

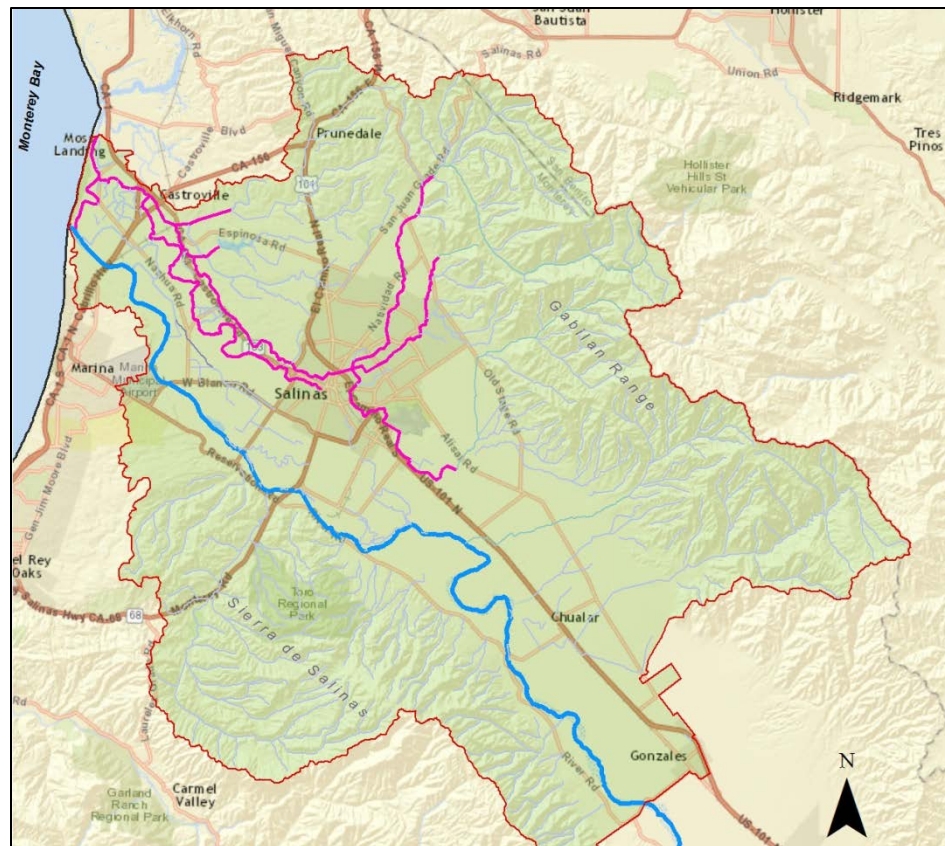
# TMDLs for Sediment Toxicity and Pyrethroid Pesticides in the Lower Salinas River Watershed

April 21, 2015



Peter Meertens

# Project Area



# Impaired Waters

- Impaired Water: *A waterbody not meeting water quality standards or may be threatened in the future...*
- Toxicity: *All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or aquatic life.*
- Pesticides: *No individual pesticide or combination of pesticides shall reach concentrations that adversely affect beneficial uses.*

# Sediment Toxicity Impairment

- Exceedance of General Objective for toxicity set to protect aquatic life beneficial uses
- Sediment toxicity test - *Hyalella azteca*, % survival after 10 days
- 303(d) List



