Developing the Sonoma Valley Salt and Nutrient Management Plan

Presenters
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RMC *Innovative Solutions for Water and the Environment*

April 10, 2013

Presentation Overview

- Background and Plan Overview
- Existing Water Quality and Assimilative Capacity
- Future Water Quality and Assimilative Capacity
- Implementation Plan Discussion
- SNMP Groundwater Monitoring Program
- Next Steps

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Salt & Nutrient Management Plan is a Regulatory Document

- Required as part of Recycled Water Policy
- Characterizes various sources of salts & nutrients

Plan Purpose:

- Helps understand effects of salts and nutrient loading within the basin
- Used to proactively manage the basin loading to be protective of groundwater quality objectives outlined by the Basin Plan

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Salt & Nutrient Management Plan Required Elements

- Groundwater monitoring plan
- Goals and objectives for water recycling and stormwater recharge
- Salt and nutrient source characterization, assimilative capacity, loading estimates and fate & transport
- Measures to manage loading
- Anti-degradation analysis

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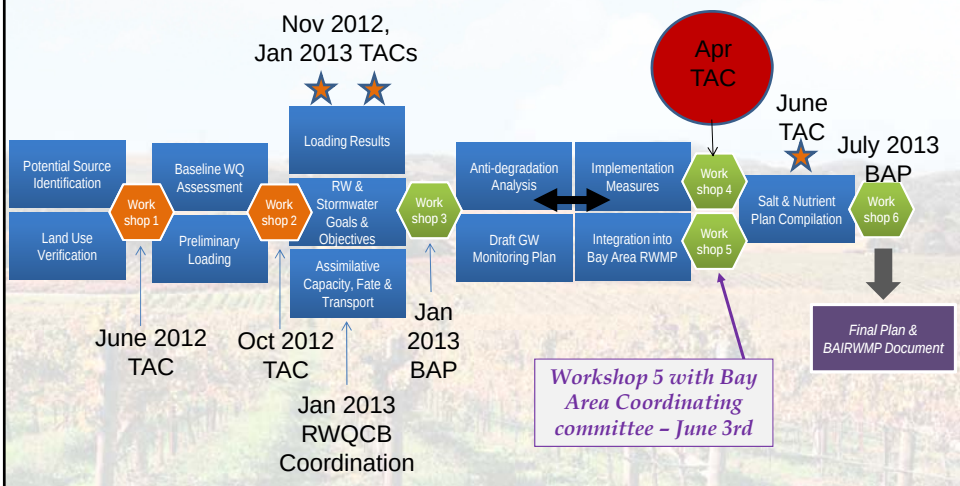
Sonoma Valley SNMP Approach



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Existing Water Quality Analysis

- Overall good water quality with very low nitrate, and generally flat trends for TDS and nitrate

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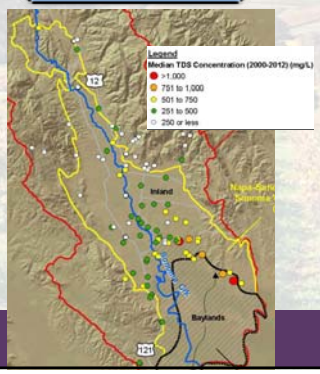
Existing Groundwater Quality - TDS

Data: 2000 to 2012

Well Medians



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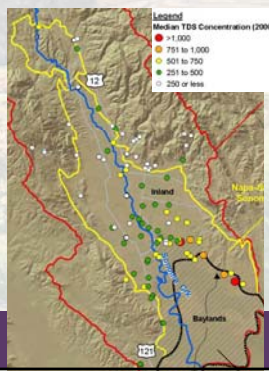
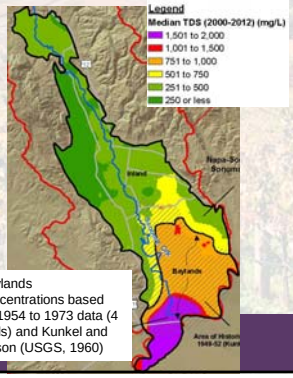
Existing Groundwater Quality - TDS

Well Medians → Contour Maps





Baylands concentrations based on 1954 to 1973 data (4 wells) and Kunkel and Upson (USGS, 1960)

