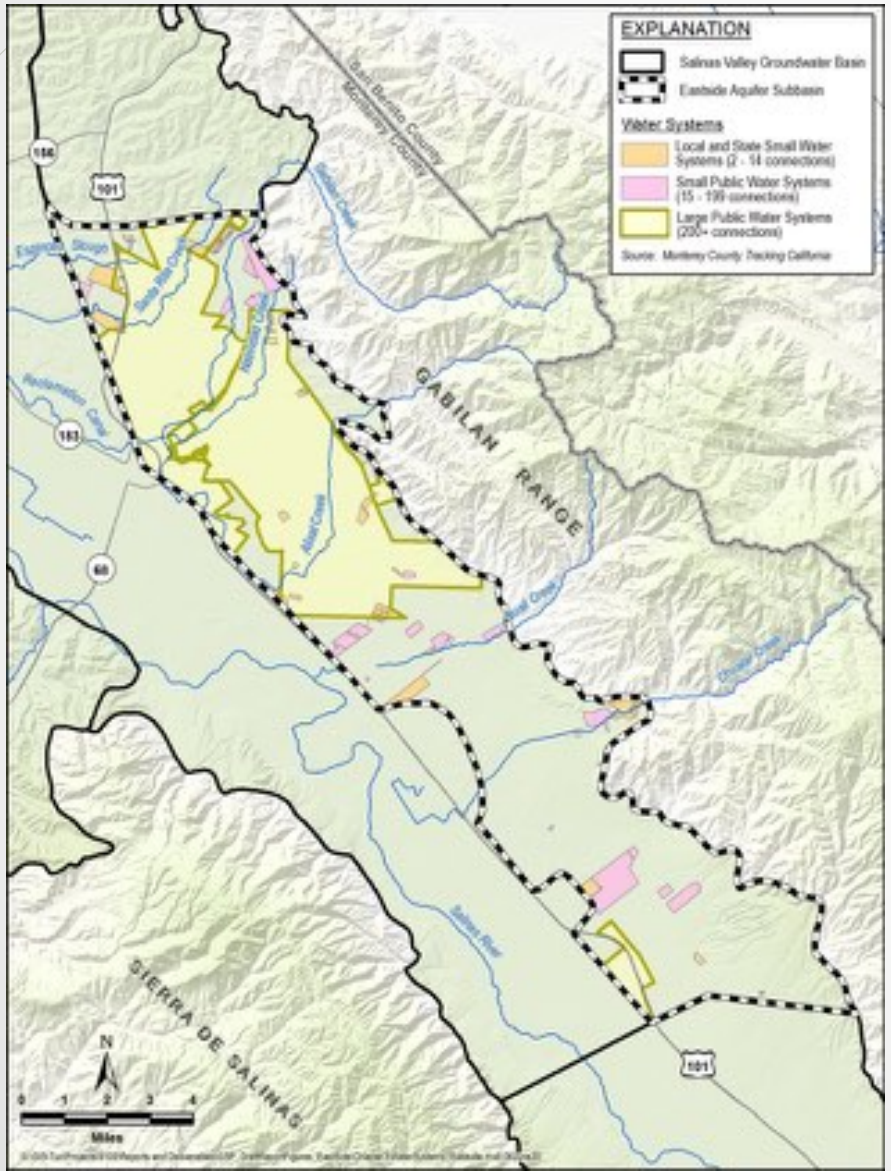
Eastside Aquifer Subbasin

- 57,500 acres
- Most land is agricultural
- Includes part of Salinas and Gonzalez





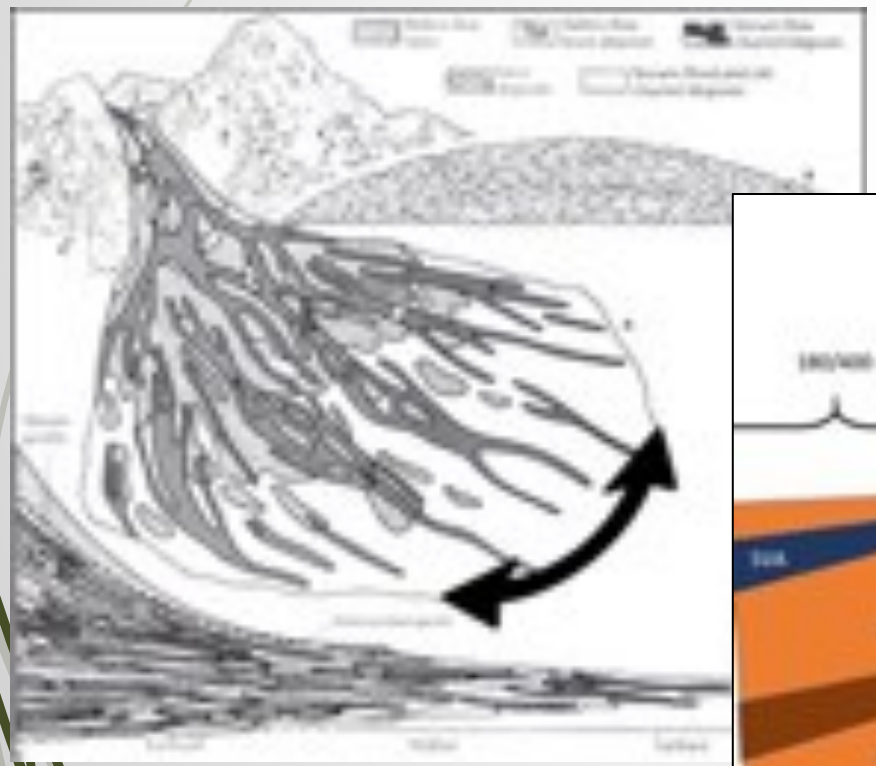
Drinking Water Systems Dependent on Groundwater

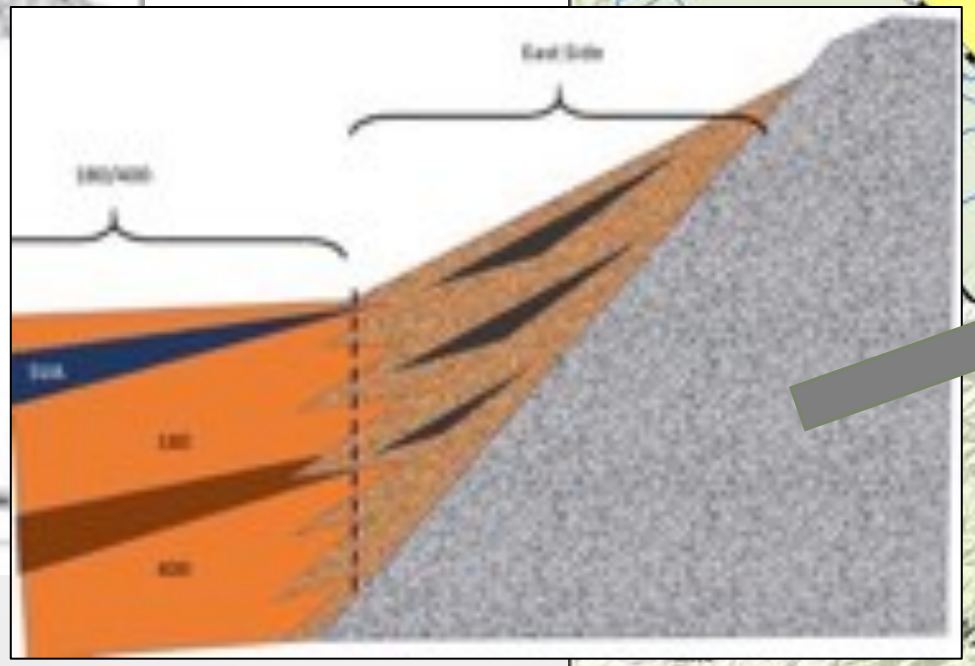


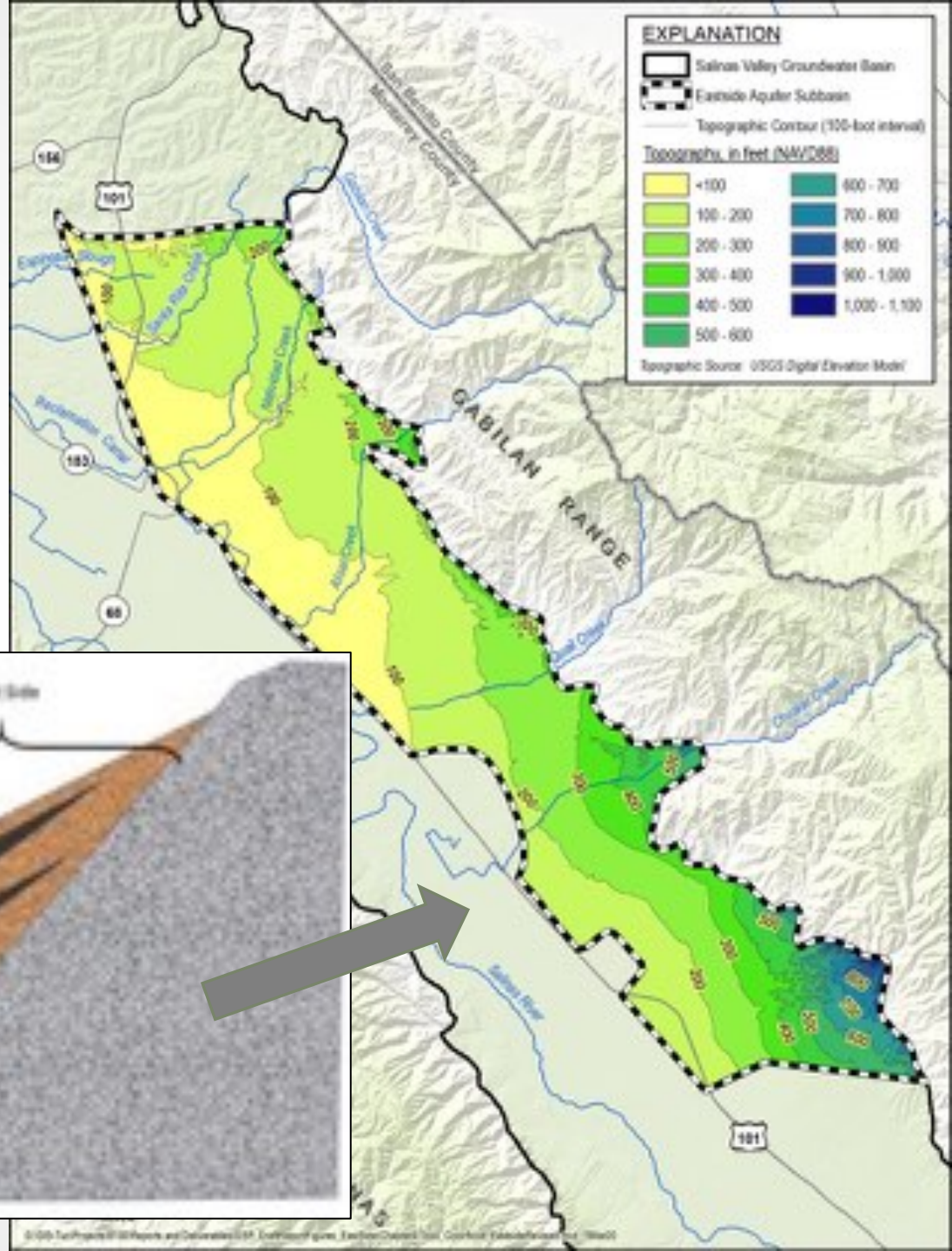
Water Systems	
Local and State Small (2 – 14 connections)	59
Small Public (15 – 199 connections)	31
Large Public (200+ connections)	4

Basin Setting - Topography

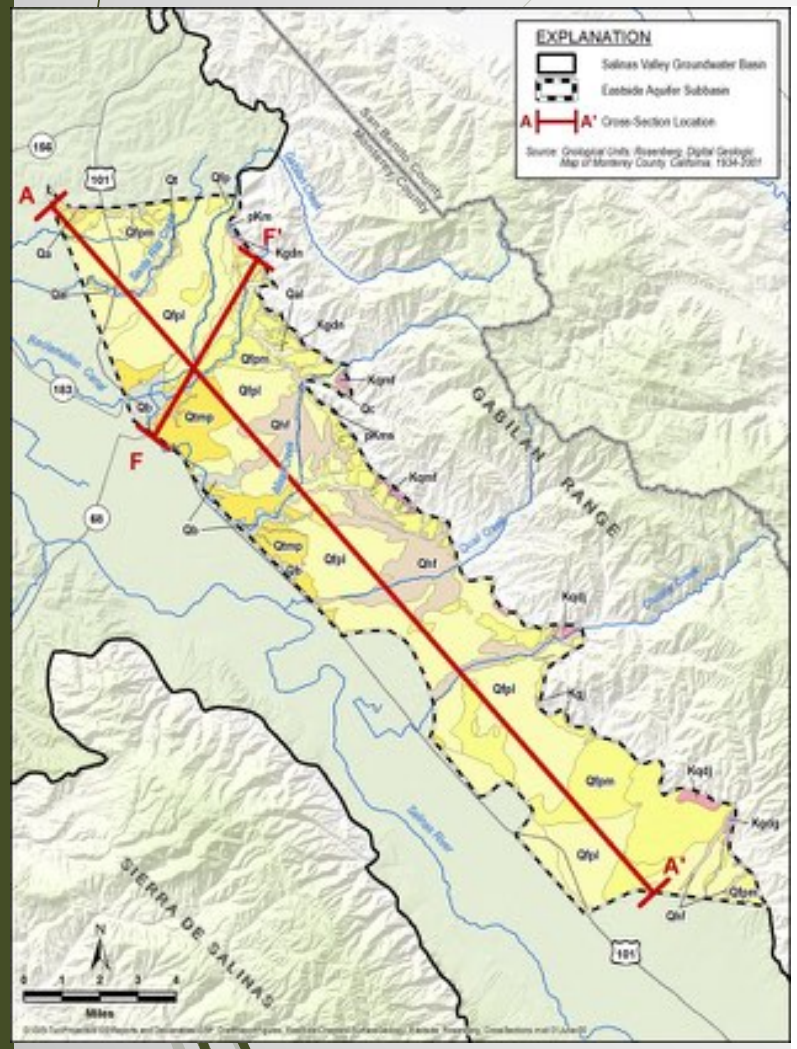
- Dominated by alluvial fan deposits

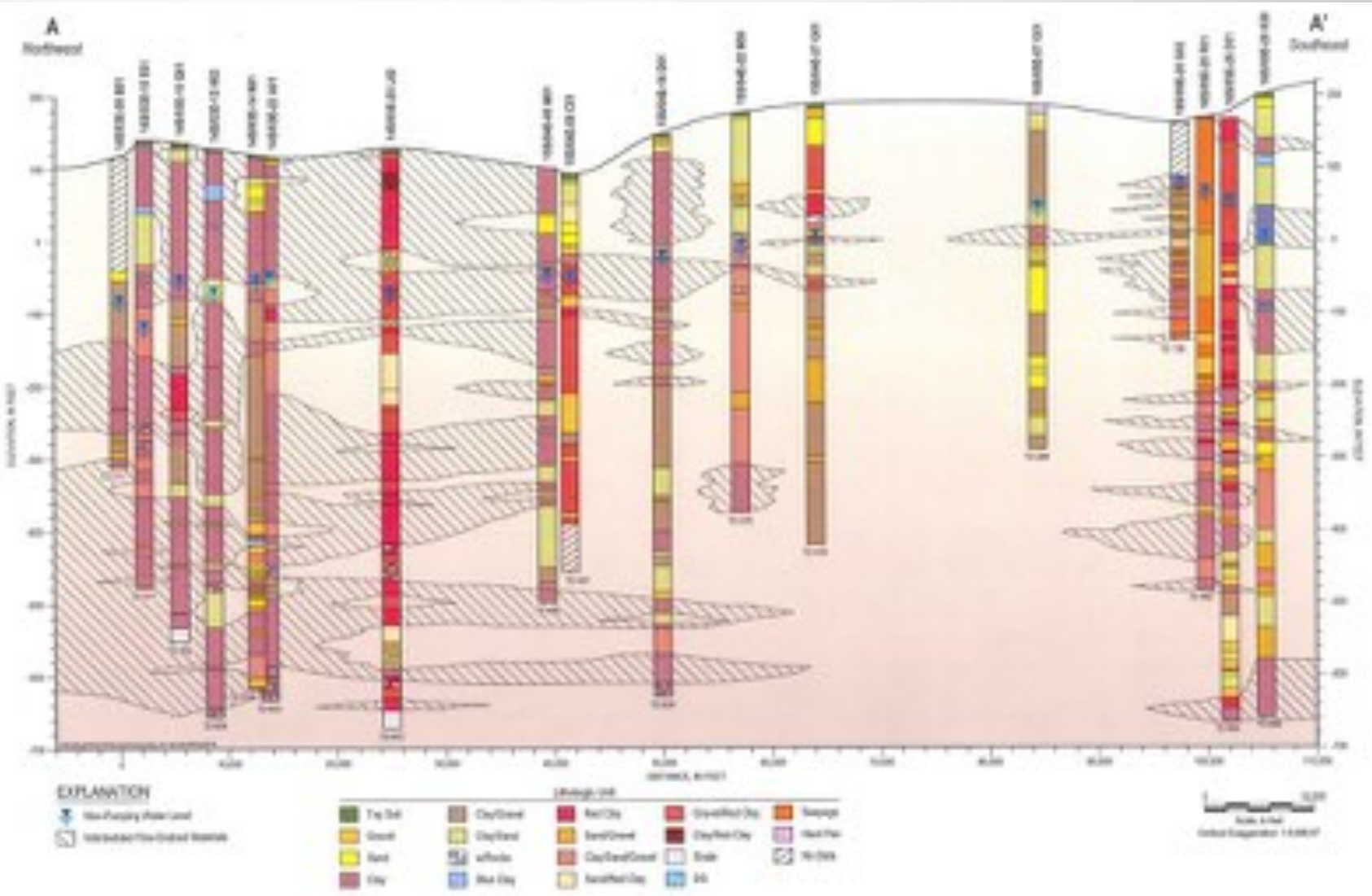




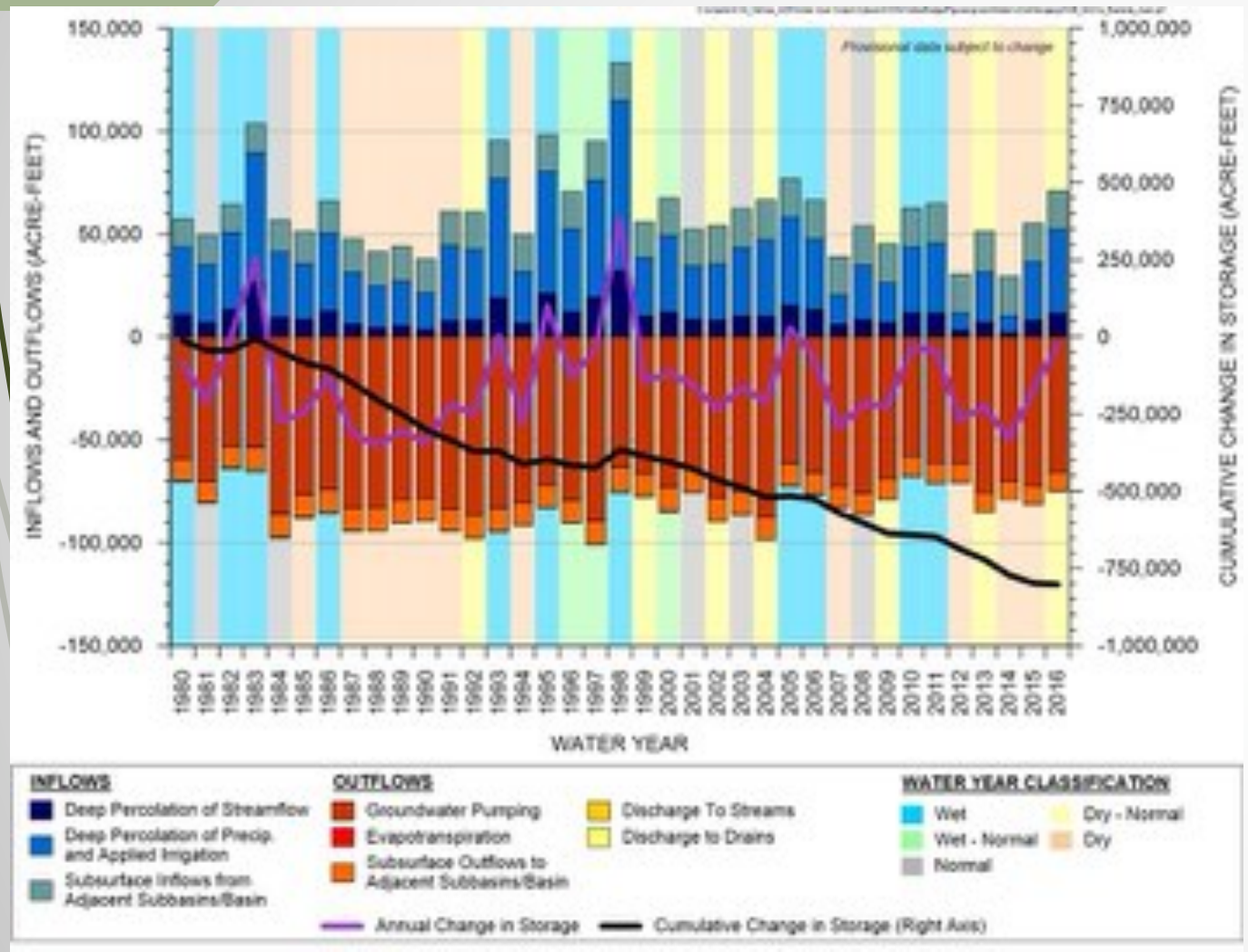


Hydrogeologic Conceptual Model





Eastside Groundwater Budget Summary



- ES has experienced chronic declines in groundwater levels resulting in a loss in storage of 10,000 AF/yr.
- Historical and future water budgets are both averages of many years/hydrologic periods
- Future water budget incorporates average climate change, but does not represent short-term climate change effects
- The sustainable yield is the maximum amount of extraction that can occur without causing undesirable results as defined for each sustainability indicator.
  - Historical pumping: GEMS (average +/- standard deviation) 79,300 to 96,700 AF/yr.
  - Historical sustainable yield ranges from 69,300 to 86,700 AF/yr.
  - Future sustainable yield is about 83,300 AF/yr.