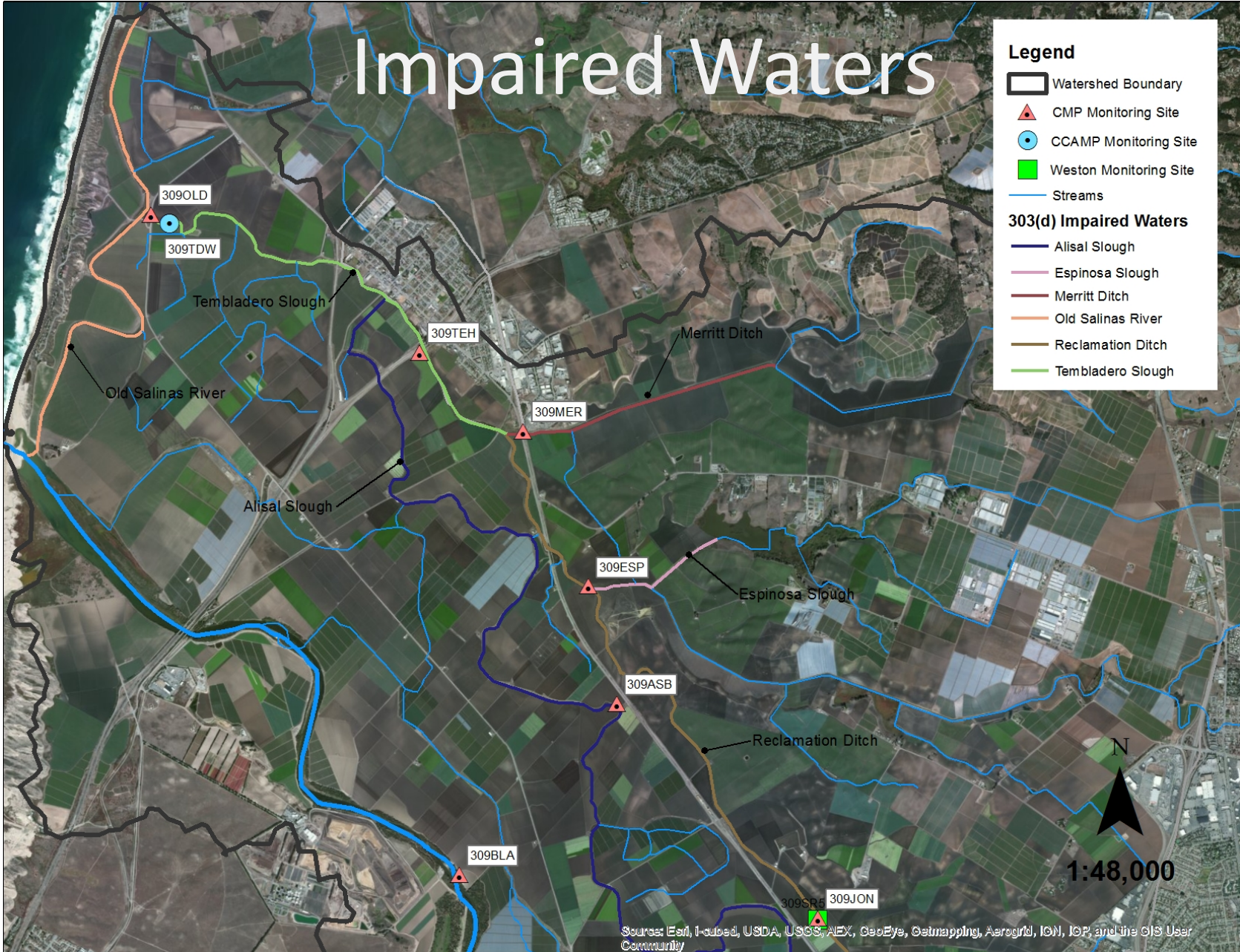
# Impaired Waters

**Legend**

- Watershed Boundary
- CMP Monitoring Site
- CCAMP Monitoring Site
- Weston Monitoring Site
- Streams

**303(d) Impaired Waters**

- Alisal Slough
- Espinosa Slough
- Merritt Ditch
- Old Salinas River
- Reclamation Ditch
- Tembladero Slough

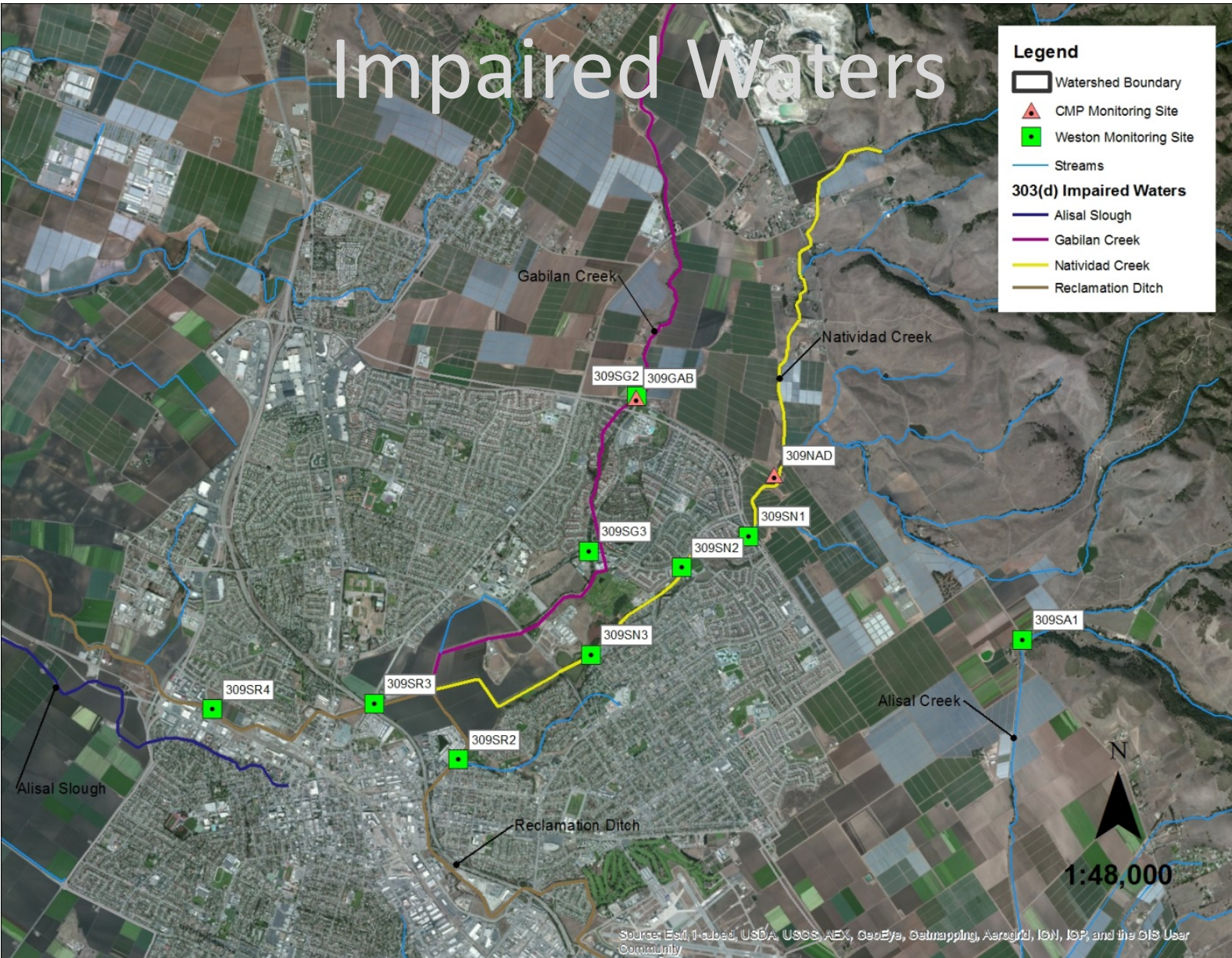


Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Geomapping, AeroGRID, IGN, IGP, and the GIS User Community

