

External Review of the Irrigated Lands Monitoring Program for the East San Joaquin River Watershed

Susan C. Paulsen, Ph.D., P.E.
Melanie Edwards, PStat

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Context

ESJWQC retained Exponent to

- Address questions posed in SWRCB Draft Order
- Identify practical limitations and constraints
- Evaluate spatial coverage
- Evaluate Pesticide Evaluation Protocol (PEP)
- Analyze water quality trends over time
- Assess effectiveness of outreach

Focus of Exponent's Review (from SWRCB Draft Order)

- Is the monitoring program of sufficient spatial and temporal density to identify water quality exceedances and problem areas?
- Are Core and Represented sites comparable to regional or watershed-based sampling?
- Is an exceedance at a Core site indicative of an exceedance at a Represented site?
- Are Core and Represented sites representative of one another, even if they exhibit differences in exceedance rates for different constituents?
- Can surface water monitoring be used to evaluate management practice effectiveness?
- Does the monitoring program include sufficient feedback mechanisms to indicate if program is achieving its stated purpose?

Conclusions from Exponent's Review of the Water Quality Monitoring Program

- Core and Represented sites within the six zones provide sufficient spatial coverage
- Data identify water quality changes over time
- Data confirm that management practices and targeted outreach have improved water quality
- Naturally occurring constituents and those with multiple sources show higher variability
- Non-irrigated agricultural sources are likely important causes of water quality exceedances
- Monitoring program uses structured framework to:
 - Incorporate data on chemical use, relative risk, exposure, and chemical behavior
 - Tailor monitoring and implementation measures
 - Maximize likelihood that water quality problems will be identified

Sampling is constrained by practical limitations

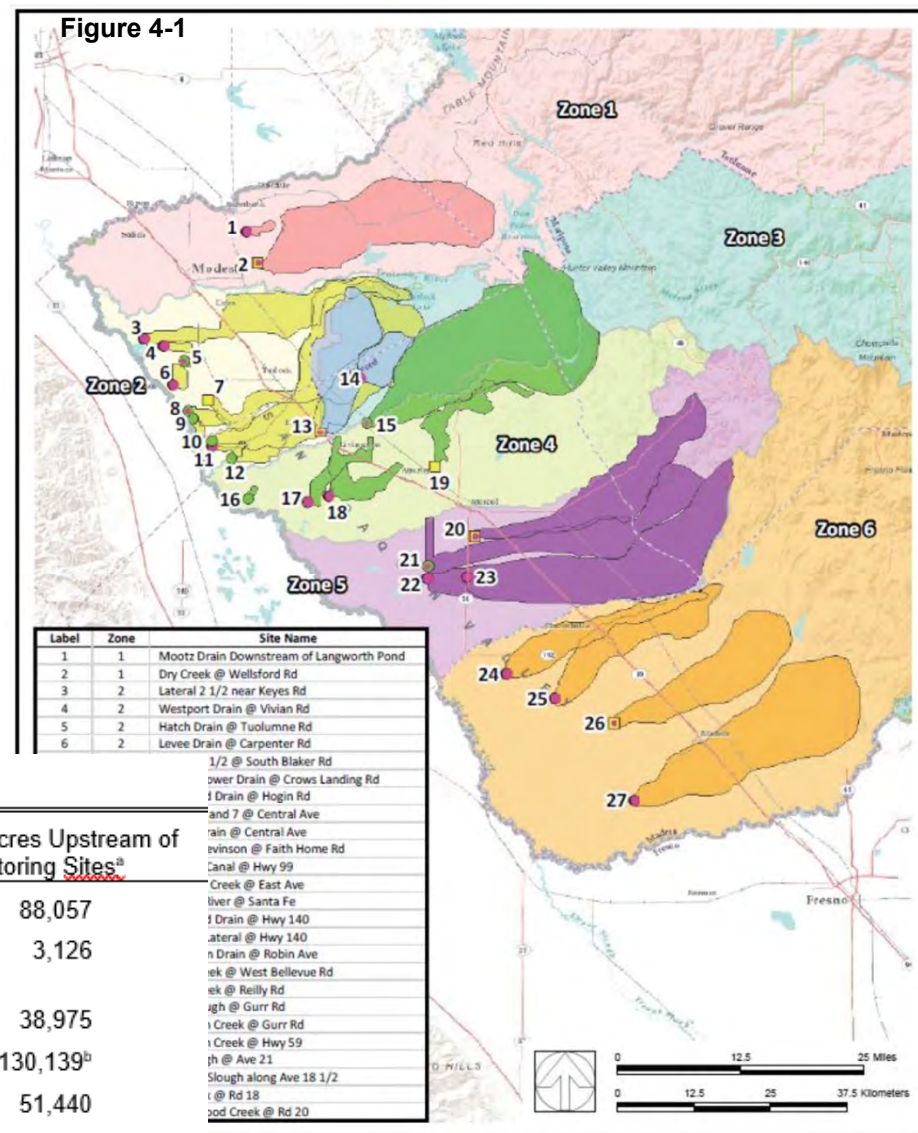
- Travel time between sites is long
- Equipment and personnel positioning is challenging during storms
- Access and passage over privately owned land may be limited
- Health and safety considerations are important
 - Safe transportation conditions
 - Weather conditions
 - Exposure to elements
 - Potentially dangerous wildlife
 - Communication from remote areas
 - Access from busy roadways
- Field equipment is expensive, requires maintenance, may break
- Sampling and analytical requirements impose limitations (e.g., holding times, laboratory open hours and labor schedules)