Groundwater conditions/SMC – **Groundwater Levels**

Chronic lowering of groundwater levels

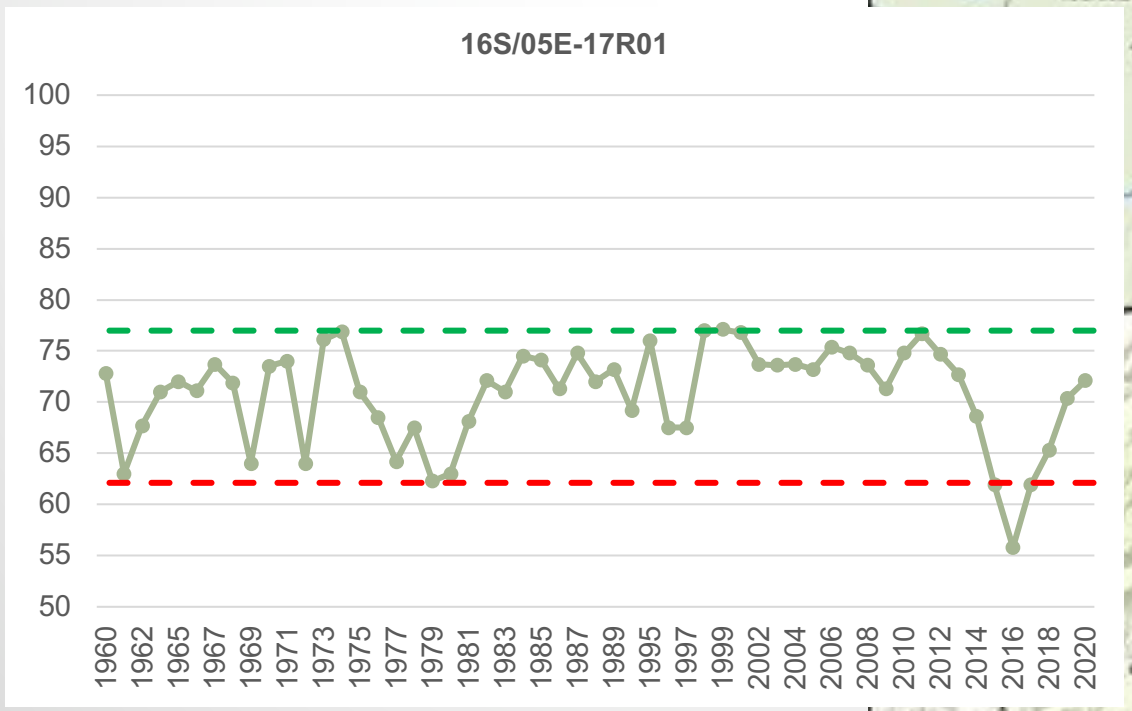
Measurable Objective (MO):
1999 groundwater elevations

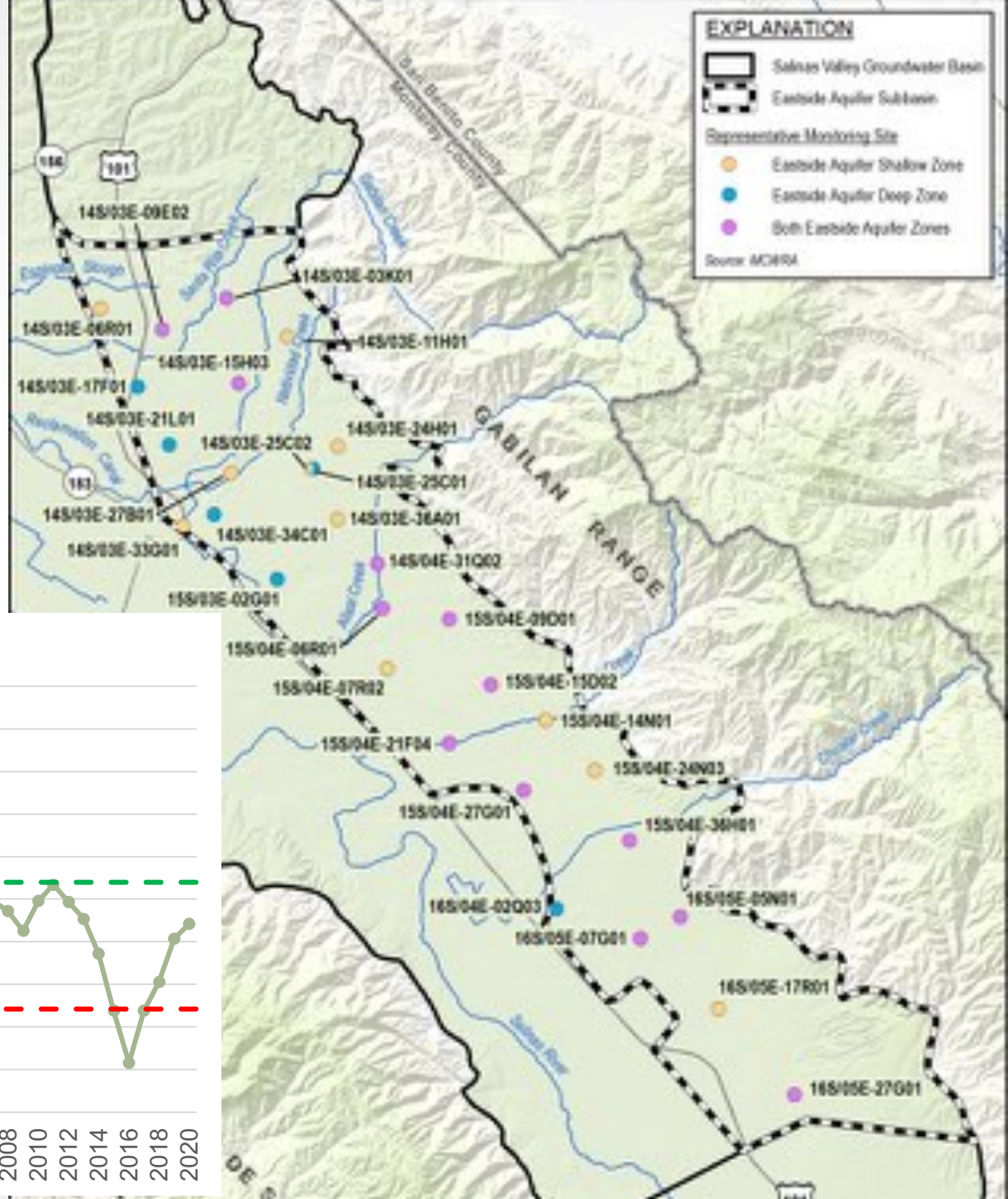
Minimum Threshold (MT):
2015 groundwater elevations

Undesirable Result:
More than 15% of groundwater elevation minimum thresholds are exceeded.

In 2019, one well was above the MO, and the rest had water levels between the MO and MT

Example Well





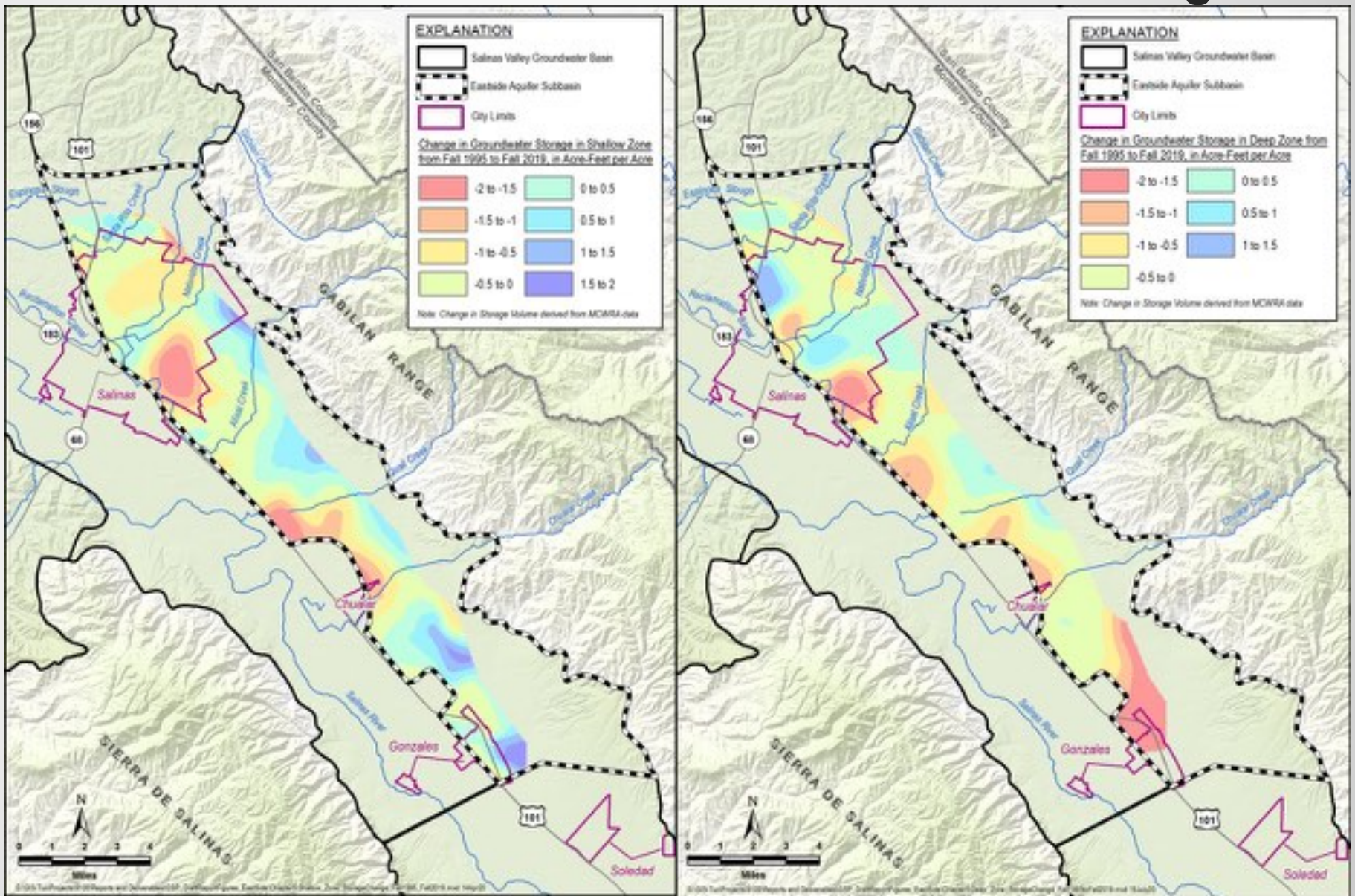
Groundwater conditions/SMC – **Groundwater Storage**

Reduction in Groundwater Storage

Measurable Objective (MO):
Established by proxy using groundwater elevations. Set to the same as groundwater levels measurable objectives.

Minimum Threshold (MT):
Established by proxy using groundwater elevations. Set to the same as groundwater levels minimum thresholds.

Undesirable Result:
More than 15% of groundwater elevation minimum thresholds are exceeded..



Groundwater conditions/SMC – **Interconnected Surface Water**

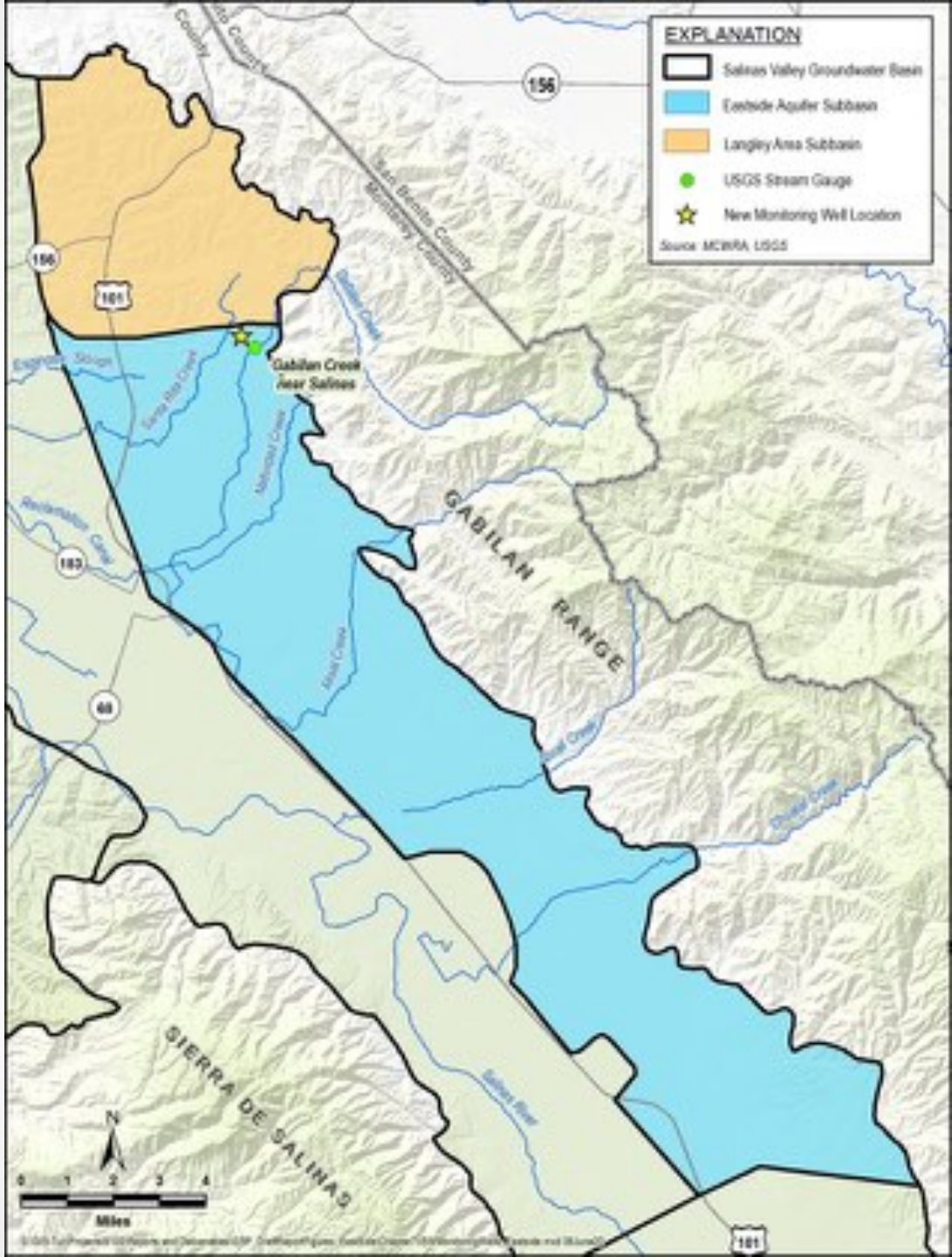
Depletion of Interconnected surface water (ISW)

Measurable Objective (MO):
Established by proxy using shallow groundwater elevations observed in 1999 near locations of ISW.

Minimum Threshold (MT):
Established by proxy using shallow groundwater elevations observed in 2015 near locations of ISW.

Undesirable Result:
There is an exceedance of the minimum threshold in a shallow groundwater monitoring well used to monitor ISW.

- No locations of interconnected surface water now, but there can be in the future
- No interconnected surface water monitoring points yet
- One shallow well will be added on Gabilan Creek (yellow star) near USGS gauge to monitor ISW in Langley



Groundwater conditions/SMC – **Seawater Intrusion**

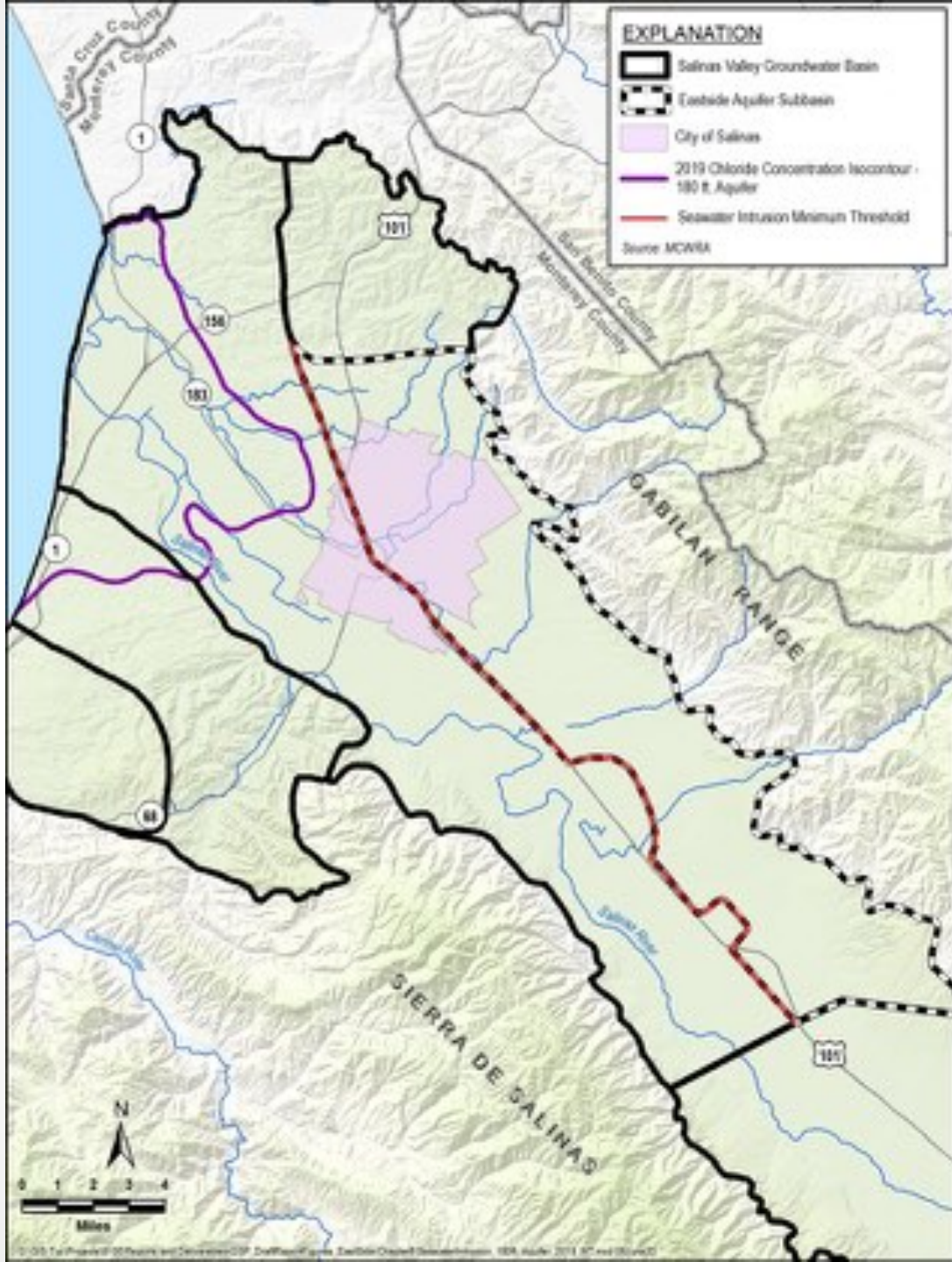
Seawater Intrusion

Measurable Objective (MO):
The 500 mg/L chloride isocontour at the Subbasin boundary, resulting in no seawater intrusion in the Eastside Subbasin.