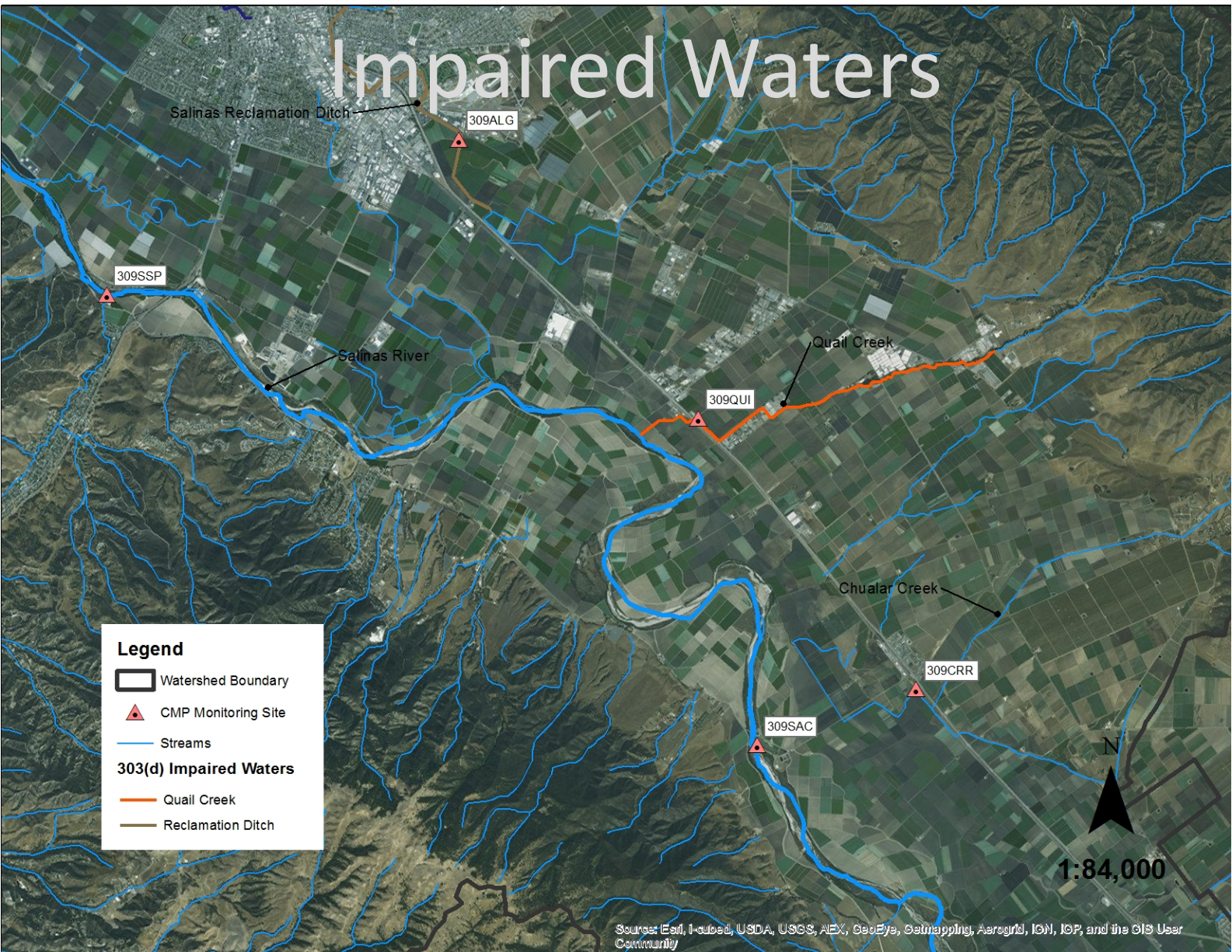
# Impaired Waters

**Legend**

- Watershed Boundary
- CMP Monitoring Site
- Weston Monitoring Site
- Streams
- 303(d) Impaired Waters**
  - Alisal Slough
  - Gabilan Creek
  - Natividad Creek
  - Reclamation Ditch



# Impaired Waters



**Legend**

- Watershed Boundary
- CMP Monitoring Site
- Streams
- 303(d) Impaired Waters**
- Quail Creek
- Reclamation Ditch

N  
1:84,000

Source: Esri, Intellicast, USDA, USGS, AEX, GeoEye, Geomapping, AeroGRID, IGN, IOP, and the GIS User Community

	Sediment Toxicity Monitoring Data					
	303(d) List		Additional Monitoring		Total	
Waterbody Name	Exc.	Samples	Exc.	Samples	Exc.	Samples
Alisal Creek	1	2	1	1	2	3
Alisal Slough	2	3	1	6	3	9
Blanco Drain	0	2	2	7	2	9
Chualar Creek			5	9	5	9
Espinosa Slough	2	2	6	6	8	8
Gabilan Creek	4	5	2	2	6	7
Merrit Ditch	2	2	5	6	7	8
Natividad Creek	5	5	6	6	11	11
Old Salinas River	7	8	3	3	10	11
Quail Creek	2	2	9	9	11	11
Reclamation Canal	8	9	15	16	23	25
Salinas River (Lower)	1	5	2	21	3	26
Tembladero Slough	3	3	17	19	20	22
<b>Totals</b>	<b>37</b>	<b>48</b>	<b>74</b>	<b>111</b>	<b>111</b>	<b>159</b>



# Pyrethroid Impaired Waters

- **Alisal Creek/Reclamation Canal**
- **Natividad Creek**
- **Salinas River (lower)**
- **Tembladero Slough.**