Spatial Coverage Is Sufficient

- Each zones includes
 - One Core station
 - Multiple Represented stations
- Downstream sampling locations represent upstream area
- Zone 1 large % irrigated lands
- Zone 6 largest acreage

Table 3-1. Irrigated acreage by monitoring zone¹⁹

Zone	Irrigated Acreage in Zone	Irrigated Acres Upstream of Core Monitoring Sites ^a
1 Dry Creek @ Wellsford Rd	120,292	88,057
2 Prairie Flower Drain @ Crows Landing Road	143,060	3,126
3 Highline Canal @ Hwy 99	90,283	38,975
4 Merced River @ Santa Fe	118,682	130,139 ^b
5 Duck Slough @ Gurr Rd	160,604	51,440
6 Cottonwood Creek @ Rd 20	349,321	98,725
Sum	982,242	410,462



Sampling and constituents monitored are comprehensive (2004-2017)

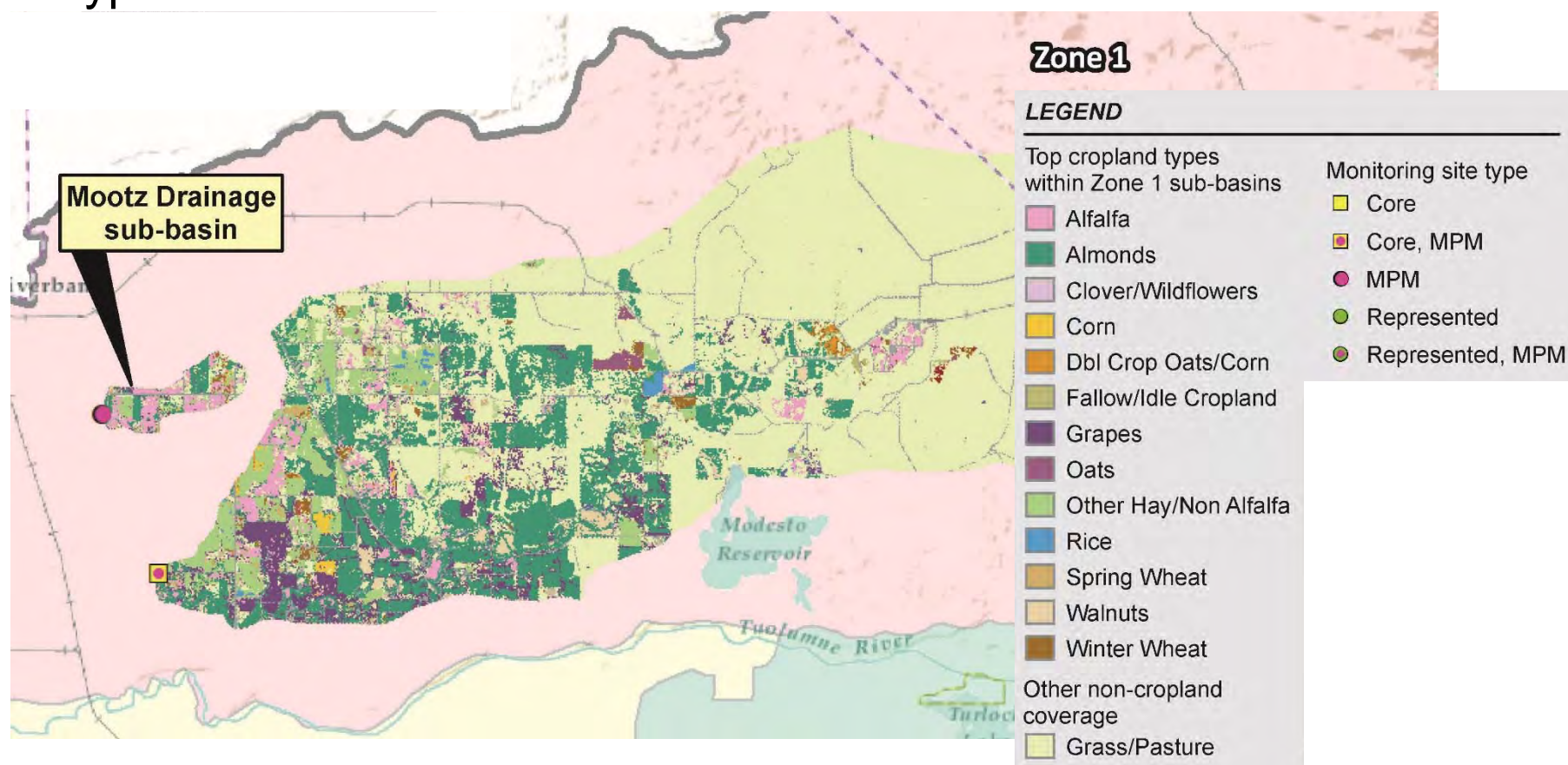
- From 2004-2017, water was collected at 51 locations within the six zones, resulting in 1,870 water monitoring samples (excluding field replicates)
- Water samples were analyzed for up to 80 constituents, including metals, pesticides, and pyrethroids; up to three water toxicity tests; and nutrients, *E. coli*, and physical measurements