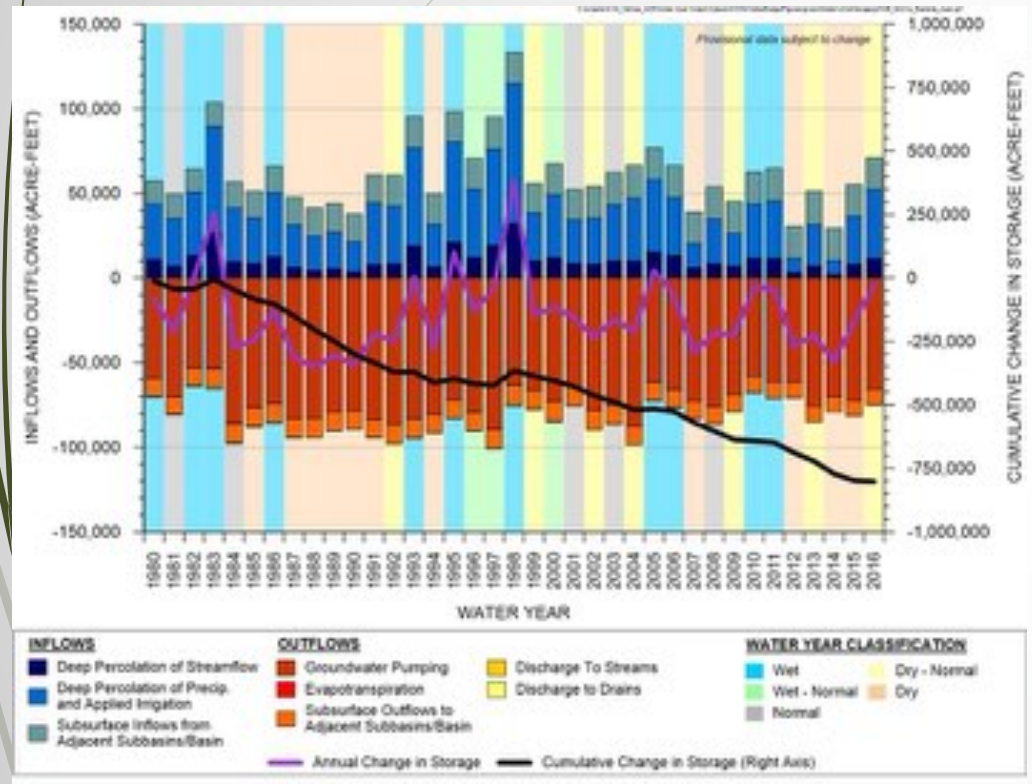
Minimum Threshold (MT):
Same as the measurable objective.

Undesirable Result:
Any exceedance of the minimum threshold, resulting in mapped seawater intrusion within the Subbasin boundary.

- No seawater intrusion in the subbasin
- Aim to keep seawater intrusion out of the Subbasin



Current Conditions - Overdraft



- Eastside Subbasin has experienced chronic lowering of groundwater elevations and has historically been in overdraft (10,000 AF/yr.). It is projected to still be in overdraft throughout the GSP planning horizon unless projects and management actions bring extraction and the sustainable yield in line.
- Overdraft can be mitigated by reducing pumping or recharging the basin, either through direct or in-lieu means.
- The potential projects and management actions in this chapter are sufficient to mitigate existing overdraft.


Increased Recharge
• A1. Overland Flow MAR
• A2. Floodplain Enhancement and Recharge
Surface Water Diversions
• B1/B2. 11043 Diversion at Chualar or Soledad
• B3. Surface Water Diversion from Gabilan Creek
Regional Alternative Water Supplies
• D1. Regional Municipal Supply Project
• D2. CSIP Optimization and Expansion
Eastside Projects & Management Actions
Alternative Water Supplies
• C1. Eastside Irrigation Water Supply Project (Somavia Road)
• C2. Salinas Scalping Plant
Demand Management
• E1. Conservation and Ag BMPs
• E2. Fallowing, Fallow Bank, and Agricultural Land Retirement
• E3. Pumping Allocations and Controls
Salinas River Projects
•F1. Multi-Benefit Stream Channel Improvements
•F2. Winter Releases with ASR
•F3. MCWRA Interlake Tunnel and Spillway Modification
•F4. MCWRA D-TAC

Floodplain Enhancement and Recharge

Description: This project restores areas along creeks and floodplains with to slow and sink flood waters and encourage streambed and floodplain infiltration.

Project Benefit: Up to 2,300 AF/yr. available for recharge, 1,000 AF/yr. in increased storage, less erosion, less flooding.

Cost: approximately $12,596,000, Unit Cost: $1,050/A

Pumping Allocations and Controls

Description: Pumping allocations and control based on various criteria (allocation structure not yet defined).

Project Benefit: Can be scaled to different levels.

Cost: Approximately $400,000 for establishment of pumping allocations and controls.

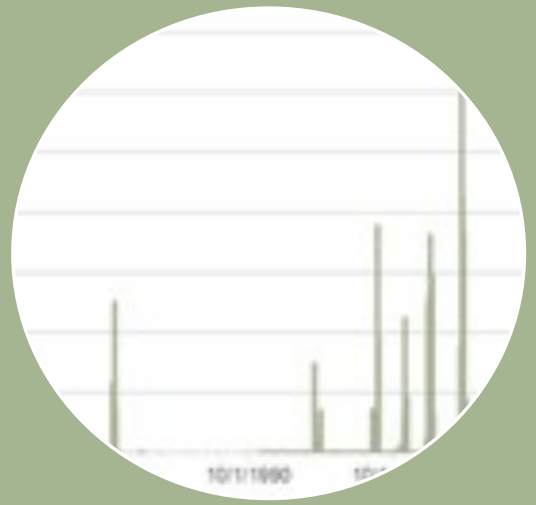
INCREASED RECHARGE --- DEMAND MANAGEMENT

11043 Diversion at Chualar or Soledad

Description: Constructs diversion facilities and pumps the water to the Eastside Subbasin where the water can be recharged (or used directly).

Project Benefit (modeled for Chualar diversion): Annual average of 6,000 AF/yr. of excess streamflow captured. 4,600 AF/yr. increase in storage. Highly variable.

Chualar Capital cost: $55,684,000; Unit cost $1,280/AF
Soledad Capital Cost: $104,688,000; Unit cost $2,110/AF
(both including O&M)



Surface Water Diversion from Gabilan Creek

Description: Diverst flood flows from Gabilan Creek and recharges water at a nearby location in recharge basins.

Project Benefit: Based on analysis of historical data, the expected benefit of this project would potentially capture 350 AF/yr. with a diversion structure with a capacity of 20 cfs.

Capital cost: $10,074,000.

Unit cost $2,350/AF including O&M

SURFACE WATER DIVERSIONS FOR RECHARGE OR DIRECT USE

Salinas Scalping Plant

Description: Builds a scalping plant for the future growth area on the east side of Salinas.

Project Benefit and Cost: in-lieu recharge, and increased groundwater elevations and storage.

250,000 gallon per day (gpd) scalping plant generates 280 AF/yr. With a capital cost of $9,839,000, the unit cost is $6,480/AF

500,000 gpd scalping plant generates 560 AF/yr. With a capital cost of $14,183,000, the unit cost is $4,730/AF

**cost does not include distribution systems*

Eastside Irrigation Project (Somavia Road)

Description: Pumps 3,000 AF/yr. from the 180-Foot Aquifer in the 180/400-Foot Aquifer Subbasin on the SW side of the Salinas River, and distributes it for irrigation or recharge in the Eastside.

Project Benefit: increased groundwater elevations from reduced subbasin pumping and in-lieu use of imported water. ~3,000 AF/yr. available for in-lieu use or recharge, and ~1,600 AF/yr. increased storage.

Capital Cost: $139,928,000.

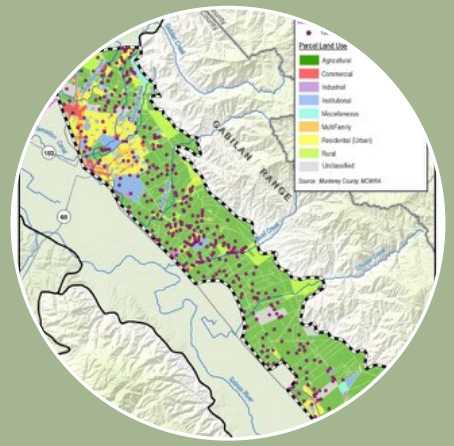
Unit cost $3,980/AF including O&M

ALTERNATIVE WATER SUPPLIES

Regional Municipal Supply Project

Description: Potential supplement to the seawater intrusion extraction barrier project. It would deliver water for direct potable use to municipal systems in the Eastside Subbasin. **Regional Project Benefit**: The proposed plant would produce up to 15,000 AF/yr. of desalinated water for the Salinas Valley. A portion of that would go to Eastside Subbasin.

Regional Capital Cost: $375-$395 million, Unit Cost: $2,830-$2,950/AF



CSIP Expansion

Description: This project would expand CSIP into agricultural land in or adjacent to the Eastside Subbasin and could reduce the amount of groundwater pumped from the Subbasin.

Regional Project Benefit: Expanding CSIP to land outside of the Eastside Subbasin may still have positive impacts on groundwater elevations within the Eastside Subbasin.

REGIONAL ALTERNATIVE WATER SUPPLIES

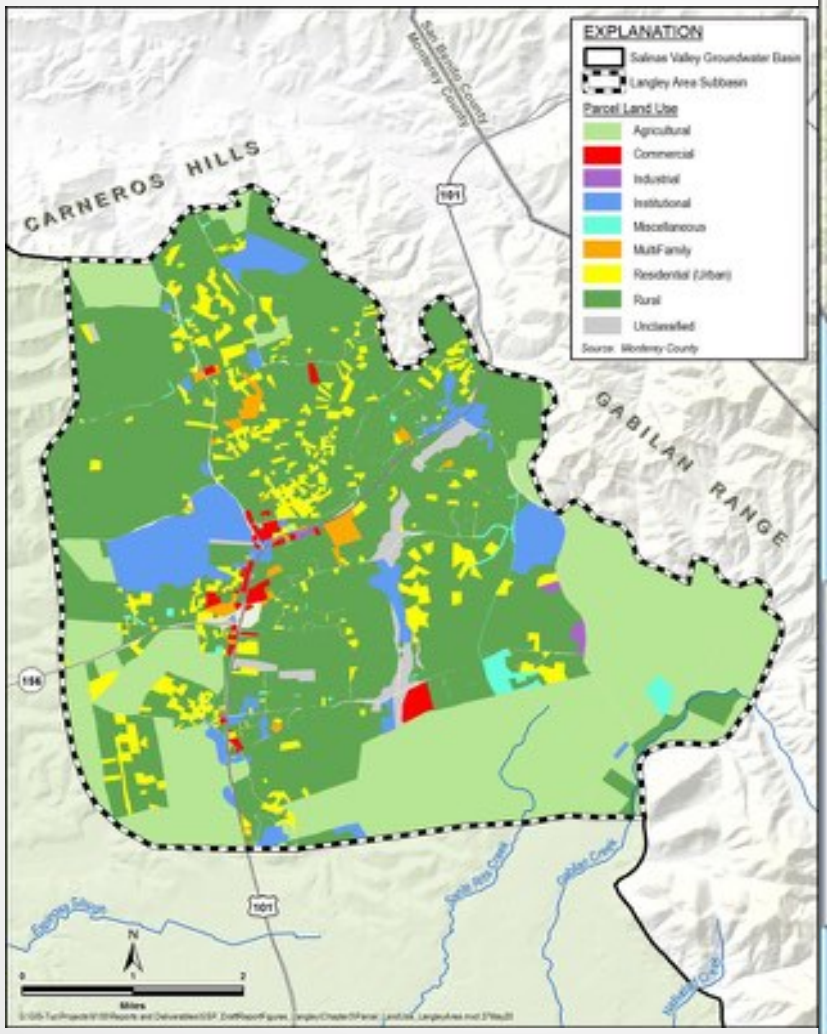
Langley Area Subbasin GSP Overview

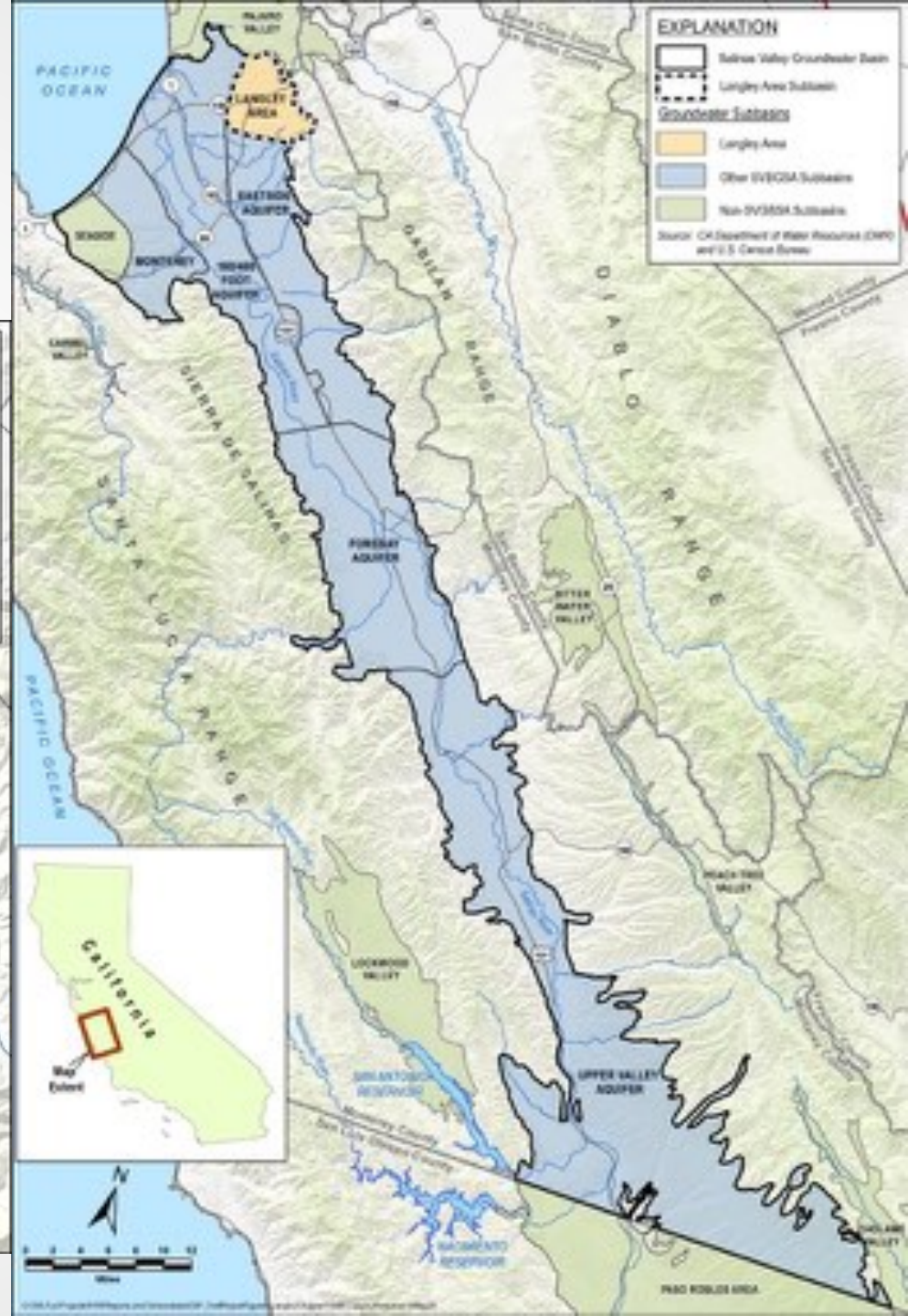
Prepared by

MONTGOMERY & ASSOCIATES

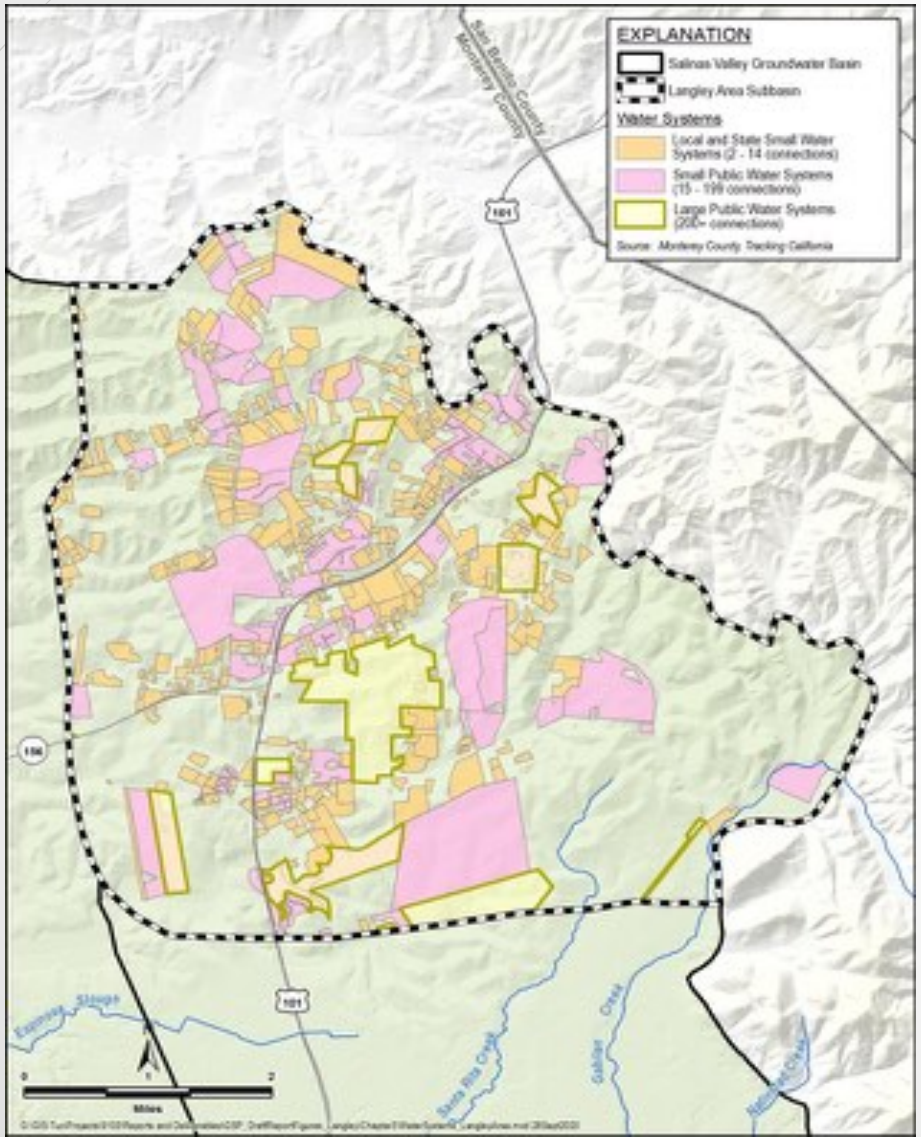
Langley Area Subbasin

- 17,600 acres
- Most land designated rural (8,862 acres)