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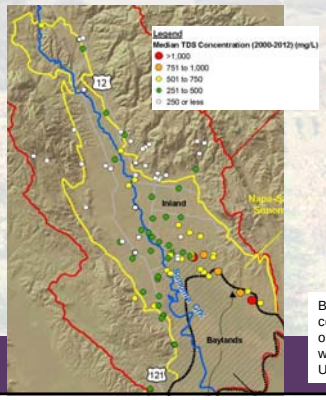
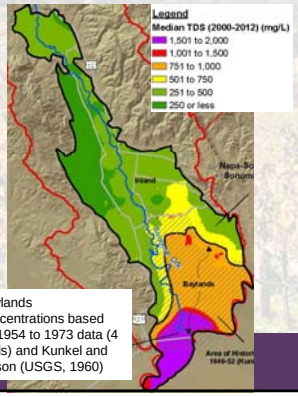
Existing Groundwater Quality - TDS

Well Medians → Contour Maps → GIS Spatial Analyst Tools Avg. WQ





Baylands concentrations based on 1954 to 1973 data (4 wells) and Kunkel and Upson (USGS, 1960)

Average TDS = 372 mg/L

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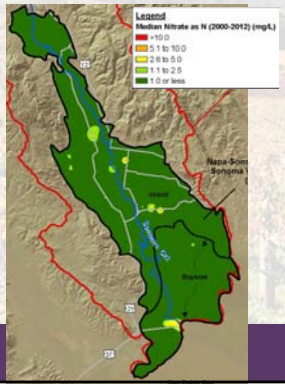
Existing Groundwater Quality – Nitrate-N

Well Medians → Contour Maps → GIS Spatial Analyst Tools Avg. WQ



Average NO_3-N = 0.07 mg/L

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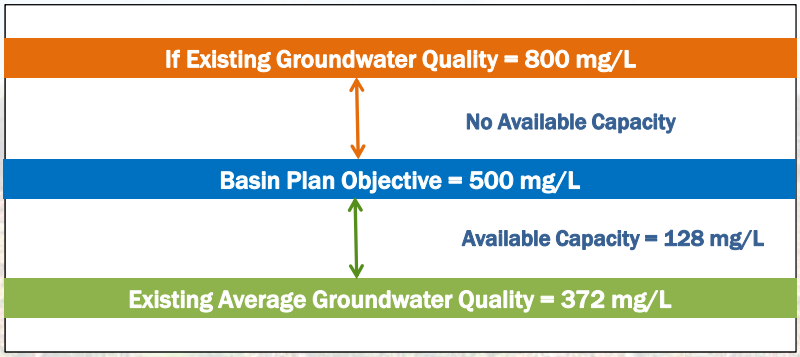
Assimilative Capacity



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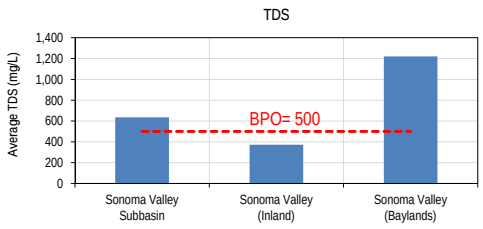
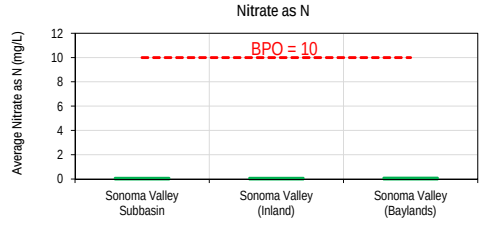
Existing Assimilative Capacity

	Sonoma Valley Subbasin	Sonoma Valley (Inland)	Sonoma Valley (Baylands)
TDS			
Average	635	372	1,220
Basin Plan Objective	500	500	500
Assimilative Capacity	-135	128	-720
Nitrate as N			
Average	0.06	0.07	0.07
Basin Plan Objective	10.00	10.00	10.00
Assimilative Capacity	9.94	9.93	9.93





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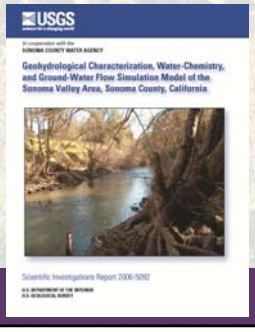
Baseline Analysis

Baseline Period Past 1997 - 2006

Water Balance

Water balance extracted from USGS/Bauer update calibrated groundwater model



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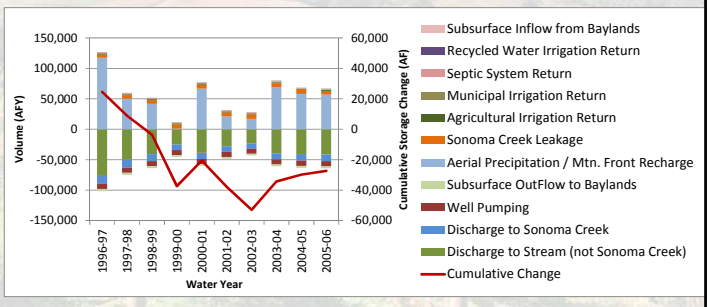
Baseline Analysis