# Pyrethroid Impairments

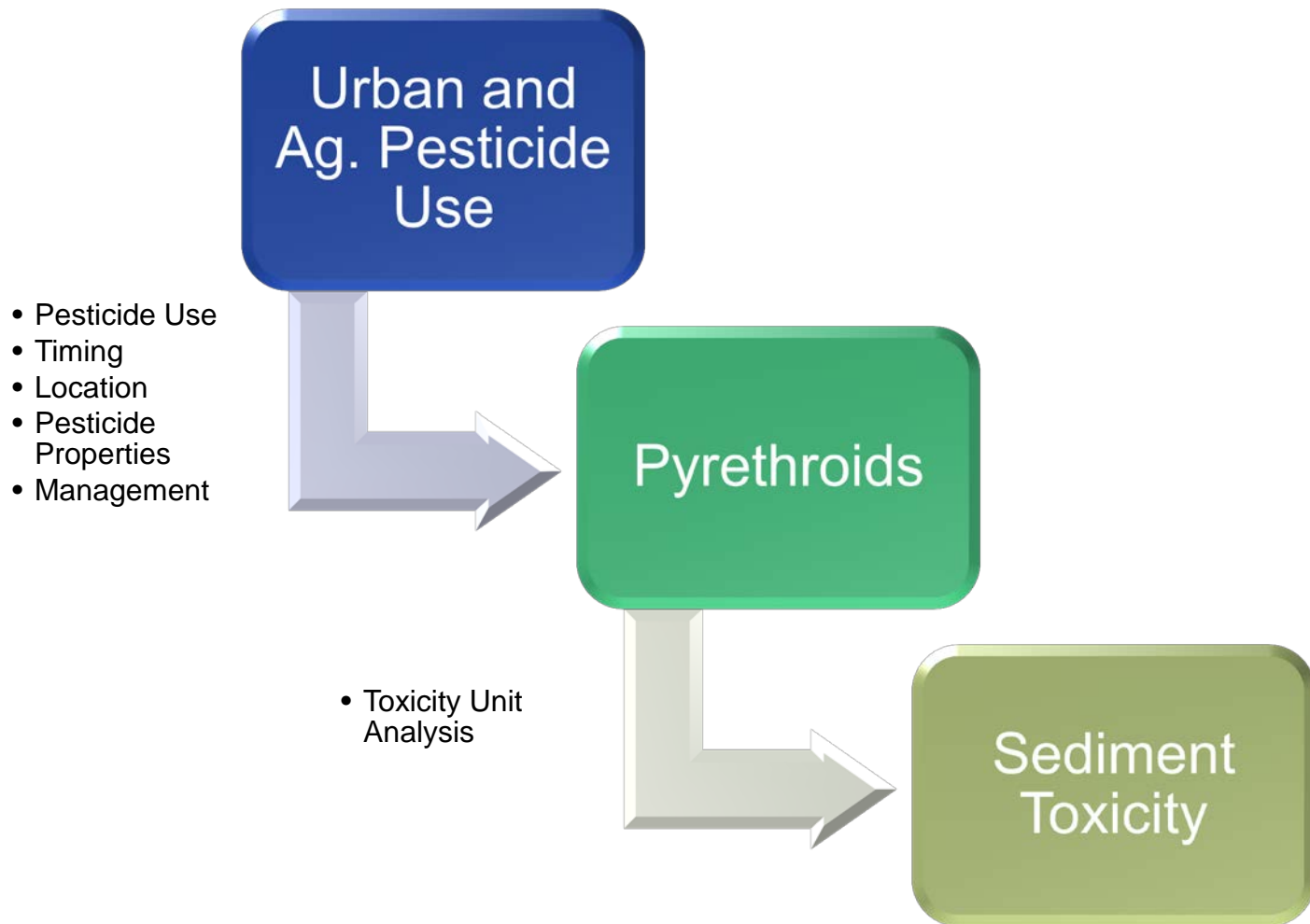
- Watershed Studies
- Statewide studies
- Toxicity Unit Analysis

# Toxicity Unit Analysis

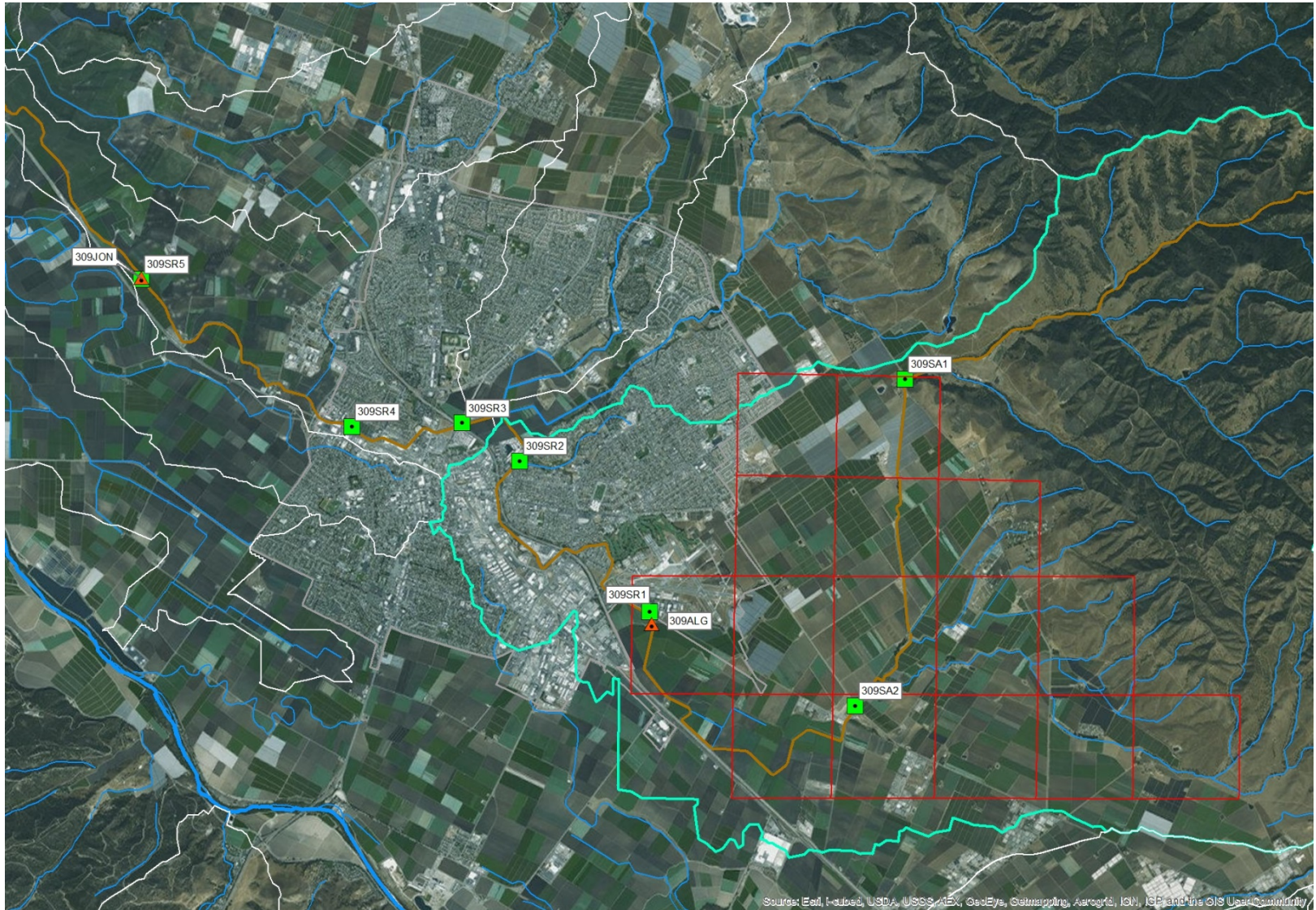
$$\text{Pyrethroid TUs} = \frac{\text{actual concentration (OC)}}{\text{known LC50 concentration values (OC)}}$$