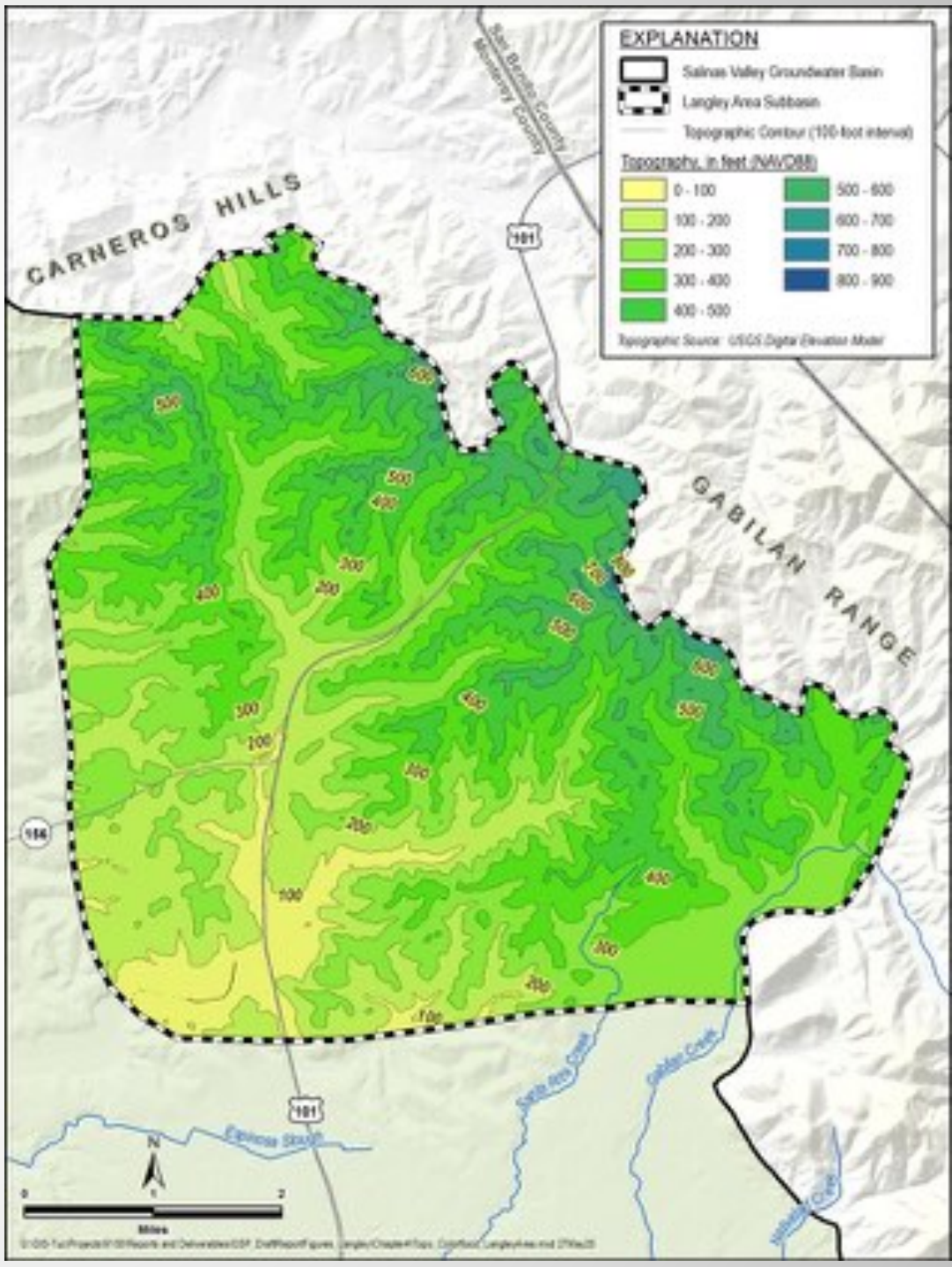
Drinking Water Systems Dependent on Groundwater



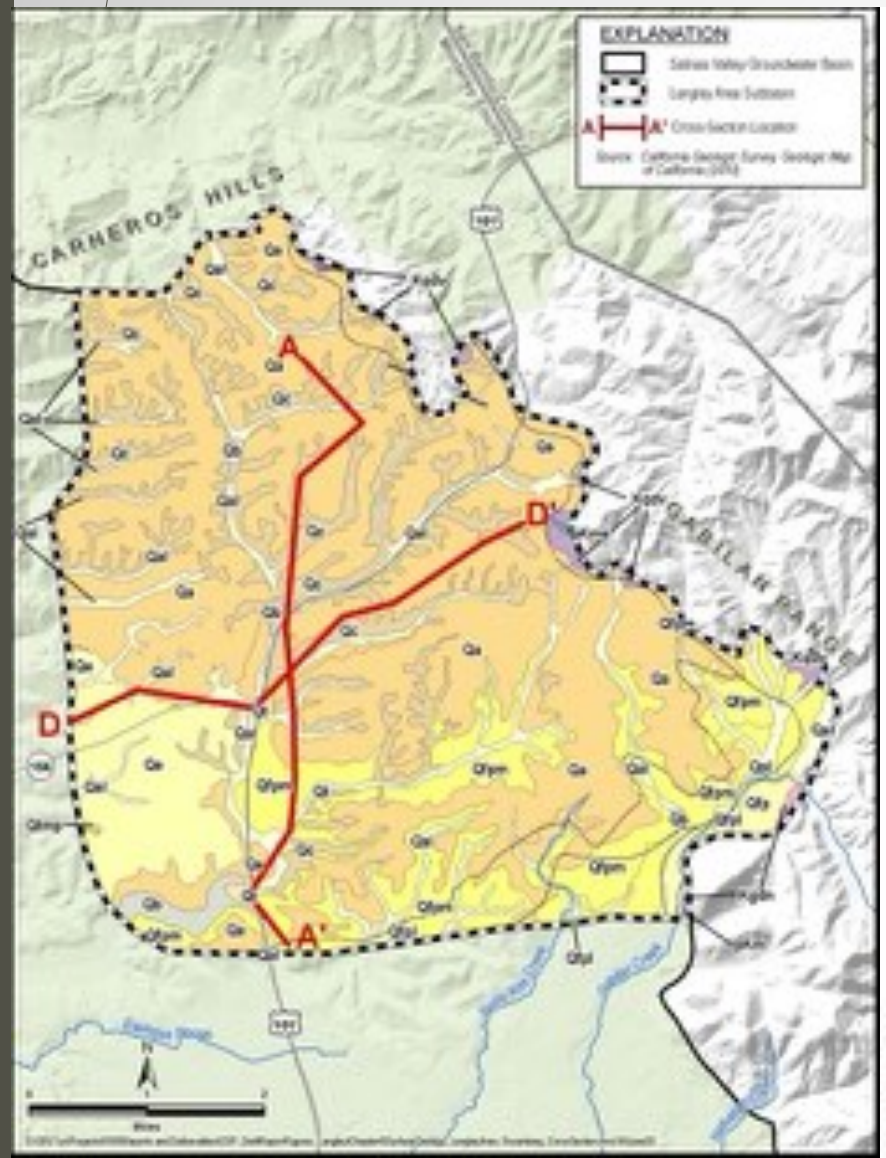
Water Systems	
Local and State Small (2 – 14 connections)	350
Small Public (15 – 199 connections)	59
Large Public (200+ connections)	3

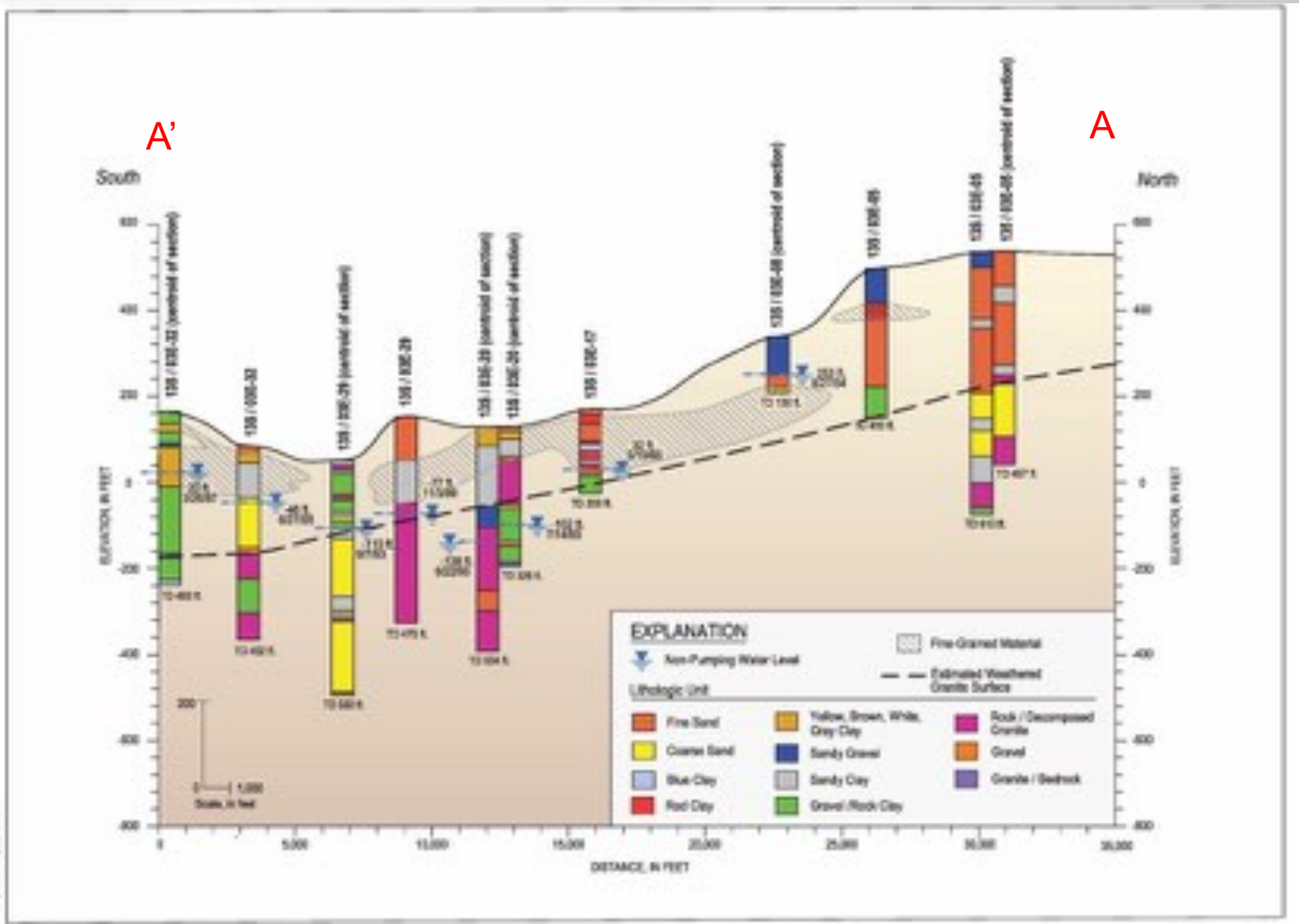
Basin Setting - Topography

- Hilly area
- Not like the other subbasins
- Underlain by fractured granite bedrock



Hydrogeologic Conceptual Model

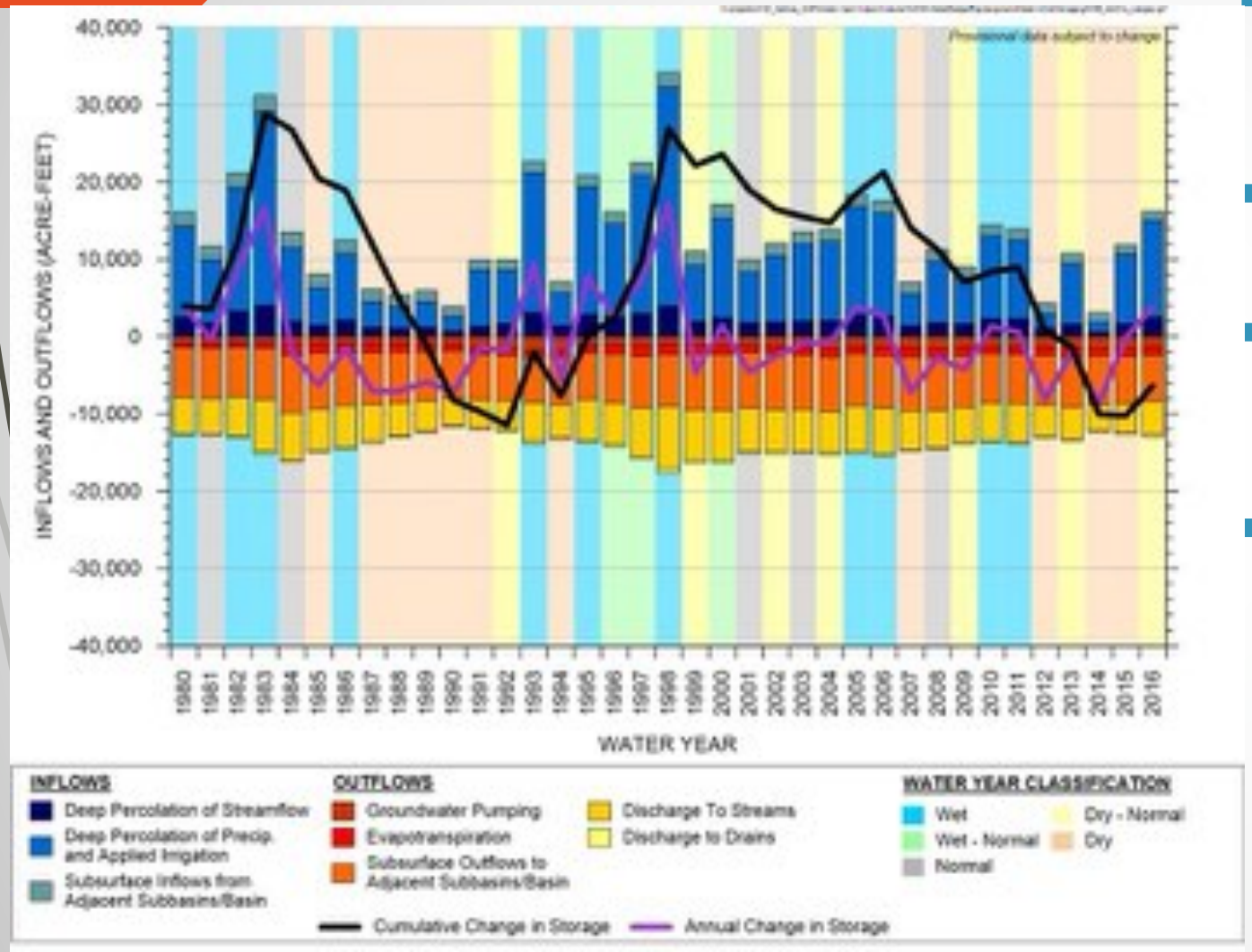




Pumping Allocations and Controls

- **Description:** Pumping allocations and control based on various criteria (allocation structure not yet defined).
- **Project Benefit**: The primary benefits expected for this project is that it is another demand-side management tool and would enhance sustainable yield and groundwater elevations. Working within a groundwater budget allows the subbasin to meet its sustainable yield volume.
- **Cost**: The cost would be relatively low cost in comparison to other projects; however, a more detailed analysis is needed.

Langley Groundwater Budget Summary



- Langley has experienced chronic declines in groundwater levels resulting in a loss in storage of 300 AF/yr.
- Historical and future water budgets are both averages of many years/hydrologic periods
- Future water budget incorporates average climate change, but does not represent short-term climate change effects
- The sustainable yield is the maximum amount of extraction that can occur without causing undesirable results as defined for each sustainability indicator.
  - Historical pumping: GEMS (average +/- standard deviation) 800 to 1,400 AF/yr.
  - Historical sustainable yield ranges from 800 to 1,400 AF/yr.
  - Future sustainable yield is about 900 AF/yr.

Groundwater conditions/SMC – **Groundwater Levels**

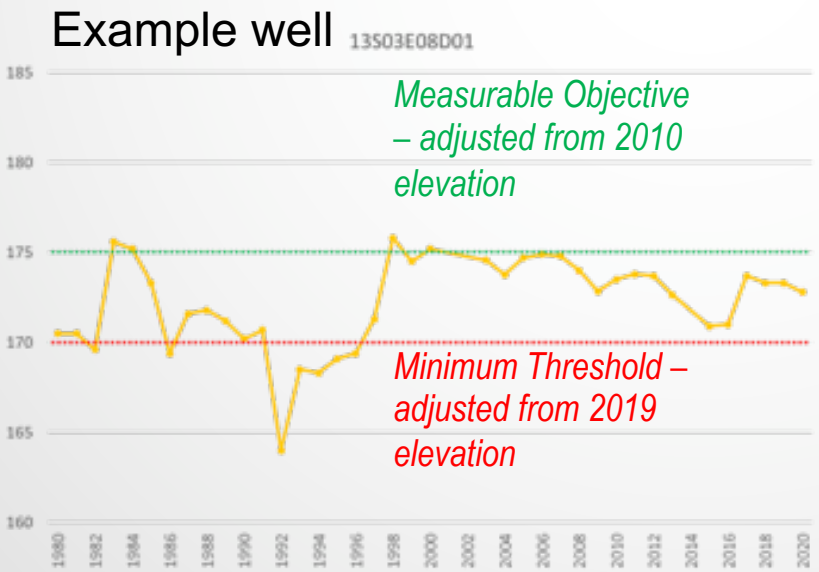
Chronic lowering of groundwater levels SMC

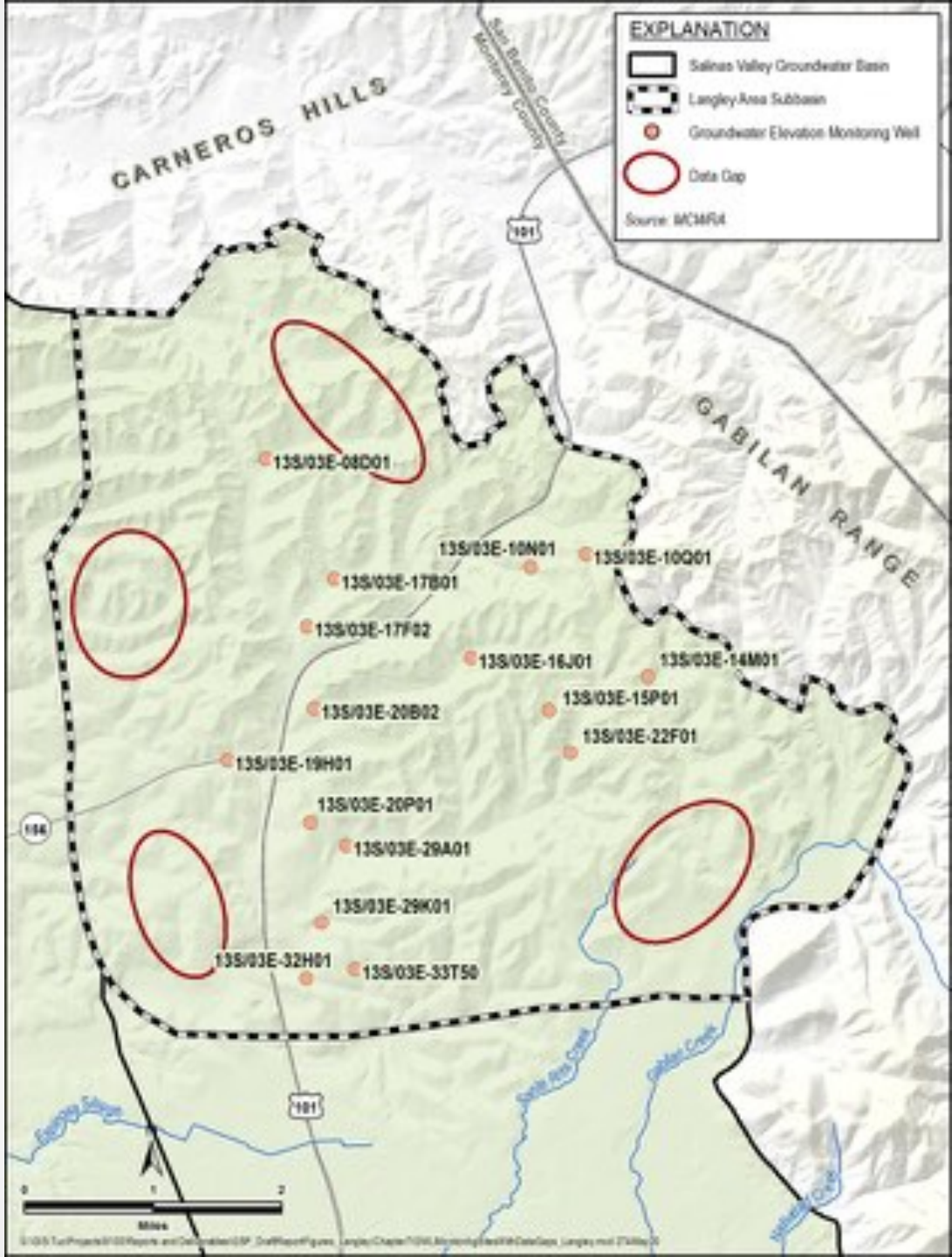
Measurable Objective (MO):
2010 groundwater elevations adjusted based on well-specific elevation assessments.