Water Balance

All annual inflow and outflow volumes characterized for baseline period



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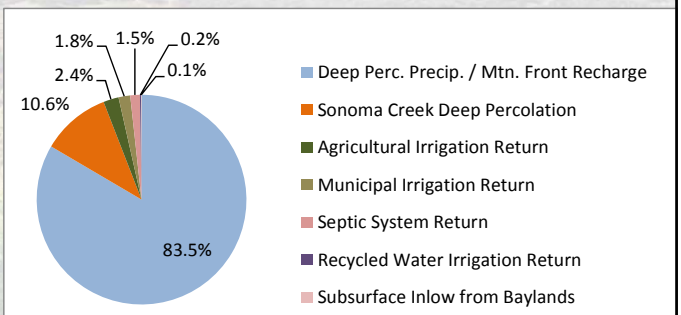
Baseline Analysis

Water Balance

- Aerial Precipitation and mountain-front recharge represent most of the inflows (83.5%)
- Return flows collectively represent only 5.8% of total inflows



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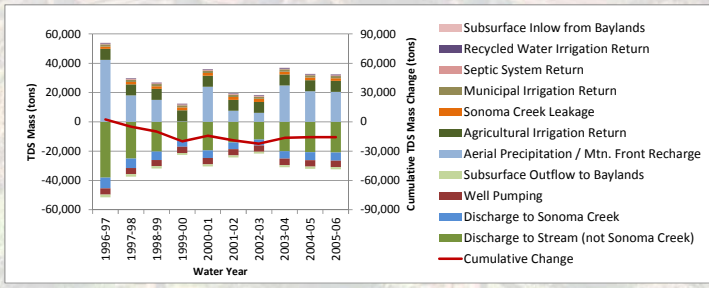
Baseline Analysis

Water Balance → S/N Balance TDS

Concentrations assigned to each inflow and outflow

Q x C = Mass



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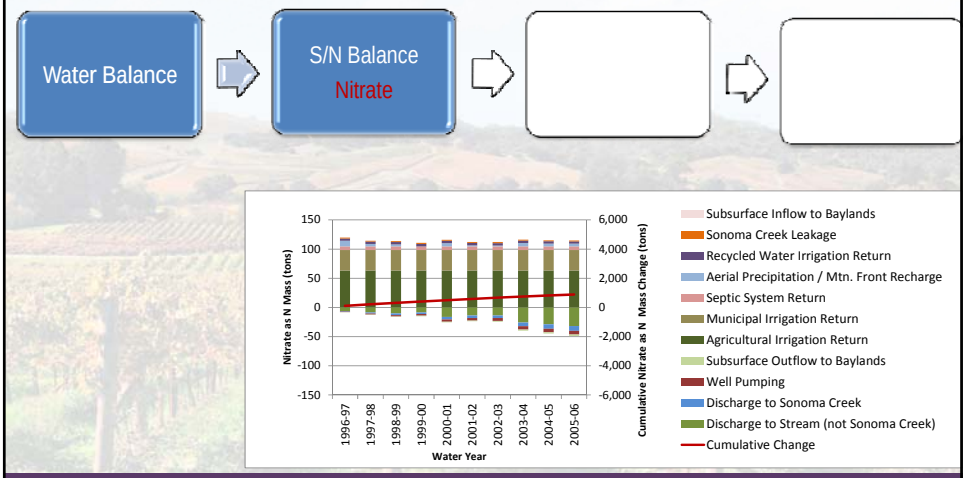
Baseline Analysis



Surface Water Recharge Quality

- Based on USGS and DWR Sonoma Creek and other tributaries sampling in 2003 and 2010 and continuous E.C. recording at one location by USGS

TDS (mg/L)	Nitrate-N (mg/L)
200	0.2

Subsurface Inflow from Baylands

- Based on average well concentrations and contouring

TDS (mg/L)	Nitrate-N (mg/L)
1,200	0.1

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Aerial Precipitation and Mountain Front Recharge Quality

- TDS slightly higher than average for surface water samples
- Final TDS concentration determined based on good match between simulated and average groundwater quality over baseline period (calibration process)
- Nitrate-N concentration assumed to be equivalent to average ambient groundwater concentration in “Inland” area

TDS (mg/L)	Nitrate-N (mg/L)
270	0.1

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Return Flows Quality – Developed from Loading Model

- TDS and nitrogen values developed by agronomist then checked against soil amendment and fertilizer sales in Sonoma County. Application rates scaled to match.
- Refinements from vineyard and dairy practice inputs
- Septic info estimated from SVCSD wastewater influent testing