$$\text{Sum Pyrethroid TUs} = \text{Pyrethroid TU (1)} + \text{Pyrethroid TU (2)}$$

# Source Analysis and Linkage



# Reclamation Canal – Alisal Creek



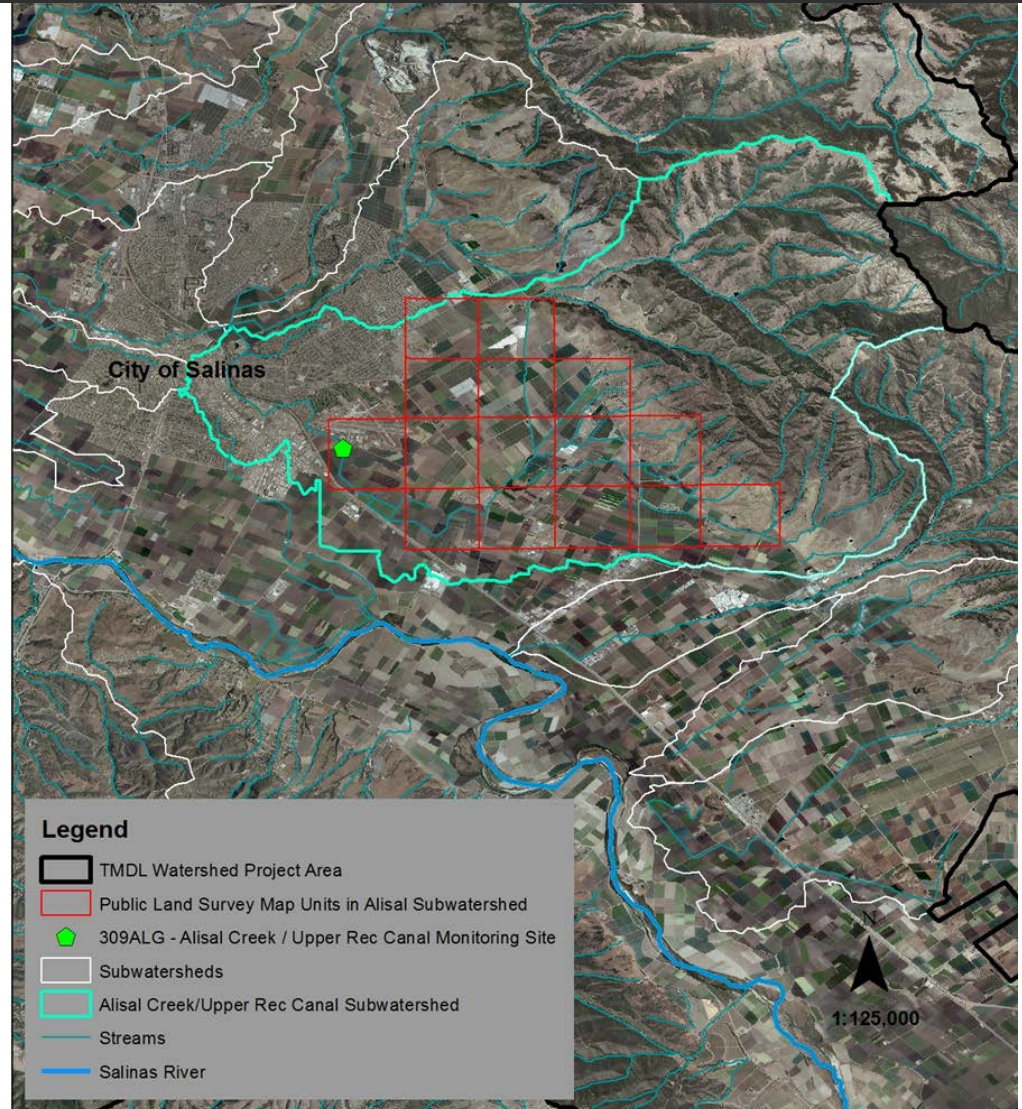
# Toxicity Unit Analysis

Date	Project	Site ID	Pyrethroid Pesticides (TUs)							Total
			Bifenthrin	Cyfluthrin	Cypermethrin	Esfenvalerate/Fenvalerate	Lambda-cyhalothrin	Permethrin	Deltamethrin	
<b>Alisal Creek/Reclamation Ditch</b>										
9/23/2005	Weston	309SA1	ND	ND	ND	ND	ND	ND	ND	ND
9/23/2005	Weston	309SA2	ND	ND	ND	ND	0.6	1.2	na	<b>1.8</b>
9/23/2005	Weston	309SR1	0.6	ND	0.2	0.1	0.5	na	na	<b>1.5</b>
9/23/2005	Weston	309SR2	0.4	0.2	1	0.1	0.8	0.4	na	<b>2.9</b>
9/23/2005	Weston	309SR3	0.3	ND	ND	0.1	0.2	0.3	na	0.9
9/23/2005	Weston	309SR4	0.1	0.1	0.4	ND	ND	<0.1	na	0.6
9/23/2005	Weston	309SR5	0.6	ND	ND	0.1	ND	ND	na	0.7
5/24/2010	CMP	309ALG	<b>1.79</b>	0	<b>1.84</b>	<b>1.84</b>	<b>2.22</b>	0.17	na	<b>7.86</b>
5/25/2010	CMP	309JON	<b>7.50</b>	0.78	<b>3.74</b>	<b>1.73</b>	<b>2.53</b>	0.62	na	<b>16.9</b>

# Alisal Creek – 309ALG

## Pyrethroid TUs (5/24/2010)

- Bifenthrin (1.79 TUs)
- Cypermethrin (1.84 TUs)
- Esfenvalerate/Fenvalerate (1.84 TUs)
- Lambda-Cyhalothrin (2.22 TUs)



# Bifenthrin

<b>Pesticide (Toxicity Units*)</b>	<b>Average Lbs 2009/2010</b>	<b>Percent</b>
<b>Crop Type</b>		
<b>Bifenthrin (1.79 TUs*)</b>		
Broccoli	0.95	1%
N-Grnhs Grwn Plants In Containers	0.19	0%
Strawberry (All Or Unspec)	119.45	99%
Total	120.59	100%



# Cypermethrin

Pesticide (Toxicity Units*) Crop Type	Average Lbs 2009/2010	Percent
<b>Cypermethrin (1.84 TUs*)</b>		
Broccoli	1.19	1%
Broccoli Raab (Rapa, Italian Turnip, Rapini)	12.53	7%
Cauliflower	0.51	0%
Celery, General	7.92	4%
Endive (Escarole)	0.86	0%
Lettuce (Total Head And Leaf)	162.55	86%
Mustard, General	0.49	0%
Radicchio	0.74	0%
Spinach	2.15	1%
Swiss Chard (Spinach Beet)	0.11	0%
Total	189.06	100%

# Esfenvalerate

<b>Pesticide (Toxicity Units*)</b>	<b>Average Lbs</b>	<b>Percent</b>
<b>Crop Type</b>	<b>2009/2010</b>	
<b>Esfenvalerate (1.84 TUs*)</b>		
Artichoke (Globe) (All Or Unspec)	0.34	2%
Broccoli	6.15	32%
Cauliflower	3.06	16%
Lettuce, Head (All Or Unspec)	9.56	50%
Total	19.10	100%