Minimum Threshold (MT):
2019 groundwater elevations adjusted based on well-specific elevation assessments.

Undesirable Result:
More than 15% of groundwater elevation minimum thresholds are exceeded.

- *All wells currently have water levels between the MO and MT*





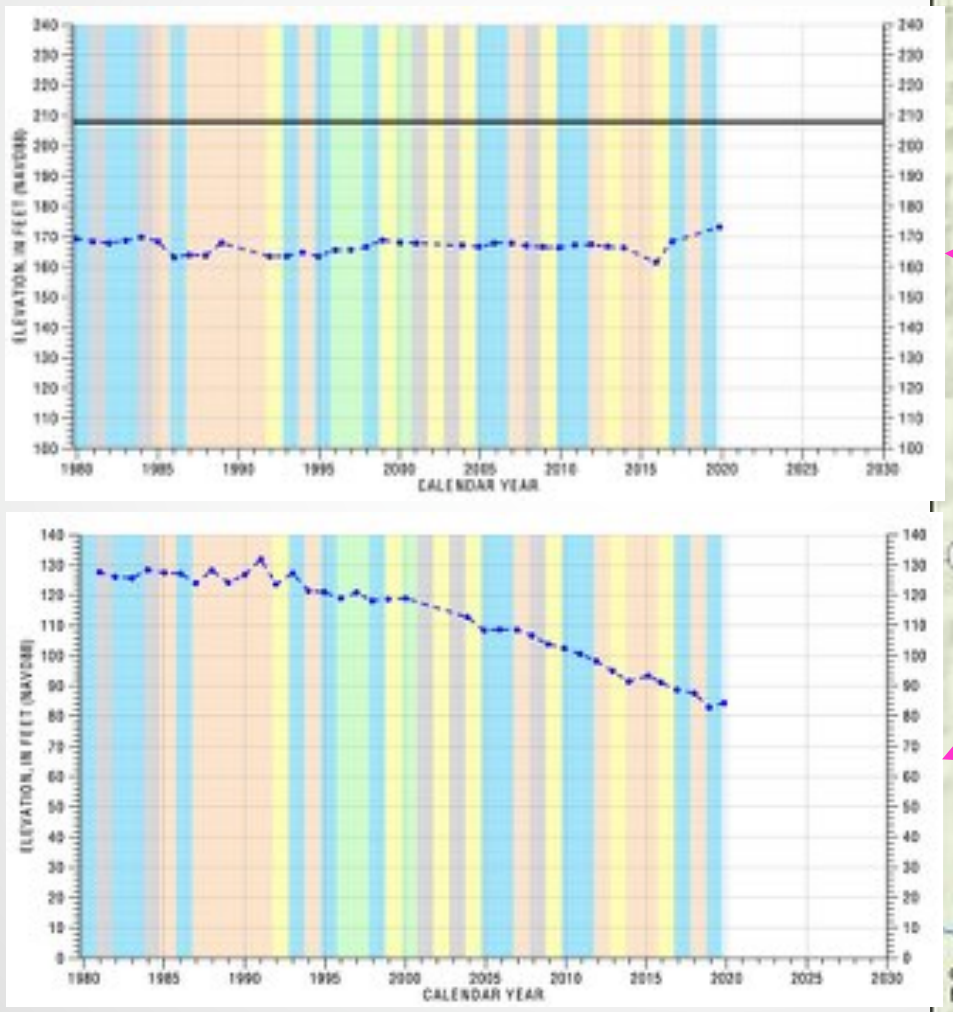
Groundwater conditions/SMC – **Groundwater Storage**

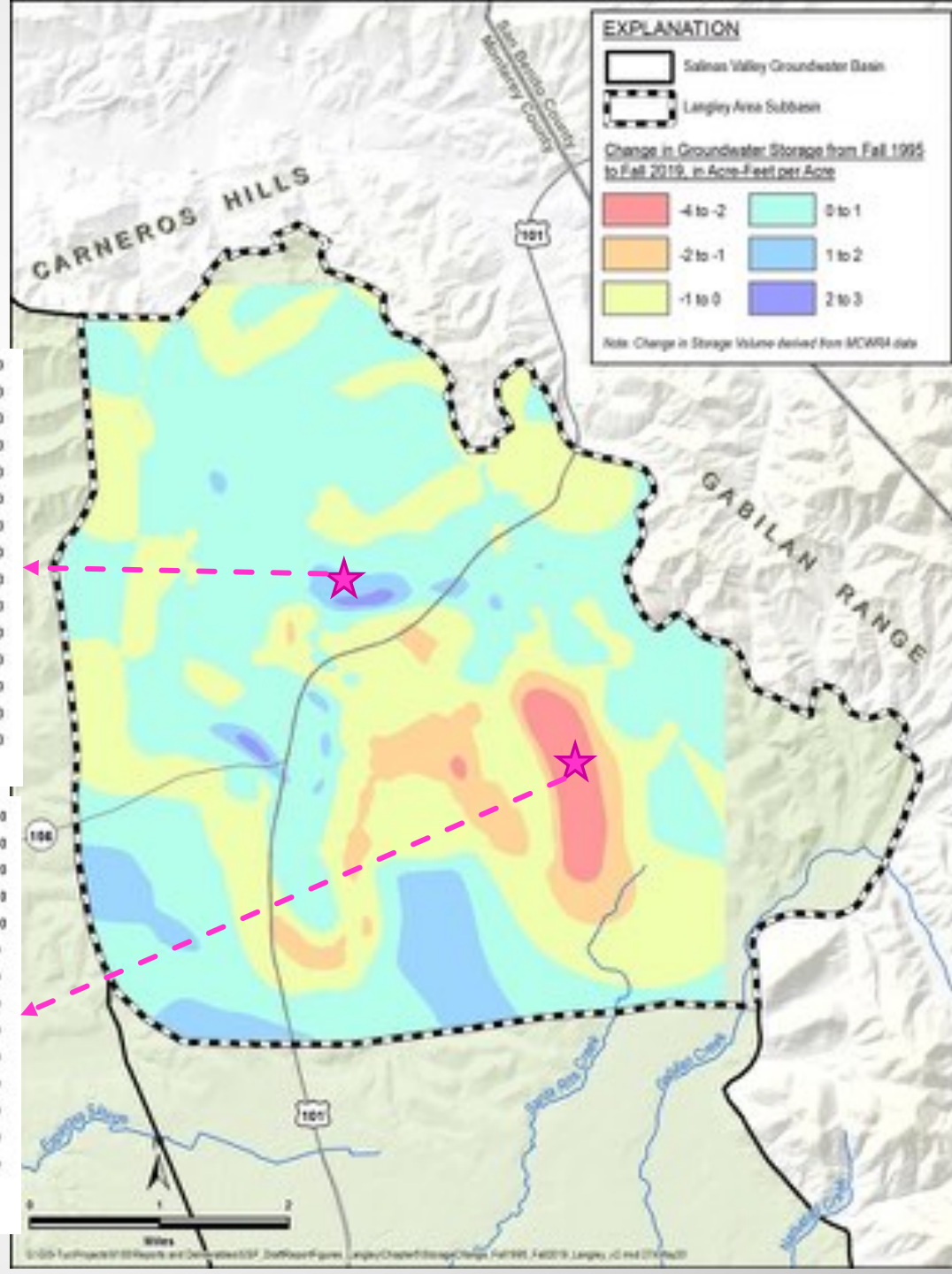
Reduction in Groundwater Storage

Measurable Objective (MO):
Established by proxy using groundwater elevations. Set to the same as groundwater levels measurable objectives.

Minimum Threshold (MT):
Established by proxy using groundwater elevations. Set to the same as groundwater levels minimum thresholds.

Undesirable Result:
More than 15% of groundwater elevation minimum thresholds are exceeded..





Groundwater conditions/SMC – **Interconnected Surface Water**

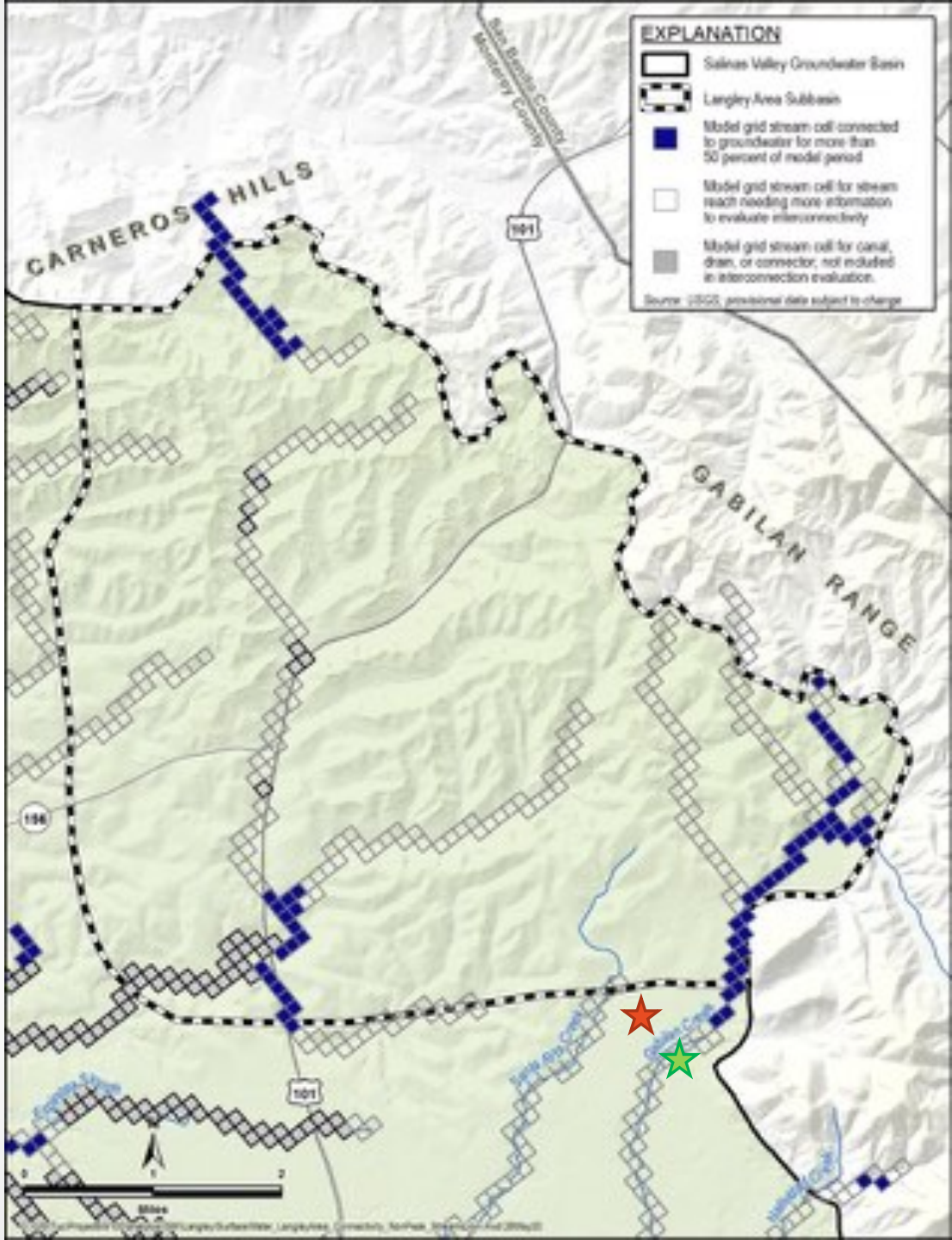
Depletion of Interconnected surface water (ISW)

Measurable Objective (MO):
Established by proxy using shallow groundwater elevations observed in 2010 near locations of ISW, adjusted based on well-specific elevation assessments.

Minimum Threshold (MT):
Established by proxy using shallow groundwater elevations observed in 2019 near locations of ISW, adjusted based on well-specific elevation assessments.

Undesirable Result:
There is an exceedance of the minimum threshold in a shallow groundwater monitoring well used to monitor ISW.

- No interconnected surface water monitoring points yet
- One shallow well will be added on Gabilan Creek (orange star) and will be paired with USGS gauge in Eastside (green star)



Groundwater conditions/SMC – **Seawater Intrusion**

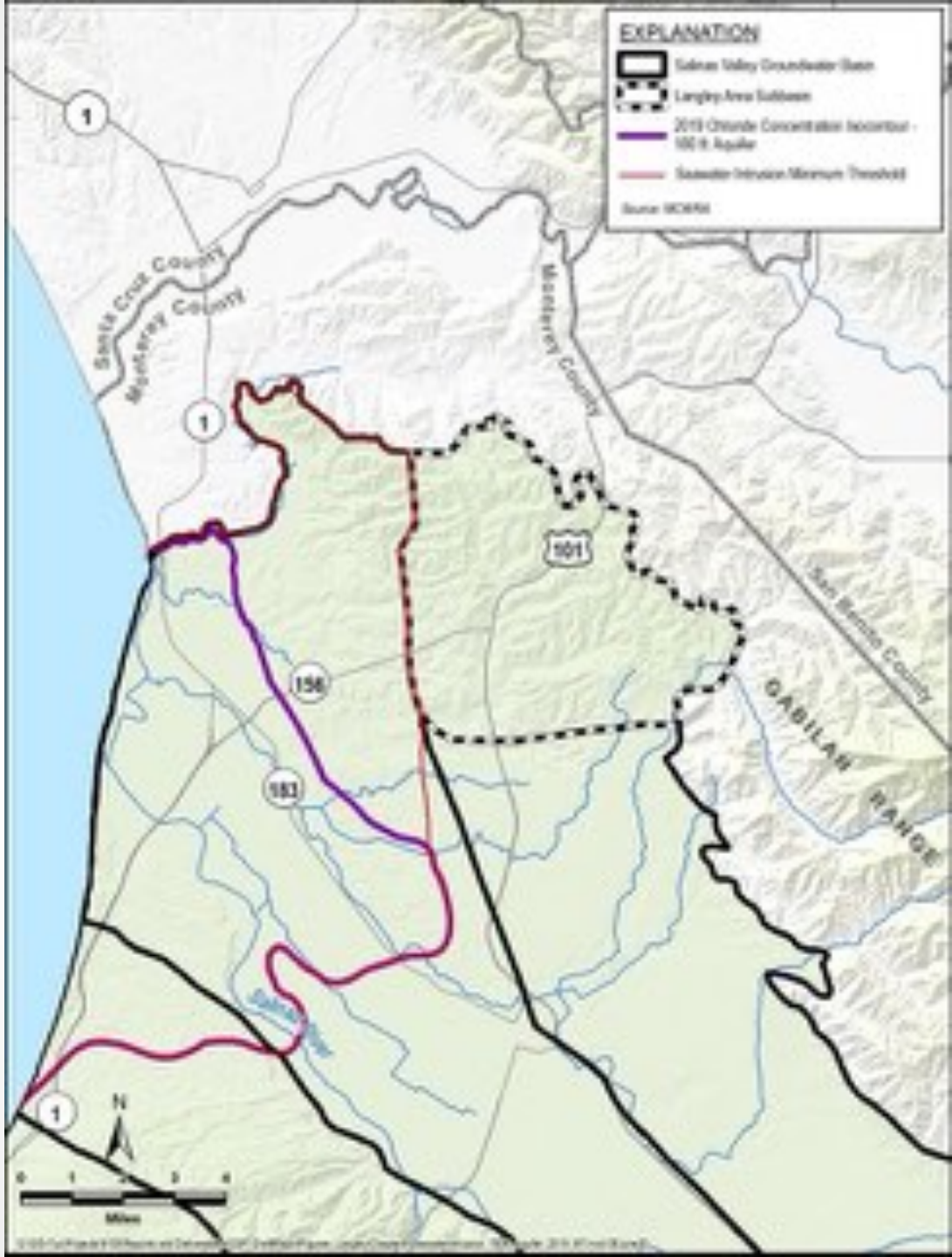
Seawater Intrusion

Measurable Objective (MO):
The 500 mg/L chloride isocontour at the Subbasin boundary, resulting in no seawater intrusion in the Langley Subbasin.

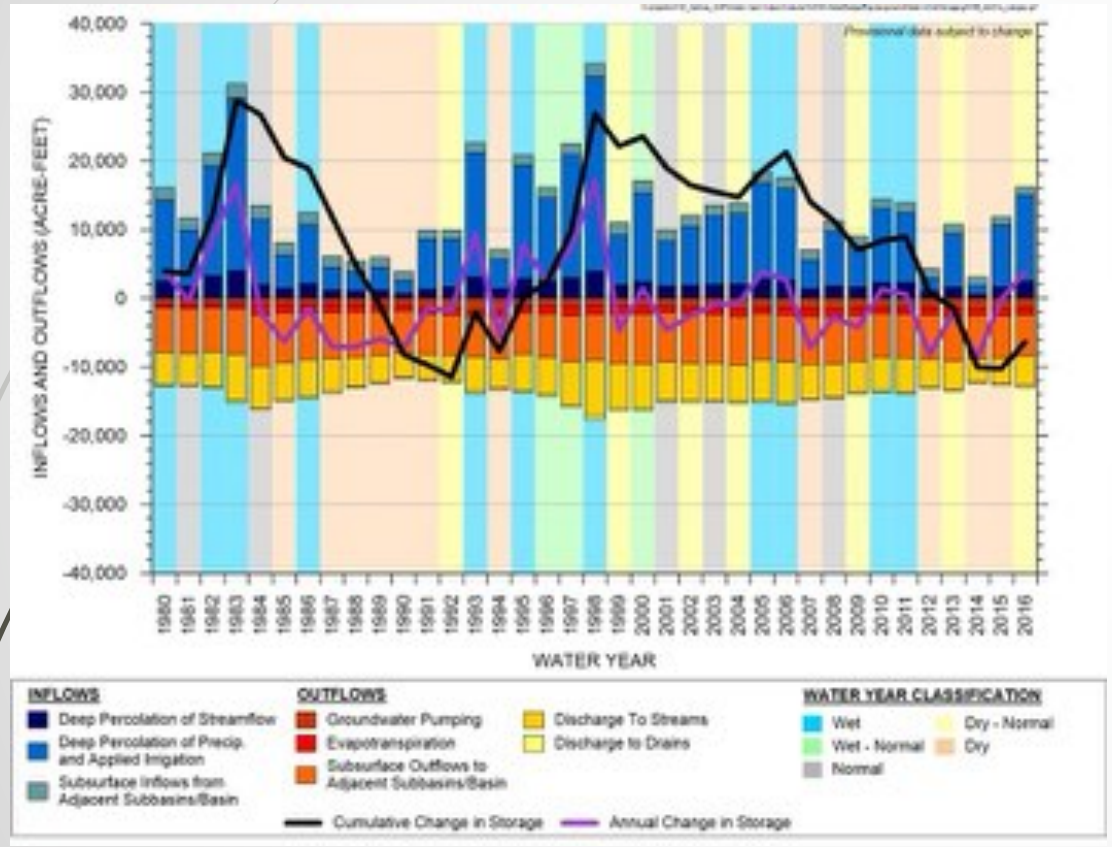
Minimum Threshold (MT):
Same as the measurable objective

Undesirable Result:
Any exceedance of the minimum threshold, resulting in mapped seawater intrusion within the Subbasin boundary.

