

Prioritization for Implementation of Nitrate Permitting Strategy (NPS) Revisited

- Slide 2 – Reminder of purpose and factors defined by NPS
- Slides 3 – 5: Recap of October 20 Policy Meeting approach
- Slides 6 – 9: Summarize the methodology used including how priorities are assigned. Key Change from Oct. 20 Version:
 - CA EnviroScreen now only considers 4 of the original 20 factors– only the 4 Socioeconomic factors – factors associated with air quality or water quality are removed (latter because water quality already accounted for in other factors)
 - Divided Kern County (5-22.14) into three parts consistent with Basin Plan
- Slides 10 – 18: Provide the results, but showing effect of adding factors and weighting
- Slides 19-20: Things to consider moving forward...

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General Framework

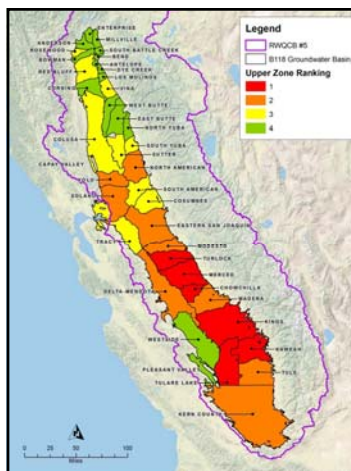
- Objective is to determine a prioritization approach for implementing the Nitrate Permitting Strategy for Central Valley floor groundwater basins
- Priority factors in the Nitrate Permitting Strategy:
 1. Current ambient groundwater quality (nitrate-N)
 2. Trends in nitrate concentrations in groundwater
 3. Number of individuals or community systems that are being impacted by groundwater that exceeds nitrate drinking water standards

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Recap of October 20 Approach

- Three initial factors to link up with Nitrate Permitting Strategy
 - Factor 1 – Current ambient nitrate in groundwater in Upper Zone (volume-weighted data); 20% weight.
 - Factor 2 - Predicted nitrate water quality groundwater in the Upper Zone in 50 Years (volume-weighted data); 20% weight.
 - Factor 3 – Looked at different potential surrogate data to be represent “impacted users”; relied on CalEnviro Screen (CES) 3.0 and used all 20 factors in CES; 20% weight.
- Added Factor 4 (average well nitrate concentration – 40% weight) – use of factor emphasizes areas we know have nitrate concerns that may be masked to some degree because of volume weighting in Factors 1 and 2.

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October 20 Priority Ranking GW Basins (% = Weight)

- N_{ambient} (20%) +
- $N_{\text{projected}}$ (20%)+
- CES (20%, all CES factors) +
- N_{well} arithmetic average (40%)

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October 20 - Priority 1 & 2

Priority Ranking	Basin Number	Basin Name	Score
Priority 1	5-22.11	Kaweah	4.65
	5-22.03	Turlock	4.32
	5-22.08	Kings	4.24
	5-22.04	Merced	4.10
	5-22.05	Chowchilla	4.02
	5-22.12	Tulare Lake	4.01
Priority 2	5-22.07	Delta-Mendota	3.99
	5-22.13	Tule	3.96
	5-22.14	Kern County	3.77
	5-22.01	Eastern San Joaquin	3.75
	5-22.02	Modesto	3.69
	5-21.67	Yolo	3.69
	5-21.66	Solano	3.62
	5-22.06	Madera	3.56
	2-4	Pittsburg Plain	3.54
	5-21.64	North American	3.17

Prioritization Revisited

- Overview of data sources, analysis methods and how groundwater basins are prioritized
- Series of figures illustrating effect of adding factors
- Final outcome using previously assigned weights (figure and table)
- Example of effect of varying weight for well average factor
- Things to consider moving forward

Data Analysis Methods

- Data
 - High resolution ambient nitrate-N (1 square mile grid)
 - High resolution projected nitrate-N (1 square mile grid)
 - Average nitrate-N concentration in groundwater basin wells (groundwater basin)
 - CES3.0 Draft Socioeconomic Factors (Census tract data only) - education, linguistic isolation, poverty, unemployment
- Convert census tract CES3.0 draft data to 1 square mile grids
 - Assign each grid an area weighted average for each overlying socioeconomic factor
 - Averaged the four socioeconomic factors for each grid
- Convert groundwater basin data to 1 square mile grids
 - Assign each grid an area-weighted average well average

Data Analysis Methods (Continued)

- Assigned a ranking from least to greatest impacted for each category: (Ambient, Projected, Well Average, & Socioeconomic Factor)
- Calculated weighted averages from the rankings given to each 1 square mile grid
- Aggregated 1 square mile grid calculated values to the groundwater basin level as an average of the 1 square mile grid values in each groundwater basin
- Assigned priority based on Equal Intervals Method
 - This method sets the value ranges in each category equal in size. The entire range of data values (max - min) is divided equally into however many categories have been chosen (see next slide for example).