Return Flow Component	TDS (mg/L)	Nitrate-N (mg/L)
Agriculture return	3,900	33
Urban landscaping return (municipal irrigation return)	1,050	24
Septic system return	450	5

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Refined Loading Factors

Land Use Group	Total Area (ac)	Percent Cultivated	Applied Water (in/yr)	Applied Nitrogen (lbs/acre-year)	Nitrogen Uptake (lbs/acre-year)	Leachable Nitrogen (lbs/acre-year)	Applied TDS (lbs/acre-year)
Non-irrigated vines	284	80%	0	18	16	0	84
Non-irrigated Orchard	41	80%	0	75	60	8	292
Non-irrigated Hay	8,489	80%	0	34	22	8	170
Urban Commercial and Industrial	1,018	5%	48.5	92	60	23	657
Urban C&I, Low Impervious Surface	807	30%	48.5	92	60	23	438
Farmsteads/Rural-Residential	5,608	10%	28.7	61	42	13	376
Urban Residential	2,238	15%	51.1	92	60	23	438
Urban Landscape/Golf Course	327	75%	48.5	92	60	23	584
Pasture	2,266	100%	51.1	110	90	14	584
Vines	13,075	100%	6.3	29	23	3	168
Other CAFOs	102	10%	0	84	0	75	730
Dairy	769	0%	0	See Dairy Parameters			
Non-irrigated vines	284	80%	0	18	16	0	84

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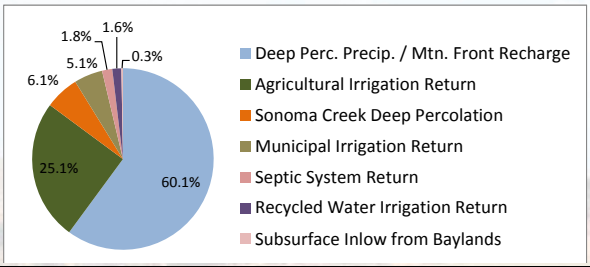
TDS Mass Loading



Inflows	Baseline Average Flow (AFY)	Baseline Average TDS (mg/L)	TDS Mass (Tons)	TDS Mass (%)
Aerial Precipitation / Mtn. Front Recharge	49,915	265	17,985	60.1%
Agricultural Irrigation Return	1,415	3,902	7,507	25.1%
Sonoma Creek Deep Precolation	6,363	210	1,817	6.1%
Municipal Irrigation Return	1,074	1,044	1,524	5.1%
Septic System Return	899	450	550	1.8%
Recycled Water Irrigation Return	91	3,863	478	1.6%
Subsurface Inlow from Baylands	51	1,220	84	0.3%
Total	**59,807**		**29,944**	**100%**
Volume-Weighted Average		**368**		

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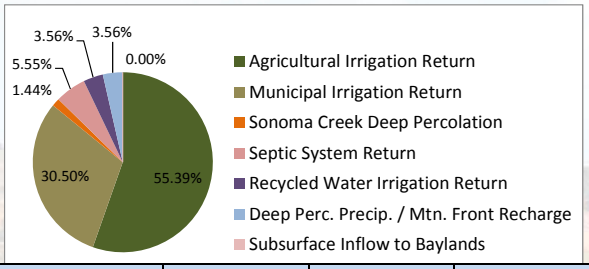
Nitrate Mass Loading



Inflows	Baseline Average Flow (AFY)	Baseline Average Nitrate (mg/L)	Nitrate-N Mass (Tons)	Nitrate-N Mass (%)
Agricultural Irrigation Return	1,415	32.94	63.4	55.4%
Municipal Irrigation Return	1,074	23.89	34.9	30.5%
Septic System Return	899	5.19	6.3	5.5%
Aerial Precipitation / Mtn. Front Recharge	49,915	0.06	4.1	3.6%
Recycled Water Irrigation Return	91	32.93	4.1	3.6%
Sonoma Creek Deep Precolation	6,363	0.19	1.6	1.4%
Subsurface Inlow from Baylands	51	0.07	0.005	0.0%
Total	**56,419**		**114**	**9%**
Volume-Weighted Average		**1.41**		

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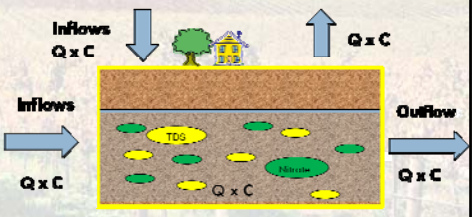
Baseline Analysis