Monitoring from
2004–2017

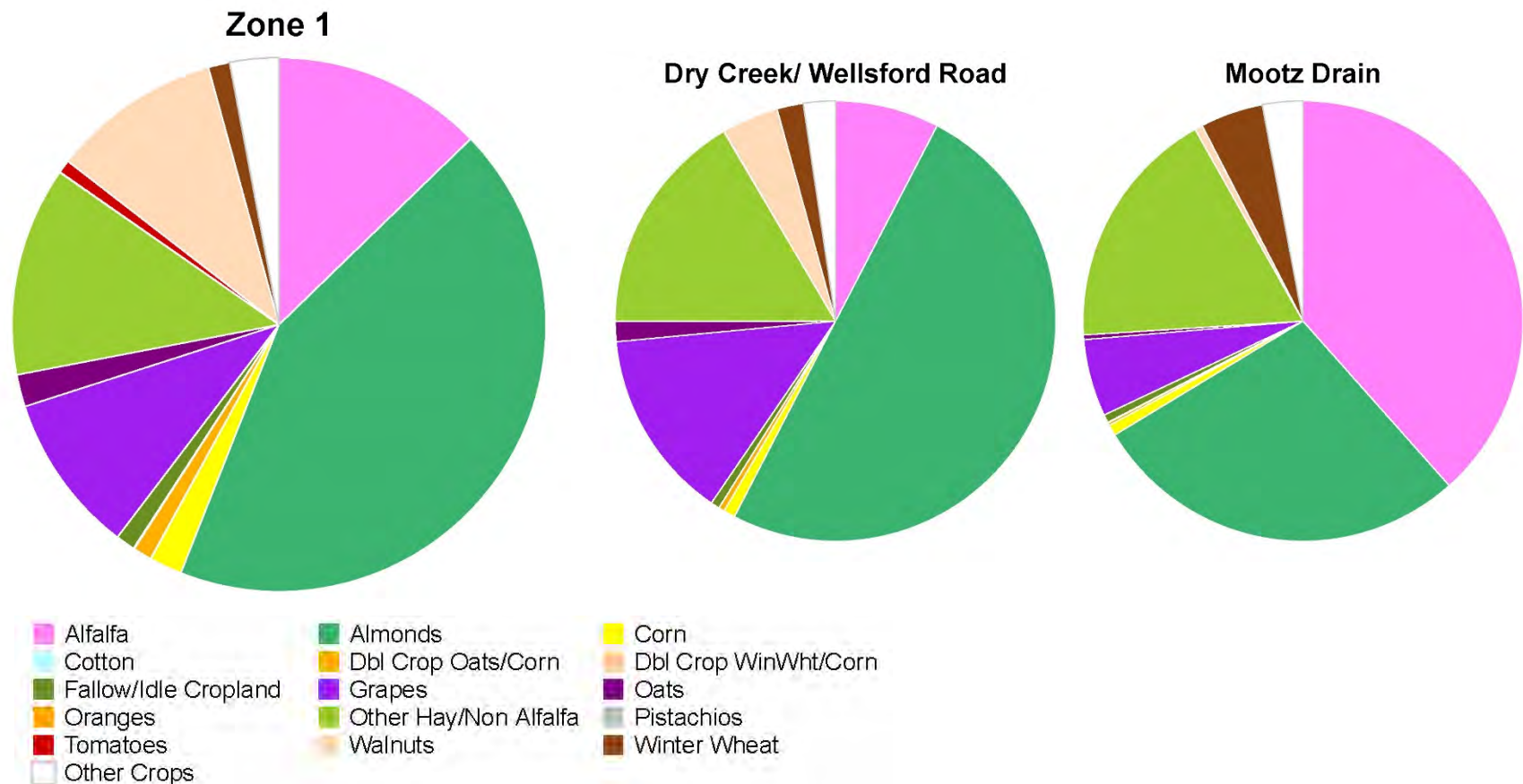
Zone	Number of sites sampled	Number of water samples analyzed
Zone 1	6	194
Zone 2	14	497
Zone 3	4	224
Zone 4	11	389
Zone 5	7	373
Zone 6	9	193