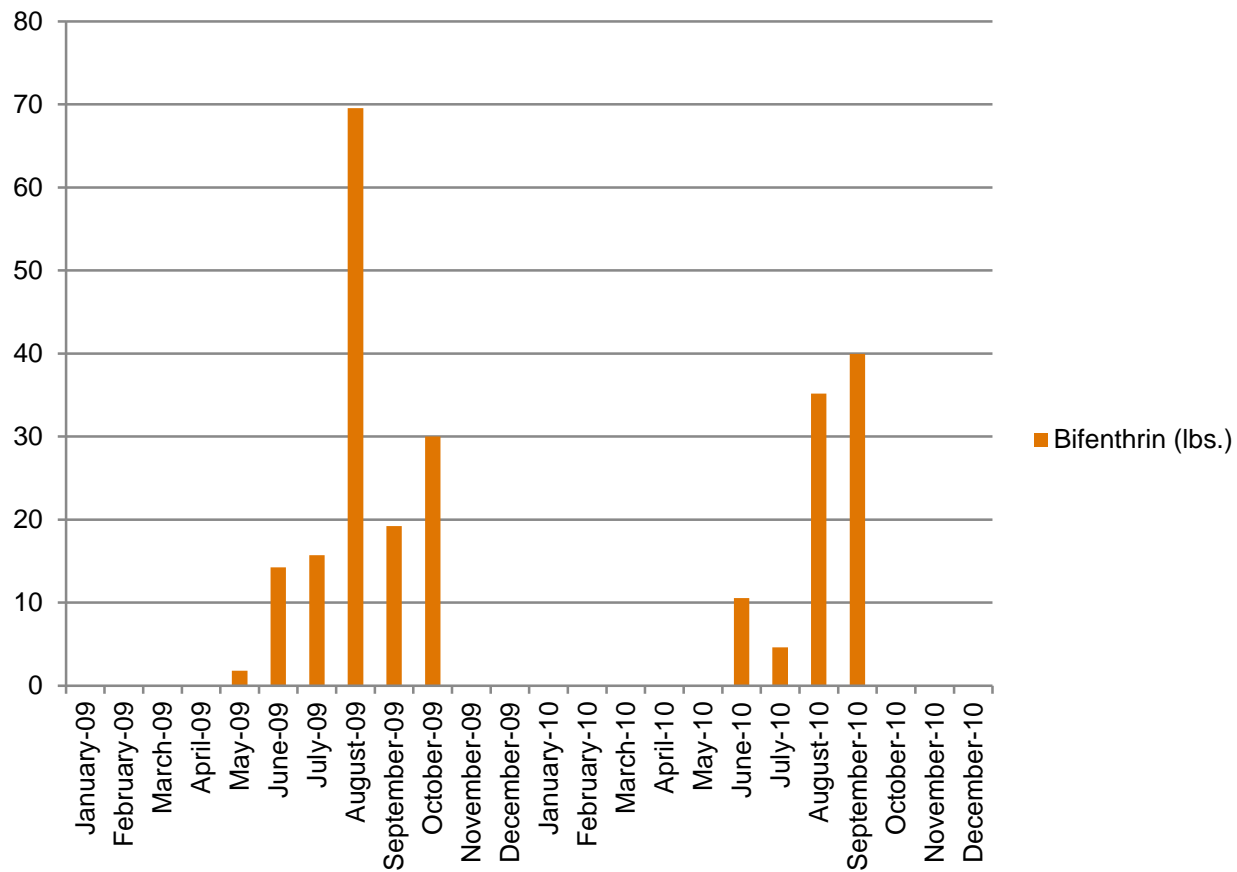
# Lambda-Cyhalothrin

<b>Pesticide (Toxicity Units*)</b>	<b>Average Lbs 2009/2010</b>	<b>Percent</b>
<b>Crop Type</b>		
<b>Lambda-Cyhalothrin (2.22 TUs*)</b>		
Broccoli	0.57	1%
Cauliflower	0.45	0%
Lettuce (Total Head And Leaf)	111.11	99%
Total	112.13	100%

# Pyrethroid Sources at 309ALG

- **Bifenthrin** (1.79TUs) – Strawberries
- **Cypermethrin** (1.84 TUs) – Lettuce
- **Esfenvalerate/Fenvalerate** (1.84 TUs) – Lettuce, Broccoli and Cauliflower
- **Lambda-Cyhalothrin** (2.22 TUs) – Lettuce