Groundwater in storage and existing avg. GW quality

mixed with S/N loads

Annual WQ Concentrations



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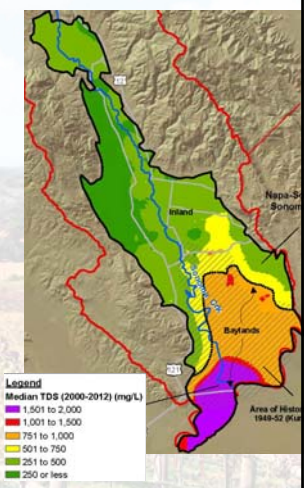
Mixing Model

- Divided in “Inland” and Baylands”
- Incorporates water budget components for “Inland” area
- Considers subsurface flow between “Inland” and “Bayland” areas



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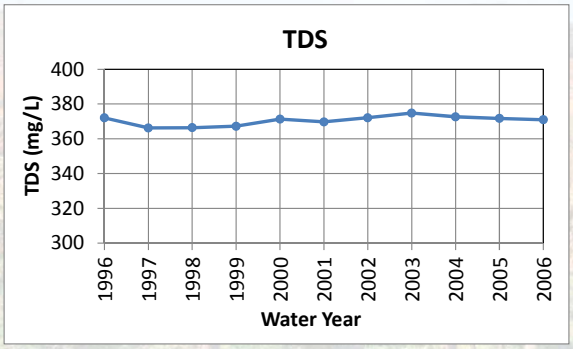
Baseline TDS Concentrations Simulated

- Generally match observed average ambient concentrations and regional (flat) trends



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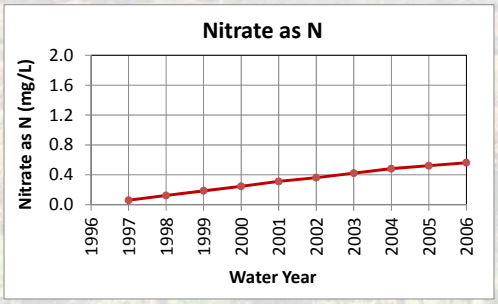
Baseline Nitrate-N Concentrations Simulated

- Slight increasing trend / observed regional trends relatively flat
- Appropriate considering relatively sparse groundwater data



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Baseline Calibration

- Baseline Period used to calibrate key S/N loads with high uncertainty (aerial precipitation / mountain front recharge)
- No other adjustments made

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Future WQ and AC

Future Planning Horizon 2013 - 2035

- Same approach as baseline
- Simulate future annual water quality and AC
- Estimate use of AC by recycled water projects
  - Single RW project uses less than 10% of the available AC
  - Multiple RW projects use less than 20% of the available AC

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Future Simulations

- Three simulations using mixing model
  - No-Project (Average Baseline)
  - Scenario 1: 2035 Recycled Water projections
  - Scenario 2: 2035 Recycled Water projections + 5,000 AFY additional recycled water
  - Stormwater capture projection (50 AFY) incorporated in both future simulations

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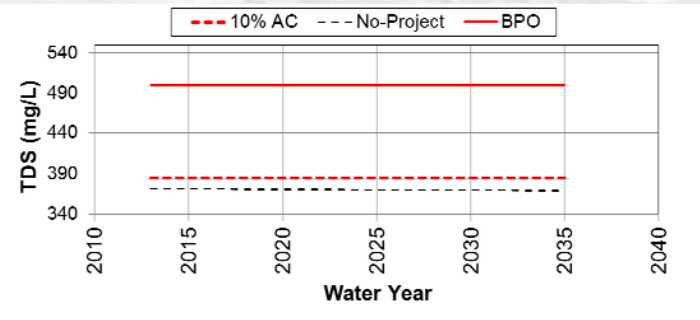
Future Average TDS Concentration

- No-Project
  - -2.5 mg/L TDS from 2013 to 2035
    - No assimilative capacity used



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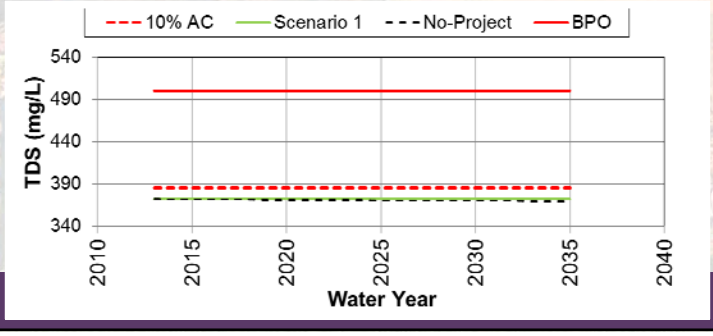
Future Average TDS Concentration