Equal Interval Calculation Example

- The rank scores range from 1.2759 to 4.4742 for the case where:
 - Well Arithmetic Mean = 40%;
 - Ambient Volume-weighted Concentration = 20%;
 - Projected Ambient Volume-weighted Concentration = 20%;
 - CES Socioeconomic Factors = 20%
- The class interval $(\text{Max}-\text{Min})/(4 \text{ categories}) = (4.4742 - 1.2759)/(4) = 0.7996$. The interval for each class is then used to calculate equal intervals for each Priority Rank

Priority Rank	Upper Class Limit	Class Interval	Lower Class Limit
1	4.4742	0.7996	3.67471
2	3.6747	0.7996	2.87511
3	2.8751	0.7996	2.07551
4	2.0755	0.7996	1.2759

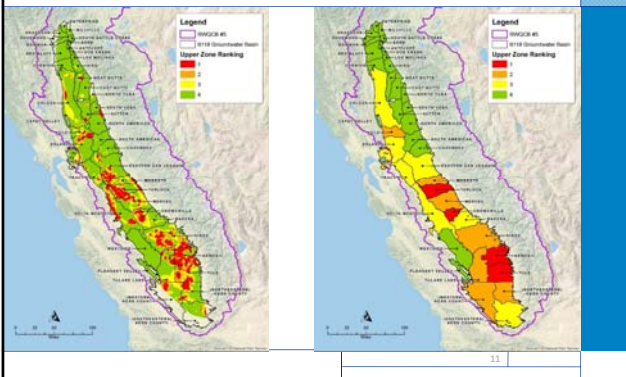
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Data Build-up

- Series of slides to illustrate effect of adding each factor
- Weights are equally distributed until final factor is added (well average)

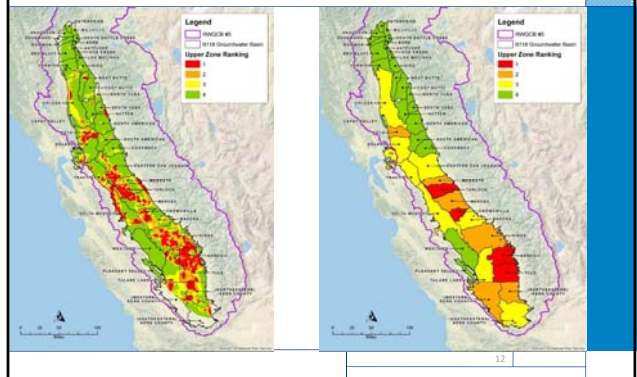
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Factor 1 Only: Ambient (100%)



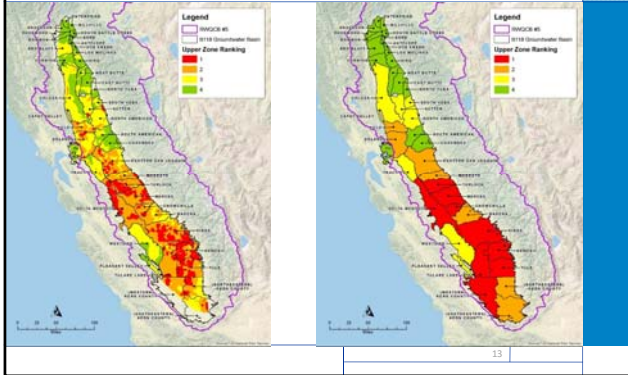
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Factors 1 & 2: Ambient (50%) + Projected (50%)

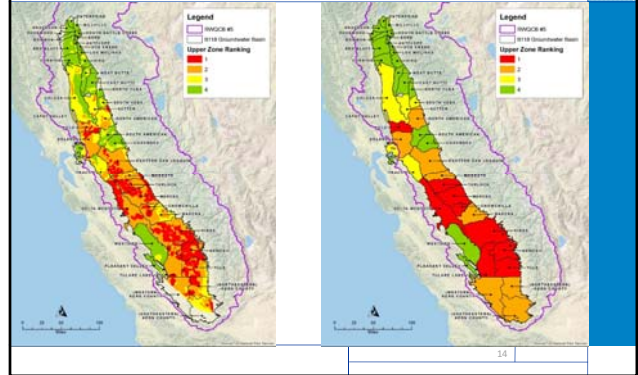


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Factors 1, 2 & 3: Ambient (33%) + Projected (33%) + CES3.0 Socioeconomic Factors only (33%)



Added Fourth Factor with Well Mean Weight Higher: Ambient (20%) + Projected (20%) + CES3.0 Socioeconomic Factors only (20%) + Well Mean (40%)

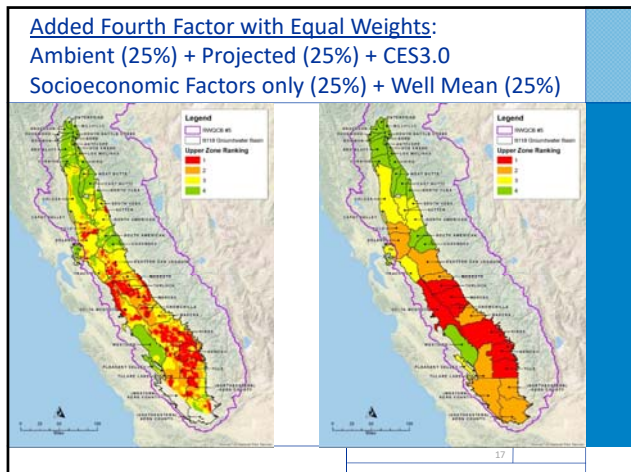


Ambient (20%) + Projected (20%) + Well Mean (40%) + CES3.0 Socioeconomic Factors only (20%)