Example crop distribution map – Zone 1

- Core and Represented sites are representative of major crop types within a zone

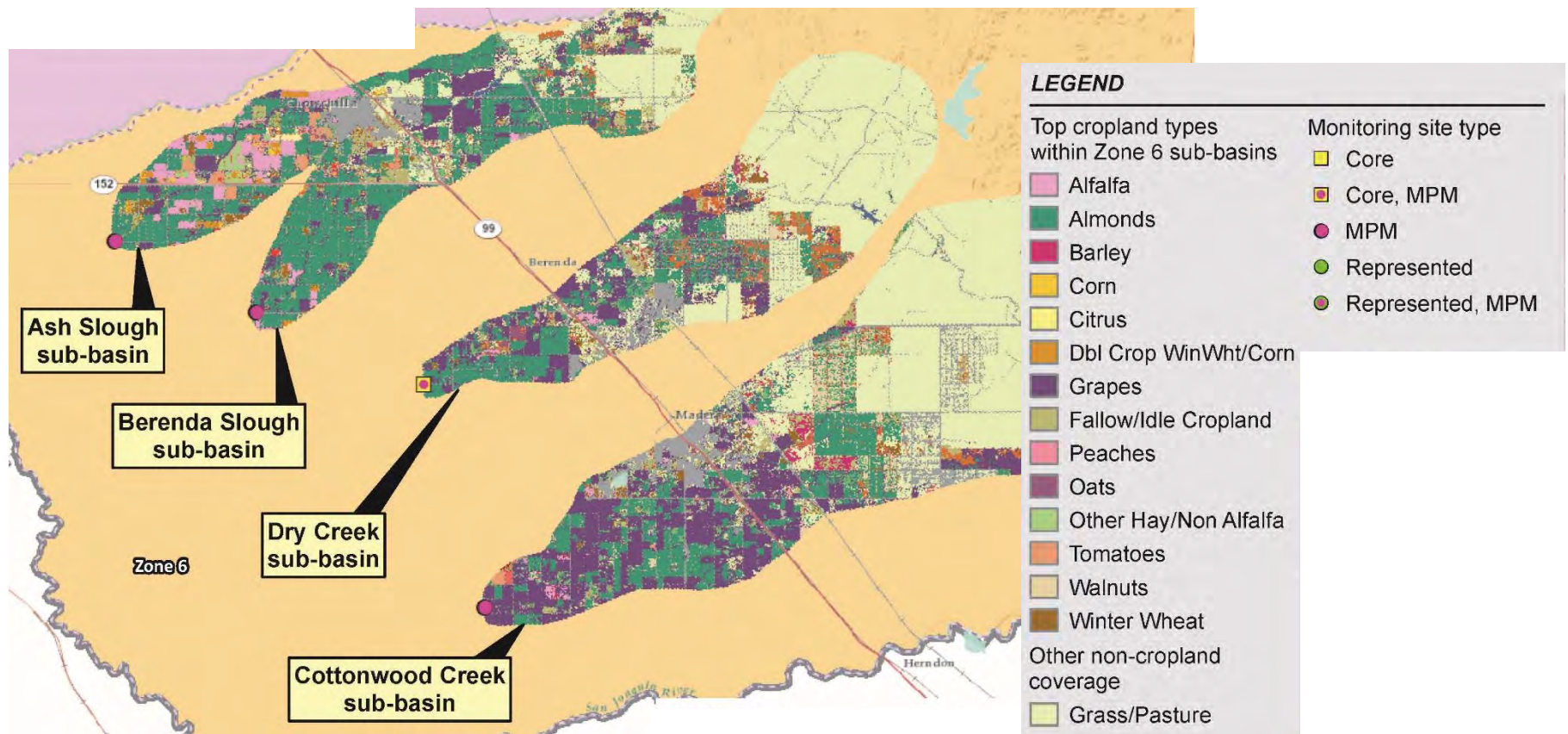


Areas draining to sampling locations are comparable to entire zone

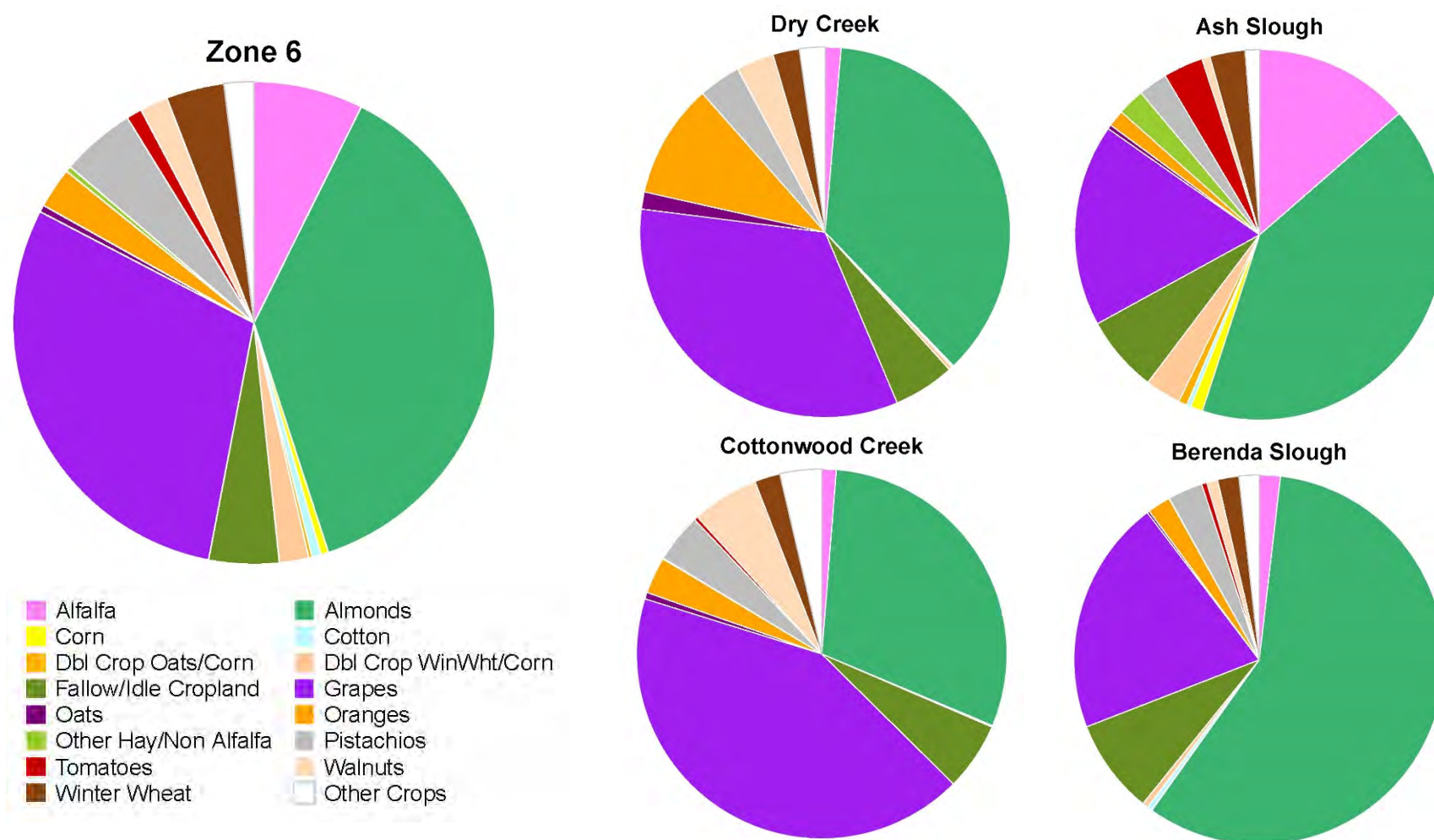


Example crop distribution map – Zone 6

- Core and Represented sites are representative of major crop types within a zone