- No seawater intrusion in the subbasin
- Minimum threshold is at the subbasin boundary

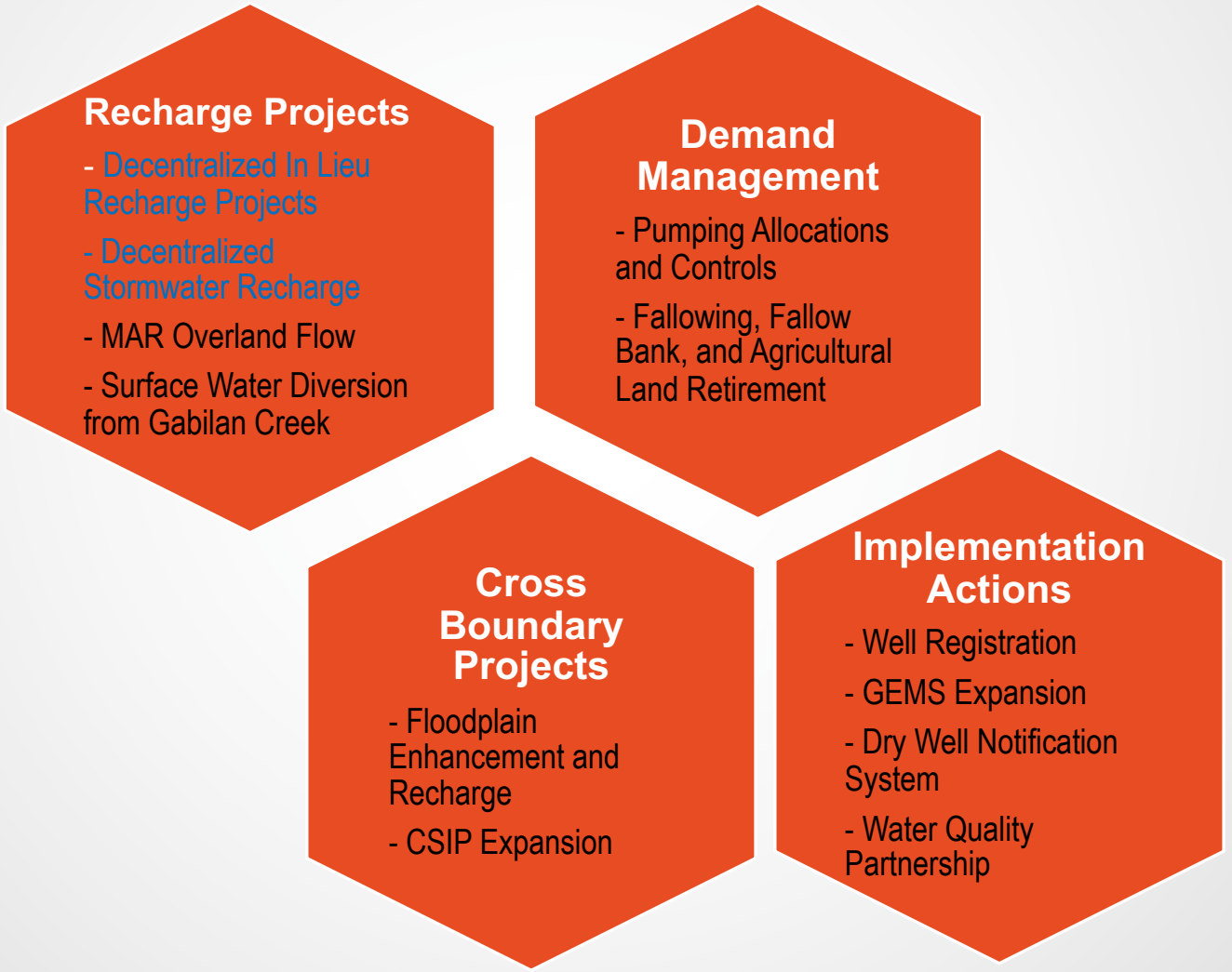


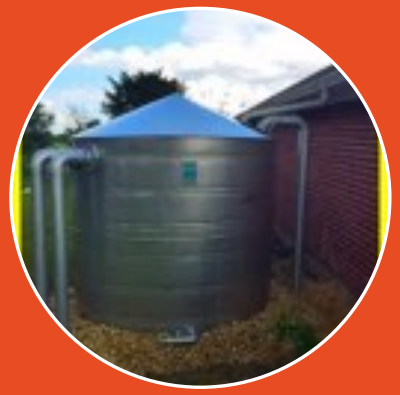
Summary of Current Conditions



- Langley Area is mostly residential, dependent on small state and local water systems
- Langley Area Subbasin has historically been in overdraft on the order of 300 AF/yr.
- From 1980 to 2016, the basin was in overdraft during 9 years
- This GSP includes a robust set of potential projects and management actions that are sufficient to mitigate overdraft

Langley Projects & Management Actions





Decentralized Residential In Lieu Recharge Projects

- Small-scale projects initiated by homeowners and business owners, including rooftop rainwater harvesting, rain gardens, and graywater systems
- **Benefit**: If 75 households install 5000-gallon rain barrels or graywater systems, it would save up to 4 AF/yr. or 1.6 AF/yr. respectively
- **Cost** to GSA (not for homeowner implementation or incentives):$50,000 for 5 workshops on rainwater harvesting and $50,000 for 5 workshops on graywater reuse

Decentralized Stormwater Recharge

Medium scale bioswales and recharge basins on non-agricultural land.

Benefit: If 1% of the Subbasin is converted from an area of runoff to an area of recharge, 279 AF/yr.

Cost to GSA (not for implementation or incentives): $150,000 - $200,000 to encourage projects through outreach, site assessments, and assistance with planning

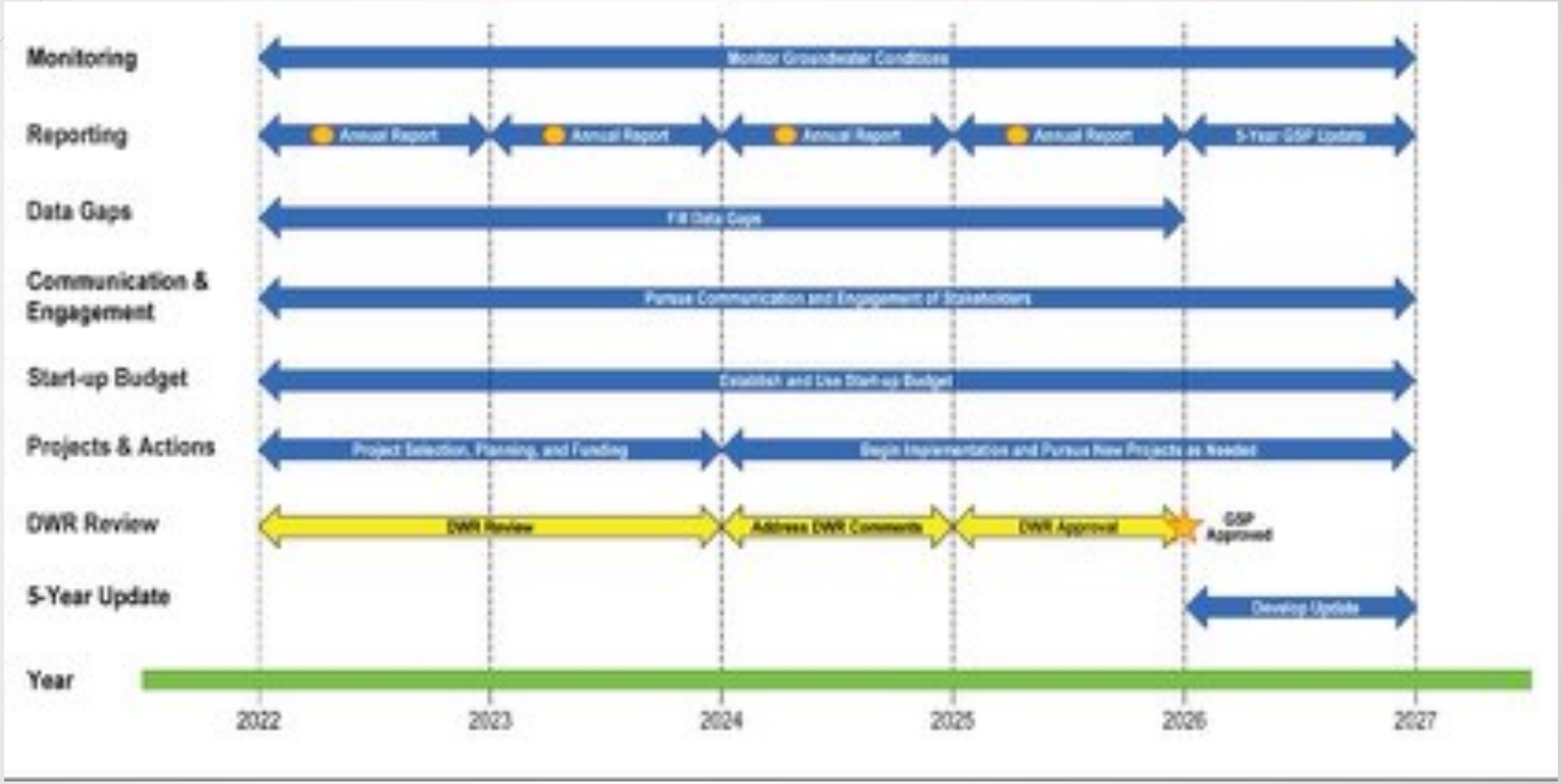
RECHARGE PROJECTS

IMPLEMENTATION (all subbasins)

Prepared by

MONTGOMERY & ASSOCIATES

Implementation Schedule



Adaptive Management

Image source: https://reefresilience.org/management-strategies/marine-protected-areas/adaptive-management

Questions

Considerations in Addressing Comments

- Factual inaccuracies
- Changes that improve the clarity of the GSP
- Changes that improve the clarity of the GSP that require significant effort
- Changes to decisions of the Subbasin Committees
- Policy issues that need to engage the Board
- Data requests are not directly related to completing the GSP
- Requests that are not necessary now, but maybe in the future
- Data requests or policy decisions outside of the scope of the GSA

Upper Valley Chapter 6 – Water Budgets

Historical Water Budget

	Modeled Historical Average (WY 1980-2016)
Groundwater Pumping - SVIHM	-91,600
Groundwater Pumping – GEMS (average +/- standard deviation)	-108,500 to -129,600
Net Stream Exchange	89,100
Groundwater Evapotranspiration	-57,900
Deep Percolation of precipitation and irrigation water	57,300
Net Flow from Adjacent Subbasins/Basin	1,900
Net Storage Gain (+) or Loss (-)	-1,200

Historical Sustainable Yield

- *The sustainable yield is the maximum amount of extraction that can occur without causing undesirable results as defined for each sustainability indicator*
- *SVIHM generated water budget was adjusted with best available extraction data - GEMS*
- UV has not experienced chronic declines in groundwater levels or storage, so change in storage is 0 AF/yr.
- Historical sustainable yield ranges from 108,500 to 129,600 AF/yr.

Upper Valley Chapter 6 – Water Budgets

Future Water Budget

	Model Estimate 2070
Groundwater Pumping - SVOM	-90,900
Groundwater Pumping – GEMS-adjusted	-117,000
Net Stream Exchange	73,200
Groundwater Evapotranspiration	-46,300
Deep Percolation of precipitation and irrigation water	66,700
Net Flow from Adjacent Subbasins/Basin	8,300
Net Storage Gain (+) or Loss (-)	10,800

Future Sustainable Yield

- UV is has not experienced chronic declines in groundwater levels or storage, so change in storage is 0 AF/yr.
- Future sustainable yield is about 117,000 AF/yr.

Forebay Chapter 6 – Water Budgets

Historical Water Budget

	Greater Forebay – Modeled Historical Average (WY 1980-2016)	ASCMA – Modeled Historical Average (WY 1980-2016)
Groundwater Pumping – SVIHM	-108,700	-34,200
Groundwater Pumping – GEMS (average +/- standard deviation)	-151,100 to -174,500	-44,400 to -53,000
Net Stream Exchange	90,300	15,600
Groundwater Evapotranspiration	-32,100	-600
Deep Percolation of precipitation and irrigation water	52,200	16,900
Net Flow from Adjacent Subbasins/Basin	0	1,600
Net Storage Gain (+) or Loss (-)	1,800	-600

Historical Sustainable Yield

- *The sustainable yield is the maximum amount of extraction that can occur without causing undesirable results as defined for each sustainability indicator*
- *SVIHM generated water budget was adjusted with best available extraction data - GEMS*
- The Greater Forebay Subbasin and ASCMA have not experienced chronic declines in groundwater levels or storage, so change in storage is 0 AF/yr.
- Greater Forebay Subbasin historical sustainable yield ranges from 151,100 to 174,500 AF/yr.
- ASCMA historical sustainable yield ranges from 44,400 to 53,000 AF/yr.

Forebay Chapter 6 – Water Budgets

Future Water Budget

	Greater Forebay – Model Estimate 2070	ASCMA – Model Estimate 2070
Groundwater Pumping – SVOM	-117,800	-37,100
Groundwater Pumping – GEMS-adjusted	-179,200	-55,400
Net Stream Exchange	105,700	23,800
Groundwater Evapotranspiration	-35,100	-1,500
Deep Percolation of precipitation and irrigation water	57,500	16,600
Net Flow from Surrounding Watersheds	0	-1,500
Net Storage Gain (+) or Loss (-)	9,600	1,600

Future Sustainable Yield

- The Greater Forebay Subbasin and ASCMA have not experienced chronic declines in groundwater levels or storage, so change in storage is 0 AF/yr.
- Future sustainable yield is about 179,200 AF/yr. for the Greater Forebay Subbasin
- Future sustainable yield is about 55,400 AF/yr. for the ASMCA

Eastside Chapter 6 – Water Budgets

Historical Water Budget

	Modeled Historical Average (WY 1980-2016)
Groundwater Pumping	-72,600
Groundwater Pumping – GEMS (average +/- standard deviation)	-79,300 to -96,700
Flow from Drains	0
Net Stream Exchange	10,500
Deep Percolation	33,400
Net Flow from Adjacent Subbasins/Basin	7,100
Groundwater Evapotranspiration	-200
Net Storage Gain (+) or Loss (-)	-21,700

Historical Sustainable Yield

- *The sustainable yield is the maximum amount of extraction that can occur without causing undesirable results as defined for each sustainability indicator*
- *SVIHM generated water budget was adjusted with best available extraction data - GEMS*
- ES has experienced chronic declines in groundwater levels resulting in a loss in storage of 10,000 AF/yr.
- Historical sustainable yield ranges from 69,300 to 86,700 AF/yr.

Eastside Chapter 6 – Water Budgets

Future Water Budget

	Model Estimate 2070
Groundwater Pumping	-90,900
Groundwater Pumping – GEMS-adjusted	-83,300
Flow from Drains	-100
Net Stream Exchange	14,400
Deep Percolation	36,000
Net Flow from Adjacent Subbasins/Basin	5,500
Groundwater Evapotranspiration	-800
Net Storage Gain (+) or Loss (-)	-20,400

Future Sustainable Yield

- Eastside has experienced chronic declines in groundwater levels resulting in a loss in storage of 10,000 AF/yr.
- Future sustainable yield is about 83,300 AF/yr.

Langley Chapter 6 – Water Budgets

Historical Water Budget

800	Modeled Historical Average (WY 1980-2016)
Groundwater Pumping – SVIHM	-1,200
Groundwater Pumping – GEMS (average +/- standard deviation)	-800 to -1,400
Flow to Drains	-300
Net Stream Exchange	-3,000
Deep Percolation	9,800
Net Flow from Eastside	-1,100
Net Flow from Surrounding Watersheds	100
Net Flow from Pajaro	-300
Net Flow from 180/400-Foot	-3,700
Groundwater Evapotranspiration	-1,000
Net Storage Gain (+) or Loss (-)	-800

Historical Sustainable Yield

- *The sustainable yield is the maximum amount of extraction that can occur without causing undesirable results as defined for each sustainability indicator*
- *SVIHM generated water budget was adjusted with best available extraction data - GEMS*
- Langley has experienced chronic declines in groundwater levels resulting in a loss in storage of 300 AF/yr.
- Historical sustainable yield ranges from 800 to 1,400 AF/yr.

Langley Chapter 6 – Water Budgets

Future Water Budget

	Model Estimate 2070
Groundwater Pumping*	-1,400
Groundwater Pumping – GEMS-adjusted	900
Flow to Drains	-600
Net Stream Exchange	-1,100
Deep Percolation	11,600
Net Flow from Eastside	-900
Net Flow from Surrounding Watersheds	100
Net Flow from Pajaro	-300
Net Flow from 180/400-Foot	-4,300
Groundwater Evapotranspiration	-2,100
Net Storage Gain (+) or Loss (-)	1,000

Future Sustainable Yield

- Langley has experienced chronic declines in groundwater levels resulting in a loss in storage of 300 AF/yr.
- Future sustainable yield is about 900 AF/yr.

Groundwater conditions/SMC – Current Water Quality Exceedance Maps

Degraded Groundwater Quality

Measurable Objective (MO)

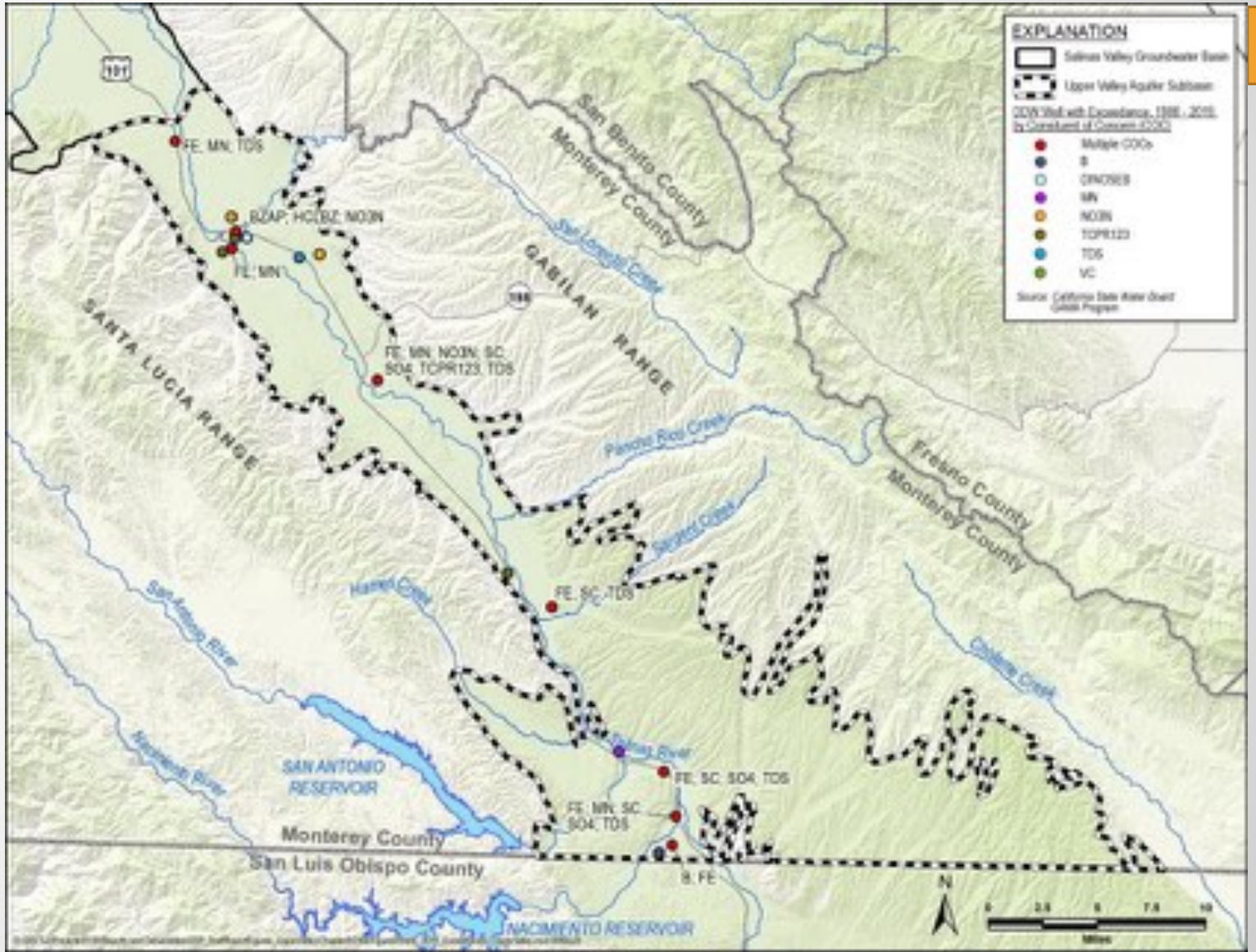
Zero additional exceedances of either the regulatory drinking water standards (potable supply wells) or the Basin Plan objectives (irrigation supply wells) beyond those observed in 2019 for groundwater quality constituents of concern.