- Scenario 1: 2035 RW Conditions
  - All Loading: -0.3 mg/L TDS from 2013 to 2035
    - No assimilative capacity used
  - RW Loading: +2.2 mg/L TDS compared to No-Project
    - = 1.7% AC compared to 2035 No-Project TDS concentration



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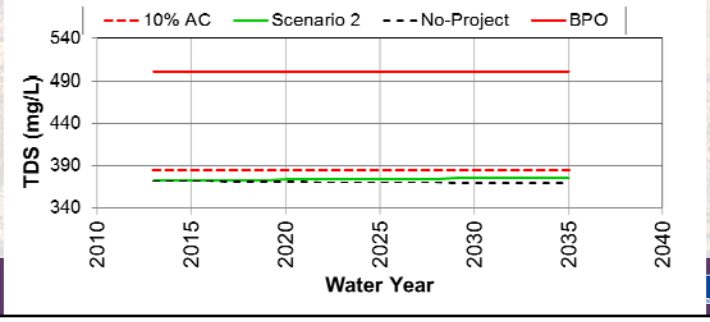
Future Average TDS Concentration

- Scenario 2: 2035 RW Conditions + 5,000 AFY additional RW
  - All Loading: +3.5 mg/L TDS from 2013 to 2035
    - = 2.7% AC compared to existing TDS concentration
  - RW Loading: +6.1 mg/L TDS compared to No-Project
    - = 4.7% AC compared to 2035 No-Project TDS concentration
  - TDS will asymptote at ~380 mg/L



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Future Average TDS Findings

- Recycled water projects use less than 10% of available AC
- BPOs will not be exceeded

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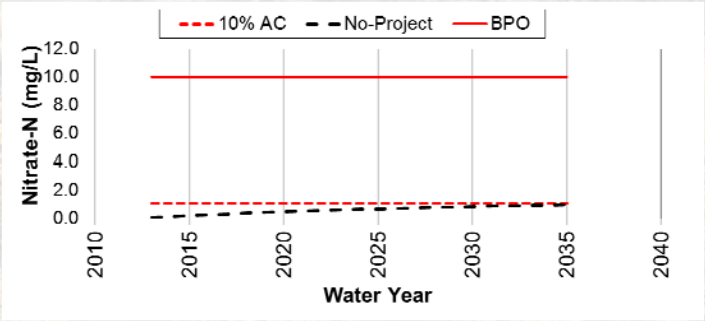
Future Average Nitrate-N Concentrations

- No-Project
  - +0.90 mg/L Nitrate-N from 2013 to 2035
    - 9.1% assimilative capacity used



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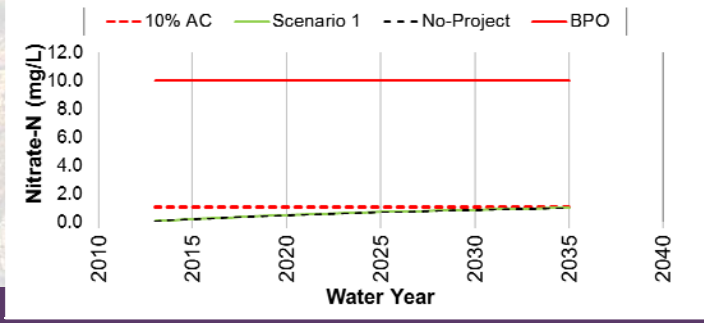
Future Average Nitrate-N Concentrations

- Scenario1: 2035 RW Conditions
  - All Loading: +0.92 mg/L Nitrate-N from 2013 to 2035
    - 9.3% assimilative capacity used
  - RW Loading: +0.02 mg/L Nitrate-N compared to No-Project
    - = 0.2% AC used compared to 2035 No-Project nitrate-N concentration
  - Nitrate will asymptote at ~1.5 mg/L



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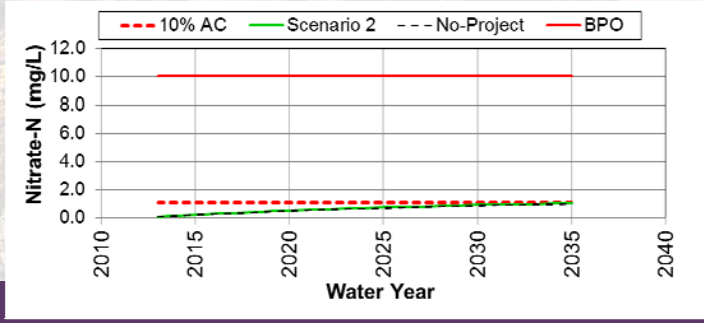
Future Average Nitrate-N Concentrations