# Bifenthrin Applied 2009-2010 (309ALG)

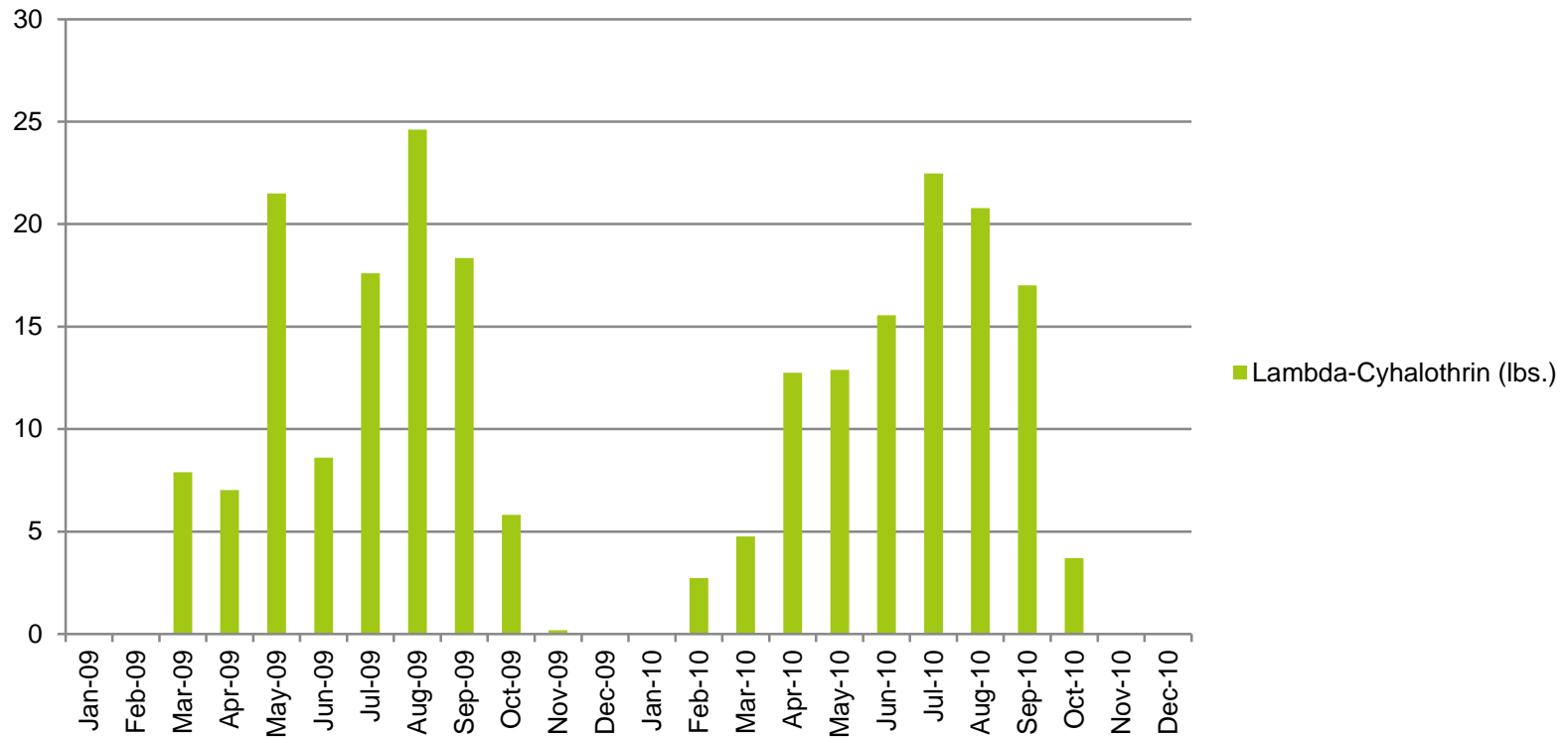


# Management Practices



<http://www.itrc.org/projects/JDWT/photos.html>

# Lambda-Cyhalothrin



# Management Practices



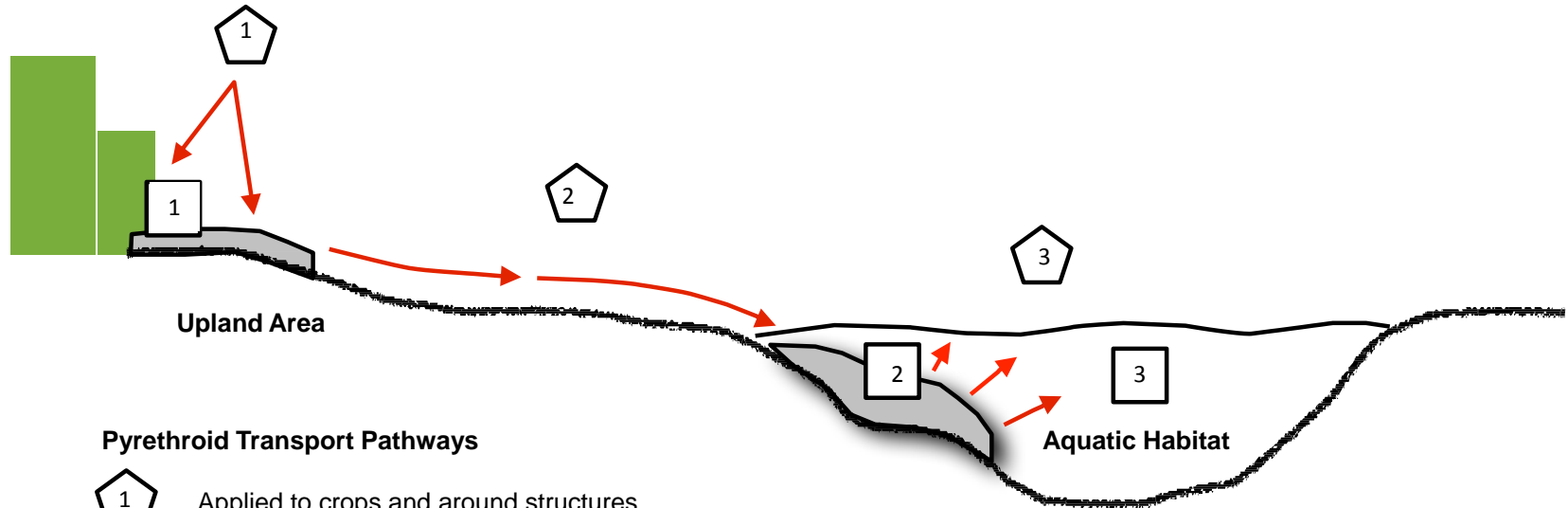


# Properties of Pyrethroids\* & Other Pesticides




Pesticide	Soil Half-life (days)	Water Solubility (mg/l)	Sorption Coefficient (soil Koc)
Bifenthrin*	97-250	<0.001	131,000 – 302,000
Cypermethrin*	20	0.004	61,000
Esfenvalerate*	39	0.002	215,000
Lambda-Cyhalothrin*	42.6	0.005	247,000 – 330,000
DDT	2000	0.0055	2,000,000
Chlorpyrifos	30	0.4	6070
Diazinon	40	60	1000
Imidacloprid	27	514	132-310