Minimum Threshold (MT)

Identical to the measurable objective.

Undesirable Result:

The minimum threshold is exceeded as a direct result of projects or management actions taken as part of GSP implementation.



Groundwater conditions/SMC – Current Water Quality Exceedance Maps

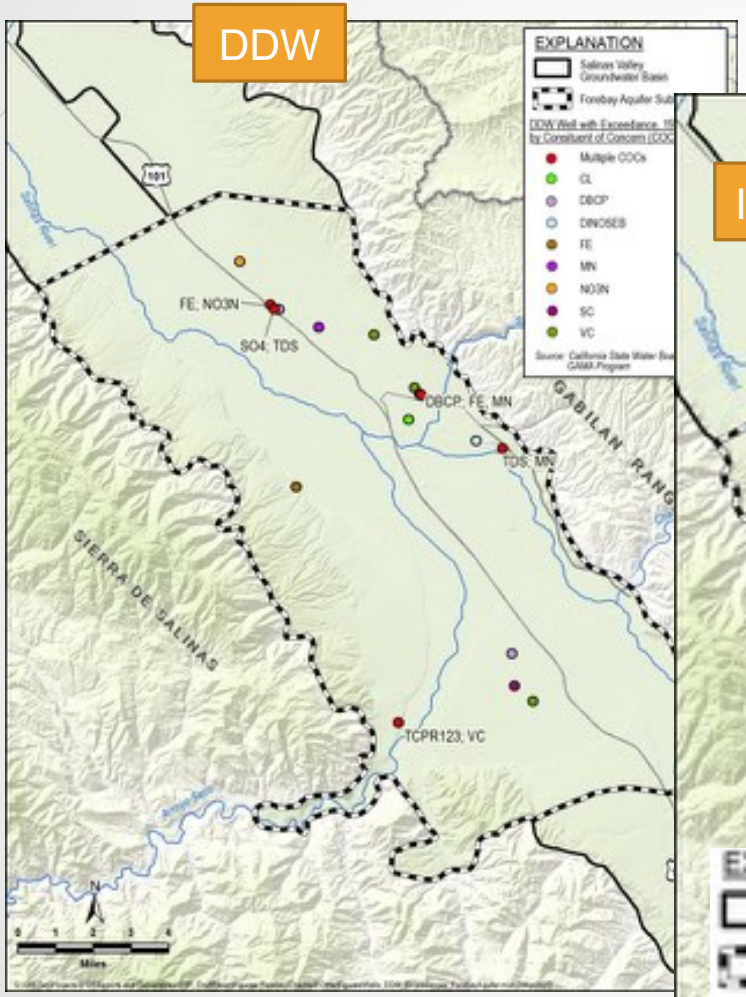
Degraded Groundwater Quality

Measurable Objective (MO)
Zero additional exceedances of either the regulatory drinking water standards (potable supply wells) or the Basin Plan objectives (irrigation supply wells) beyond those observed in 2019 for groundwater quality constituents of concern.

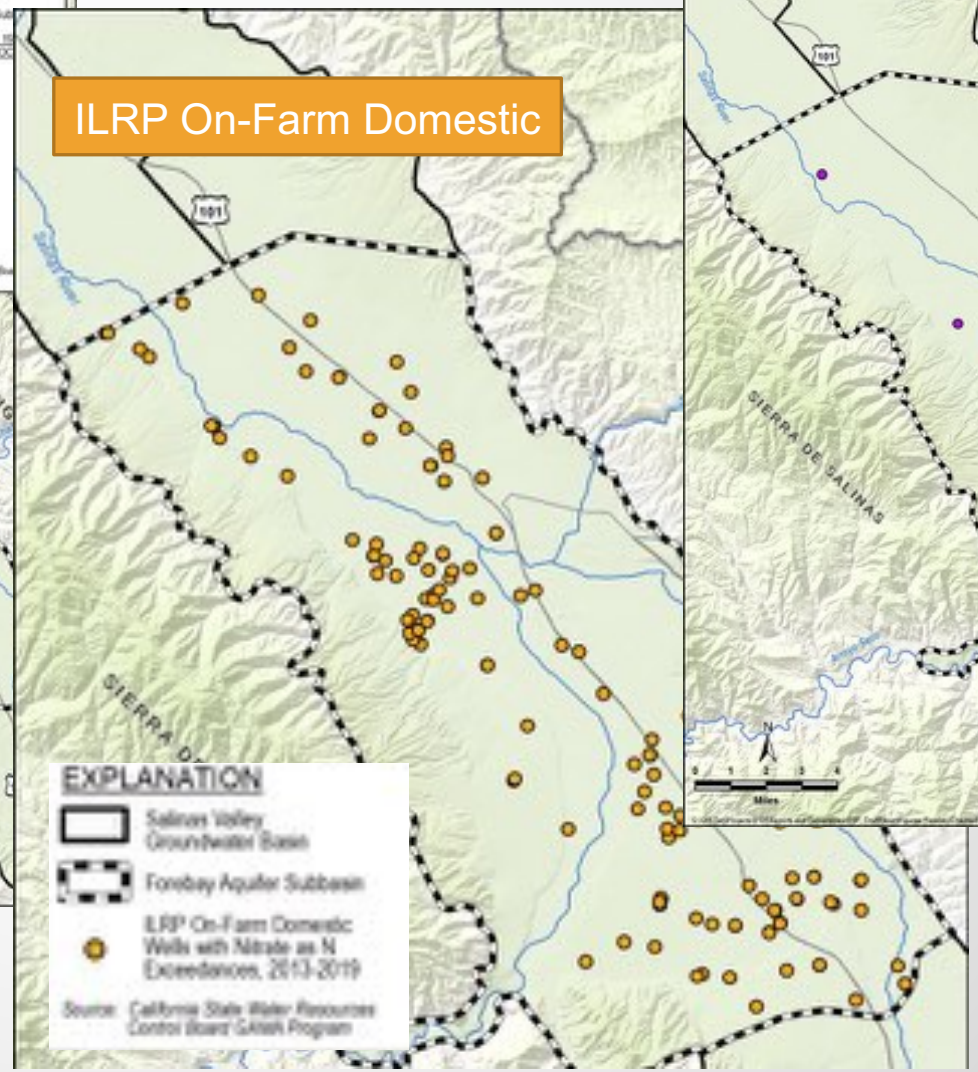
Minimum Threshold (MT)
Same as the measurable objective.

Undesirable Result:
The minimum threshold is exceeded as a direct result of projects or management actions taken as part of GSP implementation.

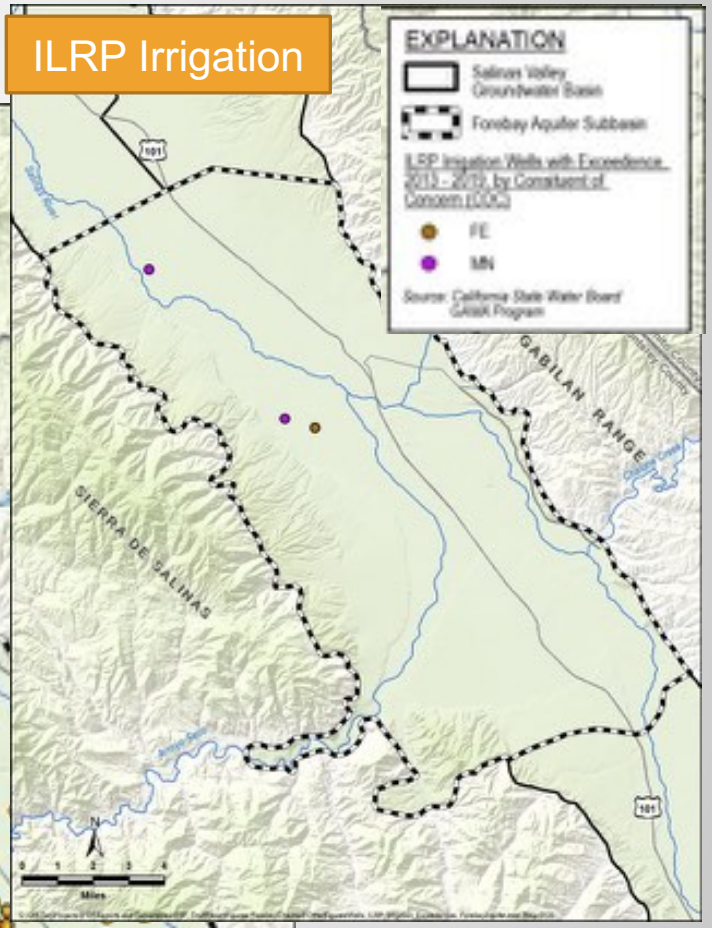
DDW



ILRP On-Farm Domestic



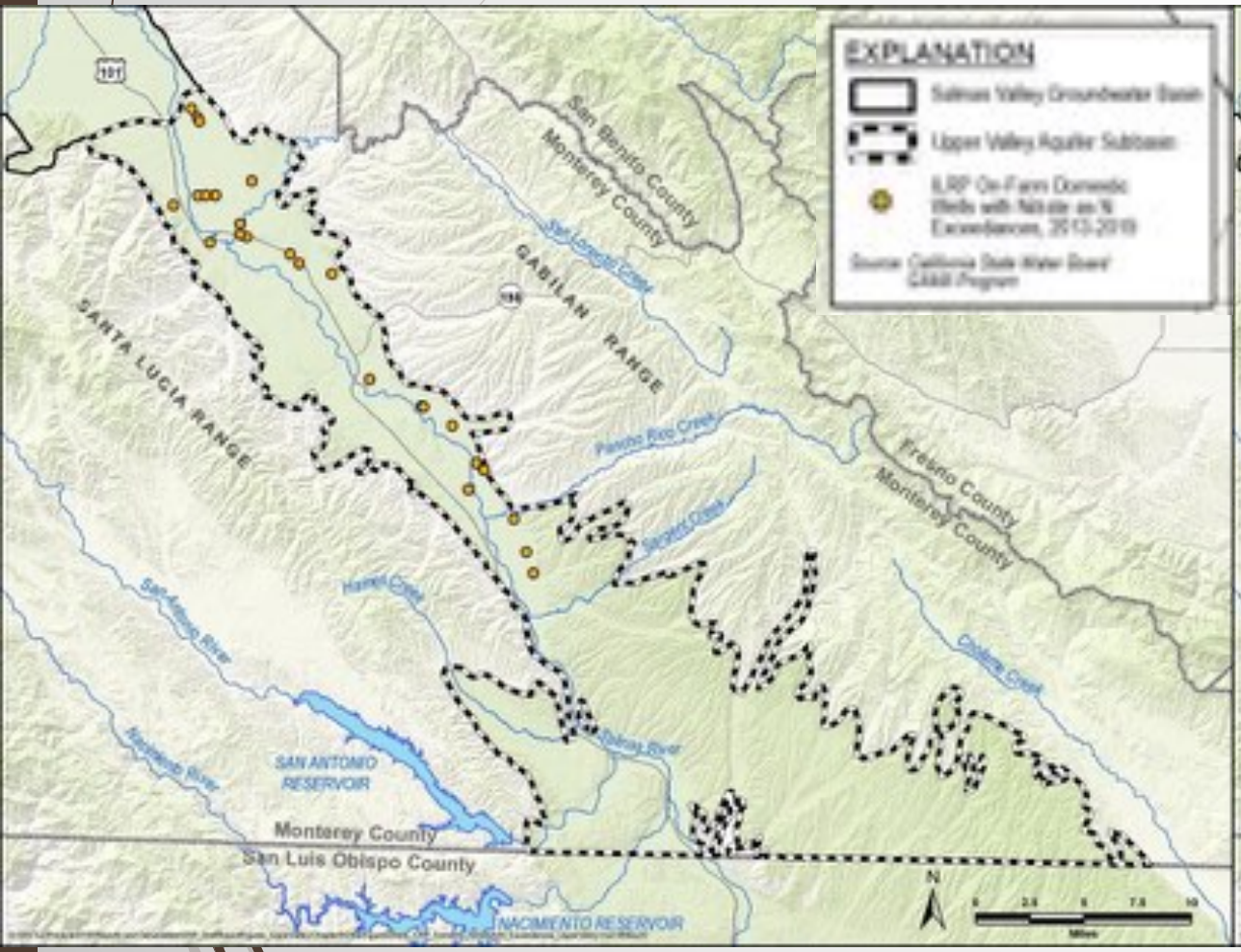
ILRP Irrigation

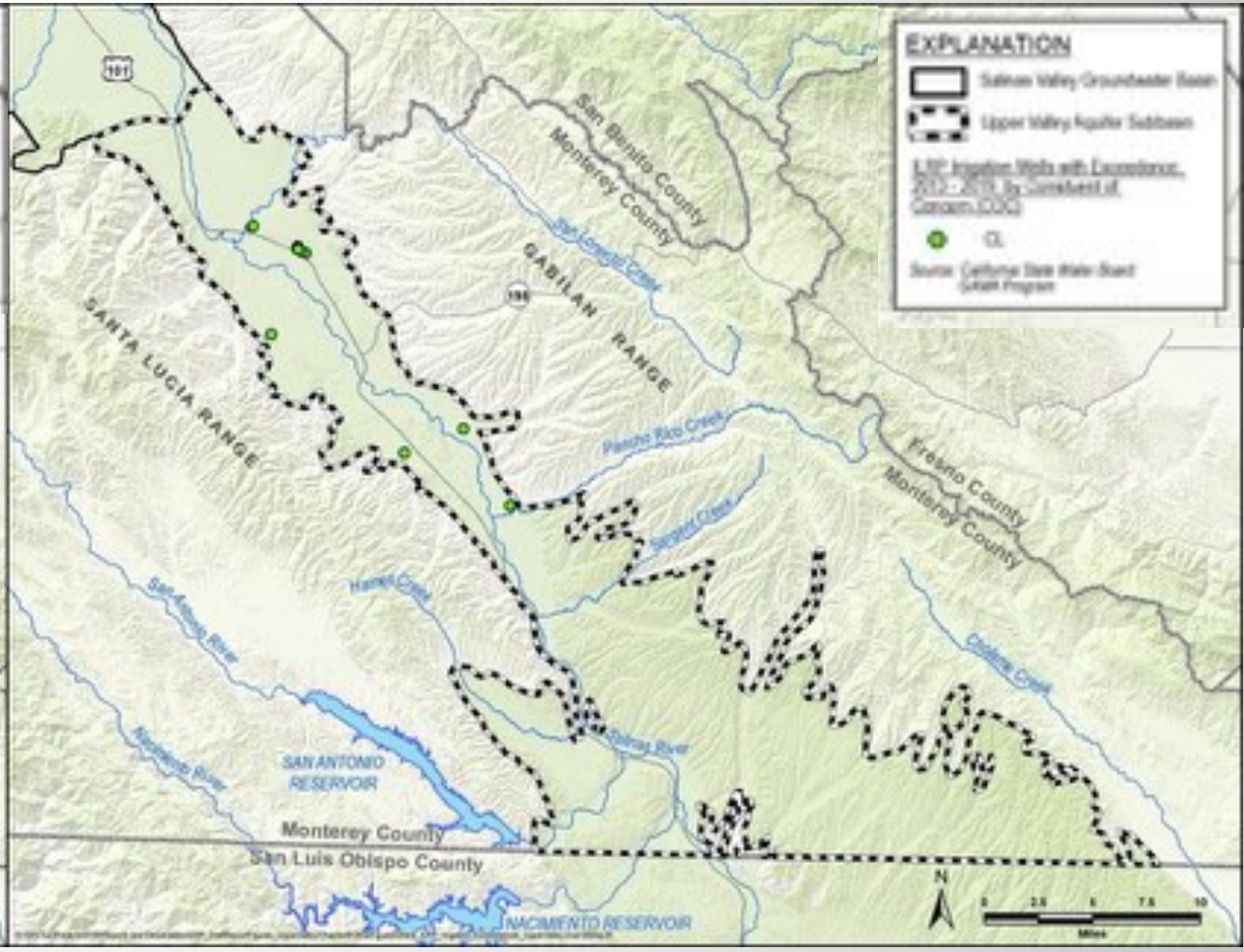


Groundwater conditions/SMC – Current Water Quality Exceedance Maps

ILRP On-Farm Domestic

ILRP Irrigation





Groundwater conditions/SMC – Current Water Quality Exceedance Maps

4. Degraded Groundwater Quality

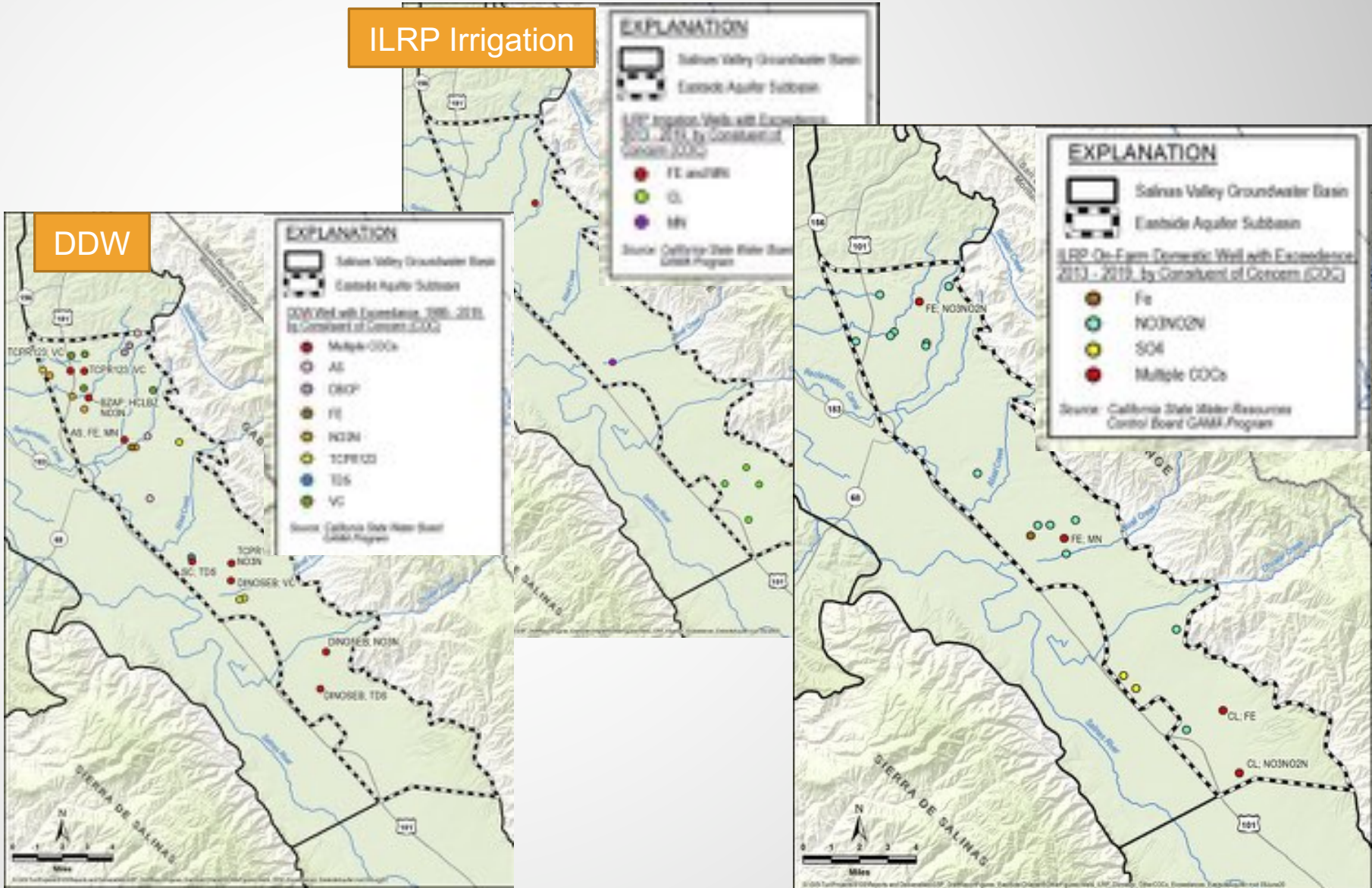
Measurable Objective (MO)
Zero additional exceedances of either the regulatory drinking water standards (potable supply wells) or the Basin Plan objectives (irrigation supply wells) beyond those in 2019 for groundwater quality constituents of concern.