- Scenario 2: 2035 RW Conditions + 5,000 AFY additional RW
  - All Loading: +0.96 mg/L Nitrate-N from 2013 to 2035
    - 9.7% assimilative capacity used
  - RW Loading: +0.06 mg/L Nitrate-N compared to No-Project
    - = 0.6% AC used compared to 2035 No-Project nitrate-N concentration



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Future Average Nitrate-N Findings

- Recycled water use less than 10% of AC
- BPOs will not be exceeded

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Current Implementation Measures are Effective and Should Continue

- Agricultural BMPs
- RW BMPs
- GW elevation monitoring
- Monitoring of new multi-level wells
- Water recycling projects to offset groundwater pumping:
  - NBWRA projects
  - SVCSD
- Stormwater Management – Groundwater Recharge projects (planned)
- LID
- Groundwater banking studies

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SNMP Groundwater Monitoring Plan

- TDS, nitrate, and EC
- CECs not required
- Based on existing programs
- Establish locations
- Frequency
- Well completions
- Reporting and evaluation criteria

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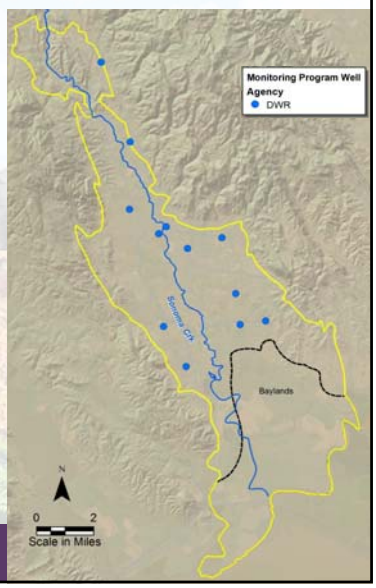
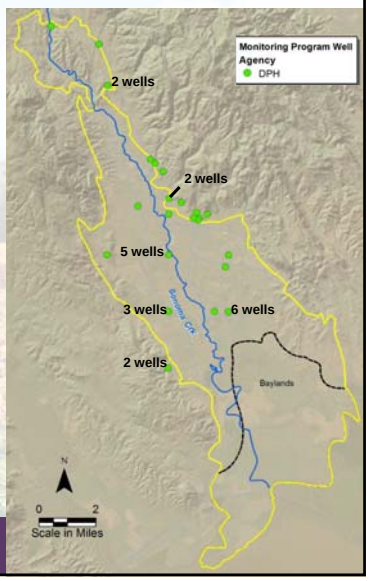
SNMP Groundwater Monitoring Plan

- DWR Monitoring
  - 12 wells
  - Every two to three years
  - Data compiled by SCWA
  - Depth for 12 wells
  - Screen intervals for 7



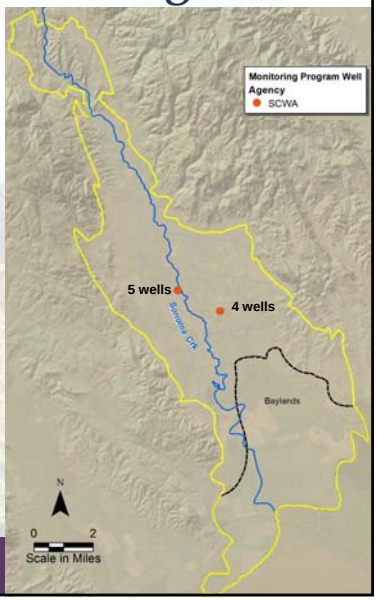
SNMP Groundwater Monitoring Plan

- CDPH Title 22 Drinking Water Well Program
  - Monitored by well owners
  - Data compiled by SCWA
  - ~39 wells
  - Frequency varies
  - Depths for 12 wells
  - Screened interval for 9 wells



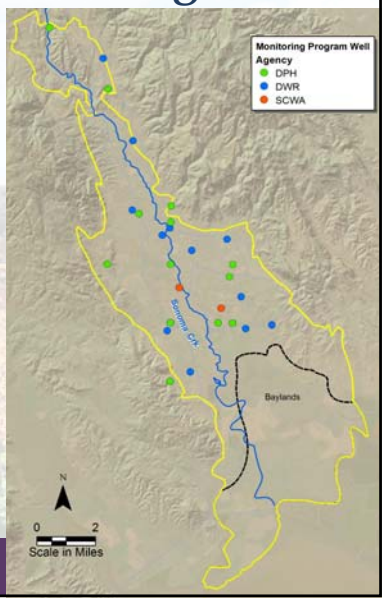
SNMP Groundwater Monitoring Plan

- New SCWA Nested Monitoring Wells
  - 2 wells with 9 screened intervals
  - Annually
  - Complete construction information