Core and Represented sites are representative of major crop types – Zone 6



Overview of Pesticide Evaluation Protocol (PEP)

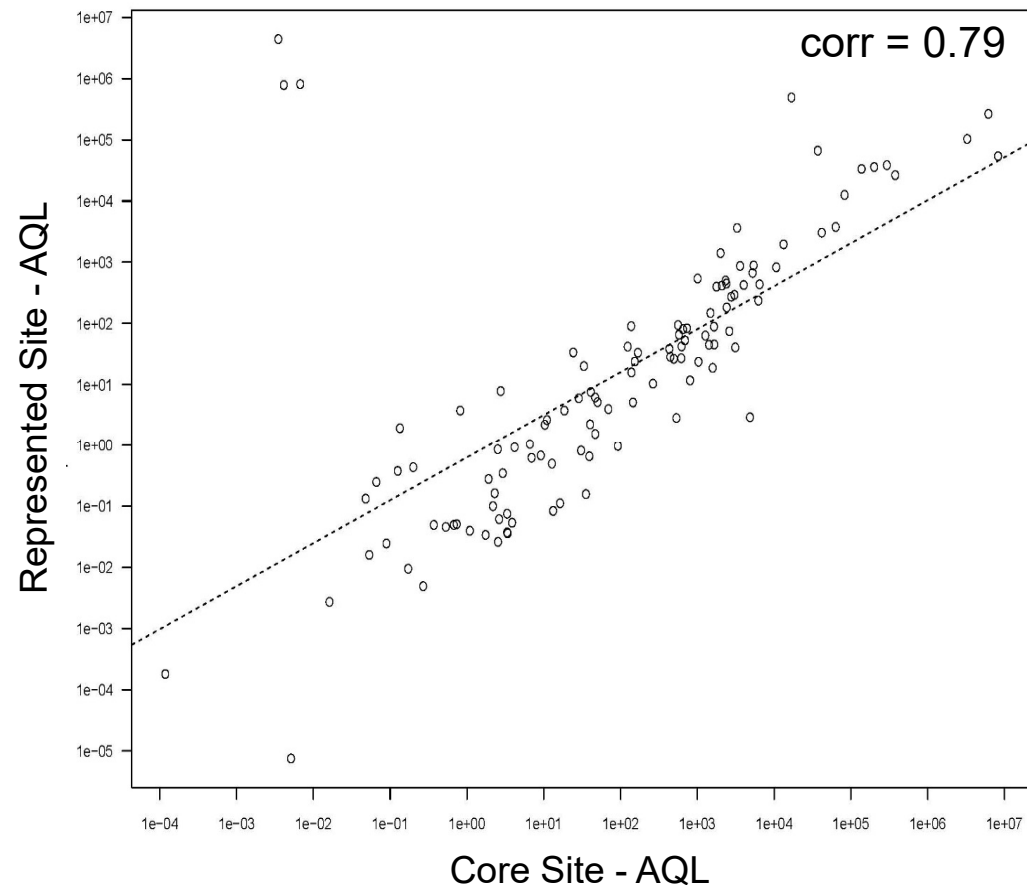
- Pesticide Evaluation Process (PEP) structured method to identify constituents to monitor
 - Incorporates usage, toxicity, degradation and impurities for total usage
 - Calculate relative risk for aquatic life (AQL) and human health
 - Exclude from monitoring only constituents that:
 - Sufficient data to assure no AQL risk
 - Unlikely to be found in water
 - No analytical methods to measure levels
 - Site-specific reasons that justify not monitoring
- Process is implemented annually, based on last 3 years of data
- PEP submitted for review/approval by RWQCB

PEP applied to Represented or Core sites results in similar monitoring priorities