Minimum Threshold (MT)
Same as the measurable objective.

Undesirable Result:
The minimum threshold is exceeded as a direct result of projects or management actions taken as part of GSP implementation.

ILRP Irrigation

DDW



Groundwater conditions/SMC – Current Water Quality Exceedance Maps

4. Degraded Groundwater Quality

Measurable Objective (MO)

Zero additional exceedances of either the regulatory drinking water standards (potable supply wells) or the Basin Plan objectives (irrigation supply wells) beyond those observed in 2019 for groundwater quality constituents of concern.

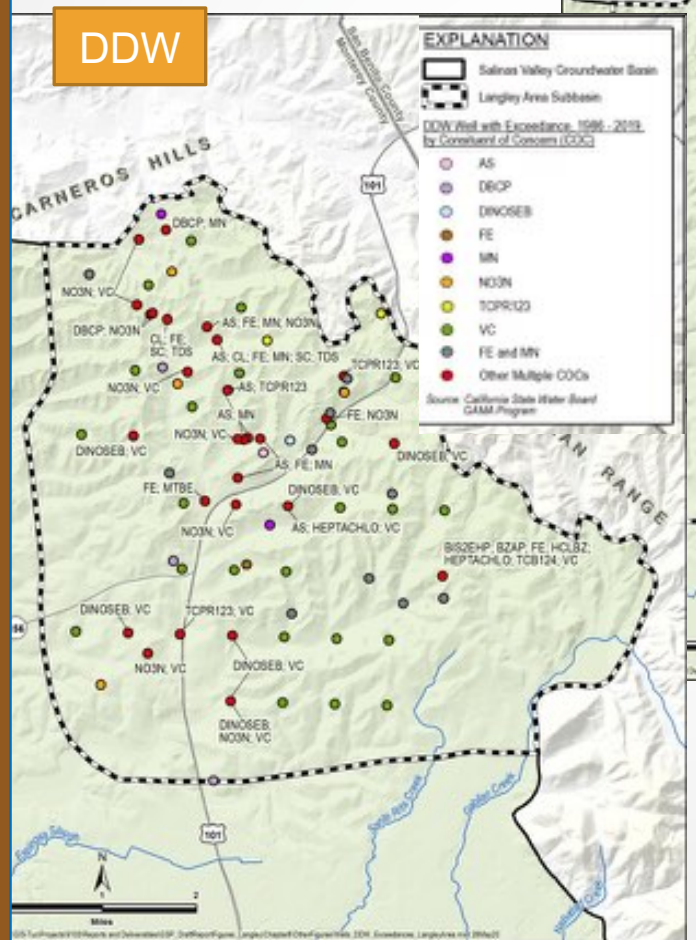
Minimum Threshold (MT)

Same as the measurable objective

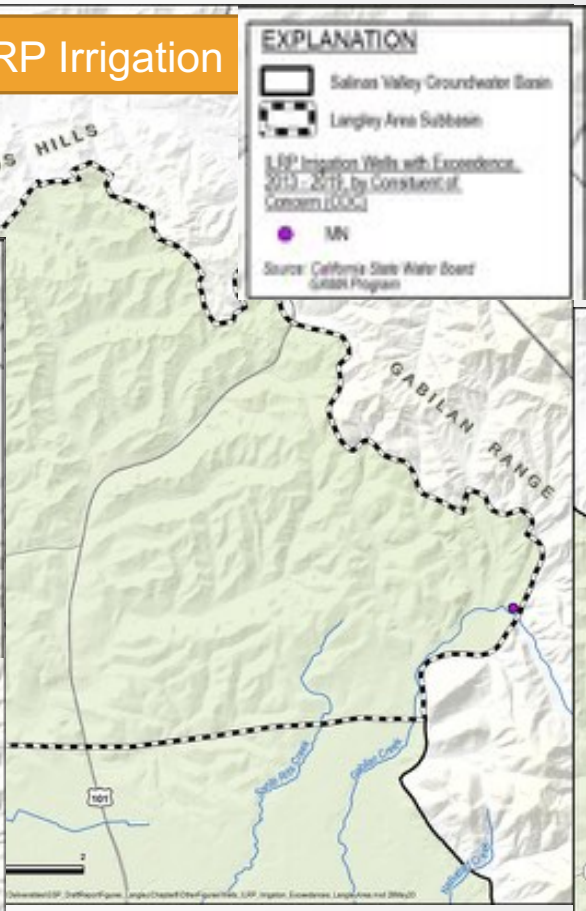
Undesirable Result:

The minimum threshold is exceeded as a direct result of projects or management actions taken as part of GSP implementation.

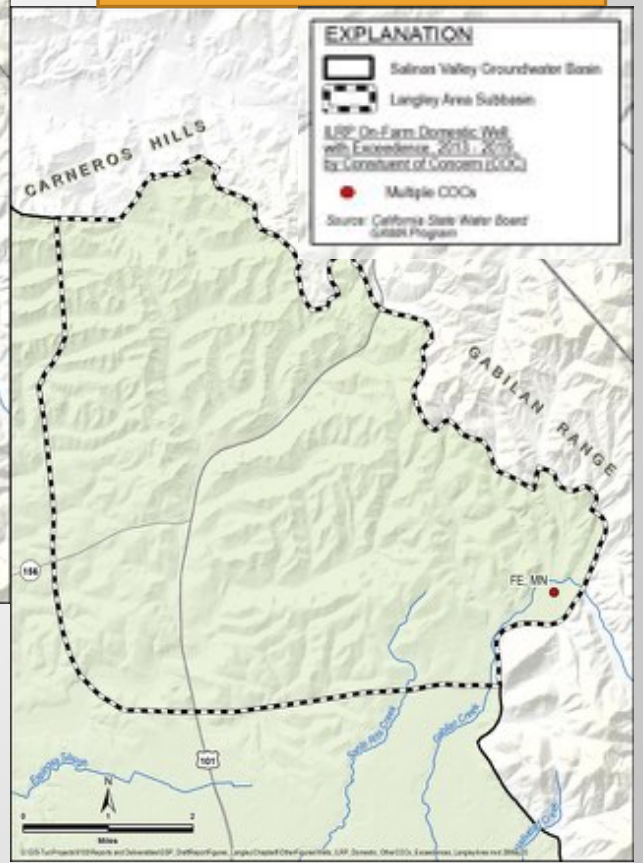
DDW



ILRP Irrigation



ILRP On-Farm Domestic



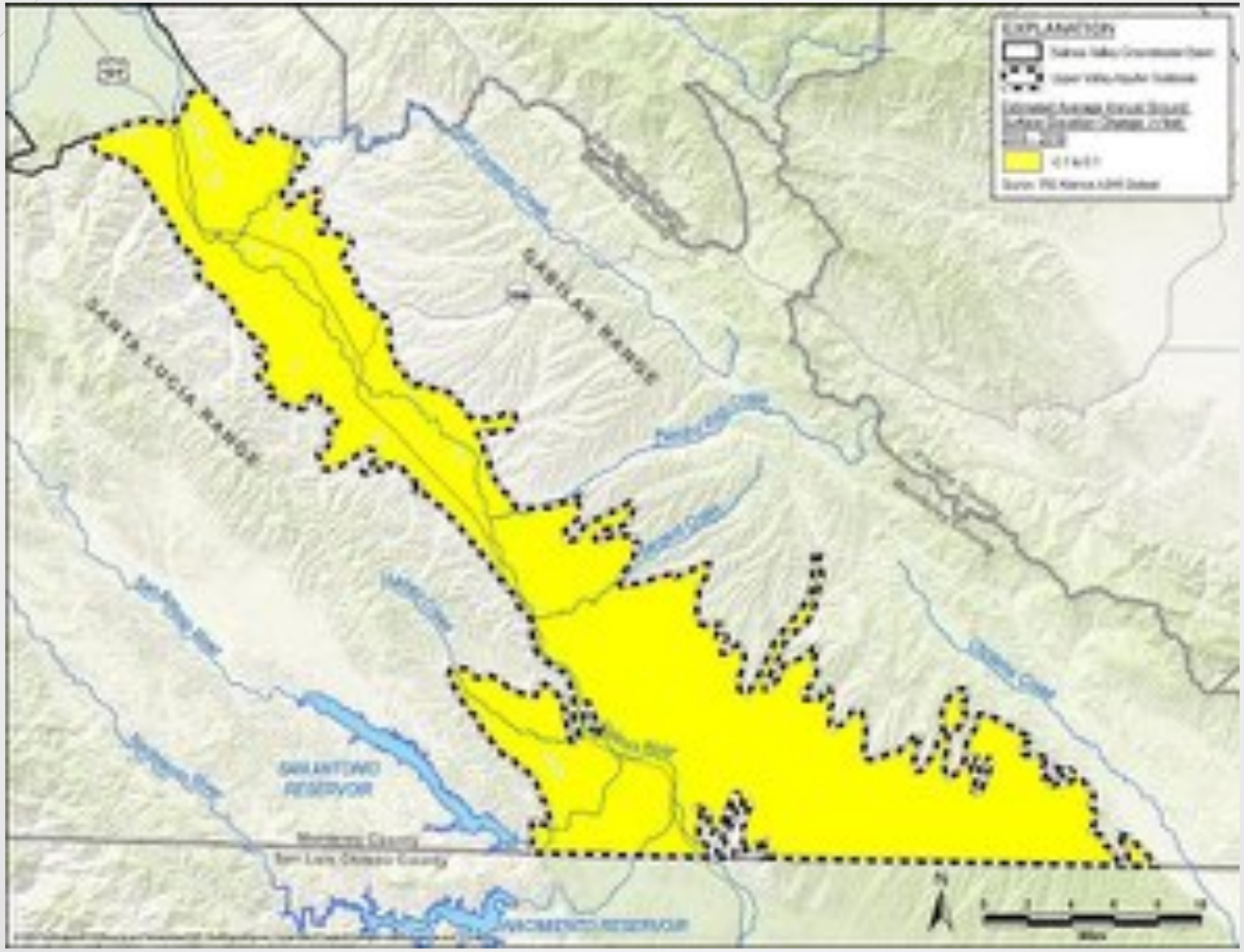
Groundwater conditions/SMC – **Subsidence**

5. Subsidence

Measurable Objective (MO):
Zero net long-term subsidence, with no more than 0.1 foot per year of estimated land movement to account for InSAR errors

Minimum Threshold (MT):
Zero net long-term subsidence, with no more than 0.1 foot per year of estimated land movement to account for InSAR errors

Undesirable Result:
There is an exceedance of minimum thresholds for subsidence.



- Negligible current subsidence
- Future subsidence due to groundwater conditions is unlikely
- Minimum threshold and measurable objective set at zero long-term subsidence

Groundwater conditions/SMC – **Subsidence**

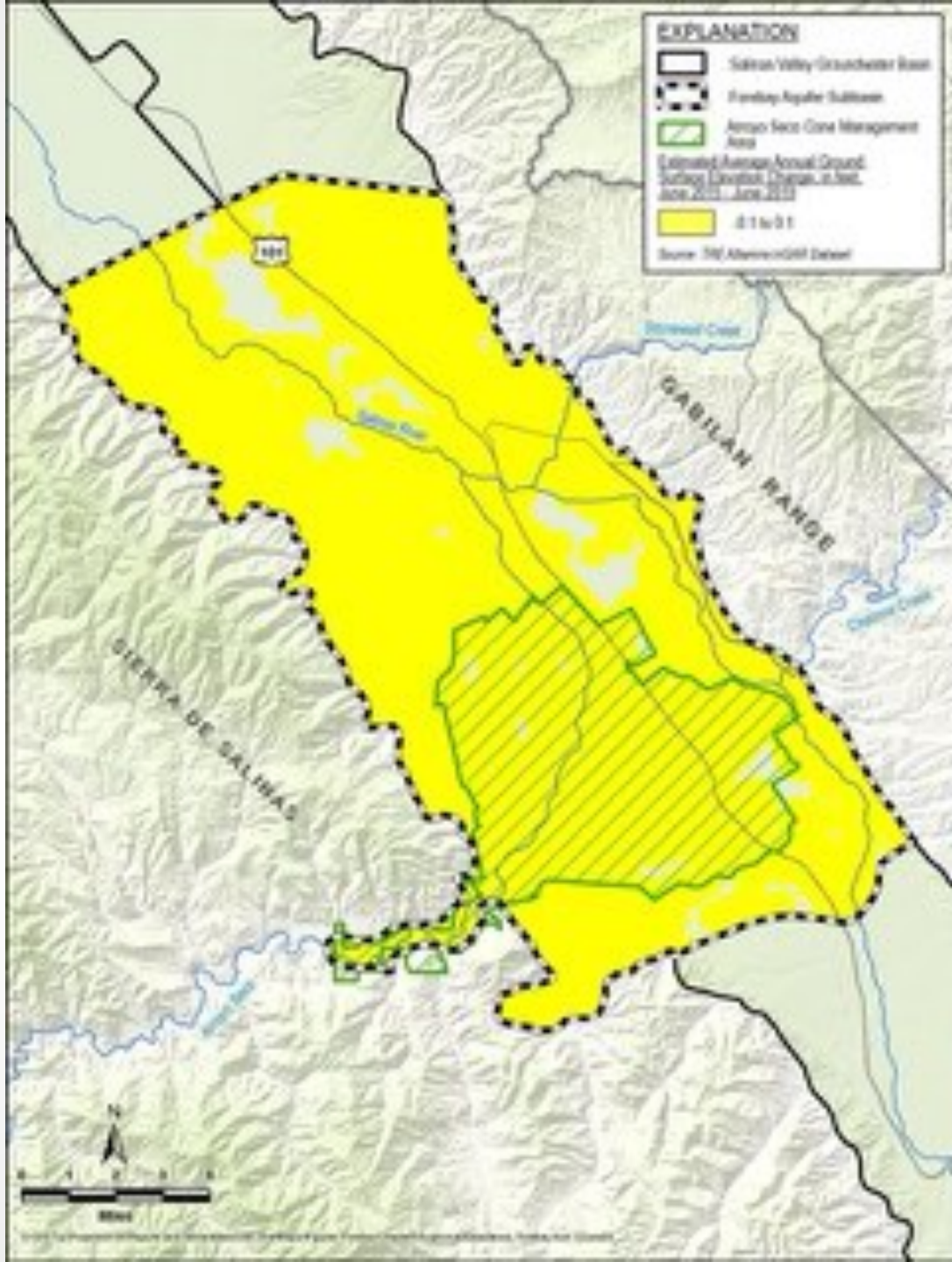
4. Subsidence

Measurable Objective (MO):
0.1 feet per year. This is a long-term rate of zero feet per year plus 0.1 feet per year of estimated land movement to account for InSAR measurement errors.

Minimum Threshold (MT):
0.133 feet per year. This is the rate that results in less than one foot of cumulative subsidence over a 30-year implementation horizon, plus 0.1 feet per year of estimated land movement to account for InSAR measurement errors.

Undesirable Result:
There is no exceedance of minimum threshold for subsidence.

- Negligible current subsidence
- Future subsidence due to groundwater conditions is unlikely



Groundwater conditions/SMC – **Subsidence**

5. Subsidence

Measurable Objective (MO):
Zero net long-term subsidence, with no more than 0.1 foot per year of estimated land movement to account for InSAR errors.

Minimum Threshold (MT):
Same as the measurable objective.

Undesirable Result:
There is an exceedance of minimum thresholds for subsidence.

- Negligible current subsidence
- Future subsidence due to groundwater conditions is unlikely
- Minimum threshold and measurable objective set at zero long-term subsidence

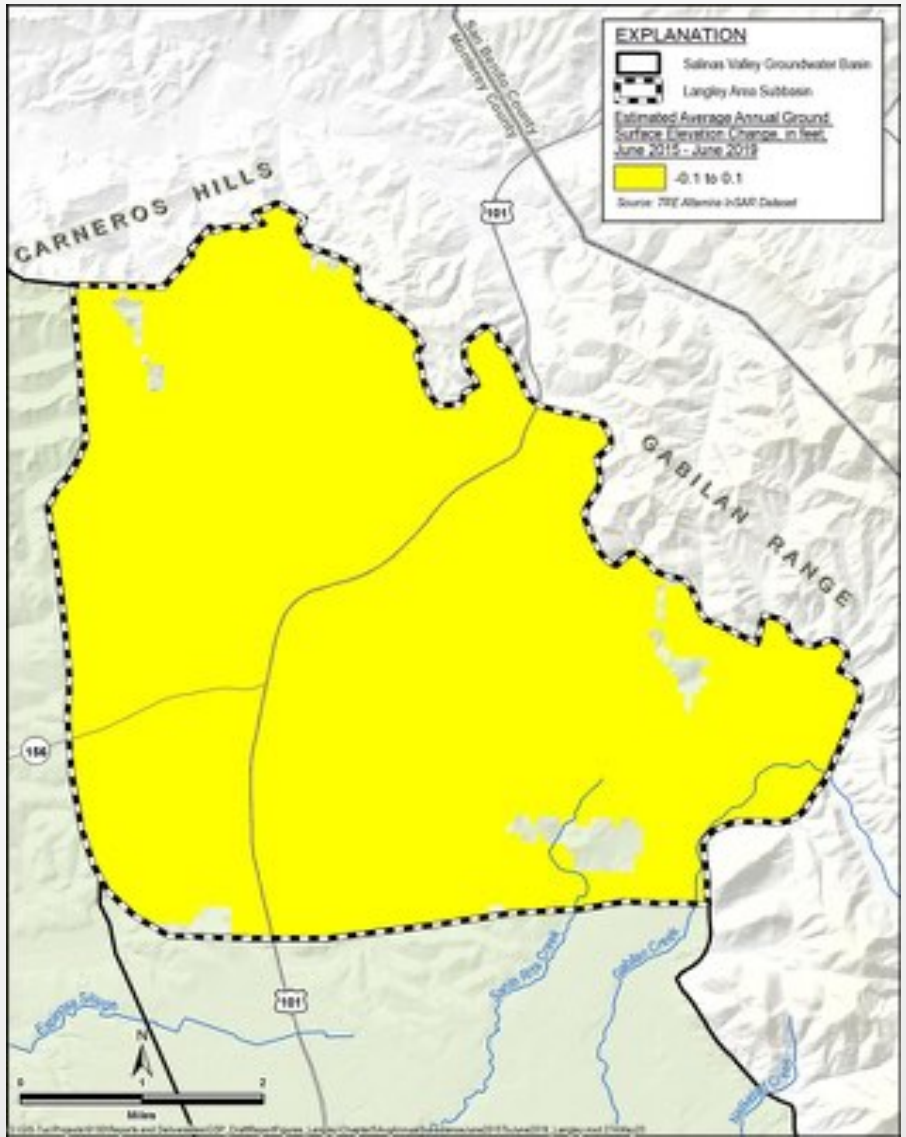
Groundwater conditions/SMC – **Subsidence**

5. Subsidence

Measurable Objective (MO):
Zero net long-term subsidence, with no more than 0.1 foot per year of estimated land movement to account for InSAR errors

Minimum Threshold (MT):
Same as the measurable objective

Undesirable Result:
There is an exceedance of minimum thresholds for subsidence.



Negligible current subsidence

Future subsidence due to groundwater conditions is unlikely

Groundwater conditions/SMC – **Groundwater Storage**

Reduction of groundwater storage

Measurable Objective (MO):
Set to zero when the groundwater elevations are held at the groundwater level measurable objectives.

Minimum Threshold (MT):
Set to -267,000 acre-feet below the measurable objective. This reduction is based on the groundwater level minimum thresholds.

Undesirable Result:
There is an exceedance of the minimum threshold.