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# Pyrethroid Sources and Pathways



## Pyrethroid Transport Pathways

-  Applied to crops and around structures
-  Attached to sediment and organic particles in runoff and deposited in streams
-  Partitioned between sediments, organic matter, and water

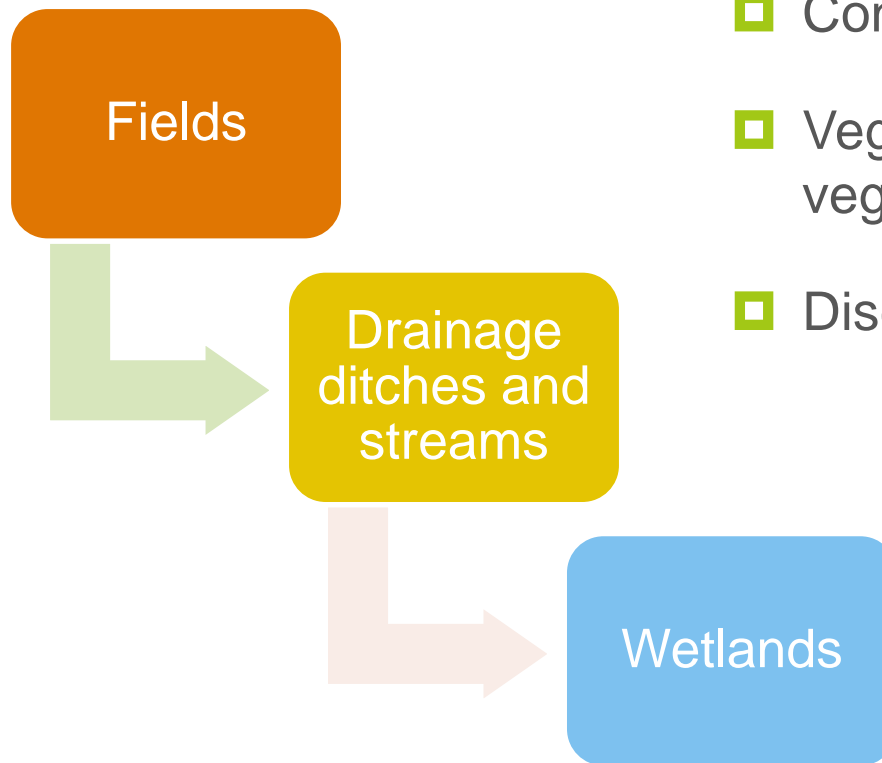
## Pyrethroids in the Environment

-  Soils and surfaces around structures and cropland
-  Deposited in sediment
-  In water

# Sources of Bifenthrin



# Env. Fate and Mitigation Strategies



- ▣ Control all run-off /sediment
- ▣ Vegetation, vegetation, vegetation
- ▣ Discontinue use

# Questions