- Exponent applied PEP to Represented sites
 - Assessed representativeness throughout the zone
 - Compared with PEP derived from the Core site
- Aquatic Life (AQL) ratio characterizes pesticide usage and risk
 - Monthly 3-year average chemical usage / risk reference value for effect
 - Higher ratio = greater volume used or lower reference value for effects

AQL for Core and Represented site in Zone 1

- AQL for average monthly pesticide use for 31 chemicals
- High correlation (0.79) indicates Core site is representative of Represented site
 - Similar chemical usage
 - Similar risk level
- Core site representative for all other zones
 - Correlations 0.79–0.99



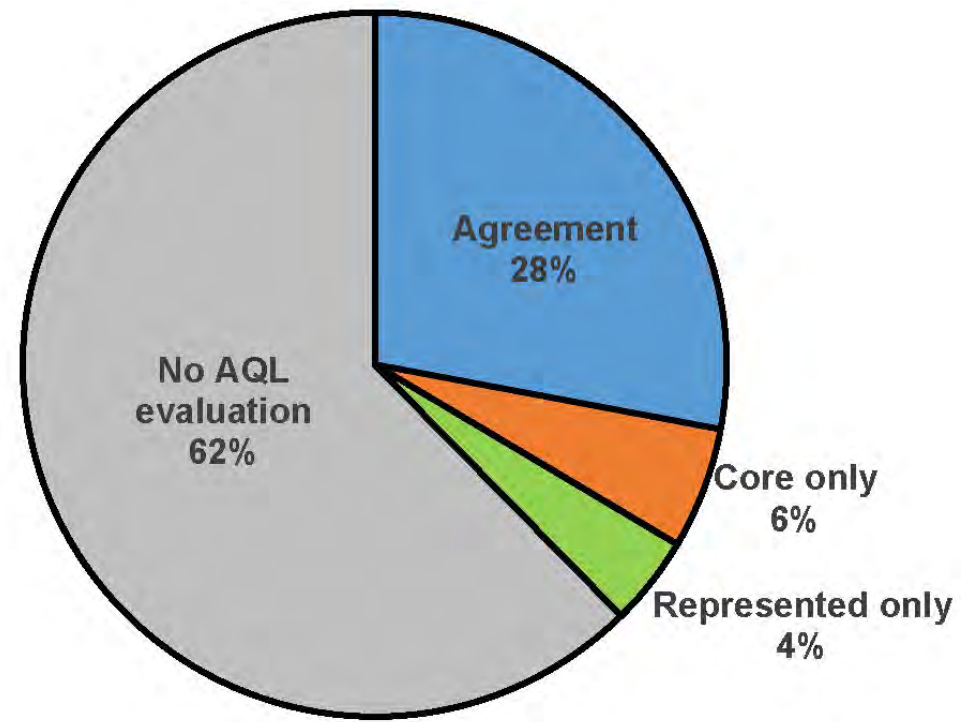
Monitoring recommendations consistent between Core and Represented sites

- Compare PEP monitoring recommendations based on Represented site with Core site recommendations
 - Evaluated every Chemical per Month
 - Agreement: Both sites or neither site recommended monitoring
 - Disagreement: Monitoring recommended for Core or Represented site only
- Recommendations derived for Core or Represented sites reflect pesticide use, agricultural practices, and water quality of the entire zone
 - Valid for all 6 zones
 - Every Represented site similar to results for the Core site in the same zone