Priority Ranking	Basin Number	Basin Name	Score
Priority 1	5-22.11	Kaweah	4.47
	5-22.03	Turlock	4.17
	5-22.08	Kings	4.03
	5-22.04	Merced	3.99
	5-22.13	Tule	3.96
	5-22.07	Delta-Mendota	3.90
	5-22.05	Chowchilla	3.83
	5-22.12	Tulare Lake	3.74
	5-21.67	Yolo	3.69
	Priority 2	5-22.02	Modesto
5-22.14		Kern County (Western)	3.64
5-22.01		Eastern San Joaquin	3.57
5-22.14		Kern County (Northeastern)	3.50
5-21.66		Solano	3.32
5-22.06		Madera	3.31
5-22.14		Kern County (Southeastern)	3.17
5-21.64		North American	3.02

Ambient (20%) + Projected (20%) + Well Mean (40%) + CES3.0 Socioeconomic Factors only (20%)

Priority Ranking	Basin Number	Basin Name	Score	
Priority 3	5-22.35	Tracy	2.75	
	5-21.62	Sutter	2.71	
	5-21.68	Capay Valley	2.62	
	2-4	Pittsburg Plain	2.63	
	5-21.52	Colusa	2.28	
	5-21.61	South Yuba	2.20	
	2-3	Suisun-Fairfield Valley	2.14	
	Priority 4	5-21.65	South American	2.07
		5-22.16	Cosumnes	1.99
		2-5	Clayton Valley	1.98
5-21.50		Red Bluff	1.93	
5-22.10		Pleasant Valley	1.92	
5-22.09		Westside	1.90	
5-21.57		Vina	1.90	
5-21.58		West Butte	1.88	
2-6		Ygnacio Valley	1.83	
5-21.56		Los Molinos	1.78	
5-21.51		Corning	1.76	
5-21.55		Dye Creek	1.74	
5-21.54		Antelope	1.74	
5-6.02		Rosewood	1.71	
5-21.53		Bend	1.70	
5-21.59		East Butte	1.65	
5-21.60		North Yuba	1.59	
5-6.01		Bowman	1.46	
5-6.03		Anderson	1.43	
5-6.06		South Battle Creek	1.39	
5-6.04	Enterprise	1.29		
5-6.05	Millville	1.28		



**Ambient (25%) + Projected (25%) + Well Mean (25%) +
 CES3.0 Socioeconomic Factors only (25%)**

Priority Ranking	Basin Number	Basin Name	Score
Priority 1	5-21.11	Kaweah	4.34
	5-22.03	Turlock	3.96
	5-22.13	Tule	3.93
	5-22.08	Kings	3.81
	5-22.04	Merced	3.75
	5-22.05	Chowchilla	3.75
	5-22.07	Delta-Mendota	3.66
Priority 2	5-22.14	Kern County (western)	3.54
	5-22.02	Modesto	3.52
	5-22.12	Tulare Lake	3.46
	5-21.67	Yolo	3.38
	5-22.14	Kern County (Northeastern)	3.38
	5-22.01	Eastern San Joaquin	3.22
	5-22.06	Madera	3.12
	5-22.14	Kern County (Southeastern)	2.97
	5-21.66	Solano	2.94
	Tulare Lake & Yolo change to Priority 2 North American changes to Priority 3		

- Things to Consider...**
- The effect of adding a fourth factor and varying the weights can be seen by clicking back and forth among Slides 13-15.
 - Weights can be adjusted any way desired, but in the end assigned weights are somewhat arbitrary and there will be no perfect "expected" outcome.
 - Primary effects of equal weighting (25% each) vs. non-equal weighting (average well concentration = 40%) are on Tulare Lake and Yolo (1 vs. 2) and North American (2 vs. 3)
 - The ranking (Priority 1 -4) is based on use of equal intervals. This is just a statistical construct with no inherent meaning.
 - Impacts/differences tend to be around the cusp of the statistical boundary between two equal intervals

- Things to Consider...**
- The outcome of this prioritization analysis does not need to be the basis for the final prioritization:
 - It can be used to provide a general order of priority so that there is a technical foundation; but
 - Discretion can be applied to decide a final priority, especially to take into account local knowledge/priorities/water quality concerns and available resources. If something is in Priority 2 it could be moved to Priority 1 or vice versa, especially if it is close to the statistical dividing line between the two groups
 - Is it necessary to prioritize all basins in this first round? Most important priorities are No. 1 & No. 2. Could consider only identifying these two groups for now.