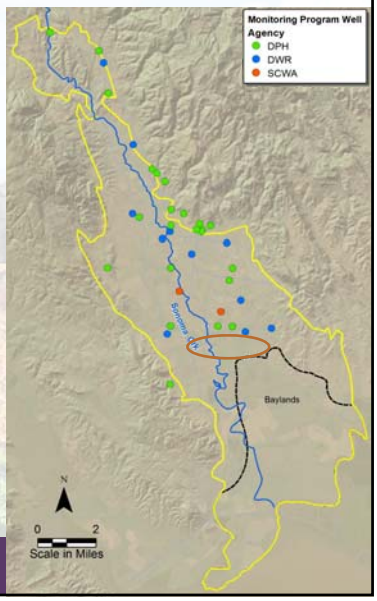
SNMP Groundwater Monitoring Plan

- Network is adequate



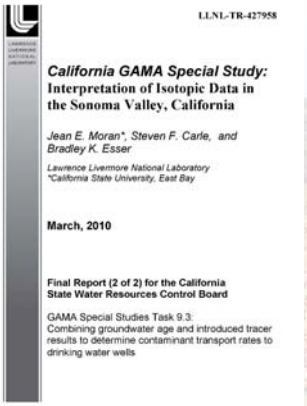
Data Gaps

- Network is adequate
- Additional wells near saline intrusion helpful
- Well completion information needed



SNMP Groundwater Monitoring Plan

- Special Studies
  - USGS
  - GAMA



LLNL-TR-427958

California GAMA Special Study:
Interpretation of Isotopic Data in the Sonoma Valley, California

Jean E. Moran, Steven F. Carle, and Bradley K. Esser*

Lawrence Livermore National Laboratory
**California State University, East Bay*

March, 2010

Final Report (2 of 2) for the California State Water Resources Control Board

GAMA Special Studies Task 9.3:
Combining groundwater age and introduced tracer results to determine contaminant transport rates to drinking water wells

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Sampling and Analysis Procedures

- CDPH guidelines
- DWR guidelines
- Establish SCWA Program
  - Certified laboratory
  - Sampling procedures
  - Field and trip blanks, duplicates

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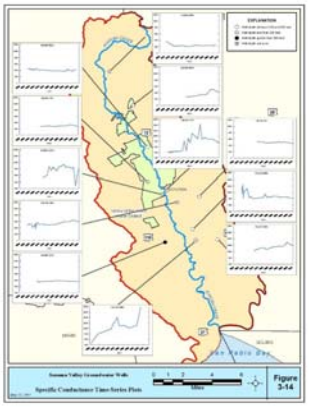
Reporting and Data Management

- SCWA
  - WQ Report every three years
  - Provided to RWQCB
  - Criteria
    - o continued flat trends
    - o BPOs
  - Website



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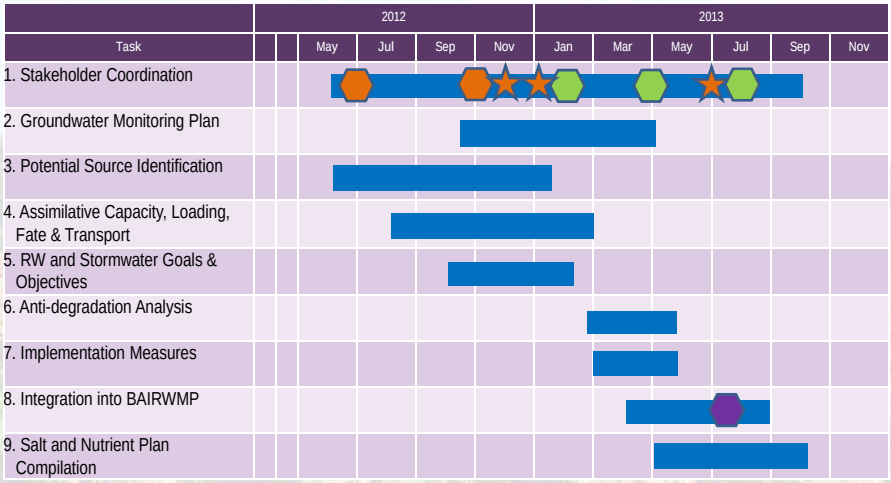
Schedule for Sonoma Valley SNP



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Please Submit Comments/Questions on SNMP Process and Technical Analysis by April 17, 2013

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More information on Sonoma Valley Groundwater can be found here: http://www.scwa.ca.gov/svgroundwater/

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