Similarity of monitoring recommendations between Core and Represented sites

Zone 1 – 535XMDDL

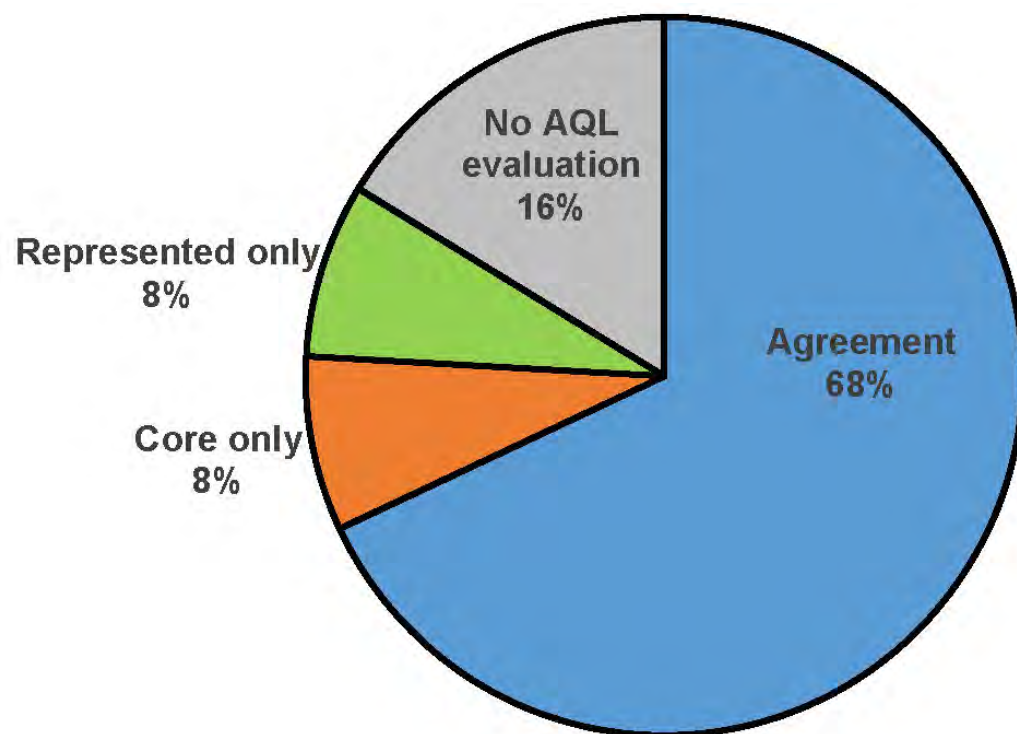
- 340 total chemical-months
 - 51 unique chemicals
- 212 do not require AQL (62%)
- 128 evaluated
 - 95 Agreement
 - 19 Core site only
 - 14 Represented site only



Similarity of monitoring recommendations between Core and Represented sites

Zone 6 – 545XBSAAE

- 369 total chemical-months
 - 56 unique chemicals
- 60 do not require AQL
- 309 evaluated
 - 251 Agreement
 - 29 Core site only
 - 29 Represented site only



Naturally occurring, non-agricultural constituents are more variable than controlled constituents

- More progress for chlorpyrifos and *C. dubia* survival
 - Chlorpyrifos registration for non-agricultural use was cancelled in 2006, and sampling sites were selected to minimize urban contribution
 - Exceedance rates have declined over time
 - Targeted outreach has been effective
 - *C. dubia* survival has improved markedly
- Effects less evident for constituents naturally occurring or from non-agricultural sources
 - Dissolved copper shows much greater variability
 - Variability evident both over time and within individual zones

Targeted outreach is generally effective

Table 4-7. Chlorpyrifos exceedance percentages by outreach type category

Outreach Period	Time Period	Zone 1 ^a	Zone 2 ^b	Zone 3	Zone 4 ^c	Zone 5	Zone 6
Before Focused Outreach	2004–2008	19.4	8.3	13.8	11.6	8.9	12.6
Focused Outreach Initiated	2009–2013	7.9	6.7	2.3	1.3	7.3	1.7
Current Monitoring Program	WY 2014–2017	1.9	10.9	2.8	1.2	3.2	0

Table 4-8. *C. dubia* survival exceedance percentages by outreach type category

Outreach Period	Time Period	Zone 1 ^a	Zone 2 ^b	Zone 3	Zone 4 ^c	Zone 5	Zone 6
Before Focused Outreach	2004–2008	5.6	2.9	12.9	11.0	5.5	2.1
Focused Outreach Initiated	2009–2013	0	5.9	0	0	6.8	0
Current Monitoring Program	WY 2014–2017	0	9.5	0	0	6.8	0

Note that Zone 2 includes agricultural operations (dairy) not subject to Coalition outreach

Coalition's monitoring program includes sufficient feedback mechanisms

- Pesticide Evaluation Protocol (PEP) is used to customize monitoring in each zone based on:
 - Chemical use by month within a zone
 - Potential for risk to aquatic life and human health
 - Prior surface water monitoring data
 - Factors related to a chemical's behavior in the environment
- Regional Board approves the final monitoring plan for each zone

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- Sources not in Coalition program are likely important causes of water quality exceedances
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Details are contained in full report



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Prepared for

Ms. Theresa Dunham
Somach Simmons & Dunn
500 Capitol Mall, Suite 1000
Sacramento, California 95814

Prepared by

Exponent
1055 E. Colorado Blvd., Suite 500
Pasadena, California 91106

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